

# NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 16

## Summary of the Henry O. Bakken No. 1

Williams County, North Dakota

By Sidney B. Anderson

July, 1953

Amerada Petroleum Corporation - Harry O . Bakken #1 well, Williams County, North Dakota, SW 1/4, NW 1/4, Section 12, T. 157N., R. 95W., (1985 feet S. of N. Line, 659 feet E. of W. line, Section 12.) G.L. 2439 K.B. 2458.

The Amerada Henry O. Bakken was spudded July 13, 1951, and 13 3/8 inch casing was run at 412 feet with 325 sacks; 9 5/8 inch casing was run at 6238 with 1500 sacks. The well was completed April 19, 1952. Set 5 1/2 inch casing at 13,066 feet with 2000 sacks.

### TESTS

- DST #1 7395 - 7415. Open 1 hour, shut in 15 minutes. Recovered 30 feet drilling mud, FP - 0#, BHP - 0#, HP - 300#.
- DST #2 7994 - 8049. Open 1 hour, shut in 15 minutes. Recovered 45 feet drilling mud, FP - 0#, BHP - 0#, HP - 4600#.
- DST #3 8186 - 8264. Open 3 hours, recovered 510 feet black oily sulphur mud with show of gas, FP - 120#, BHP - 320#, HP - 4975#.
- DST #4 8258 - 8307. Open 1 hour, shut in 15 minutes. Recovered 37 feet gas cut mud, FP - 0#, BHP - 0#, HP - 4815#.
- DST #5 8304 - 8360. Open 1 hour, Oil to surface in 40 minutes, flowed to pits for 20 minutes, no gauge, 40.4 gravity, IFP - 800#, FFP - 1000#, BHP - 3700#, HP - 4900#.
- DST #6 8361 - 8394. Open 1 hour, shut in 15 minutes, recovered 1700 feet sulphur water, FFP - 100#, No BHP, HP - 4900#.
- DST #7 8486 - 8544. Open 2 hours, shut in 15 minutes, recovered 40 feet of gas cut mud and 1320 feet of sulphur water, IFP - 200#, FFP - 975#, BHP - 3300#, HP - 4925#.
- DST #8 9908 - 10,030. Open 4 hours, shut in 15 minutes, fair blow for 1/2 hours, weak blow for 3 1/2 hours, recovered 200 feet water cushion, 690 feet gas cut salt water, IFP - 880#, FFP - 1255#, BHP - 3975#, HP - 5370#.
- DST #9 10,170 - 10,223. Open 4 hours, shut in 15 minutes, fair blow, recovered 2000 feet water cushion, 4570 feet salt water, IFP - 1210#, FFP - 3320#, BHP - 4305#, HP - 5640#.

- DST #10 10,310 - 10,410. Open 3 hours, shut in 15 minutes, fair to good blow, recovered 2000 feet water cushion, 7140 feet salt water, IFP - 2945#, FFP - 4710#, BHP - 4710#, HP - 5640#.
- DST #11 11,561 - 11,655. Open 2 1/4 hours, shut in 15 minutes, good blow for 1 hour, fair blow for 30 minutes and died. Recovered 3500 feet salt water, 3200 feet water cushion, IFP - 1600#, FFP - 2800#, BHP - 4050#, HP - 6650#.
- DST #12 12,390 - 12,550. Open 4 hours, shut in 15 minutes, fair blow, recovered 4350 feet of water cushion, 450 feet of gas above cushion, 430 feet gas cut mud, 1100 feet of oil and gas cut mud, IFP - 2090#, FFP-2395#, BHP - 4380#, HP - 6910#.
- DST #13 12,966 - 13,034. Open 3 1/2 hours, shut in 20 minutes, good to fair blow, recovered 5000 feet water cushion, 5420 feet of slightly oil and gas cut salt water and 180 feet of salt crystals, IFP - 5690#, BHP - 6380#, HP - 7770#.
- DST #14 13,567 - 13,629. Open 2 hours, shut in 15 minutes, weak blow for 15 minutes and died; recovered 5600 feet water cushion and 45 feet drilling mud, IFP - 2000#, FFP - 2000#, BHP - 2500#, HP - 7800#.
- DST #15 13,629 - 13,709. Packer failed.
- DST #16 13,550 - 13,709. Open 3 hours, shut in 15 minutes, weak blow for 2 hours and died. Recovered 5500 feet water cushion, 270 feet foamy mud, IFP - 2580#, FFP - 2630#, BHP - 2955#, HP - 7540#.

Formation tops determined from sample, electric, and radioactivity logs, not all lithologic formation tops called in following list. Color determined from rock color chart.

#### FORMATION TOPS

|                            |      |
|----------------------------|------|
| Cretaceous System          |      |
| Fox Hills Formation        | 1635 |
| Pierre Formation           | 1960 |
| Niobrara Formation         | 3390 |
| Greenhorn Member           | 4090 |
| "Muddy Sand"               | 4543 |
| Dakota                     | 4817 |
| Jurassic System            |      |
| Morrison Formation         | 5230 |
| Sundance Formation         | 5420 |
| Piper Formation (Sawtooth) | 5960 |
| Triassic System            |      |
| Spearfish Formation        | 6242 |
| Mississippian System       |      |
| Amsden Formation           | 6750 |
| Big Snowy Group            |      |
| Heath Formation            | 6910 |
| Kibbey Formation           | 7340 |
| Kibbey Lime                | 7370 |

|                             |        |
|-----------------------------|--------|
| Madison Group               |        |
| Charles Formation           | 7500   |
| Base of Last Salt           | 8117   |
| Englewood Formation         | 9615   |
| Devonian System             |        |
| Lyleton Formation           | 9790   |
| Upper Devonian Limestone    | 9910   |
| Manitoban Formation         | 10,700 |
| Winnipegogan Formation      | 10,895 |
| "Devonian Salt"             | 10,965 |
| Ashern Formation            | 11,539 |
| Silurian System             |        |
| Stonewall Formation         | 11,564 |
| Ordovician System           |        |
| Stony Mountain Shale Member | 12,755 |
| Red River Formation         | 12,825 |
| Winnipeg Formation          | 13,410 |
| Winnipeg Sand               | 13,559 |
| Total Depth                 | 13,709 |

HENRY O. BAKKEN NO. 1

| <u>From</u> | <u>To</u> | <u>Formation</u>   |
|-------------|-----------|--|
| 420         | 450       | Shale, light brown gray with very fine sand grains, soft and lumpy.                          |
| 450         | 480       | Shale and sandstone, as above.   |
| 480         | 540       | Shale and sandstone as above, with little coal.  |
| 540         | 570       | Sandstone, yellow gray 5Y8/1, soft shale, calcareous cement, fine grained.                   |
| 570         | 600       | Shale and sandstone as above and medium light gray N6 shale, calcareous.                     |
| 600         | 630       | Shale as above, silty, calcareous.   |
| 630         | 690       | Shale as above, calcareous, some coal.   |
| 690         | 780       | Shale, as above, calcareous.   |
| 780         | 810       | Shale, very pale yellow brown to very pale orange calcareous.                                |
| 810         | 840       | Missing.   |
| 840         | 870       | Shale, very pale yellow brown and yellow gray calcareous.                                    |
| 870         | 900       | Lignite, black, and little shale as above.   |
| 900         | 1030      | Lignite and siltstone, lignite and yellow gray calcareous, clayey siltstone.                 |
| 1030        | 1060      | Lignite, and yellow gray calcareous, clayey siltstone.                                       |
| 1060        | 1090      | Siltstone same as above and a little lignite.  |
| 1090        | 1120      | Lignite and siltstone as above, and much lignite.  |
| 1120        | 1140      | Siltstone as above, and a little lignite.  |
| 1140        | 1170      | Siltstone as above, a little brown black carbonaceous material.                              |
| 1170        | 1200      | Siltstone as above.  |
| 1200        | 1230      | Siltstone as above, bentonitic.  |
| 1230        | 1260      | Siltstone as above, some fine grained sandstone.   |
| 1260        | 1290      | Siltstone and lignite as above, some fine grained sandstone; bentonitic slightly calcareous. |

| <u>From</u>              | <u>To</u> | <u>Formation</u>  |
|--------------------------|-----------|---|
| 1290                     | 1320      | Siltstone as above, bentonitic.   |
| 1320                     | 1350      | Siltstone as above.   |
| 1350                     | 1380      | Siltstone as above, much very fine grained sandstone, bentonitic.               |
| 1380                     | 1410      | Siltstone as above, much very fine grained sandstone, bentonitic.               |
| 1410                     | 1470      | Siltstone and lignite as above.   |
| 1470                     | 1530      | Siltstone as above, bentonitic.   |
| 1530                     | 1560      | Siltstone as above, little lignite in siltstone.                                |
| 1580                     | 1590      | Siltstone as above, some calcareous.  |
| 1590                     | 1620      | Sandstone, yellow gray calcareous cement, siltstone as above, and some lignite. |
| 1620                     | 1680      | Siltstone and lignite as above.   |
| Fox Hills Formation 1635 |           |   |
| 1680                     | 1710      | Siltstone as above, rounded quartz grain.                                       |
| 1710                     | 1740      | Siltstone, light gray N7.   |
| 1740                     | 1770      | Mostly sandstone, fine grained, yellow gray to light gray, some siltstone.      |
| 1770                     | 1800      | Siltstone and sandstone same as above.  |
| 1800                     | 1860      | Sandstone, light olive gray, fine grained.                                      |
| 1860                     | 1890      | Sandstone, light olive gray, fine grained; some lignite shell fragments.        |
| 1890                     | 1920      | Siltstone, light olive gray; very little sand.                                  |
| Pierre Formation 1960    |           |   |
| 1920                     | 1980      | Siltstone, light olive gray.  |
| 1980                     | 2010      | Siltstone, light olive gray and medium gray.                                    |
| 2010                     | 2070      | Siltstone, light olive gray.  |
| 2070                     | 2130      | Siltstone, light olive gray, bentonitic.  |
| 2130                     | 2160      | Siltstone, light olive gray, some medium light gray shale.                      |
| 2160                     | 2200      | Siltstone and shale same as above.  |
| 2200                     | 2220      | Missing.  |
| 2220                     | 2310      | Shale, medium light gray N6.  |
| 2310                     | 2370      | Shale, medium light gray N6; some light olive gray siltstone.                   |
| 2370                     | 2400      | Shale and siltstone same as above.  |
| 2400                     | 2430      | Shale and siltstone same as above.  |
| 2430                     | 2460      | Siltstone, light olive gray, few sand grains, shell fragments.                  |
| 2460                     | 2490      | Siltstone, light olive gray.  |
| 2490                     | 2520      | Shale, green gray 5GY6/1.   |
| 2520                     | 2550      | Shale, green gray and medium light gray N6.                                     |
| 2550                     | 2580      | Shale, green gray and medium light gray, shell fragments.                       |
| 2580                     | 2610      | Shale same as above, shell fragments.   |
| 2610                     | 2670      | Shale as above, medium light gray.  |
| 2670                     | 2970      | Shale, green gray 5GY6/1.   |
| 2970                     | 3000      | Shale same as above, very pale yellow brown siltstone.                          |
| 3000                     | 3030      | Shale as above, and some fine grained sandstone.                                |
| 3030                     | 3060      | Shale same as above.  |

| <u>From</u>             | <u>To</u> | <u>Formation</u>  |
|-------------------------|-----------|---|
| 3060                    | 3090      | Shale as above, medium light gray N6.   |
| 3090                    | 3150      | Shale as above, green gray.   |
| 3150                    | 3180      | Shale, green gray 5GY6/1, and dark gray N3; Little gray limestone.                                      |
| 3180                    | 3210      | Shale, green gray 5GY6/1, and dark gray N3.   |
| 3210                    | 3240      | Shale, green gray.  |
| 3240                    | 3270      | Shale as above; piece of lignite.   |
| 3270                    | 3300      | Shale as above; iron concretion.  |
| 3300                    | 3330      | Shale same as above; some white to light gray limestone, dense.   |
| 3330                    | 3360      | Shale and limestone same as above.  |
| 3360                    | 3390      | Shale some as above.  |
| Niobrara Formation 3390 |           |   |
| 3390                    | 3400      | Shale green gray as above.  |
| 3400                    | 3450      | Shale same as above.  |
| 3450                    | 3480      | Shale as above and pieces of medium dark gray, dense limestone.   |
| 3480                    | 3570      | Shale same as above.  |
| 3570                    | 3600      | Shale same as above, and little brown shale.  |
| 3600                    | 3630      | Shale same as above, and little brown limestone.  |
| 3630                    | 3660      | Shale green gray and light gray.  |
| 3660                    | 3690      | Shale same as above; light gray siltstone.  |
| 3690                    | 3750      | Shale, green gray.  |
| 3750                    | 3780      | Shale same as above, an little brown shale.   |
| 3780                    | 3810      | Shale, medium dark gray and dark gray N3; white specks and little sandstone and glauconite, calcareous. |
| 3810                    | 3870      | Shale same as above.  |
| 3870                    | 3900      | Shale, dark gray N3 and medium dark gray N4, some white specks; pieces of medium dark gray limestone.   |
| 3900                    | 3930      | Shale dark gray N3 and medium dark gray N4, calcareous, white specks. Inoceramus Prisms.                |
| 3930                    | 3960      | Shale same as above.  |
| 3960                    | 3990      | Shale dark gray N3 and medium light gray; some white specks.  |
| 3990                    | 4020      | Shale, mostly medium light gray and some dark gray.   |
| 4020                    | 4050      | Shale, mostly medium light gray and some dark gray, few white specks in dark gray.                      |
| 4050                    | 4080      | Shale same as above.  |
| 4080                    | 4110      | Shale same as above, few white specks in dark gray.   |
| Greenhorn Member 4090   |           |   |
| 4110                    | 4140      | Shale same as above   |
| 4140                    | 4200      | Shale same as above; little very fine grained sandstone or siltstone with glauconite.                   |
| 4200                    | 4230      | Missing.  |
| 4230                    | 4260      | Shale same as above, dark gray, calcareous, and few white specks.                                       |
| 4260                    | 4290      | Shale, medium dark gray N6 with white specks.   |
| 4290                    | 4320      | Shale same as above, white specks.  |
| 4320                    | 4350      | Shale, medium dark gray N4, white specs, and yellow gray shale 5Y8/1.                                   |

| <u>From</u>        | <u>To</u> | <u>Formation</u>  |
|--------------------|-----------|---|
| 4350               | 4410      | Shale, medium dark gray N4, white specks.   |
| 4410               | 4440      | Shale, medium dark gray; one piece of limestone, brown gray 5YR4/1. Inoceramus Prisms.  |
| 4440               | 4470      | Shale same as above.  |
| 4470               | 4500      | Shale as above, few white specks.   |
| 4500               | 4520      | Shale same as above.  |
| 4520               | 4530      | Shale and sandstone, shale as above, few quartz grains.   |
| 4530               | 4550      | Shale same as above.  |
| " Muddy Sand" 4543 |           |   |
| 4550               | 4560      | Shale as above, little light gray N7 sandstone, very fine grained with glauconite.  |
| 4560               | 4590      | Shale same as above   |
| 4590               | 4600      | Shale as above; pieces of brown gray limestone and sandstone.   |
| 4600               | 4620      | Shale, medium dark gray.  |
| 4620               | 4630      | Shale, medium dark gray, few quartz grains.   |
| 4630               | 4650      | Shale, medium dark gray.  |
| 4650               | 4670      | Shale, medium dark gray, little light gray N7 sandstone, very fine grained, glauconite.                                       |
| 4670               | 4690      | Shale, medium dark gray, little light gray N7 sandstone very fine grained.  |
| 4690               | 4700      | Shale, medium dark gray, little light gray N7; pieces of dark gray limestone and sandstone.                                   |
| 4700               | 4710      | Shale as above, little light gray sandstone, and little pale yellow brown sandstone.  |
| 4710               | 4760      | Shale as above, little light gray sandstone with glauconite.  |
| 4760               | 4770      | Shale as above, little reddish sandstone with glauconite.   |
| 4770               | 4810      | Shale as above, little gray, very fine grained sandstone with glauconite.   |
| 4810               | 4830      | Shale same as above.  |
| Dakota 4817        |           |   |
| 4830               | 4840      | Shale as above and little light gray, very fine grained sandstone with glauconite.  |
| 4840               | 4860      | Shale and sandstone, shale as above, much very fine grained sandstone, light gray to yellow gray 5Y8/1.                       |
| 4860               | 4870      | Shale and sandstone, pale yellow brown 10YR6/2, and light gray very fine grained sandstone, and some pale yellow brown shale. |
| 4870               | 4880      | Shale, medium dark gray and some light gray sandstone as above.   |
| 4880               | 4900      | Shale, medium dark gray and some light gray sandstone and brown sandstone, very fine grained, quite dense.                    |
| 4900               | 4950      | Shale same as above, little sandstone.  |
| 4950               | 4960      | Shale as above, very little sandstone, piece of gray dense limestone.   |
| 4960               | 4990      | Shale as above, little sandstone as above.<br>Inoceramus Prisms. No Inoceramus Prisms from 80-90.                             |

| <u>From</u>             | <u>To</u> | <u>Formation</u>  |
|-------------------------|-----------|---|
| 4990                    | 5000      | Shale same as above, little sandstone as above, and few medium grained quartz grains.                   |
| 5000                    | 5010      | Shale same as above, little sandstone as above, and some medium quartz grains.                          |
| 5010                    | 5020      | Shale same as above, some light olive gray shale or aguagel.  |
| 5020                    | 5030      | Shale same as above, some sandstone as above, fine to medium.   |
| 5030                    | 5040      | Shale same as above, little red sandstone, fine grained.  |
| 5040                    | 5050      | Shale same as above, yellow gray and medium gray sandstone, fine grained. Large pieces cave?            |
| 5050                    | 5060      | Shale as above, red brown and medium gray sandstone, fine grained.                                      |
| 5060                    | 5070      | Shale as above, yellow gray and medium gray sandstone, fine grained.                                    |
| 5070                    | 5080      | Shale as above, little light gray sandstone with some glauconite.                                       |
| 5080                    | 5090      | Shale as above, little light gray sandstone, and light olive gray, some siltstone.                      |
| 5090                    | 5100      | Shale as above, little sandstone as above, some reddish brown sandstone; shell fragments.               |
| 5100                    | 5110      | Shale as above and green gray 5GY6/1, little sandstone as above 5YR4/1 brown gray; pieces of limestone. |
| 5110                    | 5120      | Shale as above, little sandstone as above, medium dark gray and light gray.                             |
| 5120                    | 5130      | Shale as above, little sandstone as above.  |
| 5130                    | 5140      | Shale and sandstone same as above, some medium to coarse free quartz grains.                            |
| 5140                    | 5150      | Shale same as above and some medium to coarse free quartz grains; little fine grained gray sandstone.   |
| 5150                    | 5160      | Shale same as above and some medium to coarse free quartz grains.                                       |
| 5160                    | 5180      | Shale same as above, and much medium to coarse free quartz grains.                                      |
| 5180                    | 5190      | Shale same as above, and much medium to coarse free quartz grains, little fine grained sandstone.       |
| 5190                    | 5220      | Shale and sandstone same as above.  |
| Break                   |           |   |
| 5220                    | 5230      | Shale, dark gray N3, very little sand.  |
| Morrison Formation 5230 |           |   |
| 5230                    | 5270      | Shale, dark gray N3.  |
| 5270                    | 5280      | Shale, dark gray N3, Inoceramus Prisms.   |
| 5280                    | 5320      | Shale, dark gray N3.  |
| 5320                    | 5330      | Shale same as above, one piece of light gray fine grained sandstone, glauconite. Cave?                  |
| 5330                    | 5540      | Shale same as above, few pieces of light gray fine grained sandstone, glauconite.                       |
| 5340                    | 5350      | Missing.  |
| 5350                    | 5370      | Shale, same as above.   |

| <u>From</u>   | <u>To</u> | <u>Formation</u>  |
|---------------|-----------|---|
| 5370          | 5380      | Shale, dark gray N3.  |
| 5390          | 5400      | Shale, dark gray N3, little salt and pepper sandstone, fine grained.  |
| 5400          | 5410      | Shale, dark gray N3.  |
| 5410          | 5430      | Shale, dark gray N3, little light gray sandstone, fine grained, little glauconite.                                      |
| Sundance 5420 |           |   |
| 5430          | 5440      | Shale, dark gray to medium light gray N6; more salt and pepper sandstone, fine grained, glauconitic.                    |
| 5440          | 5470      | Same as above with some salt and pepper sandstone.  |
| 5470          | 5480      | Same as above, 50% sandstone, yellow gray to light gray, fine grained, glauconitic.                                     |
| 5480          | 5500      | Same as above, much sandstone as above.   |
| 5500          | 5510      | Same as above.  |
| 5510          | 5570      | Shale, dark gray and much light gray, some glauconitic sandstone.   |
| 5570          | 5580      | Same as above, mostly dark gray shale.  |
| 5580          | 5600      | Same as above.  |
| 5600          | 5620      | Same as above, mostly shale.  |
| 5620          | 5630      | Same as above, mostly shale, sandstone glauconitic.   |
| 5630          | 5640      | Same as above, mostly medium light gray shale, sandstone glauconitic.   |
| 5640          | 5680      | As above, little sandstone, fine grained.   |
| 5680          | 5690      | Shale, medium light gray, little sandstone, fine grained.   |
| 5690          | 5710      | Shale, medium light gray, little sandstone, fine grained.   |
| 5710          | 5730      | Same as above, glauconitic.   |
| 5730          | 5790      | Shale, medium light gray, little sandstone, fine grained.   |
| 5790          | 5800      | Shale, medium light gray; few pieces of reddish shale.  |
| 5800          | 5820      | Shale, medium light gray and green gray 5GY6/1 and few pieces of reddish shale. Little very light gray dense limestone. |
| 5820          | 5840      | Shale as above.   |
| 5840          | 5850      | Shale, medium light gray and green gray; little fine grained sandstone.   |
| 5850          | 5860      | Shale, medium light gray and green gray, little light olive gray dense limestone.                                       |
| 5860          | 5870      | Shale, medium light gray, some yellow gray oolitic limestone.   |
| 5870          | 5880      | Shale, medium light gray, few pieces reddish shale; some yellow gray limestone, little sandstone, calc. cement.         |
| 5880          | 5890      | Green gray shale, little fine grained sandstone.  |
| 5890          | 5900      | Green gray shale, few pieces red shale, little sandstone as above.  |
| 5900          | 5910      | Same as above, slightly glauconitic.  |
| 5910          | 5920      | Same as above.  |
| 5920          | 5930      | As above with medium dark gray shale.   |



| <u>From</u>          | <u>To</u> | <u>Formation</u>  |
|----------------------|-----------|---|
| 5930                 | 5940      | Shale, medium dark gray, little light gray; little fine grained sandstone.                  |
| 5940                 | 5950      | Shale, green gray and little reddish; little fine grain sandstone, some glauconitic.        |
| Piper Formation 5960 |           |   |
| 5950                 | 5960      | Shale, green gray and medium dark gray, little reddish.                                     |
| 5960                 | 5970      | Shale, green gray and medium dark gray.   |
| 5970                 | 5990      | Shale, green gray, some reddish and some medium dark gray; some light gray dense limestone. |
| 5990                 | 6000      | Same as above, limestone, yellow gray dense.  |
| 6000                 | 6010      | Green gray shale, much limestone as above.  |
| 6010                 | 6030      | Limestone as above, some variegated shale.  |
| 6030                 | 6040      | As above, dense, little green gray shale.   |
| 6040                 | 6080      | As above, dense and variegated shale.   |
| 6080                 | 6100      | Mostly variegated shale, little limestone.  |
| 6100                 | 6110      | Mostly variegated shale, some green gray silty shale, little limestone.                     |
| 6110                 | 6140      | Mostly variegated shale, some fine grained sandstone, green gray; little limestone.         |
| 6140                 | 6150      | Variegated shale.   |
| 6150                 | 6160      | Variegated shale, little fine grained green gray sandstone.                                 |
| 6160                 | 6190      | Variegated shale.   |
| 6190                 | 6200      | Variegated shale, green gray and gray red 10R4/2 shale, gray shale.                         |
| 6200                 | 6210      | Variegated shale, green gray and gray red, little moderate red brown shale.                 |
| 6210                 | 6230      | Variegated shale, moderate red brown, very fine grained sandstone or siltstone.             |
| 6230                 | 6240      | Limestone, very pale orange, pinpoint porosity, much red brown fine grained sandstone.      |
| 6240                 | 6250      | As above, sandy, some pinpoint porosity.  |
| 6250                 | 6260      | Sandstone, moderate red brown 10R4/6, fine grained, some gray shale.                        |
| 6260                 | 6300      | Missing.  |
| 6300                 | 6320      | Sandstone, moderate red brown 10R4/6, fine grained.   |
| 6320                 | 6330      | Sandstone as above, little limestone as above.  |
| 6330                 | 6360      | Limestone, yellow gray 5Y8/1, some pinpoint porosity.                                       |
| 6360                 | 6370      | Limestone as above, sandy, sandstone as above, red brown 10R4/6.                            |
| 6370                 | 6410      | Sandstone as above, fine grained, some gray shale.  |
| 6410                 | 6420      | As above, some medium grained free quartz.  |
| 6420                 | 6440      | Sandstone as above, 50% limestone as above, little pinpoint porosity.                       |
| 6440                 | 6460      | Sandstone as above, little limestone.   |
| 6460                 | 6480      | As above, little gray shale.  |
| 6480                 | 6490      | Sandstone as above, little limestone.   |
| 6490                 | 6500      | Sandstone as above, some medium grained free quartz; little limestone.                      |

| <u>From</u>          | <u>To</u> | <u>Formation</u>  |
|----------------------|-----------|---|
| 6500                 | 6520      | Sandstone as above, some medium grained free quartz.                                    |
| 6520                 | 6530      | As above, some free quartz, little pale red sandstone, 10R6/2, slightly calcareous.     |
| 6530                 | 6540      | As above, some free quartz, medium to coarse, fair porosity, little pale red sandstone. |
| 6540                 | 6560      | As above, some free medium to coarse quartz, little dark gray shale.                    |
| 6560                 | 6570      | Same as above, some siltstone, same color.  |
| 6570                 | 6580      | As above, some siltstone, same color, little free quartz, medium to coarse.             |
| 6580                 | 6590      | Sandstone and siltstone as above.   |
| 6590                 | 6620      | Same as above. Color as above.  |
| 6620                 | 6630      | Siltstone, color as above, some white specks, little yellow gray limestone, dense.      |
| 6630                 | 6640      | Siltstone, color as above, some white specks.   |
| 6640                 | 6650      | Siltstone, color as above.  |
| 6650                 | 6660      | Missing.  |
| 6660                 | 6670      | Siltstone, color as above, little medium grained free quartz.                           |
| 6670                 | 6680      | Siltstone as above, few medium grained free quartz.                                     |
| 6680                 | 6690      | As above with some medium grained free quartz.  |
| 6690                 | 6750      | Siltstone, color as above.  |
| Amsden 6750          |           |   |
| 6750                 | 6760      | Siltstone as above, pale red brown dolomite, 10R5/4, gray red 10R4/2.                   |
| 6760                 | 6770      | Siltstone as above, pale red and gray dolomite, dense.                                  |
| 6770                 | 6780      | Siltstone as above shale, dark red brown 10R3/4.  |
| 6780                 | 6790      | Siltstone as above, dolomite, varicolored, dense to saccharoidal, vuggy.                |
| 6790                 | 6810      | Siltstone and shale as above, dolomite, varicolored, white limestone.                   |
| 6810                 | 6820      | Mostly shale and siltstone as above, little sand.                                       |
| 6820                 | 6850      | Variegated shale, splintery, greasy, mostly reddish shades.                             |
| 6850                 | 6870      | Shale as above, few rounded medium quartz grains.                                       |
| 6870                 | 6880      | Variegated shale as above, little white fine grained sandstone.                         |
| 6880                 | 6890      | Variegated shale as above.  |
| 6890                 | 6900      | Variegated shale, mostly gray red as above and pale red brown.                          |
| Heath Formation 6910 |           |   |
| 6900                 | 6910      | Same as above, some gray red; contains rounded quartz.                                  |
| 6910                 | 7000      | Shale, as above.  |
| 7000                 | 7300      | Missing.  |
| 7300                 | 7310      | Shale, much medium dark gray to dark gray, red shale.                                   |
| 7310                 | 7320      | Shale, as above, few rounded quartz grains.   |
| 7320                 | 7330      | Shale as above, mostly gray.  |
| 7330                 | 7340      | Shale as above, mostly gray, few free quartz grains.                                    |

| <u>From</u>            | <u>To</u> | <u>Formation</u>  |
|------------------------|-----------|---|
| Kibbey 7340            |           |   |
| 7340                   | 7350      | Sandstone, pale red 10R6/2, calcareous, fine grained.   |
| 7350                   | 7360      | Shale, reddish gray and little green, sandstone as above.   |
| 7360                   | 7370      | As above, medium grained, free quartz sand.   |
| 7370                   | 7380      | As above, mostly gray shale.  |
| 7380                   | 7390      | Floury gypsum, alabaster, anhydrite, some red and gray shale.   |
| 7390                   | 7400      | As above with brown gray, dense, lithographic limestone.  |
| 7400                   | 7420      | Missing.  |
| 7420                   | 7430      | Shale, mostly gray, dark gray N3, some red; limestone as above.   |
| 7430                   | 7450      | Shale and limestone as above, fine to medium calcareous sandstone.  |
| 7450                   | 7460      | Shale, gray, gray green, light brown, and reddish as above.   |
| 7460                   | 7470      | As above, little gray orange 10YR7/4 limestone, granular.   |
| 7470                   | 7480      | As above, granular, gray orange, some porosity.   |
| 7480                   | 7490      | Limestone, gray orange as above, granular, good porosity.   |
| Charles Formation 7500 |           |   |
| 7490                   | 7500      | As above, anhydrite, salt efflorescence, calcareous.  |
| 7500                   | 7520      | Anhydrite, salt as above.   |
| 7520                   | 7530      | Shale, mostly gray, some anhydrite as above.  |
| 7530                   | 7560      | Same as above.  |
| 7560                   | 7570      | Same as above, some salt.   |
| 7570                   | 7620      | Same as above.  |
| 7620                   | 7630      | Salt crystals.  |
| 7630                   | 7670      | Salt crystals, little reddish shale.  |
| 7670                   | 7680      | Gray shale and yellow gray anhydrite.   |
| 7680                   | 7690      | Yellow gray anhydrite.  |
| 7690                   | 7700      | Missing.  |
| 7700                   | 7710      | Anhydrite, reddish stain from shale.  |
| 7710                   | 7720      | Same as above, white anhydrite.   |
| 7720                   | 7730      | Shale, some gray, red and green, white anhydrite.   |
| 7730                   | 7740      | Same as above, more salt.   |
| 7740                   | 7760      | Salt crystals.  |
| 7760                   | 7770      | Missing.  |
| 7770                   | 7780      | White anhydrite and variegated shale.   |
| 7780                   | 7800      | White anhydrite and variegated shale, some oolitic limestone, light gray.   |
| 7800                   | 7830      | Salt crystals.  |
| 7830                   | 7840      | Salt crystals, little dark gray N3 shale.   |
| 7840                   | 7850      | Salt crystals, little light olive gray limestone, some pinpoint porosity, little red and gray shale, gray dolomite. |
| 7850                   | 7870      | Limestone, light olive gray, good pinpoint porosity.  |
| 7870                   | 7880      | Limestone, light olive gray, fair pinpoint porosity.  |
| 7880                   | 7890      | White anhydrite, limestone as above, fair porosity.   |

| <u>From</u>         | <u>To</u> | <u>Formation</u>   |
|---------------------|-----------|--|
| 7890                | 7900      | Same as above.   |
| 7900                | 7910      | Some white anhydrite, brown gray shale and gray shale, salt efflorescence.   |
| 7910                | 7920      | White anhydrite, pale red shale 5R6/2.   |
| 7920                | 7930      | White anhydrite, some white dolomite.  |
| 7930                | 7940      | White anhydrite, some light olive gray limestone, fair porosity.   |
| 7940                | 7950      | Same as above, quite dense.  |
| 7950                | 7960      | Limestone and anhydrite as above, light gray dolomite, quite dense.  |
| 7960                | 7970      | As above, quite dense, very little limestone.  |
| 7970                | 7980      | Mostly variegated shale.   |
| 7980                | 7990      | Brown gray limestone, 5YR4/1. Some medium gray shale N5.   |
| 7990                | 8000      | Limestone as above, quite dense, white anhydrite.  |
| 8000                | 8010      | Brown gray limestone, light brown gray limestone; little white anhydrite, light brown gray limestone, good porosity. |
| 8010                | 8020      | Brown gray limestone, some porosity.   |
| Core #1             |           |  |
| 8024                | 8028      | Brown gray limestone, quite dense, some porosity.  |
| 8028                | 8036      | Dolomite, light gray N7.   |
| 8036                | 8047      | Dolomite, medium dark gray N4, dense.  |
| 8047                | 8049      | White crystalline anhydrite, dense.  |
| End Core #1         |           |  |
| 8050                | 8060      | White crystalline anhydrite and brown gray limestone, dense.   |
| 8060                | 8070      | Brown gray dense limestone, medium gray dense dolomite, little white anhydrite.                                      |
| Mission Canyon 8080 |           |  |
| 8070                | 8080      | Brown gray dense limestone, light gray N7, some porosity, some slightly saccharoidal.                                |
| 8080                | 8090      | Salt crystals.   |
| 8090                | 8100      | Salt crystals.   |
| 8100                | 8110      | Salt crystals, few pieces of anhydrite.  |
| 8110                | 8120      | Salt crystals, little light gray limestone.  |
| 8120                | 8130      | Little salt as above, dolomite, medium gray N5, dense some white anhydrite.  |
| 8130                | 8140      | Dolomite, as above.  |
| 8140                | 8150      | Dolomite as above, white anhydrite.  |
| 8150                | 8160      | Dolomite as above, white anhydrite, brown gray limestone, dense.   |
| 8160                | 8170      | Same as above.   |
| 8170                | 8180      | Dolomite, medium light gray N6, dense.   |
| 8180                | 8196      | Limestone, light brown gray, 5YR6/1, dense.  |
| 8196                | 8200      | Limestone, light olive gray to light brown gray, dense. White dense anhydrite 8196-8200 1/2.                         |
| Core #2             |           |  |
| 8200                | 8202      | Limestone, brown gray 5YR4/1, dense and salt.  |

| <u>From</u> | <u>To</u> | <u>Formation</u>   |
|-------------|-----------|--|
| 8202        | 8206      | Limestone, medium dark gray, dense.  |
| 8206        | 8208 1/2  | Limestone, brown gray 5YR4/1, quite dense, few pinpoint vugs.                                  |
| 8209        | 8211      | Medium light gray dolomite N6 and light gray N7 anhydrite, dense.                              |
| 8211        | 8221      | Dolomite, medium gray N5, dense.   |
| End Core #2 |           |  |
| 8221        | 8230      | Dolomite, medium gray N5 and pale yellow brown, lith.  |
| Core #3     |           |  |
| 8230        | 8240      | Limestone, medium dark gray N4, dense crystalline and pale yellow brown, dense.                |
| 8240        | 8250      | Limestone, medium gray, dense, crystalline.  |
| 8250        | 8260      | Limestone, light brown gray 5YR6/1, dense crystalline.   |
| End Core #3 |           |  |
| Core #4     |           |  |
| 8264        | 8274      | Limestone, medium dark gray, dense.  |
| 8274        | 8284      | Limestone, brown gray 5YR4/1, dense.   |
| 8284        | 8294      | Limestone, light olive gray, dense, coarsely crystalline.                                      |
| End Core #4 |           |  |
| 8294        | 8307      | Missing.   |
| 8307        | 8310      | Limestone as above, appears to be quite dense; some slight staining.                           |
| 8310        | 8320      | Limestone, medium gray N5 to brown gray, quite dense.  |
| 8320        | 8330      | Limestone as above, some pinpoint porosity.  |
| 8330        | 8360      | Limestone, light olive gray, fair pinpoint porosity.   |
| 8370        | 8380      | Limestone, medium gray N5 to light olive gray, fair pinpoint porosity.                         |
| Core #5     |           |  |
|             | 8367 1/2  | Limestone, medium gray dense.  |
| 8371 1/2    | 8373 1/2  | Limestone, pale yellow brown, quite dense.   |
| 8373 1/2    | 8376 1/2  | Limestone, light gray N7, dense, sublithographic.  |
| 8377 1/2    | 8380      | Limestone, very light olive gray, dense, fine grained, little pinpoint porosity.               |
| 8380        | 8383      | Limestone, light gray N7, dense sublithographic.   |
| 8383        | 8389 1/2  | Limestone, light gray, dense to good pinpoint porosity.  |
| 8389 1/2    | 8394      | Limestone, light olive gray, dense, fine grained.  |
| End Core #5 |           |  |
| 8390        | 8400      | Limestone, light olive gray, dense; fine grained, some pinpoint porosity.                      |
| 8400        | 8410      | Limestone, light olive gray, fair to good porosity.  |
| 8410        | 8420      | Limestone, light olive gray and dark yellow brown 10YR4/2 quite dense, some pinpoint porosity. |
| 8420        | 8430      | Limestone, light olive gray, slightly saccharoidal, little pinpoint porosity.                  |
| 8430        | 8440      | Limestone, light olive gray, some oolitic, little pinpoint porosity.                           |
| 8440        | 8450      | Limestone, light gray to brown gray, oolitic, dense.   |
| 8450        | 8490      | Limestone, as above, mostly brown gray, oolitic, ostraced? dense.                              |

| <u>From</u>    | <u>To</u> | <u>Formation</u>  |
|----------------|-----------|---|
| 8490           | 8500      | Limestone, medium gray to light olive gray, slightly saccharoidal, little pinpoint porosity.              |
| 8500           | 8510      | Limestone, medium light gray, slightly saccharoidal, little pinpoint porosity.                            |
| 8510           | 8560      | Limestone, medium light gray and light olive gray, slightly saccharoidal, little pinpoint porosity.       |
| 8560           | 8580      | Limestone as above, dolomitic.  |
| Lodgepole 8580 |           |   |
| Core #6        |           |   |
| 8567           | 8574      | Dolomite, light olive gray, 5Y6/1, dense, fine grained.   |
| 8575           | 8576 1/2  | As above, few pinpoint vugs.  |
| 8576           | 8586      | Limestone, light olive, dense, coarsely crystalline, tight.   |
| 8586           | 8587      | Limestone, as above.  |
| End Core #6    |           |   |
| 8587           | 8607      | Missing.  |
| 8607           | 8610      | Limestone, light gray N7 to light olive gray, little pinpoint porosity.                                   |
| 8610           | 8620      | Limestone, dark gray with some brown mottling, dense.   |
| 8620           | 8760      | Limestone, dark gray with brown mottling and some light gray, dense.                                      |
| 8760           | 8770      | Limestone, as above, little white anhydrite.  |
| 8770           | 8780      | Limestone as above, some light olive gray, dense, coarsely crystalline.                                   |
| 8780           | 8790      | Limestone, as above, little white anhydrite.  |
| 8790           | 8800      | Limestone as above.   |
| 8800           | 8810      | Limestone as above, dense.  |
| 8810           | 8820      | Limestone as above, mostly medium gray N5, dense, and little dark gray N3, splintery shale.               |
| 8820           | 8830      | Limestone as above, dense.  |
| 8830           | 8840      | Limestone as above, mostly medium gray, dense, little dark gray N3 splintery shale.                       |
| 8840           | 8850      | Limestone as above, medium gray and light olive gray.   |
| 8850           | 8860      | Limestone, medium dark gray, dense.   |
| 8860           | 8880      | Limestone, medium dark gray and light gray N7, dense.   |
| 8880           | 8890      | Limestone, as above, little dark gray shale.  |
| 8890           | 8960      | Limestone, medium dark gray, dense.   |
| 8960           | 8970      | Limestone as above and very light gray limestone, dense.  |
| 8970           | 8980      | Limestone, mostly very light gray, dense.   |
| 8980           | 8990      | Limestone, medium gray N5 with brown mottling, some very light gray N7 and little white anhydrite, dense. |
| 8990           | 9010      | Limestone as above, dense.  |
| 9010           | 9020      | Limestone as above, fine grained, dense.  |
| 9020           | 9050      | Limestone as above, fine grained, dense.  |
| 9050           | 9170      | Limestone, medium gray N5, dense, fine grained. 9120 and 9140 - missing.                                  |
| 9170           | 9270      | Limestone, same as above, some very light gray, fine grained, dense.                                      |
| 9270           | 9280      | Limestone as above, lithographic.   |

| <u>From</u>    | <u>To</u> | <u>Formation</u>   |
|----------------|-----------|--|
| 9280           | 9290      | Limestone, dusky yellow brown 10YR2/2, medium gray and light gray, dense, fine grained.              |
| 9290           | 9340      | Limestone as above, (dark limestone, lithographic).  |
| 9340           | 9350      | Limestone, medium gray, dense, fine grained.   |
| 9350           | 9360      | Limestone as above.  |
| 9360           | 9460      | Limestone, medium gray to light gray, fine grained, dense.   |
| 9460           | 9470      | Missing.   |
| 9470           | 9480      | Limestone, as above.   |
| 9480           | 9500      | Limestone as above, lithographic.  |
| 9500           | 9610      | Limestone as above.  |
| Englewood 9615 |           |  |
| 9610           | 9620      | Missing.   |
| 9620           | 9640      | Shale, dark gray N3, carbonaceous.   |
| 9640           | 9650      | Shale as above and some medium light gray sandstone.   |
| 9650           | 9660      | Shale as above and much sandstone as above.  |
| 9660           | 9670      | Shale as move, some yellow gray anhydrite, much medium gray sandstone.                               |
| 9670           | 9680      | Medium gray sandstone, little pinpoint porosity, some yellow gray anhydrite.                         |
| 9680           | 9690      | Medium gray sandstone.   |
| 9690           | 9720      | Shale, dark gray N3, carbonaceous.   |
| 9720           | 9730      | Shale as above, little light olive gray, slightly saccharoidal, dolomite.                            |
| 9730           | 9740      | Shale as above and much dolomite as above.   |
| 9740           | 9750      | Shale and some dolomite as above, medium gray limestone with slight brown tinge, dense.              |
| 9750           | 9760      | Dolomite, gray orange pink 5YR7/2, dense.  |
| 9760           | 9770      | Dolomite as above and very light gray, dense dolomite.   |
| 9770           | 9780      | Dolomite, gray orange pink, dense.   |
| 9780           | 9790      | Dolomite as above, and white anhydrite.  |
| 9790           | 9800      | Dolomite, gray orange pink, dense.   |
| 9800           | 9810      | Dolomite as above, pale red 10R6/2 shale, calcareous.  |
| 9810           | 9820      | Dolomite and shale as above, medium light gray shale, calcareous.                                    |
| 9820           | 9830      | Dolomite as above, pale red and medium light gray shale, calcareous, slight green tinge under scope. |
| 9830           | 9840      | Dolomite as above, pale red and green gray 5GY6/1, slightly calcareous.                              |
| 9840           | 9850      | Shale, pale red and green gray 5GY6/1, slightly calcareous.  |
| 9850           | 9860      | Dolomite and shale as above.   |
| 9860           | 9870      | Dolomite as above, probably cave, shale as above, green gray 5G6/1.                                  |
| 9870           | 9880      | Missing.   |
| 9880           | 9890      | Shale as above, medium light gray limestone, fine grain, dense.                                      |
| 9990           | 9900      | Shale as above, some dark gray N3 and medium gray N5 limestone, dense.                               |

| <u>From</u>                   | <u>To</u>  | <u>Formation</u>   |
|-------------------------------|------------|--|
| Upper Devonian Limestone 9910 |            |  |
| 9900                          | 9910       | Variegated shale, little dolomite as above and little limestone as above, white anhydrite.       |
| 9910                          | 9920       | Variegated shale, little limestone as above, dense; white anhydrite.                             |
| 9920                          | 9930       | Limestone, dusky yellow brown 10YR2/2, lithographic, little light gray, dense; little anhydrite. |
| 9930                          | 9950       | Limestone as above, little porosity in few fragments.  |
| 9950                          | 9960       | Limestone as above.  |
| 9960                          | 9970       | Limestone as above and very light gray N8, little porosity in few fragments.                     |
| 9970                          | 9980       | Limestone as above and little white anhydrite.   |
| 9980                          | 9990       | Limestone as above, some light brown gray, slightly saccharoidal dolomite.                       |
| 9990                          | 10,000     | Limestone as above, some light brown gray limestone, little pinpoint porosity.                   |
| 10,000                        | 10,010     | Missing.   |
| 10,010                        | 10,020     | Limestone, dusky yellow brown and very light gray, quite dense, little porosity.                 |
| 10,020                        | 10,030     | Missing.   |
| 10,030                        | 10,040     | Limestone, as above.   |
| 10,040                        | 10,080     | Limestone, as above, dense, fine grained.  |
| 10,080                        | 10,090     | Limestone as above, dense.   |
| 10,090                        | 10,100     | Limestone as above and white anhydrite.  |
| 10,100                        | 10,110     | Limestone as above and little white anhydrite.   |
| 10,110                        | 10,120     | Limestone as above and white anhydrite.  |
| 10,120                        | 10,140     | Limestone as above and little white anhydrite.   |
| 10,140                        | 10,180     | Limestone as above.  |
| 10,180                        | 10,190     | Limestone as above; dolomite, pale yellow brown 10YR6/2, slightly saccharoidal, some porosity.   |
| Core                          |            |  |
| 10,192                        | 10,198 1/2 | Limestone, light olive gray, slightly saccharoidal, quite dense.                                 |
| 10,198 1/2                    | 10,202     | Limestone, dusky yellow brown, white anhydrite.  |
| 10,202                        | 10,207     | Limestone, medium dark yellow brown, little pinpoint porosity.                                   |
| 10,207                        | 10,210     | Limestone, dusky yellow brown, dense, very few vugs, stain in one vug.                           |
| 10,210                        | 10,212     | Limestone, dark yellow brown, dense, very few vugs, stain in one vug.                            |
| 10,212                        | 10,225     | Dolomite, light gray N7, porosity, carbonaceous residue.   |
| 10,226                        | 10,233     | Limestone, dusky yellow brown, dense.  |
| End of Core                   |            |  |
| 10,230                        | 10,240     | Limestone, pale yellow brown to dusky brown, little porosity, and some anhydrite.                |
| 10,240                        | 10,270     | Limestone, dusky brown to light gray.  |
| 10,270                        | 10,280     | Limestone as above, dense, some slightly saccharoidal.   |
| Core #9                       |            |  |
| 10,280                        | 10,285     | Limestone, dusky yellow brown, dense.  |
| 10,285                        | 10,299     | Limestone, pale yellow brown, dense, finely crystalline.   |



| <u>From</u> | <u>To</u> | <u>Formation</u>   |
|-------------|-----------|--|
| 10,299      | 10,312    | Dolomite, dusky brown 5YR2/2, lithographic.  |
| 10,312      | 10,321    | Limestone, dark yellow brown, dense, fine grained.   |
| 10,321      | 10,323    | Dolomite, brown gray 5YR4/1, dense, fine grained.  |
| 10,323      | 10,326    | Limestone, dark yellow brown 10YR4/2, dense, fine grained.   |
| 10,331      | 10,332    | Dolomite, pale yellow brown, dense, fine grained.  |
| 10,332      | 10,336    | Dolomite, dusky yellow brown, dense. Limestone, dusky yellow brown to dusky brown 5YR3/2.                    |
| 10,338      | 10,339    | Dolomite, pale yellow brown 10YR6/2, dense.  |
| 10,339      | 10,344    | Dolomite, dusky brown, dense, fine grained.  |
| 10,344      | 10,362    | Limestone, dark yellow brown, dense, fine grained.   |
| End of Core |           |  |
| 10,360      | 10,370    | Limestone, brown gray, slightly saccharoidal, and yellow gray with little pinpoint porosity, some red shale. |
| 10,370      | 10,380    | Limestone as above and dusky yellow brown dense.   |
| 10,380      | 10,390    | Limestone as above, some slightly saccharoidal and some red shale.   |
| 10,390      | 10,400    | Limestone as above, dense, finely crystalline.   |
| 10,400      | 10,410    | Limestone as above, dense, some yellow gray limestone; little white anhydrite.                               |
| 10,410      | 10,420    | Limestone as above and red and gray shale.   |
| 10,420      | 10,430    | Dolomite, dusky yellow brown, dense, some slightly saccharoidal, some white anhydrite, red and black shale.  |
| 10,430      | 10,440    | Missing.   |
| 10,440      | 10,450    | Limestone, dusky yellow brown, dense; shale as above and some white anhydrite.                               |
| 10,450      | 10,460    | Dolomite, light brown gray, slightly saccharoidal, shale as above, some yellow gray dolomite.                |
| 10,460      | 10,470    | Missing.   |
| 10,470      | 10,480    | Limestone, medium dark gray N4, dense; shale as above, little anhydrite.                                     |
| 10,480      | 10,490    | Limestone, medium dark gray and dusky yellow brown 10YR2/2 dense, little shale as above.                     |
| 10,490      | 10,500    | Missing.   |
| 10,500      | 10,510    | Dolomite, medium dark gray, dense, some slightly saccharoidal; dusky yellow brown limestone, dense.          |
| 10,510      | 10,520    | Dolomite as above, little shale, red and dark gray N3.   |
| 10,520      | 10,530    | Limestone, medium gray, dense; little shale as above and little white anhydrite.                             |
| 10,530      | 10,540    | Dolomite, medium light gray, dense and medium gray limestone, dense.   |
| 10,540      | 10,550    | Same as above with some white anhydrite.   |
| 10,550      | 10,570    | Missing.   |
| 10,570      | 10,580    | Limestone, gray brown 5YR3/2, dense, very fine grained; light gray dense limestone.                          |
| 10,580      | 10,585    | Limestone, gray brown 5YR3/2, dense; light gray dolomite, dense slightly saccharoidal.                       |
| 10,585      | 10,590    | Dolomite, medium light gray, dense, some limestone as above.   |

| <u>From</u>         | <u>To</u> | <u>Formation</u>   |
|---------------------|-----------|--|
| 10,590              | 10,595    | Dolomite as above, little white anhydrite.   |
| 10,595              | 10,610    | Dolomite as above.   |
| 10,610              | 10,620    | Dolomite as above and medium gray, dense, limestone.   |
| 10,620              | 10,630    | Mostly dolomite as above, some limestone as above with little white anhydrite at 30.                   |
| 10,630              | 10,635    | Limestone, medium gray N5 dense, some yellow brown, dense, limestone.                                  |
| 10,635              | 10,640    | Limestone, medium gray N5, dense.  |
| 10,640              | 10,650    | Limestone, medium dark gray N4, dense, some yellow brown, dense limestone.                             |
| 10,650              | 10,655    | Dolomite, medium light gray, dense. Some yellow brown limestone, dense.                                |
| 10,655              | 10,660    | As above, little white anhydrite.  |
| 10,660              | 10,665    | Little dolomite as above, little white anhydrite, yellow brown and gray limestone, dense.              |
| 10,665              | 10,670    | Dolomite, medium gray dense; yellow brown limestone, dense.  |
| 10,670              | 10,685    | Light to medium gray limestone, dense.   |
| 10,685              | 10,690    | Dolomite, medium gray dense, yellow gray limestone and brown gray and medium gray dense limestone.     |
| 10,690              | 10,695    | Limestone, light to medium gray, dense, some light olive gray limestone.                               |
| Manitoban 10,700    |           |  |
| 10,695              | 10,710    | Limestone as above and white anhydrite.  |
| 10,710              | 10,740    | As above, dense.   |
| 10,741              | 10,746    | Dolomite, light gray dense and medium gray limestone.  |
| 10,740              | 10,750    | Dolomite, yellow gray dense, medium gray limestone.  |
| 10,750              | 10,760    | Dolomite, yellow gray 5Y8/1 dense, some medium gray limestone and dolomite.                            |
| 10,760              | 10,775    | Dolomite, medium gray N5 and yellow gray dense.  |
| 10,775              | 10,780    | Dolomite as above, brown gray 5YR4/1, slightly saccharoidal, some pinpoint porosity,                   |
| 10,780              | 10,785    | Dolomite, brown gray, saccharoidal, fair porosity.   |
| 10,785              | 10,800    | Dolomite as above, some white anhydrite.   |
| 10,800              | 10,805    | Dolomite as above.   |
| 10,805              | 10,810    | Dolomite as above, some medium gray dolomite.  |
| 10,810              | 10,830    | Dolomite, brown gray, saccharoidal, fair porosity.   |
| 10,830              | 10,835    | Dolomite as above, some porosity.  |
| 10,835              | 10,850    | Dolomite as above, little white anhydrite.   |
| 10,850              | 10,855    | Dolomite as above, little porosity, slightly saccharoidal, little white anhydrite.                     |
| 10,855              | 10,870    | Dolomite, brown gray saccharoidal, little porosity.  |
| 10,870              | 10,875    | Dolomite as above and light gray limestone.  |
| 10,875              | 10,880    | Dolomite as above, little pinpoint porosity.   |
| 10,880              | 10,885    | Dolomite as above and light gray limestone.  |
| 10,885              | 10,890    | Limestone, light gray dense.   |
| Winnipegosan 10,895 |           |  |
| 10,895              | 10,915    | Limestone, light to medium gray and brown gray dolomitic, dense.<br>Same as above; dense at 10 and 15. |

| <u>From</u>   | <u>To</u> | <u>Formation</u>  |
|---------------|-----------|---|
| 10,915        | 10,955    | Limestone as above, dense and little gray orange pink shale.  |
| 10,955        | 10,960    | Limestone as above, dense, little dolomite, slightly saccharoidal; little coating of salt on cuttings.          |
| Devonian Salt |           |   |
| 10,960        | 10,965    | Limestone as above and little salt; red shale as above.   |
| 10,965        | 10,970    | Limestone as above, little salt and red shale.  |
| 10,970        | 10,975    | Limestone as above and salt.  |
| 10,975        | 10,980    | Limestone as above, mostly salt.  |
| 10,980        | 10,985    | Salt.   |
| 10,985        | 10,990    | Limestone and salt.   |
| 10,990        | 11,190    | Salt.   |
| 11,190        | 11,195    | Salt and little medium dolomite.  |
| 11,195        | 11,200    | Salt and medium gray dolomite; limestone, dense.  |
| 11,200        | 11,205    | Medium light gray N6 to medium dark gray N5 dolomite dense; little salt and little brown gray limestone, dense. |
| 11,205        | 11,210    | Medium light gray to medium dark gray limestone, dense.   |
| 11,210        | 11,215    | Limestone as above, little gray orange pink shale.  |
| 11,215        | 11,230    | Limestone as above, little shale as above and some white anhydrite.   |
| 11,230        | 11,235    | Limestone as above, little gray orange pink shale.  |
| 11,235        | 11,240    | Same as above, little white anhydrite.  |
| 11,240        | 11,245    | Same as above, some pale yellow brown dense limestone.  |
| 11,245        | 11,265    | Limestone, medium light gray to medium gray, a little brown gray; little white anhydrite and shale as above.    |
| 11,265        | 11,270    | Dolomite, light gray and pale yellow brown, dense; little white anhydrite and shale as above.                   |
| 11,270        | 11,275    | As above, little pinpoint porosity; some medium to medium dark gray dolomite.                                   |
| 11,275        | 11,290    | Limestone, color as above, quite dense, dolomite at 90.   |
| 11,290        | 11,300    | Dolomite, brown gray, slightly saccharoidal, little porosity.   |
| 11,300        | 11,305    | Dolomite, brown gray, slightly saccharoidal.  |
| 11,305        | 11,315    | Limestone, brown gray and light brown gray, slightly saccharoidal, little pinpoint porosity, little dolomite.   |
| 11,315        | 11,320    | Limestone, medium gray N5 to brown gray, little pinpoint porosity.  |
| 11,320        | 11,325    | Limestone as above, little salt.  |
| 11,325        | 11,330    | Limestone as above, fine grained.   |
| 11,330        | 11,335    | Limestone, dark gray N3 and limestone as above, dense.  |
| 11,335        | 11,350    | Limestone as above, fine grained, dense.  |
| 11,350        | 11,355    | Limestone, light gray N7 and medium dark gray, dense.   |
| 11,355        | 11,360    | Limestone as above, salt coating on cutting.  |
| 11,360        | 11,440    | Limestone as above.   |

| <u>From</u>               | <u>To</u>  | <u>Formation</u>  |
|---------------------------|------------|---|
| 11,440                    | 11,445     | Limestone, light gray N7 to brown gray, finely crystalline, dense.                                      |
| 11,445                    | 11,450     | Limestone as above, dense, finely crystalline.  |
| 11,450                    | 11,455     | Limestone as above, little white anhydrite.   |
| 11,455                    | 11,470     | Some limestone as above, medium light gray N6 dense, dolomite.  |
| 11,470                    | 11,475     | Light gray N7 dense dolomite, brown gray dense limestone.   |
| 11,475                    | 11,485     | Limestone, light gray N7 to medium dark gray N4, dense.   |
| Core #10                  |            |   |
| 11,482                    | 11,505     | Dolomite, medium gray N5 dense fine grained.  |
| Core #11 Ashern 11,539    |            |   |
| 11,505                    | 11,539     | Limestone, brown gray, dense, fine grained.   |
| 11,539                    | 11,548     | Dolomite, gray orange pink, dense, fine grained.  |
| Core #12 Stonewall 11,564 |            |   |
| 11,548                    | 11,564     | Dolomite, pale yellow brown and medium dark gray, dense sublithographic laminated.                      |
| End of Core               |            |   |
| 11,564                    | 11,588     | Dolomite, white, fair to good porosity, white to light gray, dense, saccharoidal, some white anhydrite. |
| 11,588                    | 11,590     | Dolomite, light gray dense and little white anhydrite.  |
| Core #13                  |            |   |
| 11,603                    | 11,619 1/2 | Dolomite, white, dense, few pinpoint vugs, sublithographic.   |
| 11,619 1/2                | 11,620     | Dolomite, gray orange pink, sublithographic.  |
| End of Core               |            |   |
| Core #14                  |            |   |
| 11,622                    | 11,665     | Dolomite, very light gray, few pinpoint vugs sublithographic  |
| End of Core               |            |   |
| 11,665                    | 11,675     | Dolomite as above.  |
| 11,675                    | 11,685     | Dolomite as above and some pale yellow brown dolomite, dense, few vugs.                                 |
| 11,685                    | 11,690     | Dolomite as above, good porosity in pale yellow brown dolomite.   |
| 11,690                    | 11,695     | Dolomite as above, some pinpoint porosity.  |
| 11,695                    | 11,700     | Missing.  |
| 11,700                    | 11,705     | Dolomite as above, some pinpoint porosity.  |
| 11,705                    | 11,710     | Dolomite, yellow gray to light gray, same as above, some pinpoint porosity.                             |
| 11,710                    | 11,715     | Dolomite as above, very pale yellow brown, some pinpoint porosity, sublithographic.                     |
| 11,715                    | 11,725     | Dolomite as above, some porosity.   |
| 11,725                    | 11,730     | Dolomite as, above, little pinpoint porosity.   |
| 11,730                    | 11,755     | Dolomite as above sublithographic.  |

| <u>From</u> | <u>To</u> | <u>Formation</u>  |
|-------------|-----------|---|
| 11,755      | 11,765    | Same as above with little pinpoint porosity.  |
| 11,765      | 11,770    | Dolomite as above, sublithographic.   |
| 11,770      | 11,825    | Dolomite as above, sublithographic, little pinpoint porosity.                           |
| 11,825      | 11,835    | Dolomite as above, sublithographic.   |
| 11,835      | 11,840    | Same as above, little pinpoint porosity.  |
| 11,840      | 11,845    | Dolomite as above, sublithographic.   |
| 11,845      | 11,855    | Same as above, little pinpoint porosity.  |
| 11,855      | 11,860    | Dolomite as above, some gray brown dolomite 5YR3/2.                                     |
| 11,860      | 11,870    | Dolomite, same as above, fair porosity.   |
| 11,870      | 11,880    | Dolomite, mostly dark yellow brown; sublithographic.                                    |
| 11,800      | 11,890    | Dolomite, same as above, sublithographic, little pinpoint porosity.                     |
| 11,890      | 11,910    | Dolomite, same as above, fair porosity.   |
| 11,910      | 11,915    | Dolomite, same as above, fair porosity, some light gray, sublithographic.               |
| 11,915      | 11,920    | Dolomite, dark yellow brown, fair porosity, mostly light gray, dense lithographic.      |
| 11,920      | 11,925    | Dolomite, mostly light gray, dense lithographic.  |
| 11,925      | 11,935    | Dolomite, mostly light gray, dense sublithographic, little pinpoint porosity.           |
| 11,935      | 11,945    | Dolomite, light gray to yellow gray 5Y8/1, sublithographic, dense.                      |
| 11,945      | 11,950    | Dolomite same as above, some slightly pinkish.  |
| 11,950      | 11,960    | Dolomite sane as above, some pale red 10R6/2.   |
| 11,960      | 11,975    | Dolomite, yellow gray to light gray, little pinpoint porosity.                          |
| 11,975      | 11,980    | Dolomite as above, fair pinpoint porosity.  |
| 11,980      | 11,985    | Same as above with some pinpoint porosity.  |
| 11,985      | 11,990    | Same as above with little pinpoint porosity.  |
| 11,990      | 12,000    | Dolomite as above, dense.   |
| 12,000      | 12,010    | Dolomite as above, little pinpoint porosity.  |
| 12,010      | 12,015    | Dolomite as above, little pinpoint porosity, fine grained.                              |
| 12,015      | 12,035    | Dolomite as above fine grained and some gray red, purple 5RP4/2, fine grained dolomite. |
| 12,035      | 12,040    | Dolomite as above, little medium dark gray N4 shale.                                    |
| 12,040      | 12,045    | Dolomite as above, shale as above and little green gray shale 5GY6/1.                   |
| 12,045      | 12,055    | Dolomite, mostly light gray to yellow gray, dense; little gray red purple.              |
| 12,055      | 12,060    | Dolomite as above, fine grained, little pinpoint porosity; little shale as above.       |
| 12,060      | 12,070    | Dolomite as above, some slightly saccharoidal, little pinpoint porosity.                |
| 12,070      | 12,075    | Dolomite as above, some saccharoidal, fair porosity.                                    |
| 12,075      | 12,085    | Dolomite as above, saccharoidal, little pinpoint porosity.                              |
| 12,085      | 12,090    | Dolomite as above, saccharoidal, dense.   |
| 12,090      | 12,100    | Dolomite as above, sublithographic, little pinpoint porosity.                           |
| 12,100      | 12,110    | Dolomite as above, dense little pinpoint porosity.                                      |

| <u>From</u> | <u>To</u> | <u>Formation</u>   |
|-------------|-----------|--|
| 12,110      | 12,120    | Dolomite as above, sublithographic.  |
| 12,120      | 12,125    | Dolomite as above, sublithographic, little pinpoint, porosity.   |
| 12,125      | 12,135    | Dolomite as above, dense, little pinpoint porosity.  |
| 12,135      | 12,145    | Dolomite, much light brown gray fine grained, dolomite as above, little pinpoint porosity. Dense at 45.                |
| 12,145      | 12,155    | Dolomite as above, much light brown gray, dense, fine grained.   |
| 12,155      | 12,165    | Dolomite, light gray, fine grained, dense.   |
| 12,165      | 12,170    | Dolomite as above, some light brown gray, fine grained.  |
| 12,170      | 12,180    | Dolomite, light olive gray, little pinpoint porosity, fine grained, dense, some slightly saccharoidal.                 |
| 12,180      | 12,185    | Missing.   |
| 12,185      | 12,190    | Same as above.   |
| 12,190      | 12,195    | Missing.   |
| 12,195      | 12,200    | Dolomite, yellow gray to light brown gray, dense, very little porosity.  |
| 12,200      | 12,210    | Dolomite, pale yellow brown, dense some slightly saccharoidal, little pinpoint porosity at 10'.                        |
| 12,210      | 12,225    | Dolomite, pale yellow brown, dense, fine grained, some slightly saccharoidal.  |
| 12,225      | 12,235    | Dolomite, pale yellow brown, dense, fine grained, salt efflorescence, salt crystal; some slightly saccharoidal at 35'. |
| 12,235      | 12,240    | Missing.   |
| 12,240      | 12,245    | Dolomite, pale yellow brown to gray brown, dense, fine grained.  |
| 12,245      | 12,250    | Dolomite as above, dense to sublithographic, some slightly saccharoidal.   |
| 12,250      | 12,255    | Dolomite as above, dense to sublithographic.   |
| 12,255      | 12,285    | Missing.   |
| 12,285      | 12,305    | Dolomite same as above mostly gray brown piece chert at 95.  |
| 12,305      | 12,310    | Dolomite, gray brown and pale yellow brown, dense, fine grained.   |
| 12,310      | 12,315    | Dolomite as above, dense, fine grained to sublithographic.   |
| 12,315      | 12,325    | Dolomite as above, some slightly saccharoidal.   |
| 12,325      | 12,335    | Dolomite, color as above, slightly saccharoidal, little pinpoint porosity.   |
| 12,335      | 12,340    | Missing.   |
| 12,340      | 12,345    | Dolomite as above, dense to slightly saccharoidal.   |
| 12,345      | 12,355    | Dolomite as above, little pinpoint porosity, dense to slightly saccharoidal.   |
| 12,355      | 12,365    | Dolomite as above, dense to slightly saccharoidal.   |
| 12,365      | 12,370    | Dolomite as above, little pinpoint porosity.   |
| 12,370      | 12,385    | Missing.   |
| 12,385      | 12,390    | Dolomite as above, some pinpoint porosity, white anhydrite and red shale.  |

| <u>From</u> | <u>To</u>  | <u>Formation</u>   |
|-------------|------------|--|
| 12,390      | 12,395     | Dolomite, color as above, dense, little white anhydrite.                             |
| 12,395      | 12,400     | Dolomite color as above, dense, little porosity.                                     |
| 12,400      | 12,405     | Dolomite, color as above, dense.   |
| 12,405      | 12,410     | Dolomite, color as above, dense, little pinpoint porosity.                           |
| 12,410      | 12,420     | Dolomite, color as above, dense, little white anhydrite.                             |
| 12,420      | 12,435     | Dolomite, color as above, dense.   |
| 12,435      | 12,481     | Dolomite, as above, dirty sample. 70 - Missing.                                      |
| Core #16    |            |  |
| 12,481      | 12,521     |  |
|             | 2 1/2      | Dolomite, dusky yellow brown, fine grained, dense.                                   |
|             | 2nd 5'     | Dolomite, medium dark gray, dense.   |
|             | 12 1/2     | Dolomite, brown gray 5YR4/1, dense.  |
|             | 13         | Dolomite, dark yellow brown, 10YR4/2, dense.   |
|             | 4          | Dolomite, same as above, finely crystalline, dense.                                  |
| End of Core |            |  |
| 12,620      | 12,625     | Dolomite, same as above.   |
| 12,625      | 12,645     | Dolomite, dusky yellow brown, dense.   |
| Core #17    |            |  |
| 12,551      | 12,566     |  |
| Top         | 1/2        | Limestone, gray brown 5YR3/2, dense.   |
| Middle      | 9 1/2      | Limestone, medium dark gray N4, dense.   |
| Bottom      | 1 1/2      | Dolomite and limestone, medium gray N5, dense.                                       |
| End of Core |            |  |
| Core #18    |            |  |
| 12,568      | 12,571 1/2 | Dolomite, brown gray, dense, sublithographic.  |
| 12,571 1/2  | 12,581     | Dolomite, brown gray, dense and light brown gray 5YR6/1.                             |
| 12,581      | 12,598     | Dolomite, dusky yellow brown, dense, fine grained, dense.                            |
| 12,598      | 12,601     | Dolomite, dusky yellow brown, fine grained, dense, few fractures.                    |
| 12,601      | 12,603     | Dolomite, dusky brown, fine grained, dense, little pyrite.                           |
| 12,603      | 12,611     | Dolomite, same as above.   |
| End of Core |            |  |
| Core #19    |            |  |
| 12,611      | 12,615     | Dolomite, same as above.   |
| 12,615      | 12,619     | Dolomite, medium dark gray N4, fine grained, dense.                                  |
| 12,619      | 12,622     | Dolomite, dusky yellow brown to gray brown, fine grained, dense, anhydritic in part. |
| 12,622      | 12,630     | Dolomite, dusky yellow brown, fine grained, dense.                                   |
| 12,630      | 12,636     | Dolomite, dark gray N3, dense, shaley.   |
| 12,636      | 12,643     | Dolomite, dusky brown, fine grained, dense.  |
| 12,643      | 12,645     | Dolomite, medium dark gray N4, fine grained, dense.                                  |
| 12,645      | 12,646     | Dolomite, light olive gray, anhydritic, dense.                                       |
| End of Core |            |  |

| <u>From</u>                        | <u>To</u> | <u>Formation</u>  |
|------------------------------------|-----------|---|
| 12,646                             | 12,650    | Dolomite as above.  |
| 12,650                             | 12,655    | Dolomite, medium dark gray, fine grained dense dolomite, some white anhydrite.      |
| 12,655                             | 12,665    | Dolomite as above, little dense pale yellow brown limestone.                        |
| 12,665                             | 12,690    | Limestone, medium dark gray N4, dense.  |
| 12,690                             | 12,695    | Limestone as above and yellow gray, 5Y8/1, dense.                                   |
| 12,695                             | 12,700    | Limestone as above, yellow gray and some light brown gray 5YR6/1, dense.            |
| 12,700                             | 12,710    | Dolomite, light brown gray, dense.  |
| 12,710                             | 12,735    | Dolomite, light olive gray 5Y6/1, dense.  |
| 12,735                             | 12,740    | Dolomite as above and brown gray, dense.  |
| 12,740                             | 12,745    | Limestone, color as above, some yellow gray, dense.                                 |
| 12,745                             | 12,750    | Missing.  |
| Stony Mountain Shale Member 12,755 |           |   |
| 12,750                             | 12,755    | Limestone, light brown gray and medium dark gray, dense.                            |
| 12,755                             | 12,760    | Limestone, medium dark gray, some brown gray, dense.                                |
| 12,760                             | 12,765    | Limestone, brown gray 5YR4/1.   |
| 12,765                             | 12,770    | Limestone, medium dark gray N4 with brown mottling, dense.                          |
| 12,770                             | 12,780    | Limestone, brown gray and medium dark gray, dense.                                  |
| 12,780                             | 12,810    | Limestone, same as above, some yellow gray, dense, mostly brown gray.               |
| 12,810                             | 12,815    | Limestone as above, little white anhydrite.   |
| 12,815                             | 12,825    | Limestone as above.   |
| Red River Formation 12,825         |           |   |
| 12,825                             | 12,830    | Limestone, brown gray to medium dark gray, dense.                                   |
| 12,830                             | 12,845    | Limestone, brown gray and very light gray N8, dense.                                |
| 12,845                             | 12,850    | Same as above, sublithographic.   |
| 12,850                             | 12,890    | Limestone as above, brown gray is sublithographic.                                  |
| 12,890                             | 12,900    | Dolomite, light brown gray, and brown gray, dense, and medium gray N5 limestone.    |
| 12,900                             | 12,905    | Limestone as above, fine grained, dense.  |
| 12,905                             | 12,940    | Limestone as above.   |
| 12,940                             | 12,945    | Limestone and dolomite, color as above, dense, fine grained.                        |
| 12,945                             | 12,960    | Dolomite, color as above, dense, little limestone.                                  |
| 12,960                             | 12,965    | Same as above.  |
| 12,965                             | 12,970    | Dolomite, same as above, mostly gray brown 5YR3/2.                                  |
| 12,970                             | 12,975    | Dolomite, same as above, some slightly saccharoidal.                                |
| Core #20                           |           |   |
| 12,976                             | 12,983    | Dolomite, yellow gray, dense and brown gray dense, hard dolomite, yellow gray soft. |
| 12,983                             | 12,993    | Dolomite and limestone, color as above, some slightly saccharoidal staining.        |
| 12,993                             | 12,995    | Dolomite, brown gray, fine grained.   |
| 12,995                             | 12,999    | Dolomite, as above, little pale yellow brown limestone slightly saccharoidal.       |



| <u>From</u>                  | <u>To</u> | <u>Formation</u>  |
|------------------------------|-----------|---|
| 12,999                       | 13,027    | Dolomite as above, little pale yellow brown dolomite, slightly saccharoidal, fair porosity. |
| 13,027                       | 13,034    | Limestone, gray brown, sublithographic dense, little pyrite.                                |
| End of Core                  |           |   |
| 13,035                       | 13,040    | Limestone as above, some slightly saccharoidal.   |
| 13,040                       | 13,045    | Limestone as above, some slightly saccharoidal, few pieces of white anhydrite.              |
| 13,045                       | 13,050    | Limestone as above, some dense to slightly saccharoidal.                                    |
| 13,450                       | 13,055    | Limestone, light gray to brown gray, dense to slightly saccharoidal.                        |
| 13,055                       | 13,070    | Limestone as above, fine grained, slightly saccharoidal.                                    |
| 13,070                       | 13,080    | Limestone as above, fine grained, quite dense.  |
| 13,080                       | 13,085    | Limestone as above, fine grained, dense.  |
| 13,085                       | 13,090    | Limestone as above, fine grained, dense, some slightly saccharoidal.                        |
| 13,090                       | 13,095    | Limestone as above, fine grained, dense to slightly saccharoidal.                           |
| 13,095                       | 13,120    | Limestone as above, fine grained, dense.  |
| 13,120                       | 13,125    | Missing.  |
| 13,125                       | 13,145    | Same as above.  |
| 13,145                       | 13,165    | Limestone as above, some slightly saccharoidal.   |
| 13,165                       | 13,200    | Limestone same as above, dense.   |
| 13,200                       | 13,205    | Limestone, light gray and medium gray with some brown gray mottling, dense.                 |
| 13,205                       | 13,210    | Limestone same as above, some brown gray, dense.  |
| 13,210                       | 13,225    | Limestone, light gray and brown gray as above, dense.                                       |
| 13,225                       | 13,230    | Limestone as above, little white anhydrite.   |
| 13,230                       | 13,270    | Limestone same as above.  |
| 13,270                       | 13,325    | Limestone same as above, dense to sublithographic.  |
| 13,325                       | 13,345    | Limestone same as above, dense.   |
| 13,345                       | 13,350    | Limestone same as above, dense, sublithographic.  |
| 13,350                       | 13,355    | Missing.  |
| 13,355                       | 13,410    | Limestone same as above, dense, sublithographic.  |
| Winnipeg Shale Member 13,410 |           |   |
| 13,410                       | 13,420    | Gray shale and some limestone as above.   |
| 13,420                       | 13,425    | Limestone as above, some medium dark gray shale.  |
| 13,425                       | 13,430    | Mostly shale as above, some limestone as above.   |
| 13,430                       | 13,445    | Shale as above.   |
| 13,445                       | 13,450    | Shale as above and some limestone as above.   |
| 13,450                       | 13,465    | Shale as above and some limestone as above.   |
| 13,465                       | 13,475    | Shale, dark gray N3 and some limestone as above.  |
| 13,475                       | 13,495    | Shale as above.   |
| 13,495                       | 13,500    | Missing.  |
| 13,500                       | 13,505    | Shale as above, splintery.  |
| 13,505                       | 13,520    | Shale, as above.  |
| 13,520                       | 13,525    | Missing.  |
| 13,525                       | 13,535    | Shale as above.   |
| 13,535                       | 13,540    | Shale as above, some limestone as above (cave ?).   |

| <u>From</u>          | <u>To</u>   | <u>Formation</u>  |
|----------------------|-------------|---|
| 13,540               | 13,545      | Missing.  |
| 13,545               | 13,550      | Shale as above.   |
| 13,550               | 13,555      | Missing.  |
| Winnipeg Sand 13,559 |             |   |
| 13,555               | 13,560      | Shale as above and some limestone (cave ?) as above, little cemented sandstone.   |
| 13,560               | 13,570      | Shale as above and some limestone {cave ?} as above, white sandstone, medium grained, tight.                                  |
| Core #21             |             |   |
| 13,572               | 13,629      | Sandstone, medium dark gray N4 to light gray N7, medium grained, tight.   |
| Core #22             |             |   |
| 13,629               | 13,642      | Sandstone, very light gray, hard - poor to fair porosity mottled by black residue, medium to coarse grained.                  |
| 13,642               | 13,656 1/2  | Sandstone, same as above, poor porosity, dense.   |
| 13,656 1/2           | 13,658      | Sandstone, very light gray, little black residue, hard tight.   |
| Core #23             |             |   |
| 13,658               | 13,664      | Sandstone, clear to light gray, little pyrite, hard, tight and clear, fine to medium grained, hard tight, some black residue. |
| Core #24             |             |   |
| 13,664               | 13,669      | Sandstone, medium light gray N6, medium grained, hard tight.  |
| Core #25             |             |   |
| 13,699               | 13,709      | Sandstone, same as above, some black residue no porosity.   |
|                      | 2nd Section | Very light gray N8, fine grained, no porosity, little black residue.  |
|                      | 3rd Section | Same as above.  |
|                      | 4th Section | Light gray N7, medium grained, hard tight.  |
| Total Depth 13,709   |             |   |