

## **SUMMARY OF WELL DATA**

**WELL NAME:** CASPER HZ BANTRY 1-23-14-11

**UNIQUE I.D.:** 103/01-23-014-11W4/0

**SURFACE CO-ORDINATES:** 1000.94m NORTH, 00.36m WEST (S.00)

**BOTTOM HOLE CO-ORD'S:** 00.0m NORTH, 000.2m WEST (S00)

**DRILLING LICENCE:** 04444

**GROUND ELEVATION:** 745.2m                      **K.B. ELEVATION:** 749.55m

**DATE SPUDDED:** 11:15 hours, January 11, 2013.

**DRILLING COMPLETED:** 07:30 hours, January 22, 2013.

**RIG RELEASED:** 23:59 hours, January 25, 2013.

**SURFACE CASING:** Ran 24 joints of 244.5mm, 53.57kg/m, J-55, LIGHT&C, new Pacrim casing. Landed @ 286.0m K.B. Cemented with 27 tonnes of SurfCem 1700 1%FP 19 + 3% CaCl<sub>2</sub>. Had 9m<sup>3</sup> returns.

**INTERMEDIATE CASING:** Ran 94 joints of 177.8 mm, 34.23 kg/m J55 Lida-80 casing. Landed @ 1121.0m KB. Cemented with 19 tonnes of SpectraCem. Had 8m<sup>3</sup> of returns.

**HOLE SIZE:** 159mm

**TOTAL DEPTH** 2863.00m

**DRILLSTEM TESTS:** None

**CORES:** None

**CONTRACTOR:** Precision Drilling                      **RIG NO.:** PD 417

**CASPER HZ BANTRY 1-23-14-11**  
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**RIG SUPERVISOR:** Mike Smith

**GEOLOGIST:** Craig Jonest/Tim Smithe

**OPERATOR:** CASPER ENERGY LTD

**WELL STATUS:** Potential Glauconite Channel Sandstone oil well.

**MARKERS & FORMATION TOPS**

FORMATION	PROGNOSIS			SAMPLES			LOGS		
	M.D.	T.V.D.	Subsea	M.D.	T.V.D.	Subsea	M.D.	T.V.D.	Subsea
PAKOWKI	235.6	235.6	514.0	NA	NA	NA	NA	NA	NA
MILK RIVER	277.6	277.6	472.0	NA	NA	NA	NA	NA	NA
COLRADO	366.6	366.6	383.0	NA	NA	NA	NA	NA	NA
MEDICINE HAT	405.6	405.6	344.0	NA	NA	NA	NA	NA	NA
SECOND WHITE SPECKS	614.6	614.6	135.0	NA	NA	NA	NA	NA	NA
BASE FISH SCALES	685.6	685.6	64	NA	NA	NA	NA	NA	NA
BOW ISLAND	740.8	739.7	9.8	NA	NA	NA	NA	NA	NA
MANNVILLE	871.8	847.6	-98.0	872.0	849.8	-100.2	NA	NA	NA
TOP GLAUCONITE CHANNEL SANDSTONE	1073.6	921.6	-172.0	1060.0	921.8	-172.3	NA	NA	NA

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TOTAL DEPTH      2950.8      925.5      -177.0      2863.0      937.5      -187.9      NA      NA      NA

**GROUND  
ELEVATION:**      **745.2m**

**T.D. DRILLER: 2863.0m**

**K.B.  
ELEVATION:**      **749.6m**

**T.D. LOGGER:      NA**

**BIT RECORD**

<b>BIT NO.</b>	<b>SIZE (mm)</b>	<b>TYPE</b>	<b>SERIAL NO.</b>	<b>IN</b>	<b>OUT</b>	<b>METRES</b>	<b>HRS.</b>	<b>AVE. R.O.P.</b>	<b>CONDITION</b>
1A	349	LH117	20652	0.0	236.0	236.0	16.75	14.1	N/R
2A	349	L121	935280	277.0	286.0	9.0	1.00	9.0	N/R
1	222	U513S	12670	286.0	1121.0	835.0	31.3	26.7	2-2-WT-A- X-0.0-NO- TD
2	159	U513M	21415	1121.0	2863.0	1742.0	68	25.6	N/R

**SURVEY SUMMARY**

<b>DEPTH (m)</b>	<b>DEGREE(S)</b>
29.0	0.82
56.0	0.98
82.0	0.92
111.0	0.64
128.0	1.11
140.0	1.17
150.0	0.23
150.0	0.23
159.0	0.86

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187.0            0.69

223.0            0.26

226.0            0.40

**SEE FOLLOWING 8 PAGES FOR REMAINDER OF DIRECTIONAL SURVEYS**

**CASPER HZ BANTRY 1-23-14-11**

**U.W.I: 103/01-23-014-11W4/o**

Job Number: 13437-377  
 Company: CASPER Energy Ltd  
 Lease/Well: 1-23-14-11w4m  
 Location: 1-23-14-11w4m  
 Rig Name: PD417  
 RKB: 749.25  
 G.L. or M.S.L.: 744.9

State/Country: AB/CDN  
 Declination: 13.34  
 Grid: -0.44  
 File name: C:\WINSERV.SVY  
 Date/Time: 22-Jan-13 / 08:19  
 Curve Name: CASPER Hz Bantry 1-23-14-11

WINSERVE SURVEY CALCULATIONS

Minimum Curvature Method

Vertical Section Plane 45.64

Vertical Section Referenced to offset from Wellhead: EW =.00 Meters, NS=.00 Meters

Rectangular Coordinates Referenced to Wellhead

Measured Depth Meters	Incl Angle Deg	Drift Direction Deg	True Vertical Depth	Subsea TVD Meters	N-S Meters	E-W Meters	Vertical Section Meters	CLOSURE Distance Meters	CLOSURE Direction Deg	Dogleg Severity Deg/30
Tie In @ Surface Casing										
286.00	.00	.00	286.00	463.55	.00	.00	.00	.00	.00	.00
304.48	.40	16.10	304.48	445.07	.06	.02	.06	.06	16.11	.65
350.46	.30	324.20	350.46	399.09	.31	-.01	.21	.31	358.54	.21
397.31	.40	353.80	397.31	352.24	.58	-.10	.33	.58	350.40	.13
443.79	1.00	180.90	443.79	305.76	.33	-.12	.15	.35	339.91	.90
471.55	.50	173.60	471.54	278.01	-.03	-.11	-.10	.12	254.50	.55
518.15	.50	162.50	518.14	231.41	-.43	-.03	-.32	.43	183.73	.06
565.29	.50	138.10	565.28	184.27	-.78	.17	-.42	.79	167.55	.13
612.62	.20	112.00	612.61	136.94	-.96	.39	-.40	1.04	158.12	.21
660.18	.40	103.70	660.17	89.38	-1.03	.62	-.27	1.21	148.82	.13
669.69	.60	103.20	669.68	79.87	-1.05	.70	-.23	1.27	146.14	.63
679.17	2.50	52.50	679.15	70.40	-.94	.92	.00	1.31	135.58	6.87
688.68	5.20	36.50	688.64	60.91	-.46	1.34	.63	1.42	109.09	9.09
698.22	7.80	33.00	698.12	51.43	.43	1.95	1.69	1.99	77.62	8.27
707.71	9.10	34.30	707.51	42.04	1.59	2.72	3.06	3.15	59.75	4.15
717.22	11.30	37.20	716.87	32.68	2.95	3.71	4.72	4.74	51.49	7.12
726.72	13.50	40.60	726.14	23.41	4.53	4.99	6.74	6.75	47.76	7.32
736.20	16.00	40.10	735.31	14.24	6.37	6.56	9.14	9.14	45.80	7.92
745.68	18.80	38.80	744.36	5.19	8.56	8.35	11.96	11.96	44.29	8.95
755.19	21.10	38.00	753.30	-3.75	11.11	10.37	15.18	15.20	43.03	7.31
764.67	21.60	38.00	762.12	-12.57	13.83	12.49	18.60	18.64	42.10	1.58

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774.18 Measured Depth Meters	24.20 Incl Angle Deg	38.50 Drift Direction Deg	770.88 True Vertical Depth	-21.33 Subsea TVD Meters	16.73 N-S Meters	14.79 E-W Meters	22.27 Vertical Section Meters	22.33 CLOSURE Distance Meters	41.46 CLOSURE Direction Deg	8.22 Dogleg Severity Deg/30
783.66	27.20	37.50	779.43	-29.88	19.97	17.31	26.34	26.43	40.92	9.59
793.13	29.80	37.30	787.75	-38.20	23.56	20.06	30.82	30.94	40.41	8.24
802.64	31.70	37.50	795.92	-46.37	27.43	23.01	35.63	35.80	40.00	6.00
812.12	33.80	36.80	803.89	-54.34	31.51	26.11	40.70	40.92	39.64	6.75
821.63	35.70	36.30	811.71	-62.16	35.87	29.34	46.05	46.34	39.28	6.06
831.15	37.60	36.00	819.34	-69.79	40.46	32.69	51.66	52.01	38.94	6.01
840.69	39.70	35.90	826.79	-77.24	45.28	36.18	57.53	57.96	38.63	6.61
850.18	41.80	36.20	833.98	-84.43	50.29	39.83	63.64	64.15	38.38	6.67
859.65	43.40	36.90	840.95	-91.40	55.44	43.65	69.97	70.56	38.22	5.29
869.03	44.90	37.10	847.68	-98.13	60.65	47.58	76.43	77.09	38.11	4.82
878.53	47.10	37.50	854.28	-104.73	66.09	51.72	83.19	83.92	38.05	7.01
888.00	49.90	37.90	860.56	-111.01	71.70	56.06	90.21	91.01	38.02	8.92
897.39	54.00	38.10	866.34	-116.79	77.53	60.61	97.54	98.41	38.02	13.11
906.76	57.50	38.00	871.62	-122.07	83.62	65.38	105.21	106.15	38.02	11.21
916.26	59.30	38.60	876.59	-127.04	89.97	70.40	113.24	114.24	38.04	5.91
925.57	61.50	39.10	881.19	-131.64	96.28	75.48	121.28	122.34	38.09	7.23
935.09	64.00	39.40	885.55	-136.00	102.83	80.83	129.69	130.80	38.17	7.92
944.60	65.90	39.40	889.58	-140.03	109.49	86.30	138.25	139.41	38.25	5.99
954.11	67.40	39.30	893.35	-143.80	116.24	91.83	146.93	148.14	38.31	4.74
963.60	69.30	39.40	896.85	-147.30	123.06	97.43	155.70	156.96	38.37	6.01
973.08	70.50	39.60	900.10	-150.56	129.93	103.09	164.55	165.86	38.43	3.84
982.57	71.50	40.10	903.19	-153.64	136.82	108.84	173.47	174.83	38.50	3.50
991.93	72.50	40.80	906.09	-156.54	143.59	114.62	182.34	183.73	38.60	3.85
1001.41	74.40	40.70	908.79	-159.24	150.48	120.55	191.39	192.81	38.70	6.02
1010.92	75.80	40.80	911.23	-161.68	157.44	126.55	200.55	201.99	38.79	4.43
1020.43	76.90	42.60	913.48	-163.93	164.34	132.69	209.77	211.22	38.92	6.52
1029.89	77.30	44.60	915.59	-166.04	171.01	139.05	218.98	220.41	39.11	6.31
1039.40	77.40	46.20	917.67	-168.12	177.53	145.66	228.26	229.64	39.37	4.93
1048.86	78.10	46.70	919.68	-170.13	183.90	152.36	237.51	238.81	39.64	2.71
1058.34	79.60	46.80	921.51	-171.96	190.27	159.13	246.81	248.05	39.91	4.76
1067.69	81.50	46.70	923.05	-173.50	196.59	165.85	256.03	257.20	40.15	6.10
1077.13	83.90	47.00	924.25	-174.70	202.99	172.68	265.39	266.51	40.39	7.69



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1086.61	85.50	46.70	925.12	-175.57	209.45	179.57	274.82	275.89	40.61	5.15
1095.97	86.00	46.40	925.82	-176.27	215.87	186.34	284.16	285.17	40.80	1.87
Measured Depth Meters	Incl Angle Deg	Drift Direction Deg	True Vertical Depth	Subsea TVD Meters	N-S Meters	E-W Meters	Vertical Section Meters	CLOSURE Distance Meters	CLOSURE Direction Deg	Dogleg Severity Deg/30
1107.00	88.30	45.70	926.36	-176.81	223.51	194.28	295.17	296.14	41.00	6.54
Magnetic interference from casing Interpolated Azimuth										
1110.99	88.80	45.80	926.47	-176.92	226.30	197.13	299.16	300.12	41.06	3.83
Magnetic interference from casing Interpolated Azimuth										
1120.58	89.50	46.20	926.61	-177.06	232.96	204.03	308.75	309.67	41.21	2.52
Magnetic interference from casing Interpolated Azimuth										
1129.85	89.90	46.50	926.66	-177.11	239.36	210.74	318.02	318.91	41.36	1.62
1139.36	90.40	46.90	926.63	-177.08	245.88	217.66	327.53	328.38	41.52	2.02
1148.72	90.60	46.20	926.55	-177.00	252.32	224.45	336.89	337.70	41.66	2.33
1158.04	89.50	45.80	926.54	-176.99	258.79	231.16	346.20	347.00	41.77	3.77
1167.64	89.20	46.20	926.65	-177.10	265.46	238.06	355.80	356.57	41.89	1.56
1176.94	89.20	45.60	926.78	-177.23	271.93	244.74	365.10	365.85	41.99	1.94
1186.29	88.70	45.50	926.95	-177.40	278.48	251.41	374.45	375.18	42.08	1.64
1195.56	88.70	45.20	927.16	-177.61	284.99	258.01	383.72	384.43	42.16	.97
1204.90	90.00	45.20	927.27	-177.72	291.57	264.63	393.06	393.76	42.23	4.18
1214.51	90.60	45.10	927.22	-177.67	298.35	271.45	402.67	403.35	42.30	1.90
1224.11	89.70	43.80	927.19	-177.64	305.20	278.17	412.26	412.95	42.35	4.94
1233.76	89.50	44.40	927.26	-177.71	312.13	284.88	421.91	422.59	42.39	1.97
1242.89	90.80	44.70	927.24	-177.69	318.64	291.29	431.04	431.72	42.43	4.38
1251.98	91.20	44.20	927.08	-177.53	325.12	297.65	440.13	440.80	42.47	2.11
1261.24	91.40	44.30	926.87	-177.32	331.76	304.11	449.38	450.05	42.51	.72
1270.82	93.50	46.20	926.46	-176.91	338.49	310.91	458.95	459.61	42.57	8.86
1280.44	93.80	46.40	925.85	-176.30	345.13	317.85	468.55	469.19	42.64	1.12
1290.01	92.70	46.40	925.30	-175.75	351.71	324.77	478.10	478.73	42.72	3.45
1299.26	92.10	45.60	924.92	-175.37	358.13	331.42	487.35	487.95	42.78	3.24
1308.39	90.70	45.60	924.69	-175.14	364.52	337.94	496.47	497.07	42.83	4.60
1318.01	89.40	45.90	924.68	-175.13	371.23	344.83	506.09	506.68	42.89	4.16
1327.34	89.50	45.90	924.77	-175.22	377.73	351.53	515.42	515.99	42.94	.32
1336.64	90.10	46.00	924.81	-175.26	384.19	358.21	524.72	525.28	43.00	1.96
1345.91	90.40	46.50	924.77	-175.22	390.60	364.91	533.99	534.54	43.05	1.89
1355.47	89.70	45.20	924.76	-175.21	397.26	371.77	543.55	544.08	43.10	4.63

**CASPER HZ BANTRY 1-23-14-11**  
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Measured Depth Meters	Incl Angle Deg	Drift Direction Deg	True Vertical Depth	Subsea TVD Meters	N-S Meters	E-W Meters	Vertical Section Meters	CLOSURE Distance Meters	CLOSURE Direction Deg	Dogleg Severity Deg/30
2348.85	88.10	48.20	927.10	-177.55	1076.74	1095.75	1536.23	1536.24	45.50	1.94
2358.10	88.50	47.90	927.38	-177.83	1082.92	1102.62	1545.47	1545.47	45.52	1.62
2367.23	89.10	47.40	927.57	-178.02	1089.07	1109.37	1554.59	1554.60	45.53	2.57
2376.85	89.30	47.10	927.70	-178.15	1095.60	1116.43	1564.21	1564.21	45.54	1.12
2386.18	90.20	47.20	927.75	-178.20	1101.94	1123.27	1573.53	1573.54	45.55	2.91
2395.46	90.10	47.90	927.72	-178.17	1108.21	1130.12	1582.81	1582.81	45.56	2.29
2404.79	88.60	47.20	927.83	-178.28	1114.50	1137.00	1592.13	1592.13	45.57	5.32
2414.08	88.50	46.80	928.06	-178.51	1120.84	1143.80	1601.42	1601.42	45.58	1.33
2423.23	88.70	47.30	928.29	-178.74	1127.07	1150.49	1610.56	1610.56	45.59	1.77
2432.83	88.90	47.20	928.49	-178.94	1133.58	1157.54	1620.16	1620.16	45.60	.70
2442.04	88.70	46.80	928.68	-179.13	1139.86	1164.27	1629.36	1629.36	45.61	1.46
2451.63	88.60	46.30	928.91	-179.36	1146.46	1171.23	1638.95	1638.95	45.61	1.59
2461.12	88.50	46.30	929.15	-179.60	1153.01	1178.09	1648.43	1648.43	45.62	.32
2470.51	88.60	45.70	929.38	-179.83	1159.53	1184.84	1657.82	1657.82	45.62	1.94
2479.98	88.40	46.00	929.63	-180.08	1166.13	1191.64	1667.29	1667.29	45.62	1.14
2489.48	88.20	45.30	929.91	-180.36	1172.76	1198.43	1676.78	1676.78	45.62	2.30
2498.94	88.00	45.40	930.23	-180.68	1179.41	1205.15	1686.24	1686.24	45.62	.71
2508.27	88.50	44.60	930.51	-180.96	1186.00	1211.75	1695.56	1695.56	45.62	3.03
2517.73	88.40	44.40	930.77	-181.22	1192.75	1218.38	1705.02	1705.02	45.61	.71
2527.23	88.50	44.80	931.02	-181.47	1199.51	1225.04	1714.51	1714.51	45.60	1.30
2536.71	88.80	44.40	931.25	-181.70	1206.26	1231.70	1723.99	1723.99	45.60	1.58
2546.17	89.50	44.60	931.39	-181.84	1213.00	1238.33	1733.45	1733.45	45.59	2.31
2555.55	89.20	45.00	931.49	-181.94	1219.66	1244.94	1742.82	1742.82	45.59	1.60
2564.99	88.90	44.50	931.65	-182.10	1226.36	1251.58	1752.26	1752.26	45.58	1.85
2574.40	88.90	44.40	931.83	-182.28	1233.08	1258.17	1761.67	1761.67	45.58	.32
2583.86	89.00	43.60	932.00	-182.45	1239.88	1264.74	1771.12	1771.12	45.57	2.56
2593.29	89.50	44.00	932.13	-182.58	1246.69	1271.27	1780.55	1780.55	45.56	2.04
2602.81	89.90	43.60	932.18	-182.63	1253.56	1277.86	1790.06	1790.06	45.55	1.78
2612.25	90.00	43.30	932.19	-182.64	1260.41	1284.35	1799.49	1799.50	45.54	1.00
2621.73	90.10	43.70	932.18	-182.63	1267.29	1290.87	1808.97	1808.97	45.53	1.30
2631.21	90.10	43.10	932.16	-182.61	1274.18	1297.39	1818.44	1818.44	45.52	1.90
2640.69	90.30	43.50	932.13	-182.58	1281.08	1303.89	1827.91	1827.92	45.51	1.42

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2650.19	89.20	43.70	932.17	-182.62	1287.95	1310.44	1837.41	1837.41	45.50	3.53
2659.67	88.40	43.80	932.37	-182.82	1294.80	1316.99	1846.88	1846.89	45.49	2.55
2669.18	88.40	43.80	932.63	-183.08	1301.66	1323.57	1856.38	1856.39	45.48	.00
2678.67	88.30	44.90	932.91	-183.36	1308.45	1330.21	1865.86	1865.87	45.47	3.49
2687.96	88.00	44.50	933.21	-183.66	1315.05	1336.74	1875.15	1875.16	45.47	1.61
2697.32	87.90	44.80	933.54	-183.99	1321.70	1343.31	1884.50	1884.51	45.46	1.01
2706.80	88.00	45.40	933.88	-184.33	1328.39	1350.02	1893.97	1893.98	45.46	1.92
2716.26	88.40	45.70	934.18	-184.63	1335.01	1356.77	1903.43	1903.44	45.46	1.59
2725.64	88.50	44.50	934.43	-184.88	1341.63	1363.41	1912.80	1912.81	45.46	3.85
2735.12	87.80	44.50	934.74	-185.19	1348.39	1370.05	1922.28	1922.29	45.46	2.22
2744.62	88.20	44.20	935.07	-185.52	1355.17	1376.69	1931.77	1931.78	45.45	1.58
2754.11	88.20	44.40	935.37	-185.82	1361.96	1383.32	1941.25	1941.26	45.45	.63
2763.61	88.10	43.20	935.67	-186.12	1368.82	1389.89	1950.74	1950.75	45.44	3.80
2773.11	88.20	42.00	935.98	-186.43	1375.81	1396.31	1960.22	1960.24	45.42	3.80
2782.61	88.70	42.00	936.24	-186.69	1382.86	1402.67	1969.70	1969.72	45.41	1.58
2792.02	89.10	41.70	936.42	-186.87	1389.87	1408.95	1979.09	1979.11	45.39	1.59
2801.50	89.10	42.10	936.57	-187.02	1396.93	1415.28	1988.55	1988.57	45.37	1.27
2811.07	89.80	42.20	936.66	-187.11	1404.02	1421.70	1998.10	1998.12	45.36	2.22
2820.44	90.30	43.20	936.65	-187.10	1410.91	1428.05	2007.46	2007.48	45.35	3.58
2829.92	89.30	43.80	936.68	-187.13	1417.78	1434.58	2016.93	2016.96	45.34	3.69
2839.39	88.50	44.70	936.87	-187.32	1424.57	1441.18	2026.40	2026.42	45.33	3.81
2849.00	88.50	45.30	937.12	-187.57	1431.36	1447.98	2036.00	2036.03	45.33	1.87
Projection to TD 2863.00	88.50	46.00	937.48	-187.93	1441.14	1457.98	2050.00	2050.03	45.33	1.50

## **SAMPLE DESCRIPTIONS**

### **BUILD SECTION**

- 0.0m - 820.0m: Sample descriptions not required.
- 820.0m - 830.0m: SHALE, SILTSTONE and rare pyrite nodules.  
SHALE: gray to black, predominantly platy, micromicaceous in part rare fine grains.  
SILTSTONE: light gray to light brown with lithic grains, argillaceous cement in part, dolomitic cement in part.
- 830.0m - 840.0m: SHALE and SILTSTONE.  
SHALE: gray to black, predominantly platy, micromicaceous in part.  
SILTSTONE: light gray to light brown with lithic grains, argillaceous cement in part.
- 840.0m - 850.0m: SHALE and SILTSTONE.  
SHALE: gray to black, predominantly platy, micromicaceous in part.  
SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement in part, dolomitic cement in part.
- 850.0m - 855.0m: SHALE and SILTSTONE.  
SHALE: gray to black, predominantly platy, micromicaceous in part.  
SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement in part, dolomitic cement in part.
- 855.0m - 860.0m: SHALE, SILTSTONE, and trace fossils debris (Inoceramus?).  
SHALE: gray to black, predominantly platy, micromicaceous in part.  
SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement in part, dolomitic cement in part.
- 860.0m - 865.0m: SHALE, SILTSTONE, trace amounts of COAL and trace fossils debris (Inoceramus?).

SHALE: gray to black, predominantly platy, micromicaceous in part.

SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement in part, dolomitic cement in part.

865.0m - 870.0m: SANDSTONE, SHALE, SILTSTONE and rare pyrite nodules.

SANDSTONE: light gray to light patchy brown, visible clear, brown and rounded quartz grains, rounded to subangular, rare unconsolidated quartz grains, appear tight, no porosity, no shows, upper fine grading to silt. Slightly vitreous and siliceous cement in aggregates.

SHALE: gray to black, predominantly platy, micromicaceous in part.

SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.

870.0m - 880.0m: SHALE, SANDSTONE, SILTSTONE and rare pyrite nodules.

SHALE: gray to black to green to red to yellow, platy to blocky, micromicaceous in part.

SANDSTONE: light gray to light green, clear quartz grains, rounded to subangular, appear tight, no porosity, no shows, upper fine grading to silt. Siliceous cement with minor dolomitic cement in aggregates.

SILTSTONE: trace light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.

880.0m - 885.0m: SHALE, SANDSTONE, COAL, SILTSTONE and rare pyrite nodules.

SHALE: gray to black to red to purple, platy to blocky, micromicaceous in part.

SANDSTONE: light gray to light brown, some clear quartz grains, rounded to subangular. No shows. upper very fine grained to medium, unconsolidated, estimated intergranular porosity of 10 to 20%.

COAL: Black, vitreous, blocky.

SILTSTONE: trace light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.

885.0m - 895.0m: SHALE, SANDSTONE, SILTSTONE, COAL and rare pyrite

nodules.

SHALE: gray to black to green to red to purple, platy to blocky, micromicaceous in part.

SANDSTONE: light gray to light green, clear quartz grains, subrounded to subangular, tight to intergranular porosity, no shows. Some unconsolidated with some aggregates, upper very fine grained to medium grained.

COAL: black, blocky, vitreous.

SILTSTONE: trace light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.

895.0m - 900.0m: SHALE, SANDSTONE, SILTSTONE, Coal and rare pyrite nodules.

SHALE: gray to black to green to red to purple, platy to blocky, micromicaceous in part.

SANDSTONE: light gray to light green, clear quartz grains, subrounded to subangular, tight to intergranular porosity, no shows. Some unconsolidated with some aggregates, upper very fine grained to medium grained.

COAL: black, blocky, vitreous.

SILTSTONE: trace light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.

900.0m - 910.0m: SHALE, SANDSTONE, SILTSTONE, COAL and rare pyrite nodules.

SHALE: gray to black to green to purple, platy to blocky, micromicaceous in part.

SANDSTONE: light gray to light brown, clear quartz grains, subrounded to subangular, tight to intergranular porosity, no shows. Some unconsolidated with some aggregates, upper very fine grained to medium grained.

COAL: black, blocky, vitreous.

SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.

910.0m - 915.0m: SHALE, SANDSTONE, SILTSTONE, COAL and rare pyrite nodules.

SHALE: gray to black to green to purple, platy to blocky, micromicaceous in part.

SANDSTONE: light gray to light brown, clear quartz grains, subrounded to subangular, tight to intergranular porosity, no shows. Some unconsolidated with some aggregates, upper very fine grained to medium grained.

COAL: trace black, blocky, vitreous.

SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.

- 915.0m - 920.0m: SHALE, SANDSTONE, SILTSTONE, COAL and rare pyrite nodules.  
SHALE: gray to black to green, platy to blocky, micromicaceous in part.  
SANDSTONE: light gray to light brown, clear quartz grains, subrounded to subangular, tight to intergranular porosity, no shows. Some unconsolidated with some aggregates, upper very fine grained to medium grained.  
COAL: black, blocky, vitreous.  
SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.
- 920.0m - 925.0m: SHALE, SANDSTONE, SILTSTONE, COAL and rare pyrite nodules.  
SHALE: gray to black to green, platy to blocky, micromicaceous in part,  
SANDSTONE: white to light gray to light brown, clear quartz grains, subrounded to subangular, tight to intergranular porosity, no shows. Predominantly unconsolidated with some aggregates, upper very fine grained to medium grained.  
COAL: black, blocky, vitreous.  
SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.
- 925.0m - 930.0m: COAL, SHALE, SANDSTONE, SILTSTONE and rare pyrite nodules.  
COAL: black, blocky, vitreous.  
SHALE: gray to black to green, platy to blocky, micromicaceous in part  
SANDSTONE: white to light gray to light brown, clear quartz grains, subrounded to subangular, tight to intergranular porosity, no shows. Predominantly unconsolidated with some aggregates, upper very fine grained to medium grained.  
SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.
- 930.0m - 937.5m: SHALE, SANDSTONE, SILTSTONE, COAL and rare pyrite

nodules.

SHALE: gray to black to brown, platy to blocky, micromicaceous in part.

SANDSTONE: white to light gray to light brown, clear quartz grains, subrounded to subangular, tight to intergranular porosity, no shows. Predominantly unconsolidated with some aggregates, upper very fine grained to medium grained.

COAL: black, blocky, vitreous.

SILTSTONE: light gray to light brown with lithic grains and visible quartz grains, argillaceous cement.

- 937.5m - 941.5m: SANDSTONE: frosted white to light gray quartz, very fine to fine grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with calcareous cement, and appear tight. No shows.
- 941.5m - 942.0m: SILTSTONE: light to medium brown. Aggregates are quartzose in part, moderately indurated with calcareous cement, and appear tight. No shows.
- 942.0m - 944.5m: SHALE and trace amounts of DOLOMITE stringers and trace amounts of pyrite nodules.  
SHALE: light to medium gray. Sub blocky to sub platy and micromicaceous in part.  
DOLOMITE: medium brown, cryptocrystalline, no shows.
- 944.5m - 947.5m: SANDSTONE: frosted white to light gray quartz, very fine to fine grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with calcareous cement, and appear tight. Trace amounts of dark gray to black chert grains. No shows.
- 947.5m - 948.5m: SILTSTONE: as above. No shows.
- 948.5m - 949.0m COAL: black, blocky, vitreous.
- 949.0m - 952.5m: SHALE, trace amounts of DOLOMITE stringers, and trace amounts of pyrite nodules.  
SHALE: light to medium gray. Sub blocky to sub platy and micromicaceous in part.  
DOLOMITE: medium brown, cryptocrystalline, no shows.



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- 952.5m - 953.5m: SANDSTONE: as above. No shows.
- 953.5m - 956.0m COAL: black, blocky, vitreous.
- 956.0m - 958.0m: SHALE, trace amounts of DOLOMITE stringers, and trace amounts of pyrite nodules.  
SHALE: light to medium gray. Sub blocky to sub platy and micromicaceous in part.  
DOLOMITE: medium brown, cryptocrystalline, no shows.
- 958.0m - 958.5m: SILTSTONE: as above. No shows.
- 958.5m - 960.0m: SANDSTONE: frosted white to light gray quartz, very fine to medium grained, sub angular to sub rounded, and moderately sorted. Aggregates are well indurated with calcareous cement, and appear tight. Trace amounts of dark gray to black chert grains. No shows.
- 960.0m - 965.5m: SHALE, trace amounts of DOLOMITE stringers and trace amounts of pyrite nodules.  
SHALE: light to dark gray. Sub blocky to sub platy and micromicaceous in part.  
DOLOMITE: medium brown, cryptocrystalline, no shows.
- 965.5m - 966.5m: SANDSTONE: frosted white to light gray quartz, very fine to fine grained, sub angular to sub rounded, and well sorted. Aggregates are well indurated with calcareous and rare silica cements, and appear tight. Trace amounts of dark gray to black chert grains. No shows.
- 966.5m - 968.5m: SHALE and trace amounts of DOLOMITE stringers. As above.
- 968.5m - 971.5m Interbedded SANDSTONE and SILTSTONE.  
SANDSTONE: frosted white to light gray quartz, very fine grained, sub angular to sub rounded, and well sorted. Aggregates are well indurated with calcareous and rare silica cements, and appear tight. Trace amounts of dark gray to black chert grains. No shows.  
SILTSTONE: light to medium brown. Aggregates are quartzose in part, moderately indurated with calcareous cement, and appear tight. No shows.

- 971.5m - 975.0m: SHALE and trace amounts of DOLOMITE stringers. As above.
- 975.0m - 979.0m Interbedded SANDSTONE and SILTSTONE.  
SANDSTONE: frosted white to light gray quartz, very fine grained, sub angular to sub rounded, and well sorted. Aggregates are well indurated with silica and rare calcareous cements, and appear tight. No shows.  
SILTSTONE: light to medium brown. Aggregates are quartzose in part, moderately indurated with calcareous cement, and appear tight. No shows.
- 979.0m - 981.5m: SHALE and trace amounts of DOLOMITE stringers. As above.
- 981.5m - 983.0m: Interbedded SANDSTONE and SILTSTONE. As above.
- 983.0m - 987.0m: SHALE and trace amounts of DOLOMITE stringers and trace amounts of pyrite nodules.  
SHALE: light to dark gray. Sub blocky to sub platy and micromicaceous in part.  
DOLOMITE: medium brown, cryptocrystalline, no shows.
- 987.0m - 989.5m: SANDSTONE: frosted white to light gray quartz, very fine grained, sub angular to sub rounded, and well sorted. Aggregates are well indurated with silica and rare calcareous cements, and appear tight. No shows.
- 989.5m - 991.0m: SHALE and trace amounts of DOLOMITE stringers. As above.
- 991.0m - 992.0m: COAL: black, blocky, vitreous.
- 992.0m - 996.5m: SHALE and trace amounts of DOLOMITE stringers and trace amounts of pyrite nodules.  
SHALE: light to dark gray. Sub blocky to sub platy and micromicaceous in part.  
DOLOMITE: medium brown, cryptocrystalline, no shows.
- 996.5m - 998.5m: COAL: black, blocky, vitreous.
- 998.5m - 1003.0m: SHALE and trace amounts of DOLOMITE stringers and

trace amounts of pyrite nodules.

SHALE: medium - dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

DOLOMITE: medium - dark brown, cryptocrystalline, no shows.

1003.0m - 1003.5m:SANDSTONE: frosted white to light gray quartz, very fine grained, sub angular to sub rounded, and well sorted. Aggregates are well indurated with silica and rare calcareous cements, and appear tight. No shows.

1003.5m - 1005.0m:COAL: black, blocky, vitreous.

1005.0m - 1007.0m:SHALE and trace amounts of DOLOMITE stringers. As above.

1007.0m - 1009.0m:SILTSTONE: light to medium brown. Aggregates are quartzose in part, moderately indurated with calcareous cement, and appear tight. No shows.

1009.0m - 1011.0m:SANDSTONE: partially unconsolidated, frosted white to light gray quartz, very fine to rare fine grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with silica and rare calcareous cements, and appear tight. No shows.

1011.0m - 1014.0m: SHALE and trace amounts of pyrite nodules.  
SHALE: medium to dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

1014.0m - 1015.0m:SANDSTONE: partially unconsolidated, frosted white to light gray quartz, very fine grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with silica cement, and appear tight. No shows.

1015.0m - 1021.5m: SHALE and trace amounts of pyrite nodules.  
SHALE: medium to dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

1021.5m - 1022.0m:SANDSTONE: as above. No shows.

1022.0m - 1026.0m:SHALE and minor amounts of pyrite nodules.

SHALE: medium to dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

1026.0m - 1033.0m: Interbedded SHALE, SANDSTONE, SILTSTONE, COAL, and minor amounts of pyrite nodules.

SHALE: medium to dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

SANDSTONE: partially unconsolidated, frosted white to light gray quartz, very fine grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with silica cement, and appear tight. No shows.

SILTSTONE: light gray. Aggregates are quartzose in part, moderately indurated with silica cement, and appear tight. No shows.

COAL: black, blocky, vitreous.

1033.0m - 1037.0m: SHALE and abundant pyrite nodules.

SHALE: dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

1037.5m - 1038.0m: SILTSTONE: dark gray. Aggregates are quartzose in part, moderately indurated with silica cement, and appear tight. No shows.

1038.0m - 1038.5m: COAL: black, blocky, vitreous.

1038.5m - 1042.0m: SHALE and abundant pyrite nodules.

SHALE: dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

1042.0m - 1048.5m: COAL: black, blocky, vitreous.

1048.5m - 1054.0m: SHALE and abundant pyrite nodules.

SHALE: dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

1054.0m - 1055.0m: SILTSTONE: dark gray. Aggregates are quartzose in part, moderately indurated with silica cement, and appear tight. No shows.

1055.0m - 1065.5m: Interbedded SHALE, SANDSTONE, SILTSTONE and occasional pyrite nodules.

SHALE: dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

SANDSTONE: partially unconsolidated, frosted white to light gray quartz, fine to medium grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with silica cement, and appear tight. No shows.

SILTSTONE: medium gray. Aggregates are quartzose in part, moderately indurated with silica cement, and appear tight. No shows.

1065.5m - 1074.0m: Interbedded SANDSTONE, SHALE and occasional pyrite nodules.

SANDSTONE: partially unconsolidated, frosted white to light gray to light brown quartz, fine to medium grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with silica cement, and appear tight. Unconsolidated nature of the sample may indicate higher porosity than visible. No shows.

SHALE: dark gray to black. Sub blocky to sub platy and carbonaceous and micromicaceous in part.

1074.0m - 1089.0m: SANDSTONE and abundant pyrite nodules.

SANDSTONE: partially unconsolidated, frosted white to light gray to light brown quartz, fine to medium grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with silica cement, and appear tight. Unconsolidated nature of the sample may indicate higher porosity than visible. No shows.

1089.0m - 1107.0m: SANDSTONE and minor amounts of pyrite nodules.

SANDSTONE: partially unconsolidated, frosted white to light gray quartz, with trace amounts of dark gray to black chert, trace very fine to fine grained, sub angular to sub rounded, and well sorted. Aggregates are moderately indurated with calcareous cement, and appear tight. Unconsolidated nature of the sample may indicate higher porosity than visible. No shows.

1107.0m - 1113.0m: SANDSTONE and rare pyrite nodules.

SANDSTONE: frosted white to light gray to light brown quartz, with trace amounts of dark gray to black chert, fine grained, sub angular to sub rounded, and well

sorted. Aggregates are moderately indurated with calcareous cement, and appear tight. Few aggregates show a patchy, light brown hydrocarbon stain, a patchy, very dull yellow fluorescence, a slow, patchy, dull yellow cut fluorescence, and a slow, "ribbony", dull yellow streaming cut fluorescence.

1113.0m - 1121.0m: SANDSTONE and trace amounts of pyrite nodules.  
SANDSTONE: frosted white to light to medium gray quartz, with trace amounts of dark gray to black chert, fine grained, sub angular to sub rounded, and well sorted. Aggregates are well indurated with calcareous cement, and appear tight. No shows.

### **LATERAL SECTION**

1121.0m - 1130.0m: SANDSTONE and trace amounts of pyrite nodules.  
SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Predominantly unconsolidated, the aggregates are moderately indurated with silica cement, and appear tight. Approximately 80% show a patchy, light gray brown hydrocarbon stain, a patchy, light yellow fluorescence, a slow, patchy, dull yellow cut fluorescence, and a slow, "ribbony", dull yellow streaming cut fluorescence.

**NOTE: Due to the unconsolidated nature of the samples, the actual porosity maybe higher than what is visible.**

1130.0m - 1160.0m: SANDSTONE and trace amounts of pyrite nodules.  
SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Predominantly unconsolidated, the aggregates are moderately indurated with silica cement, and appear tight. Approximately 80% show a patchy, light gray brown hydrocarbon stain, but no fluorescence, cut fluorescence, or streaming cut fluorescence.

1160.0m - 1190.0m: SANDSTONE, SHALE and trace amounts of pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Partly unconsolidated, the aggregates are well indurated with silica and calcareous cements, and appear tight. Approximately 50% show a patchy, light gray brown hydrocarbon stain, a patchy, faint yellow fluorescence, a slow, patchy, dull yellow cut fluorescence, and a slow, "ribbony", dull yellow streaming cut fluorescence.

SHALE: medium to dark gray. Sub blocky to sub platy, silty and micromicaceous in part.

1190.0m - 1220.0m: SANDSTONE, SHALE and occasional pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Partly unconsolidated, the aggregates are well indurated with silica and calcareous cements, and appear tight. Approximately 25% show a patchy, light gray brown hydrocarbon stain, but no fluorescence, cut fluorescence, or streaming cut fluorescence.

SHALE: as previous.

1220.0m - 1230.0m: SANDSTONE, SHALE and trace amounts of pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, fine to rare very fine grained, sub angular to sub rounded, and well sorted. The aggregates are well indurated with dolomitic cement, and appear tight. No shows.

SHALE: as previous.

1230.0m - 1240.0m: SANDSTONE, SHALE, rare SILTSTONE stringers and rare pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine grained, sub angular to sub rounded, and well sorted. The aggregates are well

indurated with dolomitic cement, and appear tight. No shows.

SHALE: medium to dark gray. Sub blocky to sub platy, silty and micromicaceous in part, with trace amounts of disseminated pyrite.

SILTSTONE: medium gray. Aggregates are quartzose, well indurated with silica cement, and appear tight. No shows.

1240.0m - 1250.0m: SANDSTONE, SHALE, SILTSTONE stringers and rare pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, fine to rare very fine grained, sub angular to sub rounded, and well sorted. No shows. Partly unconsolidated, the aggregates are well indurated with silica, dolomitic and calcareous cements, and appear tight. Approximately 25% show a patchy, light gray brown hydrocarbon stain, but no fluorescence, cut fluorescence, or streaming cut fluorescence.

SILTSTONE: medium gray. Aggregates are quartzose, well indurated with dolomitic cement, and appear tight. No shows.

SHALE: as previous.

1250.0m - 1270.0m: SANDSTONE, SHALE, SILTSTONE stringers and rare pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, fine to rare very fine grained, sub angular to sub rounded, and well sorted. No shows. Partly unconsolidated, the aggregates are well indurated with silica, and dolomitic cement and appear tight. No fluorescence, cut fluorescence, or streaming cut fluorescence.

SILTSTONE: as previous.

SHALE: as previous.

1270.0m - 1290.0m: SANDSTONE, SHALE, rare SILTSTONE and COAL stringers and abundant pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine grained, sub angular to sub



rounded, and well sorted. Predominantly unconsolidated, the aggregates are well indurated with dolomitic cement, and appear tight. They show a patchy, light gray brown hydrocarbon stain, a patchy, light yellow fluorescence, a fast, patchy, bright yellow cut fluorescence, and a fast, "blooming", bright yellow streaming cut fluorescence.

SHALE: medium to dark gray. Sub blocky to sub platy, silty and micromicaceous in part, with abundant disseminated pyrite.

SILTSTONE: as previous.

1290.0m - 1320.0m: SANDSTONE, SHALE, rare SILTSTONE and COAL stringers and abundant pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine grained, sub angular to sub rounded, and well sorted. Predominantly unconsolidated, the aggregates are well indurated with dolomitic and silica cement, and some calcite cement, appear tight, some laminated carbonaceous material. No fluorescence evident.

SHALE: brown to dark gray. Sub blocky to sub platy, silty and micromicaceous in part, with abundant disseminated pyrite.

SILTSTONE: medium gray. Aggregates are quartzose, well indurated with dolomitic cement, and appear tight. No shows.

1320.0m - 1340.0m: SANDSTONE, SHALE, rare SILTSTONE and COAL stringers and abundant pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and moderately sorted. Predominantly unconsolidated, the aggregates are well indurated with dolomitic and silica cement, appear tight, some laminated carbonaceous material. No fluorescence evident.

SHALE: brown to dark gray. Sub blocky to sub platy, silty and micromicaceous in part, with abundant disseminated pyrite.

SILTSTONE: medium gray. Aggregates are quartzose,

well indurated with dolomitic cement, and appear tight.  
No shows.

1340.0m - 1350.0m: SANDSTONE, SHALE, rare SILTSTONE and COAL stringers and abundant pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and moderately sorted. Predominantly unconsolidated, the aggregates are well indurated with dolomitic and silica cement, some laminated carbonaceous material. Light patchy hydrocarbon stain, no fluorescence, minor green streaming cut fluorescence.

SHALE: brown to dark gray. Sub blocky to sub platy, silty and micromicaceous in part, with abundant disseminated pyrite.

SILTSTONE: medium gray. Aggregates are quartzose, well indurated with dolomitic cement, and appear tight.  
No shows.

1350.0m - 1360.0m: SANDSTONE, and COAL stringers and minor pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, with trace amounts of dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted, unconsolidated Light patchy hydrocarbon stain, orange fluorescence, immediate milky yellow streaming fluorescence.

1360.0m - 1370.0m: SANDSTONE, and COAL stringers and minor pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted, unconsolidated, estimated 18 to 24% intergranular porosity. Light patchy hydrocarbon stain, minor orange fluorescence, minor immediate milky yellow streaming fluorescence.

COAL ~25%

1370.0m -1380.0m: SANDSTONE, and trace COAL and minor pyrite nodules.

SANDSTONE: frosted white to light to medium gray to

light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted, unconsolidated, estimated 18 to 24% intergranular porosity. Light patchy hydrocarbon stain, minor orange fluorescence, minor immediate milky yellow streaming fluorescence.

1380.0m - 1400.0m:SANDSTONE, and COAL and minor pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and moderately sorted, unconsolidated, estimated 18 to 24% intergranular porosity. Light patchy hydrocarbon stain, minor orange/yellow fluorescence, immediate milky yellow streaming fluorescence.

COAL ~15%

1400.0m - 1420.0m:SANDSTONE, and minor COAL and minor pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and moderately sorted, unconsolidated, estimated 18 to 24% intergranular porosity. Light patchy hydrocarbon stain, minor orange/yellow fluorescence, immediate milky yellow streaming fluorescence.

COAL ~10% black, vitreous, blocky.

1420.0m - 1440.0m:SANDSTONE, and minor COAL and minor pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and moderately sorted, unconsolidated, estimated 18 to 24% intergranular porosity. Light patchy hydrocarbon stain, minor orange/yellow fluorescence, immediate milky yellow streaming fluorescence.

COAL ~10% black, vitreous, blocky.

1440.0m - 1470.0m:SANDSTONE, and minor COAL and minor pyrite nodules.

SANDSTONE: frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and moderately sorted, unconsolidated, estimated 18 to 24%

intergranular porosity. Light patchy hydrocarbon stain, minor orange/yellow fluorescence, immediate milky yellow streaming fluorescence.  
COAL ~10% black, vitreous, blocky.

1470.0m - 1500.0m: SANDSTONE, and minor COAL and minor pyrite nodules.  
SANDSTONE: frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and moderately sorted, unconsolidated, estimated 18 to 24% intergranular porosity. Light patchy hydrocarbon stain, minor orange/yellow fluorescence, immediate milky yellow streaming fluorescence.  
COAL ~5% black, vitreous, blocky.

1500.0m - 1520.0m: SANDSTONE, trace amounts of SHALE and trace amounts of pyrite nodules.  
SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted, estimated 18 to 24% intergranular porosity. The aggregates show patchy, light brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence.  
SHALE: dark gray. Sub blocky to sub platy, carbonaceous and micromicaceous in part.

1520.0m - 1530.0m: SANDSTONE and COAL and trace amount SILTSTONE and SHALE  
SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. The aggregates show patchy, light brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Aggregates are moderately indurated with calcareous and siliceous cement.  
SHALE: dark gray. Sub blocky to sub platy, carbonaceous and micromicaceous in part.  
SILTSTONE: light gray to brown, blocky, well indurated

with dolomitic cement, no shows.

1530.0m - 1550.0m: SANDSTONE and trace amounts of SHALE.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, lower medium to fine grained, sub angular to rounded, and moderately sorted. The aggregates show patchy, light brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Aggregates are moderately indurated with calcareous and siliceous cement.

SHALE: dark gray. Sub blocky to sub platy, very carbonaceous in part, micromicaceous in part and sandy in part.

1550.0m - 1580.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Even gray brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Aggregates are moderately indurated with calcareous and siliceous cement.

1580.0m - 1590.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Even gray brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, milky yellow cut fluorescence, and immediate, blooming, milky yellow streaming cut fluorescence. Aggregates are moderately indurated with calcareous and siliceous cement.

1590.0m - 1600.0m: SANDSTONE and trace amount SHALE.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub

rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Aggregates are moderately indurated with calcareous and siliceous cement.

SHALE: dark gray. Sub blocky to sub platy, carbonaceous and micromicaceous in part.

1600.0m - 1620.0m:SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. rare aggregates moderately indurated with calcareous and siliceous cement.

1620.0m - 1640.0m:SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. rare aggregates moderately indurated with calcareous and siliceous cement.

1640.0m - 1670.0m:SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. rare aggregates moderately indurated with siliceous cement.

1670.0m - 1690.0m:SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy, bright yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. rare aggregates moderately indurated with siliceous cement.

1690.0m - 1700.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to upper fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, even bright milky yellow fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence. rare aggregates moderately indurated with siliceous cement.

1700.0m - 1730.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to upper fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, even orange fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence. rare aggregates moderately indurated with siliceous cement.

1730.0m - 1760.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to upper fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, even orange fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence. rare aggregates moderately indurated with siliceous cement.

1760.0m - 1780.0m: SANDSTONE and trace amounts of pyrite nodules.  
SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to upper fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, even orange fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. rare aggregates moderately indurated with siliceous cement.

1780.0m - 1800.0m: SANDSTONE and COAL and trace amounts of pyrite nodules.  
SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to upper fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, even orange fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence. rare aggregates moderately indurated with siliceous cement.

1800.0m - 1810.0m: SANDSTONE and COAL and trace amounts of pyrite nodules.  
SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to upper fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, even, white cut fluorescence, and immediate, blooming, white streaming cut fluorescence.

1810.0m - 1830.0m: SANDSTONE and trace COAL and trace amounts of pyrite nodules.  
SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to upper fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, even orange fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence.



1830.0m - 1860.0m:SANDSTONE and trace COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to upper fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, even orange fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence.

1860.0m - 1880.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and moderately sorted. Patchy to even, light brown hydrocarbon stain, even, yellow to orange fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence.

1880.0m - 1910.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, even, yellow to orange fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence.

1910.0m - 1940.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, even, yellow to orange fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut

fluorescence.

1940.0m - 1960.0m:SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, patchy, milky yellow fluorescence, immediate, patchy, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence.

1960.0m - 1970.0m:SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, even, milky yellow fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence.

1970.0m - 2000.0m:SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. The few aggregates are poorly indurated with dolomitic cement. Patchy to even, light brown hydrocarbon stain, even, milky yellow fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence.

2000.0m - 2010.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, patchy, yellow to orange fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Rare aggregates are

moderately indurated with calcareous and siliceous cement.

2010.0m - 2020.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, patchy, yellow to orange fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous and siliceous cement.

2020.0m - 2040.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, even, milky yellow fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous and siliceous cement.

2040.0m - 2050.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, patchy, yellow to orange fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous and siliceous cement.

2050.0m - 2080.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, even, milky yellow fluorescence, immediate, even, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous and siliceous cement.

2080.0m - 2090.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light brown hydrocarbon stain, patchy, milky white to yellow fluorescence, immediate, patchy, bright white cut fluorescence, and immediate, blooming, bright white streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous and siliceous cement.

2090.0m - 2100.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and calcite crystals. fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy, orange fluorescence, immediate, patchy, yellow cut fluorescence, and slow, bright yellow streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous cement.

2100.0m - 2120.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and calcite crystals. fine to medium grained, sub angular to sub rounded, and well sorted. Patchy,

light brown hydrocarbon stain, patchy, orange fluorescence, immediate, patchy, yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous cement. Rare glauconite grains.

2120.0m - 2150.0m: SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy to even, light to medium brown hydrocarbon stain, patchy, yellow fluorescence, immediate, even, bright yellow cut fluorescence, and immediate, blooming, bright yellow streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous cement.

2150.0m - 2170.0m: SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy faint, orange fluorescence, immediate, patchy, yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. Rare aggregates are moderately indurated with siliceous and calcareous cement.

2170.0m - 2180.0m: SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, no fluorescence, immediate, patchy light, yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. Rare aggregates are well indurated with siliceous and calcareous cement.

2180.0m - 2190.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and minor calcite fragments. fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, patchy yellow cut fluorescence, and immediate, ribbony, yellow streaming cut fluorescence. The few aggregates are well indurated with calcareous cement.

2190.0m - 2200.0m:SANDSTONE, COAL, and trace amounts of pyrite.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and minor calcite fragments. fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, bright yellow/white cut fluorescence, and immediate, ribbony, yellow/white streaming cut fluorescence. The minor amounts of aggregates are well indurated with calcareous cement.

2200.0m - 2210.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and minor calcite fragments. very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, patchy bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. The few aggregates are well indurated with calcareous cement.

2210.0m - 2220.0m:SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and minor calcite fragments. fine to medium grained, sub angular to sub rounded, and well sorted.

Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, patchy yellow cut fluorescence, and immediate, ribbony, yellow streaming cut fluorescence. The minor amounts of aggregates are well indurated with calcareous cement.

2220.0m - 2240.0m:SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and minor calcite fragments. fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. The minor amounts of aggregates are well indurated with calcareous cement.

2240.0m - 2260.0m:SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and minor calcite fragments. very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. The minor amounts of aggregates are moderately indurated with calcareous cement.

2260.0m - 2270.0m:SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and minor calcite fragments. very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. The few aggregates are poorly indurated with calcareous cement.

2270.0m - 2280.0m:SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to

black chert, and minor calcite fragments. very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, weak patchy orange fluorescence, slow yellow cut fluorescence, and slow, minor yellow streaming cut fluorescence. The few aggregates are well indurated with calcareous cement.

2280.0m - 2300.0m:SANDSTONE and trace amounts of COAL

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, and minor calcite fragments. Very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, yellow cut fluorescence, and immediate, ribbony, yellow streaming cut fluorescence. The few aggregates are poorly indurated with calcareous cement.

2380.0m - 2410.0m:SANDSTONE with trace amounts of COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and medium to well sorted. Patchy, light to medium gray hydrocarbon stain, patchy yellow fluorescence, immediate patchy, yellow cut fluorescence, and slow, ribbony, milky yellow streaming cut fluorescence. Occasional aggregates are moderately indurated with calcareous, siliceous and dolomitic cements.

2300.0m - 2330.0m:SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray to light brown quartz, and dark gray to black chert, very fine to fine grained, sub angular to sub rounded, and well sorted. Patchy, light brown hydrocarbon stain, patchy orange fluorescence, immediate, yellow cut fluorescence, and immediate, ribbony, yellow streaming cut fluorescence. The few aggregates are poorly indurated with calcareous and dolomitic cements.

2330.0m - 2350.0m:SANDSTONE and trace amounts of COAL.



SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light gray hydrocarbon stain, patchy yellow fluorescence, immediate, light yellow cut fluorescence, and immediate, ribbony, light yellow streaming cut fluorescence. The few aggregates are poorly indurated with calcareous and dolomitic cements.

2350.0m - 2360.0m: SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light gray hydrocarbon stain, patchy faint orange fluorescence, immediate patchy, light yellow cut fluorescence, and immediate, ribbony, light yellow streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous, and dolomitic cements.

2360.0m - 2370.0m: SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light gray hydrocarbon stain, patchy faint orange fluorescence, immediate patchy, light yellow cut fluorescence, and immediate, ribbony, light yellow streaming cut fluorescence. Rare aggregates are well indurated with calcareous, siliceous and dolomitic cements.

2370.0m - 2380.0m: SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light gray hydrocarbon stain, patchy orange fluorescence, immediate, yellow cut fluorescence, and immediate, even, light yellow streaming cut fluorescence. occasional aggregates are well indurated with calcareous, siliceous and dolomitic cements.

2410.0m - 2440.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, very fine to medium grained, sub angular to sub rounded, and medium sorted. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. Occasional aggregates are moderately indurated with calcareous, siliceous and dolomitic cements.

2440.0m - 2460.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. Minor aggregates are moderately indurated with calcareous, siliceous and dolomitic cements.

2460.0m - 2480.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. Minor aggregates are moderately indurated with calcareous, siliceous and dolomitic cements.

2480.0m - 2510.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. Rare aggregates are moderately indurated with calcareous, siliceous and dolomitic cements.

2510.0m - 2530.0m: SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, ribbon, bright yellow streaming cut fluorescence. Trace aggregates are moderately indurated with calcareous, siliceous and dolomitic cements.

2530.0m - 2550.0m: SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, ribbon, bright yellow streaming cut fluorescence. Trace aggregates are moderately indurated with calcareous, siliceous and dolomitic cements.

2550.0m - 2570.0m: SANDSTONE and SHALE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, moderately fast, patchy, bright yellow cut fluorescence, and moderately fast, ribbon, bright yellow streaming cut fluorescence. Trace aggregates are moderately indurated with calcareous, siliceous and dolomitic cements.  
SHALE: black, blocky to sub platy, very carbonaceous

2570.0m - 2580.0m: SANDSTONE, COAL and SHALE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon

stain, patchy weak, orange fluorescence, patchy weak, cut fluorescence, and slow weak, milky yellow streaming cut fluorescence. Trace aggregates are poor to well indurated with calcareous, siliceous and dolomitic cements.

SHALE: black, blocky to sub platy, very carbonaceous

2580.0m - 2590.0m: SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, moderately fast, patchy, bright yellow cut fluorescence, and moderately fast, ribbony, bright yellow streaming cut fluorescence. Trace aggregates are poor to moderately indurated with calcareous, siliceous and dolomitic cements.

2590.0m - 2600.0m: SANDSTONE and COAL and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium brown hydrocarbon stain, patchy weak, orange fluorescence, patchy weak, cut fluorescence, and slow weak, milky yellow streaming cut fluorescence. Trace aggregates are poor to moderately indurated with calcareous, siliceous and dolomitic cements.

2600.0m - 2610.0m: SANDSTONE: as previous. Patchy, light to medium brown hydrocarbon stain, patchy orange fluorescence, moderately fast, patchy, bright yellow cut fluorescence, and moderately fast, ribbony, bright yellow streaming cut fluorescence.

2610.0m - 2620.0m: SANDSTONE: as previous. Patchy, light to medium brown hydrocarbon stain, patchy weak, orange fluorescence, patchy weak, cut fluorescence, and slow weak, milky yellow streaming cut fluorescence.

2620.0m - 2630.0m: SANDSTONE: as previous. Patchy, light to medium

brown hydrocarbon stain, patchy orange fluorescence, moderately fast, patchy, bright yellow cut fluorescence, and moderately fast, ribbony, bright yellow streaming cut fluorescence.

2630.0m - 2660.0m:SANDSTONE and trace amounts of COAL.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and medium - dark gray to black chert, fine to medium grained, sub angular to sub rounded, and poor to medium sorted. Patchy, light to medium gray hydrocarbon stain, even orange to yellow fluorescence, fast, even, bright yellow cut fluorescence, and fast, even, bright yellow streaming cut fluorescence. Trace aggregates are moderately to well indurated with calcareous, and rare siliceous cements.

2660.0m - 2690.0m:SANDSTONE and trace amounts of pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, medium gray to brown hydrocarbon stain, patchy to even orange fluorescence, fast, even, bright yellow cut fluorescence, and fast, even, bright yellow streaming cut fluorescence. Trace aggregates are moderately to well indurated with siliceous and calcareous cements.

2690.0m - 2700.0m:SANDSTONE and trace amounts of SILTSTONE, SHALE, and COAL

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray to brown hydrocarbon stain, patchy orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. Trace aggregates are moderately to well indurated with calcareous, siliceous and dolomitic cements.

SILTSTONE: brown to black, moderately hard, sandy.

SHALE: dark brown to black, soft, carbonaceous in part.

2700.0m - 2720.0m:SANDSTONE and trace amounts of SILTSTONE, SHALE,

COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray to brown hydrocarbon stain, no fluorescence, no cut fluorescence, no streaming cut fluorescence, no halo fluorescence, no dry cut fluorescence. Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SILTSTONE: brown to black, moderately hard, sandy.

SHALE: brown to black, soft, carbonaceous in part.

2720.0m - 2730.0m: SANDSTONE and trace amounts of SHALE, COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray to brown hydrocarbon stain, immediate patchy, bright yellow cut fluorescence, and immediate, ribbon, bright yellow streaming cut fluorescence. Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SHALE: brown to black, soft, carbonaceous in part.

2730.0m - 2740.0m: SANDSTONE and trace amounts of SHALE, COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray to brown hydrocarbon stain, but no fluorescence. Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SHALE: brown to black, soft, carbonaceous in part.

2740.0m - 2750.0m: SANDSTONE and trace amounts of SHALE, COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray

to brown hydrocarbon stain, patchy, orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, ribbony, bright yellow streaming cut fluorescence. Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SHALE: brown to black, soft, carbonaceous in part.

2750.0m - 2780.0m:SANDSTONE and trace amounts of SHALE, COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray to brown hydrocarbon stain, patchy, orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, bright yellow streaming cut fluorescence. Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SHALE: brown to black, soft, carbonaceous in part

2780.0m - 2800.0m:SANDSTONE and trace amounts of SHALE, COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray to brown hydrocarbon stain, patchy, orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, bright yellow streaming cut fluorescence. Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SHALE: brown to black, soft, carbonaceous in part

2800.0m - 2820.0m:SANDSTONE and trace amounts of SHALE, COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray to brown hydrocarbon stain, even, orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, bright yellow streaming cut fluorescence.

Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SHALE: brown to black, soft, carbonaceous in part

2820.0m - 2840.0m:SANDSTONE with trace amounts of SHALE, COAL and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray to brown hydrocarbon stain, even, orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, bright yellow streaming cut fluorescence.

Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SHALE: brown to black, soft, carbonaceous in part.

2840.0m - 2863.0m:SANDSTONE and trace amounts of SHALE and pyrite nodules.

SANDSTONE: unconsolidated, frosted white to light to medium gray quartz, and abundant dark gray to black chert, fine to medium grained, sub angular to sub rounded, and well sorted. Patchy, light to medium gray hydrocarbon stain, even, orange fluorescence, immediate patchy, bright yellow cut fluorescence, and immediate, bright yellow streaming cut fluorescence.

Trace aggregates are moderately to well indurated with siliceous and dolomitic cements.

SHALE: brown to black, soft, carbonaceous in part.



## **GEOLOGICAL SUMMARY**

This horizontal well was spudded on January 11, 2013 at 11:15am, and drilling was completed on January 22, 2013 at 8:30am. It was drilled to explore the hydrocarbon potential of the Glauconite Sandstone Channel. Surface casing was set at 286.0 metres, and intermediate casing was set at 1121.0 metres. Five metre samples were caught and described from 820.0 metres to 1121.0 metres. For the lateral section, ten metre samples were caught and described from 1121.0 metres to 2863.0 metres. A portable gas detector was installed, and monitored while drilling ahead. All depths referred to in this summary are sample depths relative to the kelly bushing elevation.

The Glauconite Sandstone Channel was encountered at 1059.96 metres MD (921.80 metres TVD, -172.5 metres SS). The most prospective part of this Sandstone was encountered at 1107.0 metres to Total Depth, and was composed of frosted white to light gray to light brown quartz, with trace amounts of dark gray to black chert. It was fine grained, sub angular to sub rounded, and well sorted. The aggregates were moderately indurated with calcareous cement, and appeared tight. The few aggregates showed a patchy, light brown hydrocarbon stain, a patchy, very dull yellow fluorescence, a slow, patchy, dull yellow cut fluorescence, and a slow, "ribbony", dull yellow streaming cut fluorescence. The gas detector readings peaked at 222 units, at 1118 metres, versus a background level of 70 units.

The Glauconite Sandstone Channel throughout the lateral section consisted of frosted white to light to medium gray to light brown quartz, and dark gray to black chert. It was partly to completely unconsolidated, very fine to medium grained, sub angular to sub rounded, and moderately to well sorted. The reservoir exhibited nil to an estimated 24% intergranular porosity, although the unconsolidated nature of the samples could indicate different porosity values. The aggregates present were moderately to well indurated with calcareous, siliceous, and dolomitic cements. They showed patchy, light brown hydrocarbon staining, patchy, bright yellow fluorescence, moderately fast to immediate, patchy, bright yellow cut fluorescence, and moderately fast to immediate, blooming to ribbony, bright yellow streaming cut fluorescence. Throughout the lateral section, trace to minor amounts of shale, siltstone, coal, and pyrite nodules were encountered.

Subsequent to the drilling and logging operations, this well had a liner installed for potential Glauconite Sandstone Channel oil production.

The above is a brief geological summary outlining the main zone of hydrocarbon potential that was encountered in this well bore.

Submitted cordially,

A handwritten signature in black ink, appearing to read "L. J. Horback", with a stylized flourish at the end.

L. Horback, P.Geol.