Geological Report

on

NCY Ehnjuu Choo B-73

Surface Location: 300/H-60-6620-13645/0

Bottom Hole Location: 66:12:10.35N/136:59:01.56W

Well Reached Total Depth on
Jun 22, 2013@ 13:45

for

NORTHERN CROSS YUKON LIMITED

Well License # : 1128

Prepared For: B.McDowell, D.Stachiw. P.Moignard
NORTHERN CROSS YUKON LTD.

Prepared By: Keith Miller (M45781)
Keitech Consultants Ltd. (P10492)

Keith Miller (M45781)

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NCY Ehnjuu Choo B-73 is an exploratory well drilled to evaluate multiple conventional targets, identified as AVO anomalies on 2-D seismic, and several other Paleozoic unconventional targets identified in Carboniferous through Devonian aged rocks. Primary targets were the Devonian Ogilvie formation, for conventional oil production, and the Devonian Ford Lake and Canol formations for unconventional shale gas production. Secondary targets were both conventional and unconventional objectives within the Carboniferous Hart River formation.

Ehnjuu Choo B-73 is the fourth well, drilled and operated by Northern Cross Yukon, in the 2012-2013 drilling season. The well is located at kilometre 341 on the north side of Dempster highway in the Eagle Plain area of the north central Yukon Territory. The Eagle Plain is an intermontane compressional basin bounded on the east by the Richardson Mountains, and on the north, west and south by the Keele, Nahoni and Taiga ranges respectively, of the Ogilvie Mountains. The basin covers an area of approximately 20,608km2, and is bisected by the Arctic Circle. The area is characterized by lightly forested low rolling hills with elevations ranging between 400 and 800 metres, and can be accessed year round by the Dempster highway, which exists as a high grade roadbed, consisting either of compacted sandstone, limestone or shale quarried from numerous pits located close to the roadway. As such, the road can have challenging conditions over the seasons in any particular year. Dawson City is located approximately 5 hours by road to the southwest, Whitehorse is 11 hours to the south, and Inuvik is approximately 6-7 hours to the northeast, however to travel to Inuvik by road, there are two ferry crossings over each of the Peel and Mackenzie Rivers that only operate in the summer and fall. To cross in the winter requires the rivers freeze over, and an ice road be established. Most personnel working on the project not travelling by road, were flown into Inuvik by charter on jets from Edmonton, then chartered from Inuvik to the project by Twin Otter aircraft. Commercial air travel is also available into Inuvik Monday through Friday each week. Twin Otters landed on the Dempster highway, opposite the approach to the projects main camp site.

Ehnjuu Choo B-73 was spudded April 16th, 2013, and was drilled to a depth of 3350mMD, reached 68 days later on June 23th, 2013. For the most part drilling operations progressed smoothly and without significant delay with the exception of surface hole, where 7 cement plugs were run to heal loses over the Parkin Orange Marker. Surface hole was drilled to 352mMD in 35.75 hours rotating, but required 9 days operating, with the additional time spent due to the lost circulation problems. Surface hole was logged without incident, and 339.7mm casing was then run and cemented to surface. Surface hole was logged without incident, and 339.7mm casing was then run and cemented to surface.
The hole above the Orange Marker is extensively washed out. Oil is present in the conglomerates and sandstones associated with the upper 19 meters of strata which overlie the Lower Cretaceous angular unconformity, within the underlying Jungle Creek Formation and within the Blackie High-Stand Systems Tract between 295 and 300 mMD.

Intermediate hole (311 mm) was drilled from 366m to 1252mMD relatively quickly and without incident in 13 days between April 27th and May 9th, requiring ~223 rotating hours and utilizing 6 bits. Kick-off point occurred at 399mMD and the well was drilled to the northwest at ~320 degree azimuth, reaching a maximum angle of 37.1deg. Approximately 13.9m of core was cut and recovered over the top of the Ford Lake representing part of the section where some of the highest gamma response occurred. The core is currently being analyzed and several sections are being desorbed to ascertain the potential for shale gas production from these rocks.

The 222mm phase of the hole was drilled from 1252-2855mMD and was drilled entirely within the Imperial formation. The Imperial is a very thick section (1570.7mTVD) of predominantly variably

carbonaceous shales with minor interbedded thin turbiditic sandstones and siltstones deposited in prominent clinoforms. Clinoforms are interrupted, or augmented with blocky sandstones, believed to have been deposited in lower to upper shoreface settings, and are collected referred to as "Tuttle Sands". A "sequence stratigraphy" approach to studying this basin is required to fully understand the complexity of the section, and get an understanding of the broad-based correlation between the stratigraphic units.

Unlike holes drilled at A-25 and H-28 the Imperial was relatively undeformed, although near vertical jointing was seen in both conventional and sidewall cores recovered from this section. Shearing, which was prominent in both A-25 and H-28 was not nearly as prevalent in the shales at B-73, and as a consequence, this well did not experience the hole problems seen in the aforementioned holes. Drilling this phase of the hole required 24 days operating, utilizing 10 drill bits and ~274 rotating hours. After logging and sidewall coring operations were conducted, casing was run and cemented full length without incident and drilling the 156mm phase of the hole resumed.

The 156mm phase of the hole was drilled from 2850-3350mMD, also relatively quickly and without any significant delay or incident. The Imperial persisted down to 3044mMD, where the Canol top was encountered. The Canol top occurs 322mTVD deeper than anticipated on the prognosis, attesting to the complexity of the stratigraphic section in this basin. A core was planned for the Canol, but was not cut, as the zone was fully penetrated before it was realized that the formation had been encountered, being only 12.2mMD (11.1mTVD) in thickness.

The Ogilvie is in sharp contact with the overlying Canol. Sample and sidewall cores seem to indicate that the well was drilled outboard of the any potential reef build-up that may be present. Two sidewall cores showed cylindrical and small bulbous Stromatoporoid remains in a muddy wackestone matrix, indicative of the rock fabric one typically sees in a foreslope setting. Mudstone partings are likely indicative of a relative rise in sea level, and more basinal deposition.

This well was cased to total depth and remains standing in the event further evaluation is warranted.

Well Summary

Storage Units: Metric

Well Information

Operator:	**NORTHERN CROSS YUKON LIMITED**
Well Name:	**NCY Ehnjuu Choo B-73**
Surface Location:	**300/H-60-6620-13645/0**
Bottom Hole Location:	**66:12:10.35N/136:59:01.56W**
UWI:	300H60662013645
Pool:	Wildcat
Field:	Wildcat
State / Province:	Yukon
Country:	Canada
License Number:	1128
Well Status:	**Cased and Standing**

Surface Co-ordinates

Hole Type: Deviated **Fault Indicator:**

Latitude: 66.121035 **Longitude:** 136.590156

UTM Northing: 7343938.10 **UTM Easting:** 410691.44

N / S :
E / W :

Int. Casing Co-ordinates

Latitude: **Longitude:**

N / S :
E / W :

Bottom Hole Co-ordinates

Latitude: **Longitude:**

N / S :
E / W :

Elevations

Reference: Sea Level

Ground Elevation:	673.20	**Kelly Bushing to Ground:**	8.50
Kelly Bushing Elevation:	681.70	**Cut (-):**	0.00
Casing Flange Elevation:		**Fill (+):**	0.00

Total Depth

	Measured Depth	**True Vertical Depth**
Total Depth Driller (Tally) :	3,350.00	2,946.87
Total Depth Driller (Strap or SLM):		
Total Depth Logger:	3,353.00	2,949.81

Miscellaneous Depths

Plugback Depth: **Water Depth Reference:**

Sidetrack Depth: **Water Depth:**

Well Summary

Drilling Contractor: Patterson-UTI Drilling Company **Spud Date:** Apr 16, 2013 @ 02:00

Rig Release Date: Jun 26, 2013 @ 23:59 **Total Depth Date:** Jun 22, 2013 @ 13:45

Cores

#	Formation	Interval		Cut	Recovered	%
1	Ford Lake	940.60	954.52	13.92	13.92	100.00
2	Imperial	2,908.59	2,912.59	4.00	4.00	100.00
3	Canol	2,931.40	2,949.40	18.00	18.00	100.00

Well Summary

Storage Units: Metric

Casing Summary

Casing Type	Casing Size	Landed Depth	Hole Size
Surface	339.7	366.00	444.5
Intermediate	244.5	1,249.00	311.0
	177.8	2,853.00	222.0
Liner	114.3	3,349.00	156.0

Logging Summary

Company	Engineer	Total Depth (MD)	Logging tools
Schlumberger	Micheal Lapointe	366.00	AIT, PEX, HNGS to surface.
			DSI, PPC, GPIT from 366 to surface.
	Michel Lapointe	1,252.00	MSCT-GR
			FMI-GPIT-Sonic Scanner-PPC2 (x2)
			ADT-ECS-CMR
			PEX: AIT-CNL-LDT-GR-SP w/HNGS, GPIT, PPC-2
	Mark Gonsalves	2,855.00	MSCT-GR
			FMI-GPIT-PPC2-Sonic Scanner
			ADT/Stringray/CMR
			PEX/AIT/HRLA/HNGS/CNL-TLD2 with GR & SP
	Michel Laponte	3,350.00	MSWCT-GR
			FMI-PPC-MSIP-PPC
			ADT-NEXT-CMR
			AIT-PEX-HNGS-HRLA-GPIT-PPL-TLD2

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Apr 11, 13	0.00		0.00	0.00	00:00-24:00Hrs; April 10, 2013 Wait on day light, safety meeting with crews, company reps, move rig, Wait on day light.
Apr 12, 13	0.00	0.00	0.00	0.00	00:00-24:00Hrs; April 11, 2013 Wait on day light, spot substructure, matting, level sub, lift and pin derrick, rig in dog house, spot and rig in pump houses, mud tanks, degasser, generater buildings, SCR, boiler # 1, TD gen and TDSU, rig in water, fuel, power, hydraulic air lines, rig in mud tanks.
Apr 13, 13	0.00	0.00	0.00	0.00	00:00-24:00Hrs; April 12, 2013 Wait on day light, preform yearly inspection of brakes, pads and linkages and pins, prepare to raise derrick, prepare mud tanks, rig in power cords, finish spring inspections, prepare to raise derrick, safety meeting, raise derrick, plug in derrick cords and rig in derrick.
Apr 14, 13	0.00	0.00	0.00	0.00	00:00-24:00Hrs; April 13, 2013 Safety meeting with crews, rig up JSA#217, unbridal and remove equalizer from blocks, un bridal and remove equalizer, rig in floor, pason, prefabs, and prepare floor for raising, prepare substructure for raising, safety meeting, raise substructure, rig in cable tray, pason lines, power lines, lift V door, install beavertail slide, P/U and rig in sub pumphouse, prefabs and tarps, finish installing sub prefabs, and doors.
Apr 15, 13	0.00	0.00	0.00	0.00	00:00-24:00Hrs; April 14, 2013 Safety meeting prior to lifting and installing torque tube, rig up top drive, service loop, torque tube, power and hydraulics, pin top drive torque track to crown, install diverter, flow tee, flowline, rig in diverter line, set up flare stack, rig in top drive, setup top drive cable tray and hook up connections, rig up top drive cords, top drive console cords, kelly hose and BOP valve.
Apr 16, 13	94.00	94.00	5.50	17.09	00:00-24:00Hrs; April 15, 2013 Rig up and prepare to spud. Rig up top drive and perform necessary repairs with Canrig Technician. Work on steam lines and water lines. Heat 400 barrel tanks of stored drilling mud and water

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Apr 17, 13	100.00	6.00	0.50	12.00	00:00-24:00Hrs; April 16, 2013 M/U bit, bit sub, shock sub, and 8 inch collars, drill 444.5 mm hole from 20-99 m (MD), (a 10 meters depth correction at 80 m (MD) was made), loss of circulation, pump LCM slugs @ 98 m (MD), POOH, add 37 sacks of enviroplug, top fill with water, well static, RIH to 80 m (MD), wash to 97 m (MD), loss of circulation at 97 m (MD), spot high vis plug at 97 m (MD), POOH, add 35 sacs of enviroplug, top fill hole with water, well static, RIH to 51 m (MD), pump and squeeze, RIH to 99 m (MD), POOH, mix LCM, build volume, dump 30 sacks of enviroplug down hole.
Apr 18, 13	102.00	2.00	0.25	8.00	00:00-24:00Hrs; April 17, 2013 RIH, circulate and condition mud, drill 444.5 mm hole from 99-100 m (MD), POOH, build volume, mix LCM, dump enviroplug, RIH. attempt to circulate, POOH, RIH with 5 inch drill pipe, wait on cementers, rig up cementers, wait on cementers, safety meeting prior to cementing plug 1, pump plug 1, tear out circulating head, pressure test line, top fill hole and circulate clean, pump 8 cubic meters of mud, no returns to surface, wait on cement, RIH and tag cement at 88 m (MD), circulate, safety meeting with Halliburton cementers, rig in Halliburton, pump cement plug 2, pull out of cement plug, POOH, M/U bit, BHA, RIH.
Apr 19, 13	116.00	14.00	1.75	8.00	00:00-24:00Hrs; April 18, 2013 Wait for cement plug to set, wash into hole to 65 m (MD), drill cement from 65-83 m (MD), and from 90-98 m (MD), drill 444.5 mm hole from 100-102 m (MD) with no returns, POOH, RIH, Wait on cementers, pressure test lines and pump plug # 3 (6 m3), break off pup joint, pull two stands of drill pipe, fill annulus with no returns to surface, wait on cement, POOH, M/U bit, P/U collars, RIH to 84 m (MD), drill out cement from 84-102 m (MD), drill blind from 102-116 m (MD), POOH, L/D BHA, RIH, rig in Halliburton and wait while they prepare cement plug.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Apr 20, 13	116.00	0.00	0.00	0.00	00:00-24:00Hrs; April 19, 2013 Pump cement plug #4, POOH, WOC, top fill hole, RIH, drill out cement from 73-102 m (MD), LOC, POOH, drop LCM down annulus from floor, RIH to 75m, drill out cement to 104 m (MD), pump LCM sweep. POOH, RIH, wash through tight spot at 75 m (MD), rig in cementers, pump plug #5. POOH, WOC. Top fill hole, run in one stand of pipe and close BOP bag and squeeze cement plug. Slip & cut. RIH to 60 m (MD) and tagged LCM bridge wash in to 75m, drill cement to 106 m (MD), LOC.
Apr 21, 13	152.00	36.00	4.50	8.00	00:00-24:00Hrs; April 20, 2013 POOH, drop LCM from floor, pump high vis sweep, RIH, hit bridge @ 70 m (MD), pump and rotate through bridge, wash to 104 m (MD), drill cement to 116 m (MD) and spot LCM pill. POOH, RIH / cement stinger, rig in cementers, cement plug 6, POOH, top fill annulus, squeeze cement, RIH / BHA, WOC, tag cement @ 77 m (MD), drill out cement from 77-116 m (MD), LOC, POOH, RIH / BHA, mix & pump LCM slug, condition and circulate mud, rig in cementers, run cement plug 7, POOH, squeeze cement, P/U bit & BHA, RIH, circulate and WOC.
Apr 22, 13	238.00	86.00	17.50	4.91	00:00-24:00Hrs; April 21, 2013 Circulate and WOC, drill cement from 89-116 m (MD), drill 444.5 mm hole & survey from 116-216 m (MD).
Apr 23, 13	301.00	63.00	10.25	6.15	00:00-24:00Hrs; April 22, 2013 Drill 444.5 mm hole from 216-246 m (MD), circulate bottoms up, POOH, P/U dir tools, & 311 mm bit, RIH, dir drill 311 mm hole from 246-262 m (MD).
Apr 24, 13	352.00	51.00	10.50	4.86	00:00-24:00Hrs; April 23, 2013 Dir drill 311 mm hole from 262-352 m (MD), pump high vis sweep, POOH, P/U 444 mm bit, RIH, jack and level rig, wash into hole from 241-246 m (MD), ream 444 mm hole from 246-253 m (MD).
Apr 25, 13	366.00	14.00	3.25	4.31	00:00-24:00Hrs; April 24, 2013 Ream 444.5 mm hole from 253-353 m (MD), drill 444.5 mm hole from 352-366 m (MD), pump pill, POOH, rig up Schlumberger loggers, log hole.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Apr 26, 13	366.00	0.00	0.00	0.00	00:00-24:00Hrs; April 25, 2013 Rig out Schlumberger loggers, rig up casing equipment, power tongs, run 339.7 mm surface casing, circulate and condition mud, rig up pack off tools, RIH, rig up import tools, circulating tool, and spider, RIH, set pack off tool, circulate, cement surface casing, flush diverter and rig out pack off tool, POOH, WOC.
Apr 27, 13	366.00	0.00	0.00	0.00	00:00-24:00Hrs; April 26, 2013 Wait on cement, back off landing joint, tear out and L/D diverter equipment, cut off conductor barrel, P/U bowl and install, safety meeting prior to nippling up BOP, nipple up BOP, kill line, HCR lines, shock hoses to manifold shack & flare lines, safety meeting, pressure test.
Apr 28, 13	417.00	51.00	9.00	5.67	00:00-24:00Hrs; April 27, 2013 Pressure test BOP, accumulator, P/U dir tools, scribe motor, RIH, tag cement @ 241 m (MD), drill out cement, float, dir drill 311 mm hole from 366-371 m (MD), circulate hole clean, preform leak off test, dir drill 311 mm hole from 371-408 m (MD), circulate bottoms up, POOH for gamma.
Apr 29, 13	489.00	72.00	20.00	3.60	00:00-24:00Hrs; April 28, 2013 POOH, re-program gamma tool, change out bit, RIH, wash from 403-408 m (MD), dir drill 311 mm hole from 408-463 m (MD).
Apr 30, 13	566.00	77.00	20.25	3.80	00:00-24:00Hrs; April 29, 2013 Drill and survey 311mm directional hole f/463-543mMD.
May 1, 13	634.00	68.00	21.00	3.24	00:00-24:00Hrs; April 30, 2013 Drill and survey 311mm directional hole f/543-611mMD.
May 2, 13	683.00	49.00	12.00	4.08	00:00-24:00Hrs; May 1, 2013 Drill and survey 311mm directional hole f/611-649mMD. Circulate bottoms up. POOH. Rack monels. Drain motor. Break bit. Handle MWD tools. Change bit. RIH w/ Bit #3 to 339m Slip and cut 14m drilling line. RIH.
May 3, 13	792.00	109.00	21.00	5.19	00:00-24:00Hrs; May 2, 2013 Wash 2 stands to bottom and pattern bit. Drill and survey 311mm directional hole f/649-758mMD.
May 4, 13	870.00	78.00	22.00	3.55	00:00-24:00Hrs; May 3, 2013 Drill and survey 311mm directional hole f/758-848mMD.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
May 5, 13	906.00	36.00	1.50	24.00	00:00-24:00Hrs; May 4, 2013 Drill and survey 311mm directional hole f/848-906mMD. Circulate bottoms up.
May 6, 13	942.00	36.00	6.75	5.33	00:00-24:00Hrs; May 5, 2013 Pump pill. POOH. Break off reamer and shock sub. Handle directional tools - rack monels, drain motor. Break bit. Change out mud motor. Check MWD tool. Make up Bit #4. Scribe mud motor. P/U reamer and short monel. Down load MWD data and program tool. Run in directional BHA. P/U shock sub. RIH. Wash f/883-906mMD - 0.5m fill. Pattern bit. Drill and survey 311mm directional hole f/906-924mMD. Circulate sample. Drill ahead. Circulate samples at 935 & 940mMD.
May 7, 13	978.00	36.00	7.00	5.14	00:00-24:00Hrs; May 6, 2013 Drill 311mm directional hole f/940-942mMD. Circulate bottom hole sample. Mix and pump pill. L/D 2 jts DP. POOH to core. L/D reamer and shock sub. Handle directional tools. Rack monels. Download MWD data. Remove MWD tool. Rack tool housing and Mud Motor. P/U and M/U coring BHA. RIH. Drop ball. Cut Core #1 f/942-956mMD. Jam-off. POOH. Recover core. L/D core barrels. Make up bit and directional BHA - set bend @ 1.5deg.
May 8, 13	1,113.00	135.00	18.50	7.30	00:00-24:00Hrs; May 7, 2013 RIH. Ream rathole f/942-956mMD. Drill 311mm directional hole f/956-1079mMD.
May 9, 13	1,208.00	95.00	20.00	4.75	00:00-24:00Hrs; May 8, 2013 Drill 311mm directional hole f/1079-1179mMD.
May 10, 13	1,252.00	44.00	12.50	3.52	00:00-24:00Hrs; May 9, 2013 Drill 311mm directional hole f/1179-1252mMD. Reach ICP @ 23:00Hrs. Bottom hole survey. Circulate hole clean. Pump pill.
May 11, 13	1,252.00	0.00	0.00	0.00	00:00-24:00Hrs; May 10, 2013 Circ mud and condition hole (0.5hr). W/T to shoe. Slip & cut 17m drilling line. RIH. Circulate and clean to btm f/820mMD. Condition mud and circulate (2hrs). Back ream out of hole f/1252-361mMD. POOH. L/D shock sub, reamer, monels & stabalizer. Remove MWD tool. Drain motor. Break bit. L/D mud motor.
May 12, 13	1,252.00	0.00	0.00	0.00	00:00-24:00Hrs; May 11, 2013 Clean floor and prep for logging. Rig in and log with Schlumberger. (Runs 1, 2 & 3)

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
May 13, 13	1,252.00	0.00	0.00	0.00	00:00-24:00Hrs; May 12, 2013 Log with Schlumberger (complete run 3). P/U SWCT. Cut and recovery 56 sidewall cores in 2 descents. Rig out Schlumberger. Pull wear bushing. Rig to, and run 244.5mm casing.
May 14, 13	1,252.00	0.00	0.00	0.00	00:00-24:00Hrs; May 13, 2013 Run 244.5 mm casing, circulate hole clean, wait on Halliburton, safety meeting with Halliburton, rig in cementers, cement casing, rig out cementers, safety meeting with pressure tester, pressure test, install wear bushing.
May 15, 13	1,283.50	31.50	9.00	3.50	00:00-24:00Hrs; May 14, 2013 Pressure test, P/U dir tools, M/U bit 5, motor, monels, reamers, gap sub, function test blind rams, RIH, drill out float and collar, pressure test casing to 16400 KPa, drill out cement and shoe, dir drill 222 mm hole from 1249.15-1257 m (MD), preform a leak off test, displace 38 cubic meters of water to ultradrill mud system, dir drill 222 mm hole from 1257-1279 m (MD), held BOP drill.
May 16, 13	1,407.00	123.50	12.00	10.29	00:00-24:00Hrs; May 15, 2013 Dir drill 222 mm hole from 1279-1283 m (MD), circulate bottoms up, POOH, L/D MWD tool, gap sub, program tool, check motor, P/U PDC bit #6, RIH, slip and cut, dir drill 222 mm hole from 1283-1361 m (MD).
May 17, 13	1,560.00	153.00	20.25	7.56	00:00-24:00Hrs; May 16, 2013 Dir drill 222 mm hole from 1361-1508 m (MD).
May 18, 13	1,579.00	19.00	2.50	7.60	00:00-24:00Hrs; May 17, 2013 Dir drill 222 mm hole from 1508-1575 m (MD), wiper trip to casing, RIH, dir drill 222 mm hole from 1575-1577 m (MD), POOH for bit, L/D shock sub, out gap sub, MWD and transmitter, drain motor & P/U bit 7, program MWD tool, orientate tool, RIH to 375 m (MD).
May 19, 13	1,606.00	27.00	7.50	3.60	00:00-24:00Hrs; May 18, 2013 RIH, slip and cut drill line, RIH, ream and clean from 1395-1577 m (MD), dir drill 222 mm hole from 1577-1585 m (MD), circulate up bottom hole sample, POOH, L/D shock sub, out gap sub, MWD, transmitter, drain and change out motor, M/U bit 8, scribe motor, program tool, RIH.
May 20, 13	1,697.00	91.00	16.00	5.69	00:00-24:00Hrs; May 19, 2013 Wash into hole from 1362-1460 m (MD), tight spots @ 1325, 1345, 1364, 1379, 1403, 1414, 1429, and 1432 m (MD). Wash to bottom, dir drill 222 mm hole from 1585-1689 m (MD).

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
May 21, 13	1,831.00	134.00	9.00	14.89	00:00-24:00Hrs; May 20, 2013 Dir drill 222 mm hole from 1689-1697 m (MD), circulate bottoms up, POOH, handle dir tools, change out bit, RIH, wash into hole from 1680-1697 m (MD), dir drill 222 mm hole from 1697-1745 m (MD).
May 22, 13	1,900.00	69.00	7.00	9.86	00:00-24:00Hrs; May 21, 2013 Dir drill 222 mm hole from 1745-1860 m (MD), circulate and troubleshoot MWD, POOH, handle dir tools, L/D TBR, shock tool, gap sub, M/U bit 10, scribe motor, program tool, RIH.
May 23, 13	1,959.00	59.00	11.50	5.13	00:00-24:00Hrs; May 22, 2013 RIH, slip and cut drill line, RIH, wash from 1820-1960 m (MD), no fill, pattern bit, dir drill 222 mm hole from 1960-1959 m (MD), circulate hole clean.
May 24, 13	2,054.00	95.00	14.25	6.67	00:00-24:00Hrs; May 23, 2013 POOH for bit, L/D shock sub, monel, MWD tool, drain motor, break bit, scribe, M/U bit 11, down load surveys and program tool, RIH, wash into hole from 1980-1959 m (MD), dir drill 222 mm hole from 1959-2024 m (MD).
May 25, 13	2,061.00	7.00	1.75	4.00	00:00-24:00Hrs; May 24, 2013 Dir drill 222 mm hole from 2024-2061 m (MD), circulate bottoms up, POOH for bit, L/D shock sub, reamer, rack monels, test and download data from MWD tool, break bit, change motor, install bit, P/U shock sub, monels and reamer, RIH, scribe motor, change out MWD segments, M/U and reprogram MWD tool, P/U and install upper TBR, RIH.
May 26, 13	2,160.00	99.00	19.50	5.08	00:00-24:00Hrs; May 25, 2013 RIH, slip and cut drill line, RIH from 1252 m (MD), wash and ream from 1626-bottom, tight spots at 1626, 1637, and 1928 m (MD), dir drill 222 mm hole from 2061-2127 m (MD).
May 27, 13	2,235.00	75.00	19.00	3.95	00:00-24:00Hrs; May 26, 2013 Dir drill 222 mm hole from 2127-2207 m (MD).
May 28, 13	2,324.00	89.00	19.25	4.62	00:00-24:00Hrs; May 27, 2013 Drill and survey 222 mm directional hole f/2207-2279mMD. Rig repairs (change cap gasket on pump #2; change head on pump #1 1.5hrs). Drill and survey ahead f/2279-2297mMD.
May 29, 13	2,412.00	88.00	20.00	4.40	00:00-24:00Hrs; May 28, 2013 Drill and survey 222 mm directional hole f/2297-2390mMD.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
May 30, 13	2,419.00	7.00	2.00	3.50	00:00-24:00Hrs; May 29, 2013 Drill and survey 222mm directional hole f/2412-2417mMD. Circulate bottoms up. Pump pill. POOH. L/D Reamer. Handle directional tools. P/U and M/U new motor and bit. RIH to 1241mMD.
May 31, 13	2,501.00	82.00	20.50	4.00	00:00-24:00Hrs; May 30, 2013 Fill pipe. Slip & cut 17m drill line. RIH. Wash f/2374-2417mMD. Pattern bit. Drill 222mm directional hole f/2417-2475mMD.
Jun 1, 13	2,501.00	0.00	0.00	0.00	00:00-24:00Hrs; May 31, 2013 Drill and survey 222mm directional hole f/2475-2501mMD. Circulate bottoms up. Pump pill. POOH. L/D Reamer and shock sub. L/D MWD tool. Drain motor. Change bit and MWD tool. P/U monels reamer & shock sub. Trip in hole to 835mMD. Slip and cut 12m drill line. Trip in hole - Ream and clean 2006-2014m & 2104-2115mMD.
Jun 2, 13	2,580.00	79.00	13.25	5.96	00:00-24:00Hrs; June 1, 2013 Ream and clean f/2115-2338mMD. Stuck at the bit @ ~2338mMD. Work and jar to free stuck bit. Ream and clean f/2338-2501mMD. Drill and survey 222mm directional hole f/2501-2544mMD
Jun 3, 13	2,666.00	86.00	17.50	4.91	00:00-24:00Hrs; June 2, 2013 Drill and survey 222mm directional hole f/2544-2645mMD. Replace worn head and liner in Pump #1.
Jun 4, 13	2,730.00	64.00	12.50	5.12	00:00-24:00Hrs; June 3, 2013 Drill and survey 222mm directional hole f/2645-2655mMD. Rig maintenance (change discharge seat and valve in pump #1 - .75hrs). Drill and survey 222mm directional hole f/2655-2730mMD.
Jun 5, 13	2,785.00	55.00	14.75	3.73	00:00-24:00Hrs; June 4, 2013 Work on pump #1 (washed-out circulating line). Circulate botttoms up. W/T to 1865mMD. Change heads and liners on pump #2. Trip in hole. Drill and survey 222mm hole f/2730-2742mMD. Circulate bottoms up. W/T to 2300mMD. Trip in hole. Drill and survey ahead f/2742-2761mMD.
Jun 6, 13	2,855.00	70.00	18.75	3.73	00:00-24:00Hrs; June 5, 2013 Drill and survey 222mm hole f/2761-2839mMD

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jun 7, 13	2,855.00	0.00	0.00	0.00	00:00-24:00Hrs; June 6, 2013 Drill and survey 222mm hole f/2839-2855mMD. Circulate bottoms up. W/T and condition hole for logging. RIH. Circulate hole clean. POOH to Log. Rig in and log with Schlumberger.
Jun 8, 13	2,855.00	0.00	0.00	0.00	00:00-24:00Hrs; June 7, 2013 Log with Schlumberger. Complete Run #1 - PEX/AIT/HRLA/HNGS/CNL-TLD2 with GR & SP. Prepare for Run #2 - ADT/Stringray/CMR. Magnetic interference after logging ~300m- Retrieve CMR tool string. Tools became stuck at 1410mMD. Work tools free. Hoist tools. Recover slip dyne on CMR tool. Clean and examine tool string and run it back in the hole. Bridge at 1410m - tool is showing signs of becoming stuck. Hoist and lay down logging tools. Rig out Loggers. L/D reamer & directional tools. Make up BHA. Re-run Bit #14. RIH for clean-out trip to 639mMD.
Jun 9, 13	2,855.00	0.00	0.00	0.00	00:00-24:00Hrs; June 8, 2013 Slip & cut 28m drill line. RIH to 1378mMD. Ream and clean f/1378-1501mMD. Circulate hole clean. RIH to TD. Circulate hole clean. POOH. Rig in and log with Schlumberger.
Jun 10, 13	2,855.00	0.00	0.00	0.00	00:00-24:00Hrs; June 9, 2013 Log with Schlumberger; Run #2 ADT-Stringray-CMR. Run #3 ADT-Stringray-CMR. Run #4 MSWCT-GR
Jun 11, 13	2,855.00	0.00	0.00	0.00	00:00-24:00Hrs; June 10, 2013 Continue to cut sidewall cores, issues with tool jamming, POOH, recover 15 cores, RIH, jammed off at 1700 m (MD), POOH, recover 12 cores, RIH, cut cores, POOH, recover core, (cut a total of 46 sidewall cores). RIH to clean out hole to 1222 m (MD), slip and cut drill line, RIH to 1395 m (MD), wash and ream from 1395-1505 m (MD), RIH to 2404 m (MD).
Jun 12, 13	2,855.00	0.00	0.00	0.00	00:00-24:00Hrs; June 11, 2013 Wash & ream from 2805-2855 m (MD), 1.5 meters of fill on bottom, circulate and condition mud, POOH, L/D drill string, pull wear bushing, rig and run 177.8 mm casing to 1238 m (MD), rig in volant tool, circulate, run casing.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jun 13, 13	2,855.00	0.00	0.00	0.00	00:00-24:00Hrs; June 12, 2013 RIH / 177.8 mm casing, circulate hole clean and condition mud, cement casing with Halliburton, set seal assembly with WFT, pressure test seal assembly and blind rams, P/U mud motor, MWD, scribe motor, RIH.
Jun 14, 13	2,870.00	15.00	4.75	3.16	00:00-24:00Hrs; June 13, 2013 P/U BHA, RIH / 102 mm drill pipe, tag cement at 2821 m (MD), displace casing with 1300 kg/m3 mud, pressure test lower and outer pipe rams, choke line, annular preventer, BOP's, manual well control, accumulator, slip and cut drill line, drill out cement and shoe.
Jun 15, 13	2,908.00	38.00	18.25	2.08	00:00-24:00Hrs; June 14, 2013 Dir drill 156 mm hole from 2855-2863 m (MD), circulate bottoms up, preform leak off test, dir drill 156 mm hole from 2863-2908 m (MD), circulate botom hole sample.
Jun 16, 13	2,912.00	4.00	6.25	0.64	00:00-24:00Hrs; June 15, 2013 Circulate hole clean, POOH, L/D jars, MWD tool, P/U core barrel, M/U bit & coring assembly, P/U coring jars, RIH, wash to bottom, drop ball, pattern bit, core from 2908-2910 m (MD).
Jun 17, 13	2,929.00	17.00	6.75	2.52	00:00-24:00Hrs; June 16, 2013 Cut 3.5 inch core from 2910-1212 m (MD), POOH, lay down and recover core, RIH / directional tools & PDC bit, slip and cut drill line, RIH, relog gamma from base of casing, drill out rat hole, dir drill 156 mm hole from 2912-2917 m (MD).
Jun 18, 13	2,936.00	7.00	7.75	0.90	00:00-24:00Hrs; June 17, 2013 Dir drill 156 mm hole from 2917-2930 m (MD), circulate bottoms up, POOH for core barrel, L/U dir tools. P/U core barrel, core barrel assembly, RIH to 2627 m (MD).
Jun 19, 13	2,948.00	12.00	17.75	0.68	00:00-24:00Hrs; June 18, 2013 RIH / core barrel from 2672 to 2921 m (MD), wash from 2921 to 2930 m (MD), drop ball, cut core from 2930-2948 m (MD), circulate bottoms up, POOH.
Jun 20, 13	3,045.00	97.00	16.50	5.88	00:00-24:00Hrs; June 19, 2013 POOH, L/D core barrels, recover core, P/U dir tools, scribe, P/U reamer, RIH, flow check @ 491, 1488, 2833, wash & ream from 2930-2948 m (MD), dir drill 156 mm hole from 2948-3007 m (MD).

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jun 21, 13	3,154.00	109.00	18.25	5.97	00:00-24:00Hrs; June 20, 2013 Dir drill 156 mm hole from 3007-3097 m (MD), troubleshoot MWD tool, dir drill 156 mm hole from 3097-3116 m (MD).
Jun 22, 13	3,291.00	137.00	21.25	6.45	00:00-24:00Hrs; June 21, 2013 Dir drill 156 mm hole from 3115-3230 m (MD).
Jun 23, 13	3,350.00	59.00	5.25	11.24	00:00-24:00Hrs; June 22, 2013 Dir drill 156 mm hole from 3230-3350 m (MD), wiper trip into intermediate casing, RIH, circ bottoms up, POOH for loggers.
Jun 24, 13	3,350.00	0.00	0.00	0.00	00:00-24:00Hrs; June 23, 2013 L/D dir tools, rig in loggers, log run 1 : AIT-PEX-HNGS-HRLA-GPIT-PPC-TLD2, log run 2: ADT-NEXT-CMR, log run 3: FMI-PPC-MSiP-PPC.
Jun 25, 13	3,350.00	0.00	0.00	0.00	00:00-24:00Hrs; June 24, 2013 Log with Schlumberger (Runs 3; & 4; SWCT). Slip and cut 24m drill line with top drive. Rig in casing elevators and power tongs and run 114mm liner. Make up hanging tool. RIH to 2039mMD.
Jun 26, 13	3,350.00	0.00	0.00	0.00	00:00-24:00Hrs; June 25, 2013 RIH f/2039-3351mMD. Fill pipe. Circulate and condition hole. L/D 1 single DP. P/U pup joint and cross-overs. Set Hanger. Rig in and P/T cement head. Cement Liner. Drop plug and displace drill pipe and liner with stripped water. Pull off liner. Circulate and displace wellbore mud to stripped water. Trip out of hole. L/D cross-over and Liner hanger. P/U and RIH with 2 7/8" DP. Tag cement @ 3238mMD. Drill and wash cement f/3238-3270mMD.
Jun 27, 13	3,350.00	0.00	0.00	0.00	00:00-24:00Hrs; June 26, 2013 Drill and wash cement f/3270-3333mMD. Circulate bottoms up. P/T casing to 7,000KPa for 15min. Pressure held. POOH and L/D DP. Trip in hole with 14 stands of HWDP. POOH and L/D DP and HWDP. Nipple down BOPs. Clean mud tanks. Rig Release: June 26, 2013 @ 24:00Hrs.

Casing Data Summary

Storage Units: Metric

Casing Type: Surface

Casing Size:	339.7	**Hole Size:**	444.5
Casing Landed @:	366.00	**Total Joints:**	29
Casing Date:	Apr 25, 2013 @ 07:15	**Plug Down Date:**	Apr 25, 2013 @ 18:30

# of Joints / Length / O.D. / Weight: Ran twenty nine joints of Summit, K-55, 339.9 mm (OD), 315.30 mm (ID), 101.2 kg/m, surface casing, landed at 366 meters (MD).

Cementing Details: Pumped 3 m3 water preflush, followed by 7.7 tonnes (6.1 m3) of 1870 kg/m3 Artic lead #1 with 0.27% PFR-1, from O-62 meters (MD), followed by 14 tonnes (10.6 m3) extendacem II LT, (1600 kg/m3) with 2% CaCl2, from 62-176 meters (MD), followed by 41 tonnes (31.2 m3) of Halchem "G" tail (1895 kg/m3) with 0.5% Halad 568 with 2% CaCl2 from 176-366 meters (MD).

Remarks: Four cubic meters of cement returned to surface and one cube was lost after dropping the plug. The float held.

Casing Type: Intermediate

Casing Size:	244.5	**Hole Size:**	311.0
Casing Landed @:	1,249.00	**Total Joints:**	89
Casing Date:	May 13, 2013 @ 08:15	**Plug Down Date:**	May 13, 2013 @ 16:00

# of Joints / Length / O.D. / Weight: Ran 89 joints of Summit L80, 244.5 mm (OD), 224.4 mm (ID), 59.53 kg/m, intermediate casing set at 1249 meters (MD).

Cementing Details: Cemented with: one cubc meter water preflush; followed by 6.2 tonnes (10 m3) Arcticcem lead #1 (1870 kg/m3) + 0.3% PFR-1, F/0-257 m (MD), followed by 29.9 tonnes (32.2 m3) Halchem "G" lead 2 (1665 kg/m3) / 0.5% Halad 567 + 1.15% Halliburton Gel, + 1% Econolite from 257-1105 m (MD), 4) followed by 13.2 tonnes (10m3) Halchem "G" tail (1895 kg/m3) / 0.5% Halad 567 + 0.2% HR-4 from 1105-1252 m (MD).

Remarks: Two cubes of cement returned to surface, floats held.

Casing Type: Intermediate

Casing Size:	177.8	**Hole Size:**	222.0
Casing Landed @:	2,853.00	**Total Joints:**	203
Casing Date:	Jun 12, 2013 @ 10:00	**Plug Down Date:**	Jun 12, 2013 @ 14:26

# of Joints / Length / O.D. / Weight: Ran 203 joints of Tenaris 177.8 mm, L-80, LT&C 43.157 kg/m intermediate casing, landed at 2853 m (MD).

Casing Data Summary

Storage Units: Metric

Cementing Details: Cemented with 27 tonnes of HalCem G with 2% HR-5, 1.6% Gel. Lead slurry: 29.2 m3, 1665kg/m3, 12.8 tonnes HalCem G with 3% HR-5. Tail slurry: 9.7m3 @1895kg/m3. Dropped plug & displaced with 55.4 m3 of mud.
The plug was down @14:26hrs.

Remarks: Bumped plug @ 3500kpa over, held 5 mins, bled off, floats held.

Casing Type: Liner

Casing Size:	114.3	**Hole Size:**	156.0
Casing Landed @:	3,349.00	**Total Joints:**	43
Casing Date:	Jun 25, 2013 @ 03:15	**Plug Down Date:**	Jun 25, 2013 @ 07:32

# of Joints / Length / O.D. / Weight: Ran 43 joints (599.91m) of 114.3mm; 17.26Kg/m; L-80; 8rd; LT&C; Range 3 new Tenaris liner.

Cementing Details: Pumped 3m3 weighted spacer, 8 tonnes of HalCem "G" w/ 0.5% Halad 567, 3% HR5; 6m3 slurry @ 1895kg/m3. Pumped out lines. Dropped plug & displaced w/ 19.3m3 of inhibited H2O. Bumped plug @ 3500kpa over. Floats held.
floats held.Plug down 07:32hrs.Got off liner,circulated well to inhibited H2O,tripped out of hole,layed down liner hanger
Rigged to & picked up 64 joints of tubing & 100mm bit,tripped in hole,tagged cement @3238m& drilled outcementto3270m

Remarks: Hung liner at 2749mMD. Had some difficulty pulling off the liner, but it eventually came without incident.

Bit Record Table (IADC Grading System)

Storage Units: Metric

***** For more detailed Bit Information refer to Bit Record *****

Bit #	Make	Type	Size	Depth In	Depth Out	Made	Hours	Avg. P.R.	I.A.D.C. Bit Condition								
									I	O	MDC	Loc	B	G	ODC	RP1	RP2
1A	Varel	HRO 4JM	444.5	20.0	246.0	226.0	27.00	8.37	1	1	NO	A	E		NO	BHA	
2A	Smith	GFI30BO	311.0	246.0	352.0	106.0	8.75	12.11	1	8	BT	A	E	3	WT	BHA	
1ARR	Varel	HRO 4JM	444.5	246.0	366.0	120.0	11.50	10.43	1	8	WT	A	E	3	BT	TD	
1	Smith	GF128BC	311.0	352.0	408.0	56.0	6.00	9.33	2	8	CT	G	E		BT	BHA	
2RR	Smith	GF130B	311.0	408.0	649.0	241.0	82.50	2.92	4	8	BT	H	F	9	FC	PR	
3	Smith	GFi35B0D	311.0	649.0	906.0	257.0	63.25	4.06	2	6	WT	A	E	2	BT	PR	
4	Hughes	GX-35DX	311.0	906.0	942.0	36.0	6.75	5.33	1	5	CT	G	1	1	BT	CP	BHA
5C	Quest	DC-813	311.0	942.0	956.0	14.0	2.33	6.01	0	0	NO	N	X	I	NO	BHA	
4RR	Hughes	GX-35DX	311.0	956.0	1,252.0	296.0	62.50	4.74	2	6	BT	A	E	5	WT	TD	
5	Smith	XRPS	222.0	1,252.0	1,283.5	31.5	9.00	3.50	7	7	WT	A	E	I	FC	PR	
6	Security	FX54R	222.0	1,283.5	1,577.0	293.5	29.00	10.12	5	8	CT	A	X	17	BC	RIG	
7	Smith	MDSsi613	222.0	1,577.0	1,585.0	8.0	4.00	2.00	2	4	CC	H	X	I	BC	RIG	
8	Hughes	28DX2	222.0	1,585.0	1,697.0	112.0	19.50	5.74	6	8	BT	A	E	2	NO	PR	
9	Smith	SD1513M	222.0	1,697.0	1,860.0	163.0	12.00	13.58	1	2	NO	H	X	2	CC	DTF	
10	Smith	SD1513M	222.0	1,860.0	1,959.0	99.0	14.50	6.83	2	8	CC	H	X	21	BC	PP	
11	Smith	SD1513M	222.0	1,959.0	2,061.0	102.0	15.50	6.58	8	8	CC	A	X	23	BC	PR	
12	Hughes	DP605X	222.0	2,061.0	2,417.0	356.0	77.25	4.61	3	5	CC	N	X	5	CC	PR	
13	Smith	FHI35OD	222.0	2,417.0	2,501.0	84.0	20.50	4.10	5	7	WT	A	E	2	BT	PR	
14	United D	U516M	222.0	2,501.0	2,855.0	354.0	72.64	4.87	2	4	CC	H	X	4	BC	TD	
15	Ulterra	U613M	156.0	2,855.0	2,908.0	53.0	18.25	2.90	1	1	NO	N	X	I	NO	CP	
16C	Corepro	DC 813LS	156.0	2,908.0	2,912.0	4.0	6.25	0.64	0	0	NO	A	X			BHA	
17RR	Ulterra	U613M	156.0	2,912.0	2,930.0	18.0	30.75	0.59	1	1	WT	N	X	1		CP	
18C	Corepro	RS-713	156.0	2,930.0	2,948.0	18.0	17.75	1.01	0	0	NO	A	X			BHA	
19RR	Ulterra	U613M	156.0	2,930.0	3,350.0	420.0	66.25	6.34	1	1	WT	H	x	I	CT	TD	

Total Rotating Hours: 683.72

Core Report

Storage Units: Metric

Date: May 6, 2013
Core #: 1
Formations Cored: **Ford Lake**

Cored Interval
From: 940.60 **To:** 954.52
Cut: 13.92 **Recovered:** 13.92 100.00 %
Core Diameter: 102.0

Coring Company: Corepro
Service Representative: Sean McBurney

Core Bit Information
Bit Make: Quest **Bit Type:** DC-813
Bit Size (OD): 222.0 **Serial #:** 1012
Original Hole Size: 222.0

Remarks: Directional hole. Angle over cored interval was ~35deg off vertical. Core jammed after cutting 13.92m.
Core displays open high angle (~perpendicular to bedding) jointing. Joint surfaces are exceptionally smooth, displaying shear.
Core has a strong petroliferous and mercantan-type odor.
Driller's core interval = 942.0-955.9mMD
Interval shown above is corrected to open-hole gamma.

Detailed Core Descriptions

942.00 to 942.02 (0.02)	**SHALE** very dark brown to black, blocky, non fissile, silty, slightly calcareous, 2mm light to medium brown non calcareous laminae, bituminous, stong petroliferous odor, no fluorescence, weak immediate cut, firm, moderately brittle, trace to minor disseminated pyrite
943.50 to 943.52 (0.02)	**SHALE** very dark brown to black, blocky, silty, very finely laminated, calcareous, bituminous, strong petroliferous odor, slow blooming cut, trace disseminated pyrite
945.00 to 945.02 (0.02)	**SHALE** very dark brown to black, blocky, silty, grading to siltstone, increasingly calcareous, bituminous, strong petroliferous odor with slow blooming cut as above, firm, brittle, pyritic as above
945.50 to 945.51 (0.01)	**SILTY LIMESTONE** very dark grayish brown, cryptocrystalline, silty, grading to calcareous siltstone, bituminous, hard, brittle, tight, no visible fluorescence, slow dead oil cut, trace disseminated pyrite
945.80 to 945.81 (0.01)	**SILTY LIMESTONE** as above, bituminous, silty throughout, grading to calcareous siltstone, tight, slow weak dead oil cut

946.27 to 946.28 (0.01)	**SILTY LIMESTONE** very dark grayish brown, cryptocrystalline, silty, extremely calcareous, grading to calcareous siltstone, bituminous, no visible fluorescence, slow cut, also one small rock chip of black bituminous shale showing slickensided surface with micro veinlet cemented with dark brown bitumen + calcite
947.57 to 947.59 (0.02)	**SILTY CALCAREOUS SHALE** dark brown, non to weakly fissile, very finely laminated, silty, bituminous, very calcareous, strong petroliferous odor, non fluorescence, weak cut, hard, brittle, trace pyrite
947.87 to 947.89 (0.02)	**SILTY CALCAREOUS SHALE** as above, prominant slickensided surface, strong odor, very calcareous, silty throughout, grading to siltstone, moderate immediate stringer & blooming cut, trace pyrite
949.37 to 949.38 (0.01)	**SILTY CALCAREOUS SHALE** as above, one very small chip, bituminous, moderate immediate blooming dead oil cut, clast appears sheared
950.87 to 950.89 (0.02)	**LIMESTONE** dark grayish brown, cryptocrystalline, argillaceous & silty in part, tight, bituminous, strong petroliferous odor, moderate immediate greenish yellow cut
952.37 to 952.38 (0.01)	**CALCAREOUS SILTSTONE** black, becoming brown after etching, blocky, hard, brittle, very finely laminated with augen-shaped bedding features, casting on bedding planes, extremely calcareous, grading to silty Limestone, bituminous, no visible fluorescence, fair immediate cut
953.06 to 953.07 (0.01)	**SHALE** black, subfissile, silty in part, slightly calcareous, bituminous, no fluorescence, very slow weak cut, 4 very small shards only

Core Report

Storage Units: Metric

Date:
Core #: 2
Formations Cored: **Imperial**

Cored Interval
From: 2,908.59 **To:** 2,912.59
Cut: 4.00 **Recovered:** 4.00 100.00 %
Core Diameter: 89.0

Coring Company: Corepro
Service Representative: Rick Forster

Core Bit Information
Bit Make: Corepro **Bit Type:** DC-813LS
Bit Size (OD): 156.0 **Serial #:** 1084
Original Hole Size: 156.0

Remarks: The core jammed at 2912 m (MD). The steal ring of the rabbit broke off down hole.

Coring times 2908-2908.2 m (MD): 13 minutes
2908.2-2908.4 m (MD): 23 minutes
2908.4-2908.6 m (MD): 18 minutes
2908.6-2908.8 m (MD): 11 minues
2908.6-2909.0 m (MD): 17 minutes
2909.0-2909.2 m (MD): 18 minutes
2909.2-2909.4 m (MD): 14 minutes
2909.4-2909.6 m (MD): 23 minutes
2909.6-2909.8 m (MD): 17 minutes
2909.8-2910.0 m (MD): 21 minutes
2910.0-2910.2 m (MD): 43 minutes
2910.2-2910.4 m (MD): 19 minutes
2910.4-2910.6 m (MD): 15 minutes
2910.6-2910.8 m (MD): 17 minutes
2910.8-2911.0 m (MD): 14 minutes
2911.0-2911.2 m (MD): 13 minutes
2911.2-2911.4 m (MD): 18 minutes
2911.4-2911.6 m (MD): 16 minutes
2911.6-2911.8 m (MD): 11 minutes
2911.8-2912.0 m (MD): 38 minutes

The part of the rabbit, specifically a steal brittle ring was left in the hole.

Detailed Core Descriptions

2,909.40 to 2,909.50 (0.10)
SHALE
medium to dark brown, firm, as clay shale, micromicaceous, occasional very fine nearly vertical silica lined fractures, slightly carbonaceous, very weak, slow yellow green blooming cut fluorescence.

2,910.90 to 2,911.00 (0.10)	**SANDSTONE** medium brown gray, consolidated, salt and pepper, silty to very fine lower grained, grading in part to sandy to silty shale, poorly sorted, subangular to subrounded, angular in part, siliceous, argillaceous, commonly with light gray, medium brown argillaceous matrix, poor grain relief, slightly pyritic & micaceous, very tight, very weak yellow green blooming cut fluorescence., core with near vertical silica lined & slightly calcareous lined white fracture fills.
2,911.90 to 2,912.00 (0.10)	**SHALE** medium to dark brown, commonly hard & sub fissile, fragments swell & soften in water, becoming fissile, well consolidated in core, predominately as clay shale, slightly sandy, firm,

Core Report

Storage Units: Metric

Date: June 18, 2013
Core #: 3
Formations Cored: **Canol**

Cored Interval
From: 2,931.40 **To:** 2,949.40
Cut: 18.00 **Recovered:** 18.00 100.00 %
Core Diameter: 3.0

Coring Company: Corepro
Service Representative: Rick Forster

Core Bit Information
Bit Make: Corepro **Bit Type:** RS 713
Bit Size (OD): 156.0 **Serial #:** 1112
Original Hole Size: 156.0

Remarks: We recovered 100 percent of the core. Shales were largely medium brown and contained carbonaceous flakes. Shales here differ from the shales examined between 2920 and 2930 m (MD).

2930.0-2930.2 m (MD): 6 minutes
2330.2-2930.4 m (MD): 16 minutes
2930.4-2930.6 m (MD): 13 minutes
2930.6-2930.8 m (MD): 12 minutes
2930.8-2931.0 m (MD): 11 minutes
2931.0-2931.2 m (MD): 10 minutes
2931.2-2931.4 m (MD): 10 minutes
2931.4-2931.6 m (MD): 11 minutes
2931.6-2931.8 m (MD): 11 minutes
2931.8-2932.0 m (MD): 7 minutes
2932.0-2932.2 m (MD): 8 minutes
2932.2-2932.4 m (MD): 7 minutes
2932.4-2932.6 m (MD): 7 minutes
2932.6-2932.8 m (MD): 7 minutes
2932.8-2933.0 m (MD): 8 minutes
2933.0-2933.2 m (MD): 7 minutes
2933.2-2933.4 m (MD): 8 minutes
2933.4-2933.6 m (MD): 10 minutes
2933.6-2933.8 m (MD): 9 minutes
2933.8-2934.0 m (MD) 9 minutes
2934.0-2934.2 m (MD) 9 minutes
2934.2-2934.4 m (MD): 15 minutes
2934.4-2934.6 m (MD): 17 minutes
2934.6-2934.8 m (MD) 20 minutes
2934.8-2935.0 m (MD): 20 minutes
2935.0-2935.2 m (MD) 27 minutes:
2935.2-2935.4 m (MD) 17minutes
2935.4-2935.6 m (MD): 17 minutes
2935.6-2935.8 m (MD) 14 minutes
2935.8-2936.0 m (MD) 17 minutes
2936.0-2936.2 m (MD): 13 minutes
2936.2-2936.4 m (MD): 15 minutes
2926.4-2936.6 m (MD): 14 minutes
2936.6-2936.8 m (MD): 16 minutes

2936.8-2937.0 m (MD): 14 minutes
2937.0-2937.2 m (MD) 15 minutes
2937.2-2937.4 m (MD): 15 minutes
2337.4-2937.6 m (MD): 15 minutes
2937.6-2937.8 m (MD): 13 minutes
2937.8-2938.0 m (MD): 14 minutes
2938.0-2938.2 m (MD): 15 minutes
2938.2-2938.4 m (MD): 12 minutes
2938.4-2938.6 m (MD): 9 minutes
2938.6-2938.8 m (MD): 13 minutes
2938.8-2939.0 m (MD): 12 minutes
2939.0-2939.2 m (MD): 10 minutes
2939.2-2939.4 m (MD): 12 minutes
2939.4-2939.6 m (MD): 13 minutes
2939.6-2939.8 m (MD): 9 minutes
2939.8-2940.0 m (MD): 10 minutes
2940.0-2940.2 m (MD): 10 minutes
2940.2-2940.4 m (MD): 12 minutes
2940.4-2940.6 m (MD): 10 minutes
2940.6-2940.8 m (MD): 11 minutes
2940.8-2941.0 m (MD): 13 minutes
2941.0-2941.2 m (MD): 12 minutes
2941.2-2941.4 m (MD): 12 minutes
2941.4-2941.6 m (MD): 10 minutes
2941.6-2941.8 m (MD): 11 minutes
2941.8-2942.0 m (MD): 9 minutes
2942.0-2942.2 m (MD): 13 minutes
2942.2-2942.4 m (MD): 14 minutes
2942.4-2942.6 m (MD): 8 minutes
2942.6-2942.8 m (MD): 6 minutes
2942.8-2943.0 m (MD): 12 minutes
2943.0-2943.2 m (MD): 10 minutes
2943.2-2943.4 m (MD): 15 minutes
2943.4-2943.6 m (MD): 13 minutes
2943.6-2943.8 m (MD): 12 minutes
2943.8-2944.0 m (MD): 12 minutes
2944.0-2944.2 m (MD): 12 minutes
2944.2-2944.4 m (MD): 13 minutes

2944.4-2944.6 m (MD): 14 minutes
2944.6-2944.8 m (MD): 11 minutes
2944.8-2945.0 m (MD): 14 minutes
2945.0-2945.2 m (MD): 11 minutes
2945.2-2945.4 m (MD): 13 minutes
2945.4-2945.6 m (MD): 13 minutes
2945.6-2945.8 m (MD): 14 minutes
2945.8-2946.0 m (MD): 14 minutes
2946.0-2946.2 m (MD): 13 minutes
2946.2-2946.4 m (MD): 13 minutes
2946.4-2946.6 m (MD): 12 minutes
2946.6-2946.8 m (MD): 9 minutes
2946.8-2947.0 m (MD): 7 minutes
2947.0-2947.2 m (MD): 7 minutes
2947.2-2947.4 m (MD): 6 minutes
2947.4-2947.6 m (MD): 9 minutes
2947.6-2947.8 m (MD): 6 minutes
2947.8-2948.0 m (MD): 8 minutes

Detailed Core Descriptions

2,931.50 to 2,931.60 (0.10)	**SANDSTONE** medium brown, silty to very fine lower grained, subangular to subrounded, very poorly sorted & with medium brown argillaceous matrix, grading to silty, sandy shale, micromicaceous, carbonaceous, micaceous, tight, very very poor grain relief, very firm, carbonaceous, very weak, very poor yellow green blooming cut fluorescence.
2,933.50 to 2,933.60 (0.10)	**SHALE** medium to dark brown, soft, micromicaceous, slightly pyritic, sub fissile, slightly carbonaceous, predominately as clay shale, trace silt, no cut fluorescence.
2,934.50 to 2,934.60 (0.10)	**SHALE** medium brown, dek brown, sub fissile, soft to medium hard, slightly pyritic, scattered carbonaceous flakes, slow weak poor yellow green blooming cut fluorescence.
2,936.10 to 2,936.20 (0.10)	**SHALE** medium brown, soft to medium hard, sub fissile, micromicaceous, scattered carbonaceous flakes, slightly pyritic, trace silt & sand grains, predominately as clay shale, slow weak poor yellow green blooming cut fluorescence.
2,937.50 to 2,937.60 (0.10)	**SHALE** medium brown, soft, sub fissile, slightly silty & sandy, sub fissile, slightly pyritic, non calcareous. scattered carbonaceous flakes,
2,938.90 to 2,939.00 (0.10)	**SHALE** medium to dark brown, sub fissile, firm, slightly pyritic, non swelling, becoming silty & sandy, weak poor yellow green blooming cut fluorescence.
2,940.40 to 2,940.50 (0.10)	**SHALE** medium brown, soft, sub fissile, commonly slightly silty & sandy, micromicaceous, micaceous, commonly with scattered carbonaceous flakes, weak poor, slow yellow green blooming cut fluorescence.

2,943.40 to 2,943.50 (0.10)	**SHALE** medium brown, silty & sandy, pyritic, firm, siliceous, grading to silty to very fine lower grained, subangular to subrounded, very poorly sorted, very argillaceous, tight silty salt and pepper sandstone or sandy siltstone, micromicaceous, micaceous, occasional carbonaceous flakes or dark mica flakes, weak slow yellow green blooming cut fluorescence.
2,944.90 to 2,945.00 (0.10)	**SHALE** none brown, soft, as clay shale, sub fissile, slightly pyritic,
2,946.40 to 2,946.50 (0.10)	**SHALE** medium to dark brown, soft, sub fissile, micromicaceous, slightly pyritic, as clay shale, scattered carbonaceous flakes.
2,947.90 to 2,948.00 (0.10)	**SHALE** medium to dark brown, soft, sub fissile, non calcareous, slightly carbonaceous, as clay shale, weak, slow yellow green blooming cut fluorescence.

Sidewall Cores

Storage Units: Metric

Date		**Service Company**	Schlumberger
Run No.	1	**Tool Type**	MSCT - Mechanical
Top Depth	369.90	**Cores Requested**	50
Base Depth	1,225.50	**Cores Obtained**	32
Geologist	Trevor Wall	**Cores Lost**	0

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
1	1,225.50	**SANDSTONE**
50	699.15	medium gray, very fine to lf grained, subrounded to subangular, moderate sorting, silica cement, poor intergranular porosity (6-8%)

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
2	1,212.00	**SANDSTONE**
50	698.39	light to medium gray, very fine grained, quartz with common gray chert, very fine to fine grained, silica cement, trace pyrite cement, weak porosity (4-6%)

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
3	1,031.20	**SHALE**
20	685.31	dark gray to black, silty, silty laminations, bituminous in part, jointing, poor recovery, desorbed sample.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
4	1,031.10	**SHALE**
20	685.30	dark gray to black, silty, blocky, carbonaceous, bituminous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
5	1,031.00	**SHALE**
60	685.28	dark gray to black, silty, blocky, carbonaceous, bituminous in part, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
6	1,030.90	**SHALE**
30	685.28	dark gray to black, blocky, carbonaceous, finely laminated silty stringers

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

7	991.70	**SHALE**
75	681.41	very dark gray to black, blocky, carbonaceous, bituminous in part, trace finely disseminated pyrite, silty in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
8	991.60	**SHALE**
60	681.40	dark gray to black, blocky, carbonaceous, bituminous in part, trace disseminated pyrite

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
9	991.50	**SHALE**
60	681.40	dark gray to black, blocky, carbonaceous, bituminous in part, shearing evident, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
10	991.40	**SHALE**
60	681.39	dark gray to black, blocky, carbonaceous, bituminous in part, shearing evident, desorbed sample.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
11	969.70	**SHALE**
15	678.99	dark gray to black, blocky, carbonaceous, bituminous in part, shearing evident, very small pieces

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
12	969.60	**SHALE**
50	678.96	dark gray to black, blocky, carbonaceous, bituminous in part, shearing evident, high angle jointing with slickenside

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
13	969.50	**SHALE**
30	678.95	dark gray to black, blocky, silty, bituminous, jointing, desorbed sample.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
14	969.40	**SHALE**
30	678.95	black, blocky, silty in part, bituminous, jointing, high angle joint with smooth open contact, shearing

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
15	955.20	**SHALE**
20	677.26	black, blocky, jointing, shearing, bituminous, rubble, poor recovery

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
16	955.10	**SHALE**
20	677.25	black, blocky, carbonaceous, bituminous, silty, pyritic

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
17	955.00	**SHALE**
20	677.23	black, blocky, silty, bituminous, jointing, very small pieces, poor recovery

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
18	954.90	**SHALE**
20	677.21	black, blocky, silty, bituminous, jointing, rubble, very small pieces, poor recovery, re-cut; see core #36

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
19	943.20	**SILTY SHALE**
65	675.74	dark gray to black, silty, blocky, bituminous, firm, hard, strong petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
20	943.10	**SILTY SHALE**
65	675.73	dark gray to black, silty, blocky, bituminous, firm, hard, strong petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
21	943.00	**SILTY SHALE**
65	675.71	dark gray to black, silty, blocky, bituminous, firm, hard, strong petroliferous odor, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
22	942.90	**SILTY SHALE**
65	675.70	dark gray to black, silty, blocky, bituminous, firm, hard, strong petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
23	914.10	**SANDSTONE**
25	671.60	medium to dark gray, bituminous odor, rubble, poor recovery

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
24	907.00	**Sandstone**
	670.47	medium gray, fine to lower coarse grained, poorly sorted, strong petroliferous odor, desorbed sample.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
25	890.50	**SANDSTONE**
80	667.66	medium gray, fine to lower coarse grained, poorly sorted, strong petroliferous odor, high angle joints with smooth contacts, weak porosity

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
26	871.10	**SILTY SHALE**
35	663.91	dark gray to black, very fine grained sandstone to silty laminations, carbonaceous, pyritic

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
27	871.00	**SILTY SHALE**
50	663.86	dark gray to black, blocky, carbonaceous, pyritic, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
28	832.50	**SANDSTONE**
30	655.01	medium gray, fine to coarse grained, chert with minor quartz, subrounded, moderate sorting, calcite cement, 8-10% porosity

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
29	829.20	**SILTSTONE**
	654.14	medium to dark gray, interlaminated vfg sandstone, carbonaceous, bituminous in part, slightly calcareous, grading to silty shale, desorbed sample.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
30	829.10	**SILTSTONE**
	654.11	medium to dark gray, interlaminated vfg sandstone, carbonaceous, bituminous in part, slightly calcareous, grading to silty shale, high angle joint with smooth contacts, desorbed sample.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
31	829.00	**SILTSTONE**
50	654.09	medium to dark gray, interlaminated very fine grained sandstone, carbonaceous, bituminous in part, slightly calcareous, grading to silty shale, high angle joint with smooth contacts

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
32	828.90	**SILTSTONE**
70	654.06	medium to dark gray, very fine grained sandy laminations, carbonaceous, strong petroliferous odor, bituminous in part, slightly calcareous, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
33	1,487.90	**SHALE**
100	1,077.63	massive, predominately as very fine interlaminated wispy, irregular dark & medium brown shale laminae, pyritic, with a single 4 to 5 millimeter thick inclined medium brown shale laminae approximately 30 degrees to horizontal, as clay shale, trace silt, commonly with very fine disseminated or massive pyrite, pyrite in part sheared, trace very fine disseminated carbonaceous specks, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
34	1,487.80	
	1,077.59	

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
35	1,487.70	**SHALE**
15	1,077.55	medium brown gray, massive as clay shale, trace silt & sand grains, trace very fine carbonaceous specks, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
36	1,487.60	**SHALE**
15	1,077.51	medium to dark brown gray, massive, as clay shale, firm, brittle to sub fissile, as clay shale, rare silt & sand grains, micromicaceous, trace disseminated pyrite & very fine carbonaceous flakes, core with single pyritized trace fossil, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
37	1,487.50	**SHALE**
10	1,077.46	medium brown gray, massive, as clay shale, medium hard, fissile in part, trace silt & sand grains, occasionally carbonaceous, trace disseminated very fine pyrite, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
38	1,530.60	**interbedded shale & sandstone**
40	1,095.13	Sandstone: light gray, very light gray brown, quartzose, very hard, silty to very fine lower grained, subangular to subrounded, siliceous, with light gray argillaceous matrix, slightly pyritic, tight, commonly carbonaceous, , no cut fluorescence, commonly interlaminated or intbedded with medium to dark brown gray , firm, slightly silty, sandy sly carbonaceous, pyritic shale.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
39	1,530.50	**Interbedded shale & sandstone**
95	1,095.09	Sandstone: light gray, very light gray brown, quartzose, silty to very fine lower grained, angular to subrounded, siliceous, commonly with light gray or gray brown argillaceous matrix, pyritic, no visible porosity, carbonaceous, no cut fluorescence, laminae often irregular, dewatering structures?, bioturbated? Shale: medium brown gray, as very irregular very fine laminae, commonly silty, sandy, occasional carbonaceous partings, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
40	1,530.40	
95	1,095.05	Sandstone: light gray, very light gray brown, quartzose, silty to very fine lower grained, angular to subrounded, siliceous, comly/ light gray or gray brown argillaceous matrix, pyritic, no visible porosity, carbonaceous, no cut fluorescence, laminae often irregular, dewatering structures?, bioturbated? Shale: medium brown gray, as very irregular very fine laminae, commonly silty, sandy, occasional carbonaceous partings, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
41	1,530.30	**SHALE**
80	1,095.01	medium to dark brown, commonly fine interlaminated, wispy & irregular in part, commonly silty & sandy & grading in part to very poorly sorted, very argillaceous, silty to very fine lower grained, very argillaceous, tight quartzose sandstone, commonly with minr light gray, silty to very fine lower grained, angular to subrounded, argillaceous, siliceous, tight, sandstone laminae, bioturbated, tight, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
42	1,530.20	
	1,094.97	

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

43	1,395.50	**SANDSTONE**
80	1,040.27	light gray brown, light brown, consolidated, quartzose to salt and pepper, with < 20% dark chert grains, fine to occasionally lower medium grained, subangular to subrounded, angular in part, slightly calcareous, siliceous, friable to firm. siliceous with silica overgrowths, 18 -21 % white intergranular kaolin matrix porosity , kaolin in part siliceous, cherty, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
44	1,391.50	**SANDSTONE**
70	1,038.69	light gray brown, light brown, consolidated, quartzose to salt and pepper, with < 20% dark chert grains, fine to occasionally lower medium grained, subangular to subrounded, angular in part, slightly calcareous, siliceous, friable to firm. siliceous with silica overgrowths, 18% white intergranular kaolin matrix porosity , kaolin in part siliceous, cherty, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
45	1,366.50	**SANDSTONE**
100	1,028.82	light gray brown, light brown, consolidated, quartzose to salt and pepper, with < 20% dark chert grains, fine to occasionally lower medium grained, subangular to subrounded, angular in part, slightly calcareous, siliceous, friable to firm. siliceous with silica overgrowths, 18-21%as white intergranular kaolin matrix porosity, kaolin in part siliceous or cherty, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, no visible intergranular porosity, very poor, slow yellow green flash cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
46	1,384.50	**SANDSTONE**
100	1,035.94	light gray brown, light brown, consolidated, salt and pepper, with < 20% dark chert grains, fine to occasionally lower medium grained, slightly calcareous, friable to firm. siliceous with silica overgrowths, 15% white intergranular kaolin matrix porosity, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, very poor weak slow yellow green blooming cut fluorescence.

Date		**Service Company**	Schlumberger
Run No.	2	**Tool Type**	Mechanical
Top Depth	369.90	**Cores Requested**	24
Base Depth	969.50	**Cores Obtained**	24
Geologist	Trevor Wall	**Cores Lost**	0

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
33	969.60	**SHALE**
40	678.96	black, blocky, carbonaceous, bituminous in part, high angle jointing, poor recovery, combine cores 33 & 34 for desorbtion

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
34	969.50	**SHALE**
40	678.95	black, blocky, carbonaceous, bituminous in part, high angle jointing, poor recovery, combine cores 33 & 34 for desorbtion

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
35	955.00	**SHALE**
50	677.23	dark gray to black, blocky, silty in part, fractures, jointing, carbonaceous, bituminous in part, strong petroliferous odor, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
36	954.90	**SHALE**
	677.21	interlaminated black shale & gray siltstone, carbonaceous, bituminous, jointing

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
37	914.10	**SANDSTONE**
	671.60	medium gray, very fine to upper fine grained, silicification, tight to very weak porosity, low angle cross-bedding, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
38	890.50	**SANDSTONE**
	667.66	medium gray, predominately gray chert, minor quartz, fine to very coarse grained, silicification, tight to weak porosity

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
39	783.20	**SANDSTONE**
	640.69	light to medium gray, interlaminated dark gray to black silty shale

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
40	783.10	**SANDSTONE**
	640.66	light to medium gray, interlaminated dark gray to black silty shale

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
41	783.00	**SILTY SHALE**
	640.64	dark gray to black, 15-20% interbedded very fine grained gray Sandstone, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
42	782.90	**SANDSTONE**
	640.61	medium to dark gray silty shale, interbedded light gray very fine to lower medium grained Sandstone, silicification, ~tight

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
43	736.70	**SILTY SHALE**
	624.12	dark gray to black, blocky, silty, carbonaceous, calcareous, slight petroliferous odor, trace pyrite

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
44	736.60	**SILTY SHALE**
	624.08	dark gray to black, blocky, silty, carbonaceous, calcareous, slight petroliferous odor, trace pyrite

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
45	736.50	**SILTY SHALE**
	624.06	dark gray to black, blocky, silty, carbonaceous, calcareous, slight petroliferous odor, trace pyrite, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
46	736.40	**SILTY SHALE**
	624.00	dark gray to black, blocky, silty, carbonaceous, calcareous, slight petroliferous odor, trace pyrite, high angle joint

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
47	712.70	**SILTY SHALE**
	614.20	dark gray to black, blocky, silty in part, carbonaceous, calcareous, moderate petroliferous odor, bituminous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
48	712.60	**SILTY SHALE**
	614.15	dark gray to black, blocky, silty in part, carbonaceous, calcareous, moderate petroliferous odor, bituminous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
49	712.50	**SILTY SHALE**
	614.13	dark gray to black, blocky, silty in part, carbonaceous, calcareous, moderate petroliferous odor, bituminous in part, interlaminated siltstone, firm, 2 high angle joints, sample desorbed

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
50	712.40	**SHALE**
	614.08	black, blocky, silty in part, bituminous, jointing

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
51	677.50	**SILTY SHALE**
	597.73	dark gray to black, blocky, silty, carbonaceous, bituminous

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
52	418.10	**SANDSTONE**
	412.60	medium gray, abundant gray to black chert, fine to coarse grained, subrounded, poorly sorted, calcite cement, tight to poor intergranular porosity

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
53	411.00	**SANDSTONE**
	405.53	medium gray, abundant gray to black chert, fine to coarse grained, subrounded, poorly sorted, calcite cement, tight to poor intergranular porosity

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
54	398.20	**SANDSTONE**
	392.95	medium gray, very fine to medium grained, poorly sorted, silty & argillaceous in part, bioturbated, calcite cement, tight

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

55	379.00 373.75	**SANDSTONE** medium gray, very fine to medium grained, poorly sorted, silty & argillaceous in part, bioturbated, calcite cement, tight, massive, hard

Core No. **% Recovery**	**Depth (MD)** **Depth (TVD)**	**Rock Type** **Description**
56	369.90 364.90	**SANDSTONE** medium gray, gray to black chert & minor quartz, very fine to medium grained, weakly bioturbated, calcite cement, poor porosity (4-8%), silica overgrowths, trace spotty fluorescence, fair immediate cut

Date		**Service Company**	Schlumberger
Run No.	3	**Tool Type**	Mechanical
Top Depth	2,183.90	**Cores Requested**	49
Base Depth	2,815.00	**Cores Obtained**	15
Geologist	Trevor Wall	**Cores Lost**	0

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
1	2,815.00	**SANDSTONE**
100	1,663.92	medium to dark gray, very fine grained, grading to coarse siltstone, silica cement, moderately well indurated, tight to very weak porosity, no visible show

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
2	2,811.00	**SANDSTONE**
100	1,662.07	medium to dark gray, very fine to fine, silty argillaceous matrix, hard, moderately well indurated, tight, no visible show

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
3	2,791.10	**SHALE**
55	1,652.76	dark gray to black, blocky, carbonaceous, silty in part, non calcareous, Desorbed Core (combined with core #5 for desorption due to low recovery)

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
4	2,791.00	**SHALE**
30	1,652.70	dark gray to black, blocky to subblocky, non calcareous, carbonaceous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
5	2,790.90	**SHALE**
40	1,652.65	dark gray to black, blocky, carbonaceous, non calcareous, Desorbed Core (combined with core #3 for desorption due to low recovery)

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
6	2,748.20	**SHALE**
40	1,632.67	dark gray to black, blocky, non calcareous, carbonaceous, minor medium gray sandy siltstone in interval

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
7	2,748.10	**SHALE**
50	1,632.62	medium to dark gray, subfissile to blocky, silty in part, carbonaceous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
8	2,260.20	**SHALE**
75	1,412.92	dark gray to black, subblocky to blocky, interlaminated light to medium brown silty shale, carbonaceous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
9	2,260.10	**SHALE**
75	1,412.88	medium to dark gray, interbedded silty shale, blocky, non calcareous, carbonaceous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
10	2,260.00	**SHALE**
85	1,412.82	medium to dark brownish gray, blocky, non calcareous, carbonaceous in part, Desorbed Core

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
11	2,259.90	**SHALE**
75	1,412.78	interbedded mk & dark gray to black, blocky, non calcareous, carbonaceous in part, silty in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
12	2,184.20	**SHALE**
5	1,378.96	medium to dark gray, subblocky, non calcareous, carbonaceous in part, trace silt

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
13	2,184.10	**SHALE**
75	1,378.91	medium to dark gray, subblocky, non calcareous, carbonaceous in part, trace silt, Desorbed Core

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
14	2,184.00	**SHALE**
15	1,378.86	medium to dark gray, subblocky, non calcareous, carbonaceous in part, trace silt

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
15	2,183.90	**SHALE**
25	1,378.81	medium to dark gray, subblocky, non calcareous, carbonaceous in part, trace silt

Date		**Service Company**	Schlumberger
Run No.	4	**Tool Type**	Mechanical
Top Depth	1,763.80	**Cores Requested**	34
Base Depth	2,748.00	**Cores Obtained**	13
Geologist	Trevor Wall	**Cores Lost**	

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
16	2,748.00	**SHALE**
20	1,632.58	dark gray to black, subblocky, non calcareous, carbonaceous in part, silty in part, rubble

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
17	2,749.90	**SHALE**
75	1,633.46	dark brownish gray to black, blocky, carbonaceous, non calcareous, interbedded silty shale

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
18	2,735.40	**SANDSTONE**
85	1,626.85	medium to dark brownish gray, very fine grained, fine grained in part, silty & argillaceous matrix, silica cement, moderately well indurated, tight to very weak intergranular porosity, no visible show

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
19	2,586.10	**SHALE**
20	1,559.97	dark gray to dark brownish gray, subblocky, non calcareous, carbonaceous in part, high angle polished joint

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
20	1,929.00	**SANDSTONE**
50	1,264.15	light to medium gray, very fine to lower coarse grained, poorly sorted, silica cement, moderate to well indurated, poor intergranular porosity (6-9%), no visible show

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
21	1,887.70	**SILTSTONE**
80	1,246.05	medium to dark gray, brownish gray, grading to very fine grained sandstone, carbonaceous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
22	1,887.60	**SILTSTONE**
40	1,246.01	medium to dark gray, brownish gray, grading to very fine grained sandstone, carbonaceous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
23	1,887.50	**SILTSTONE**
70	1,245.97	medium to dark gray, brownish gray, grading to very fine grained sandstone, carbonaceous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
24	1,887.40	**SILTSTONE**
75	1,245.92	medium to dark gray, very finely laminated, sandy in part, interlaminated silty shale, carbonaceous in part, Desorbed Core

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
25	1,871.20	**MUD & RUBBLE**
10	1,238.71	no description available.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
26	1,764.00	**SHALE**
25	1,192.47	dark gray, fissile to subfissile, silty in part, carbonaceous in part, rubble

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
27	1,763.90	**SHALE**
25	1,192.43	dark gray, fissile to subfissile, silty in part, carbonaceous in part, rubble

Date		**Service Company**	Schlumberger
Run No.	5	**Tool Type**	Mechanical
Top Depth	1,690.50	**Cores Requested**	21
Base Depth	1,717.20	**Cores Obtained**	5
Geologist	Trevor Wall	**Cores Lost**	0

Core No. / % Recovery	Depth (MD) / Depth (TVD)	Rock Type / Description
28 / 25	1,717.20 / 1,173.18	**SHALE** dark gray to black, sbbkly to blocky, silty in part, carbonaceous in part, poor recovery, rubble

Core No. / % Recovery	Depth (MD) / Depth (TVD)	Rock Type / Description
29 / 30	1,717.10 / 1,173.14	**SHALE** dark gray to black, silty in part, carbonaceous in part, high angle joint or shear, combined cores 29 and 30 for desorption into same chamber due to recovery.

Core No. / % Recovery	Depth (MD) / Depth (TVD)	Rock Type / Description
30 / 70	1,717.00 / 1,173.10	**SHALE** dark gray to black, silty in part, carbonaceous in part, high angle joint or shear, combined cores 29 and 30 for desorption into same chamber due to recovery.

Core No. / % Recovery	Depth (MD) / Depth (TVD)	Rock Type / Description
31 / 30	1,716.90 / 1,173.06	**SHALE** dark gray to black, subblocky, silty in part, carbonaceous in part

Core No. / % Recovery	Depth (MD) / Depth (TVD)	Rock Type / Description
32 / 75	1,690.50 / 1,162.09	**SANDSTONE** dark gray, very fine to fine grained, silica cement, well indurated, hard, brittle, poor intergranular porosity, no visible show

Date		**Service Company**	Schlumberger
Run No.	6	**Tool Type**	Mechanical
Top Depth	1,384.50	**Cores Requested**	14
Base Depth	1,487.00	**Cores Obtained**	14
Geologist	H. Gluth	**Cores Lost**	0

Core No. / % Recovery	Depth (MD) / Depth (TVD)	Rock Type / Description
33 / 100	1,487.90 / 1,077.63	**SHALE** massive, predominately as very fine interlaminated wispy, irregular dark & medium brown shale laminae, pyritic, with a single 4 to 5 millimeter thick inclined medium brown shale laminae approximately 30 degrees to horizontal, as clay shale, trace silt, commonly with very fine disseminated or massive pyrite, pyrite in part sheared, trace very fine disseminated carbonaceous specks, no cut fluorescence.
34 / 100	1,487.80 / 1,077.59	**Desorbed sample, no data** Desorbed sample, no data
35 / 15	1,487.70 / 1,077.55	**SHALE** medium brown gray, massive as clay shale, trace silt & sand grains, trace very fine carbonaceous specks, no cut fluorescence.
36 / 15	1,487.60 / 1,077.51	**SHALE** medium to dark brown gray, massive, as clay shale, firm, brittle to sub fissile, as clay shale, rare silt & sand grains, micromicaceous, trace disseminated pyrite & very fine carbonaceous flakes, core with single pyritized trace fossil, no cut fluorescence.
37 / 10	1,487.50 / 1,077.46	**SHALE** medium brown gray, massive, as clay shale, medium hard, fissile in part, trace silt & sand grains, occasionally carbonaceous, trace disseminated very fine pyrite, no cut fluorescence.
38 / 40	1,530.60 / 1,095.13	**Interbedded SHALE & SANDSTONE** Sandstone: light gray, very light gray brown, quartzose, very hard, silty to very fine lower grained, subangular to subrounded, siliceous, with light gray argillaceous matrix, slightly pyritic, tight, commonly carbonaceous, no cut fluorescence, commonly interlaminated or intbedded with medium to dark brown gray , firm, slightly silty, sandy slightly carbonaceous, pyritic shale.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
39	1,530.50	**Interbedded SHALE & SANDSTONE**
95	1,095.09	Sandstone: light gray, very light gray brown, quartzose, silty to very fine lower grained, angular to subrounded, siliceous, commonly with light gray or gray brown argillaceous matrix, pyritic, no visible porosity, carbonaceous, no cut fluorescence, laminae often irregular, dewatering structures?, bioturbated? Shale: medium brown gray, as very irregular very fine laminae, commonly silty, sandy, occasional carbonaceous partings, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
40	1,530.40	**Interlaminated SHALE and SANDSTONE**
95	1,095.05	Sandstone: light gray, very light gray brown, quartzose, silty to very fine lower grained, angular to subrounded, siliceous, commonly with light gray or gray brown argillaceous matrix, pyritic, no visible porosity, carbonaceous, no cut fluorescence, laminae often irregular, dewatering structures?, bioturbated? Shale: medium brown gray, as very irregular very fine laminae, commonly silty, sandy, occasional carbonaceous partings, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
41	1,530.30	**SHALE**
80	1,095.01	medium to dark brown, commonly fine interlaminated, wispy & irregular in part, commonly silty & sandy & grading in part to very poorly sorted, very argillaceous, silty to very fine lower grained, very argillaceous, tight quartzose sandstone, commonly with minr light gray, silty to very fine lower grained, angular to subrounded, argillaceous, siliceous, tight, sandstone laminae, bioturbated, tight, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
42	1,530.20	**Desorbed sample, no data.**
100	1,094.97	

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
43	1,395.50	**SANDSTONE**
80	1,040.27	consolidated, light brown, fine to lower medium grained, rare floating upper medium quartz grains, subangular to subrounded, angular in part, moderately sorted, quartzose, trace calcareous, commonly with light brown argillaceous cement, siliceous, pyritic, 1-18% white kaolin matrix porosity, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

44	1,391.50	**SANDSTONE**
70	1,038.69	light gray brown, light brown, consolidated, quartzose to salt and pepper, with < 20% dark chert grains, fine to occasionally lower medium grained, subangular to subrounded, angular in part, slightly calcareous, siliceous, friable to firm. siliceous with silica overgrowths, 18% white intergranular kaolin matrix porosity , kaolin in part siliceous, cherty, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
45	1,386.50	**SANDSTONE**
100	1,036.72	light gray brown, light brown, consolidated, quartzose to salt and pepper, with < 20% dark chert grains, fine to occasionally lower medium grained, subangular to subrounded, angular in part, slightly calcareous, siliceous, friable to firm. siliceous with silica overgrowths, 18-21% as white intergranular kaolin matrix porosity, kaolin in part siliceous or cherty, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, no visible intergranular porosity, very poor, slow yellow green flash cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
46	1,384.50	**SANDSTONE**
100	1,035.94	light gray brown, light brown, consolidated, salt and pepper, with < 20% dark chert grains, fine to occasionally lower medium grained, slightly calcareous, friable to firm. siliceous with silica overgrowths, 15% white intergranular kaolin matrix porosity, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, very poor weak slow yellow green blooming cut fluorescence.

Date		**Service Company**	Schlumberger
Run No.	7	**Tool Type**	Mechanical
Top Depth	3,006.20	**Cores Requested**	28
Base Depth	3,327.50	**Cores Obtained**	28
Geologist	Trevor Wall	**Cores Lost**	0

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
1	3,327.50	**LIMESTONE**
40	2,924.82	medium brownish gray, cryptocrystalline, argillaceous, platy, hard, dense, tight, no fossil content, badly broken

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
2	3,222.80	**CRINOIDAL PACKSTONE**
100	2,822.45	medium gray, cryptocrystalline, abundant crinoidal debris throughout, slightly argillaceous wackestone matrix, dense, tight, massive, no show

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
3	3,211.20	**CRINOIDAL WACKESTONE**
90	2,811.14	medium to dark gray, cryptocrystalline, common crinoidal debris in fragmental wackestone to floatstone matrix, argillaceous in part, common calcite cemented high angle microfractures, dense, tight, no show

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
4	3,209.60	**MUDSTONE to WACKESTONE**
30	2,809.58	dark gray, cryptocrystalline, argillaceous in part, rare white calcitic shell fragment, platy, dense, tight

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
5	3,194.60	**MUDSTONE**
20	2,794.96	predominately dark gray, minor patchy mottled medium brownish gray, no recognizable fossil, argillaceous in part, platy, dense, tight, hard, badly broken, poor recovery

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
6	3,088.60	**BULBOUS STROMATOPOROID FLOATSTONE**
80	2,691.81	light gray stromatoporoid fragments in dark gray muddy brachiopod wackestone matrix, common bulbous stromatoporoid fragments, dense, tight, Foreslope

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

7	3,070.00	**MUDSTONE**
40	2,673.71	medium grayish brown, cryptocrystalline, argillaceous in part, dense, tight, badly broken, rubble, poor recovery

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
8	3,059.00	**FRAGMENTAL LIMESTONE**
85	2,663.00	medium gray to brownish gray, predominately cryptocrystalline, minute rounded calcium carbonate fragments and rare large rounded clasts to 7mm in slightly argillaceous matrix, dense, tight occasional calcite cemented microfracture

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
9	3,058.00	**STROMATOPOROID FLOATSTONE**
65	2,662.03	light to medium brownish gray scattered stromatoporoid fragments in dark brownish gray argillaceous wackestone matrix, dense, tight, Foreslope

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
10	3,055.90	**SHALE**
40	2,659.99	black, blocky, very slightly calcareous, bituminous, firm, sheared, badly broken, poor recovery

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
11	3,055.80	**SHALE**
40	2,659.90	black, blocky, very slightly calcareous, bituminous, firm, sheared, badly broken, poor recovery, high angle planar jointing

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
12	3,055.70	**SHALE**
35	2,659.80	black, blocky, very slightly calcareous, bituminous, firm, sheared, badly broken, poor recovery, high angle planar jointing

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
13	3,055.60	**SHALE**
	2,659.70	black, blocky, very slightly calcareous, bituminous, firm, sheared, badly broken, poor recovery, high angle planar jointing, desorbed sample, not seen prior to placing in desorbtion cannister.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
14	3,050.20	**SHALE**
100	2,654.46	very dark gray to black, blocky, non calcareous, small trace pyrite, bituminous in part, one high angle planar open joint with glossy surface

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
15	3,050.10	**SHALE**
	2,654.36	Sample desorbed, not seen prior to placing in desorbtion cannister.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
16	3,050.00	**SHALE**
100	2,654.26	very dark gray to black, blocky, non calcareous, small trace pyrite, bituminous in part, high angle planar fracture cemented with pyrite, carbonaceous to bituminous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
17	3,049.90	**SHALE**
100	2,654.17	very dark gray to black, blocky, non calcareous, small trace pyrite, bituminous in part, high angle planar fracture cemented with pyrite, carbonaceous to bituminous in part

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
18	3,047.20	**SHALE**
	2,651.55	Sample desorbed, not seen prior to placing in desorbtion cannister.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
19	3,047.10	**SHALE**
80	2,651.45	very dark gray to black, blocky, non calcareous, pyritic bed ~4mm thick, very carbonaceous to bituminous in part, high total organic carbon

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
20	3,047.00	**SHALE**
60	2,651.35	very dark gray to black, blocky, non calcareous, very carbonaceous to bituminous in part, high total organic carbon

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
21	3,046.90	**SHALE**
70	2,651.26	very dark gray to black, blocky, non calcareous, common pyritic laminations, prominent pyritic bed ~5mm thick, very carbonaceous, high total organic carbon

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

22	3,021.50	**SHALE**
100	2,626.76	dark gray, blocky, non calcareous, trace pyrite, solid, firm, no fractures or visible jointing, carbonaceous in part, moderate to low total organic carbon

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
23	3,021.40	**SILTSTONE**
100	2,626.67	medium gray, blocky, calcareous, occasional dark gray shale laminations, trace pyrite, slightly carbonaceous, low total organic carbon, calcite cemented microfracture

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
24	3,021.30	**No Description**
100	2,626.57	Sample not seen before placing in desorbtion cannister.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
25	3,021.20	**SILTY SHALE**
90	2,626.48	medium to dark gray, blocky, silty throughout, grading to shaly siltstone, firm, non calcareous, slightly carbonaceous, common pyritic laminae

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
26	3,006.40	**No Description**
100	2,612.32	Sample not seen before placing in desorbtion cannister.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
27	3,006.30	**SHALE**
35	2,612.22	dark gray, blocky to subfissile, non to slightly calcareous, occasional silty laminae, carbonaceous in part, broken

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
28	3,006.20	**SHALE**
70	2,612.13	dark gray, blocky to subfissile, non to very slightly calcareous in part, carbonaceous in part, interbedded silty shale, occasional pyritic laminae, solid, firm

Date		**Service Company**	Schlumberger
Run No.	8	**Tool Type**	Mechanical
Top Depth	2,973.90	**Cores Requested**	5
Base Depth	3,006.10	**Cores Obtained**	5
Geologist	Trevor Wall	**Cores Lost**	0

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
29	3,006.10	**SHALE**
100	2,612.03	dark gray, blocky, non calcareous, occasional silty laminae, carbonaceous in part, firm, solid, one calcite + pyrite cemented microfracture, interbedded silty shale

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
30	2,974.20	**No Description**
	2,581.86	Desorbed sample. Sample not seen prior to placing in desorbtion cannister.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
31	2,974.10	**SHALE**
100	2,581.77	dark gray, blocky, non calcareous, minor disseminated pyrite, carbonaceous in part, firm, solid

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
32	2,974.00	**SHALE**
100	2,581.67	dark gray, blocky, non calcareous, minor disseminated pyrite, carbonaceous in part, firm, partly broken, silty shale laminae

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
33	2,973.90	**SHALE**
70	2,581.58	dark gray, blocky, non calcareous, minor disseminated pyrite, carbonaceous in part, firm, partly broken, silty shale laminae, rock breaks with conchoidal fracture

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 1
Wireline Logging Company: Schlumberger
District: Grande Prairie
Witness: Harry Gluth

Engineer: Micheal Lapointe
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No

Maximum Deviation: 3.000 º
Hole Size: 444.5

Total Lost Time:
Loggers' Total Down Time:
Total Job Time (From Rig up to Rig down): 7.50

	Measured Depth	True Vertical Depth
Casing Depth Driller	20.00	20.00
Casing Depth Logger	28.50	28.50
Total Depth Driller (Tally)	366.00	365.80
Total Depth Driller (Strap or SLM)		

General Remarks: Loggers began rigging up at 17:00hrs and were on bottom at 18:45hrs. Two runs were performed. The first sonic run was completed at 20:00hrs. Loggers picked up the tools for run two at 21:30hrs and were on bottom at 22:10hrs and completed the job April 25, @ 00:30hrs.

Logging Run #: 1
Date: Apr 24, 2013

Drilling Fluid Data

Drilling Fluid Type: Gel Polymer
Fluid Density: 1100.0 **Viscosity:** 60 **pH:** 9.0 **Fluid Loss:** 15.0

Mud Resistivity (Rm): 1.030 @ 19.9 º
Mud Resistivity (Rm) @ BHT: 0.710 @ 39.1 º
Mud Filtrate Resistivity (Rmf): 0.880 @ 19.9 º
Mud Cake Resistivity (Rmc): 0.930 @ 19.9 º

Maximum Temperature: 39.1 º
Source (Rmf): Flow line
Source (Rmc): Flow line

Logging Run Information

Date on Bottom: Apr 24, 2013
Total Depth Logger: 362.70 (MD) 362.52 (TVD)

Logging Tools: DSI, PPC, GPIT from 366 to surface.

Remarks: Loss of circulation occurred in the Orange Marker.

Hole Conditions: The Lower Parkin was very washed out and fill was present at the base of the hole.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Apr 24, 2013

Drilling Fluid Data

Drilling Fluid Type: Gel Polymer

Fluid Density:	1100.0	**Viscosity:**	60	**pH:**	9.0	**Fluid Loss:**	15.0

Mud Resistivity (Rm):	1.030	@	19.9 º		
Mud Resistivity (Rm) @ BHT:	0.800	@	32.0 º	**Maximum Temperature:**	32.0 º
Mud Filtrate Resistivity (Rmf):	0.880	@	19.9 º	**Source (Rmf):**	Flow Line
Mud Cake Resistivity (Rmc):	0.930	@	19.9 º	**Source (Rmc):**	Flow line

Logging Run Information

Date on Bottom: Apr 24, 2013
Total Depth Logger: 361.00 (MD) 360.82 (TVD)

Logging Tools: AIT, PEX, HNGS to surface.

Remarks: The second logging run was shallower due to additional fill.

Hole Conditions: Washed out hole above 98 meters (MD).

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 2
Wireline Logging Company: Schlumberger
District: Grande Prairie
Witness: Trevor Wall

Engineer: Michel Lapointe
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No

Maximum Deviation: 37.500 °
Hole Size: 311.0

Total Lost Time: 3.00
Loggers' Total Down Time: 0.00
Total Job Time (From Rig up to Rig down): 44.50

	Measured Depth	True Vertical Depth
Casing Depth Driller	364.00	363.80
Casing Depth Logger	364.00	363.80
Total Depth Driller (Tally)	1,252.00	1,160.82
Total Depth Driller (Strap or SLM)		

General Remarks: Logger's total depth was 1.5m deeper than Driller's depth. All drill depths have been shifted to agree with log depths using the MWD gamma to synchronize depths. MWD gamma values are consistently higher than open hole gamma values.
All logging data is reliable.
Total job time includes all 4 logging runs - rig up to rig down.
Salty mud adversely affects logging response (eg, SP, AIT).

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 1
Date: May 11, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL-Polymer

Fluid Density:	1230.0	**Viscosity:**	62	**pH:**	9.5	**Fluid Loss:**	5.0

Mud Resistivity (Rm):	0.090	@	23.6 º		
Mud Resistivity (Rm) @ BHT:	0.060	@	43.8 º	**Maximum Temperature:**	43.8 º
Mud Filtrate Resistivity (Rmf):	0.060	@	23.6 º	**Source (Rmf):**	Pressed
Mud Cake Resistivity (Rmc):	0.110	@	23.6 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: May 11, 2013
Total Depth Logger: 1,253.50 (MD) 1,162.08 (TVD)

Logging Tools: PEX: AIT-CNL-LDT-GR-SP w/HNGS, GPIT, PPC-2

Remarks: Platform Express (Array Induction, Compensated Neutron, Litho Density, Gamma Ray, Spontaneous Potential with Spectral GR, Global positioning tool, 4-arm caliper).
Ran dual density, however one of the density tools shorted out and had to be removed from the string.
Data is reliable.

Hole Conditions: Good to 1035mMD. Shale washed out to some degree from 1035-1252mMD

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: May 11, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL-Polymer

Fluid Density:	1230.0	**Viscosity:**	62	**pH:**	9.5	**Fluid Loss:**	5.0

Mud Resistivity (Rm):	0.090	@	23.6 º		
Mud Resistivity (Rm) @ BHT:	0.060	@	43.8 º	**Maximum Temperature:**	43.8 º
Mud Filtrate Resistivity (Rmf):	0.060	@	23.6 º	**Source (Rmf):**	Pressed
Mud Cake Resistivity (Rmc):	0.110	@	23.6 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: May 11, 2013
Total Depth Logger: 1,253.50 (MD) 1,162.08 (TVD)

Logging Tools: ADT-ECS-CMR

Remarks: Array Dielectric Tool-Elemental Capture Spectroscopy-Compensated Magnetic Resonnance
All tools performed within specifications. Data is reliable.

Hole Conditions: Good to ~1035mMD. Shale washed out to some degree from 1035-1252mMD

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 3
Date: May 11, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL-Polymer

Fluid Density:	1230.0	**Viscosity:**	62	**pH:**	9.5	**Fluid Loss:**	5.0

Mud Resistivity (Rm):	0.090	@	23.6 º		
Mud Resistivity (Rm) @ BHT:	0.060	@	43.8 º	**Maximum Temperature:**	43.8 º
Mud Filtrate Resistivity (Rmf):	0.060	@	23.6 º	**Source (Rmf):**	Pressed
Mud Cake Resistivity (Rmc):	0.110	@	23.6 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: May 12, 2013
Total Depth Logger: 1,253.50 (MD) 1,162.08 (TVD)

Logging Tools: FMI-GPIT-Sonic Scanner-PPC2 (x2)

Remarks:

Hole Conditions: Good to ~1035mMD. Shale washed out to some degree from 1035-1252mMD

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 4
Date: May 12, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL-Polymer

Fluid Density:	1230.0	**Viscosity:**	62	**pH:**	9.5	**Fluid Loss:**	5.0

Mud Resistivity (Rm):	0.060	@	23.6 º		
Mud Resistivity (Rm) @ BHT:		@	º	**Maximum Temperature:**	º
Mud Filtrate Resistivity (Rmf):		@	º	**Source (Rmf):**	Pressed
Mud Cake Resistivity (Rmc):		@	º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: May 12, 2013
Total Depth Logger: (MD) (TVD)

Logging Tools: MSCT-GR

Remarks: Mechanical Sidewall Coring Tool - Gamma Ray
Tool run twice, recovering 32 cores on the first run, and 24 cores on the second run.
Barrel jammed on first run. Also on the first run mud and rock debris became caked onto the tool preventing full bit penetration, reducing recoveries.

Hole Conditions: 311mm hole drilled directionally. Maximum deviation ~37.4 degrees.
Shales are washed out to some degree below 1035mMD.

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 3
Wireline Logging Company: Schlumberger
District: Grande Pairie
Witness: Trevor Wall/ H. Gluth

Engineer: Mark Gonsalves
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No

Maximum Deviation: 39.000 °
Hole Size: 222.0

Total Lost Time: 24.50
Loggers' Total Down Time: 2.00
Total Job Time (From Rig up to Rig down): 47.50

	Measured Depth	True Vertical Depth
Casing Depth Driller	1,249.00	1,158.45
Casing Depth Logger	1,248.00	1,157.66
Total Depth Driller (Tally)	2,855.00	2,473.18
Total Depth Driller (Strap or SLM)		

General Remarks: 4 runs in total in Logging Job #3.
While performing Run 3.2 it was noticed that the delta B-0 on the CMR was too high. While pulling the tool string out of the hole to check for metal it became stuck for ~30 minutes at 1410mMD. Pulled free and continued to surface to check tools. Discovered a slip dyne magnetically adherred onto tool disrupting the normal operating parameters. Removed metal and ran tool string back in the hole. Bridged at 1410mMD, necessitating a clean-out trip.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 1
Date: Jun 6, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL-Polymer

Fluid Density:	1500.0	**Viscosity:**	65	**pH:**	9.5	**Fluid Loss:**	5.5

Mud Resistivity (Rm):	0.120	@	21.0 º		
Mud Resistivity (Rm) @ BHT:	0.050	@	74.5 º	**Maximum Temperature:**	74.5 º
Mud Filtrate Resistivity (Rmf):	0.090	@	21.1 º	**Source (Rmf):**	Pressed
Mud Cake Resistivity (Rmc):	0.220	@	21.0 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: Jun 7, 2013
Total Depth Logger: 2,859.00 (MD) 2,476.66 (TVD)

Logging Tools: PEX/AIT/HRLA/HNGS/CNL-TLD2 with GR & SP

Remarks: Platform Express with Array Induction, High Resolution Laterlog Array, Compensated Neutron, Dual Litho Density, Gamma Ray & Spontaneous Potential
AIT tool failed on the ascent - no AIT data available.
Rxoz from the bottom tld is not reading right. Presented Rxoz values from the top tld.
The PPC arms are reading values out of tolerance. Could not edit the coefficients to fix the arms' readings as the offset values are out of range of the software constraints.
SP shows poor response - data is not useful.

Hole Conditions: Cased to 1249mMD. Rugose hole in some shale sections with more frequent wash-outs between 1406-1660mMD.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Jun 8, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL-Polymer

Fluid Density:	1500.0	**Viscosity:**	73	**pH:**	9.5	**Fluid Loss:**	5.0

Mud Resistivity (Rm):	@	º			
Mud Resistivity (Rm) @ BHT:	@	º	**Maximum Temperature:**	º	
Mud Filtrate Resistivity (Rmf):	@	º	**Source (Rmf):**		
Mud Cake Resistivity (Rmc):	@	º	**Source (Rmc):**		

Logging Run Information

Date on Bottom: Jun 8, 2013
Total Depth Logger: 2,859.00 (MD) 2,476.66 (TVD)

Logging Tools: ADT/Stringray/CMR

Remarks: Array Dielectric Tool-Stringray-Compensated Magnetic Resonnance
This tool string was originally run June 7 @ 07:30Hrs. Magnetic interference from junk in the hole required hoisting the tool string, where it became stuck briefly at 1410mMD. Once metal junk was cleared from the CMR the tool string was run back in but bridged at 1410mMD, necessitating a clean-out trip. On the June 8th run, the CMR was giving anomalous readings on running in (noticed at ~1460mMD) and was changed out. Time lost for tool ~2hrs. Lost telemetry with the Stringray at 1440mMD. Logged out with the ADT-CMR, then mysteriously the Stringray telemetry was regained, so dropped back to where the Stringray lost telemetry and recovered that data (another 2hrs lost).

Hole Conditions: Cased to 1249mMD. Rugose hole in some shale sections with more frequent wash-outs between 1406-1660mMD.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 3
Date: Jun 9, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL-Ploymer

Fluid Density:	1500.0	**Viscosity:**	73	**pH:**	9.5	**Fluid Loss:**	5.0

Mud Resistivity (Rm):		@	º		
Mud Resistivity (Rm) @ BHT:		@	º	**Maximum Temperature:**	º
Mud Filtrate Resistivity (Rmf):		@	º	**Source (Rmf):**	
Mud Cake Resistivity (Rmc):		@	º	**Source (Rmc):**	

Logging Run Information

Date on Bottom: Jun 9, 2013
Total Depth Logger: 2,859.00 (MD) 2,476.66 (TVD)

Logging Tools: FMI-GPIT-PPC2-Sonic Scanner

Remarks: Formation Imager, Global Positioning, 4-arm caliper x2-Sonic Scanner
All data appears reliable.
CVL log generated from PPC data captured during this run.

Hole Conditions: As above.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 4
Date: Jun 9, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL-Polymer

Fluid Density:	1500.0	**Viscosity:**	73	**pH:**	9.5	**Fluid Loss:**	5.0

Mud Resistivity (Rm):	@	º			
Mud Resistivity (Rm) @ BHT:	@	º	**Maximum Temperature:**	º	
Mud Filtrate Resistivity (Rmf):	@	º	**Source (Rmf):**		
Mud Cake Resistivity (Rmc):	@	º	**Source (Rmc):**		

Logging Run Information

Date on Bottom: Jun 10, 2013
Total Depth Logger: (MD) (TVD)

Logging Tools: MSCT-GR

Remarks: Mechanical Sidewall Coring Tool - Gamma Ray
Cores jammed in barrel after 15 cores were cut on first descent. Made a second descent at 04:00hrs June 10th to resume sidewall coring program. In total 46 cores were cut over the 222 mm section of hole. Desorbtion tests were preformed for cores 3,5 (together), 10, 13, 24, 29 & 30 (together), 34 and 42 for a total of seven tests.

Hole Conditions: As Above

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number:	4		
Wireline Logging Company:	Schlumberger	**Engineer:**	Michel Laponte
District:	Grande Paririe	**Unit Number:**	2034
Witness:	H. Gluth		

Was Pressure Control Equipment Utilized:	No	**Maximum Deviation:**	39.000 º
Was the Logging Job Mechanically Assisted:	No	**Hole Size:**	115.0

Total Lost Time:	0.00
Loggers' Total Down Time:	0.00
Total Job Time (From Rig up to Rig down):	38.00

	Measured Depth	True Vertical Depth
Casing Depth Driller	2,853.00	2,471.41
Casing Depth Logger	3,353.00	2,949.81
Total Depth Driller (Tally)	3,350.00	2,946.87
Total Depth Driller (Strap or SLM)		

General Remarks: The rig was released to the loggers at 2 AM, June 23rd. Four runs were preformed. Loggers began the first run (PEX) on June 23, @ 0200 hrs and were on bottom and completed run 1 at 11:30 hrs, respectively. Run number two (the stingray) , three (FMI) and four (Sidewall coring) were completed at 20:00hrs June 23rd, 04:00hrs June 24th and at 14:00hrs June 24th, respectively.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 1
Date: Jun 22, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL Ultradrill

Fluid Density:	1165.0	**Viscosity:**	70	**pH:**	5.2	**Fluid Loss:**	9.3

Mud Resistivity (Rm):	0.140	@	25.1 º		
Mud Resistivity (Rm) @ BHT:	0.060	@	93.3 º	**Maximum Temperature:**	93.3 º
Mud Filtrate Resistivity (Rmf):	0.100	@	25.1 º	**Source (Rmf):**	Flowline
Mud Cake Resistivity (Rmc):	0.160	@	25.1 º	**Source (Rmc):**	Flowline

Logging Run Information

Date on Bottom: Jun 23, 2013
Total Depth Logger: 3,353.00 (MD) 2,949.81 (TVD)

Logging Tools: AIT-PEX-HNGS-HRLA-GPIT-PPL-TLD2

Remarks: All data is reliable.

Hole Conditions: Good.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Jun 22, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL Ultradrill

Fluid Density:	1165.0	**Viscosity:**	70	**pH:**	5.2	**Fluid Loss:**	9.3

Mud Resistivity (Rm):	0.140	@	25.1 º		
Mud Resistivity (Rm) @ BHT:	0.060	@	93.3 º	**Maximum Temperature:**	93.3 º
Mud Filtrate Resistivity (Rmf):	0.100	@	25.1 º	**Source (Rmf):**	Flowline
Mud Cake Resistivity (Rmc):	0.160	@	25.1 º	**Source (Rmc):**	Flowline

Logging Run Information

Date on Bottom: Jun 23, 2013
Total Depth Logger: 3,353.00 (MD) 2,949.81 (TVD)

Logging Tools: ADT-NEXT-CMR

Remarks: Rigged in loggers at 1200 hrs. The loggers were on bottom at 1330 hrs.

Hole Conditions: Good

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 3
Date: Jun 22, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL Ultradrill

Fluid Density:	1165.0	**Viscosity:**	70	**pH:**	5.2	**Fluid Loss:**	9.3

Mud Resistivity (Rm):	0.140	@	25.1 º		
Mud Resistivity (Rm) @ BHT:	0.060	@	93.3 º	**Maximum Temperature:**	93.3 º
Mud Filtrate Resistivity (Rmf):	0.100	@	25.1 º	**Source (Rmf):**	Flow line
Mud Cake Resistivity (Rmc):	0.160	@	25.1 º	**Source (Rmc):**	Flow line

Logging Run Information

Date on Bottom: Jun 23, 2013
Total Depth Logger: 3,353.00 (MD) 2,949.81 (TVD)

Logging Tools: FMI-PPC-MSIP-PPC

Remarks: On bottom by 9 PM.

Hole Conditions: Good.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 4
Date: Jun 22, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL Ultradrill
Fluid Density: 1165.0 **Viscosity:** 70 **pH:** 5.2 **Fluid Loss:** 9.3

Mud Resistivity (Rm):	0.140	@	25.1 º			
Mud Resistivity (Rm) @ BHT:	0.060	@	93.3 º	**Maximum Temperature:**	93.3 º	
Mud Filtrate Resistivity (Rmf):	0.100	@	25.1 º	**Source (Rmf):**	Flow line	
Mud Cake Resistivity (Rmc):	0.160	@	25.1 º	**Source (Rmc):**	Flow line	

Logging Run Information

Date on Bottom: Jun 24, 2013
Total Depth Logger: 3,553.00 (MD) 3,145.81 (TVD)

Logging Tools: MSWCT-GR

Remarks: Six sidewalls were selected for desorption.
Sidewall core intervals

2974	S	Shale	Gas	Imperial#	4	
3006.2	S	Shale	Gas	Imperial#		4
3021.3	S	Shale	Gas	Imperial#	4	
3047	S	Shale	Gas	Canol #	4	
3050	S	Shale	Gas	Canol #	4	
3055.7	S	Shale	Gas	Canol #	4	
3058	R	limestone	gas	Ogilvie #	1	
3059	B	shale	mfs	Ogilvie #	1	
3070	B	Shale	MFS	Ogilvie #	1	
3088.6	R	Limestone	porosity	#	1	
3194.6	R	limestone	porsity	Ogilvie #	1	
3209.6	R	limestone	porosiy	Ogilvie #	1	
3211.2	B	Shale	mfs	Ogilvie #	1	
3222.8	B	Shale	mfs	Ogilvie #	1	
3327.5	B	shale	gas	Ogilvie #	1	
Total				33		

Hole Conditions: Two runs were needed due to the dog leg severity around 3050mMD.

Deviation / Directional Survey Report

Directional Drilling Company: Cathedral Energy Services
Directional Drillers: Bruce Wheeler/Bruce Kary
Measured While Drilling (MWD) Hands: Ben
Survey Type: magnetic
Survey Mode: MWD
Survey Date: Apr 15, 2013
Survey Calculation Method: minimum curvature
Target Azimuth: 320.80 °
Dog Leg Severity Characteristic: 30.00

Survey Tie-In Information

Tie-In Co-Ordinates
Latitude: 66.121035
Longitude: 136.590156
N / S:
E / W:

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00

Kick-Off (Whipstock) Information

Kick-Off Co-Ordinates
Latitude: 66.121035
Longitude: 136.590156
N / S:
E / W:

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity
399.00	398.79	1.310	295.34	5.52	4.01	1.75	1.52

Remarks: Wireline surveys were made between 20m (MD) and 246m (MD). The directional drilling program began at 246m (MD), on April 22, 2013. The well was kicked off at 399 meters (MD).

Survey Points

Storage Units: Metric

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00
90.69	90.68	1.500	59.80	0.60	1.03	-0.19	0.50
118.56	118.54	2.200	50.50	1.12	1.75	-0.24	0.82
145.30	145.25	2.600	48.20	1.85	2.60	-0.21	0.46
172.84	172.76	2.700	49.30	2.69	3.56	-0.16	0.12
200.54	200.44	2.300	52.50	3.45	4.50	-0.16	0.46
237.36	237.21	3.300	56.40	4.49	5.96	-0.29	0.83
246.60	246.44	2.900	51.40	4.78	6.37	-0.32	1.57
256.73	256.56	2.200	41.40	5.09	6.70	-0.29	2.45
266.19	266.01	1.100	19.70	5.31	6.85	-0.21	3.95
275.49	275.31	0.700	293.10	5.42	6.83	-0.12	4.09
284.73	284.55	1.400	261.90	5.42	6.66	-0.01	2.86
294.10	293.92	1.600	260.40	5.39	6.42	0.12	0.65
303.46	303.27	1.500	256.50	5.34	6.17	0.23	0.47
312.82	312.63	1.500	261.30	5.29	5.93	0.35	0.40
322.31	322.12	1.600	262.20	5.25	5.68	0.48	0.33
334.00	333.80	1.200	272.80	5.24	5.39	0.65	1.22
353.00	352.80	1.300	284.40	5.30	4.99	0.96	0.43
364.00	363.80	1.300	283.48	5.36	4.74	1.15	0.06
379.24	379.03	1.300	282.20	5.44	4.41	1.43	0.06
388.60	388.39	1.100	275.50	5.47	4.21	1.57	0.78
392.19	391.98	1.100	282.10	5.48	4.15	1.62	1.06
399.00	398.79	1.310	295.34	5.52	4.01	1.75	1.53
401.55	401.34	1.400	299.20	5.55	3.96	1.80	1.51
410.85	410.63	1.900	313.00	5.71	3.75	2.06	2.05
420.09	419.87	2.700	318.60	5.98	3.49	2.43	2.69
429.42	429.18	3.700	322.70	6.38	3.16	2.95	3.30
438.89	438.63	4.700	324.30	6.94	2.75	3.64	3.19
448.39	448.09	5.700	325.40	7.65	2.26	4.50	3.17
457.88	457.52	6.400	323.60	8.46	1.67	5.50	2.29
467.35	466.93	7.100	320.10	9.33	0.99	6.61	2.57
476.68	476.18	7.600	317.20	10.23	0.20	7.80	2.00

485.98	485.39	8.500	316.30	11.18	-0.70	9.10	2.93
495.28	494.58	8.900	316.30	12.20	-1.67	10.50	1.29
504.50	503.69	9.100	316.20	13.24	-2.67	11.94	0.65
513.81	512.88	9.500	317.50	14.33	-3.69	13.44	1.46
523.27	522.21	9.600	318.60	15.50	-4.74	15.01	0.66
532.72	531.52	9.800	319.30	16.70	-5.79	16.60	0.74
542.16	540.82	10.000	320.00	17.94	-6.84	18.23	0.74
551.40	549.92	10.000	319.90	19.17	-7.87	19.83	0.06
560.85	559.22	10.300	319.90	20.44	-8.94	21.49	0.95
570.35	568.57	10.400	320.10	21.75	-10.04	23.20	0.34
579.81	577.87	10.400	319.60	23.05	-11.14	24.91	0.29
589.08	586.98	11.000	319.40	24.36	-12.26	26.63	1.95
598.43	596.16	11.200	318.50	25.72	-13.44	28.43	0.85
607.76	605.30	11.900	316.70	27.10	-14.70	30.29	2.53
617.02	614.35	12.700	313.70	28.50	-16.09	32.26	3.32
626.33	623.42	13.300	315.20	29.96	-17.59	34.34	2.22
639.62	636.33	14.000	317.80	32.24	-19.75	37.46	2.10
649.13	645.55	14.200	320.00	33.99	-21.27	39.78	1.80
658.43	654.57	14.400	319.10	35.73	-22.76	42.08	0.96
667.87	663.70	14.700	318.50	37.52	-24.32	44.45	1.07
677.18	672.70	14.900	318.20	39.29	-25.90	46.82	0.69
686.94	682.12	15.500	318.50	41.21	-27.60	49.38	1.86
695.75	690.59	16.400	319.80	43.04	-29.18	51.80	3.30
705.27	699.71	17.300	321.60	45.17	-30.93	54.56	3.28
714.50	708.50	18.000	322.20	47.38	-32.66	57.36	2.35
724.30	717.81	18.500	323.50	49.82	-34.51	60.42	1.97
733.84	726.84	18.900	323.30	52.28	-36.33	63.48	1.27
743.66	736.12	19.600	323.90	54.88	-38.26	66.71	2.22
753.39	745.26	20.300	323.50	57.56	-40.22	70.03	2.20
762.74	754.02	20.800	322.20	60.18	-42.20	73.31	2.17
772.61	763.24	21.000	320.50	62.93	-44.40	76.83	1.94
782.39	772.36	21.400	320.20	65.65	-46.66	80.36	1.27
792.15	781.43	21.900	320.30	68.42	-48.96	83.96	1.54
801.80	790.36	22.600	319.80	71.22	-51.31	87.62	2.25
811.66	799.44	23.300	320.00	74.16	-53.78	91.46	2.14

821.34	808.30	24.200	321.40	77.18	-56.25	95.36	3.29
830.89	816.97	25.400	322.30	80.33	-58.73	99.37	3.95
840.63	825.72	26.500	323.50	83.73	-61.30	103.62	3.75
850.08	834.14	27.700	322.90	87.17	-63.88	107.93	3.91
859.88	842.75	29.200	322.00	90.87	-66.72	112.59	4.78
869.63	851.23	30.100	321.50	94.66	-69.71	117.41	2.87
879.53	859.75	31.000	320.60	98.57	-72.87	122.45	3.06
888.62	867.49	32.300	320.60	102.26	-75.90	127.22	4.29
900.00	877.04	33.600	315.60	106.86	-80.03	133.39	7.94
907.50	883.24	34.800	316.30	109.89	-82.96	137.59	5.05
916.92	890.96	35.300	317.30	113.83	-86.67	142.99	2.42
926.70	898.90	36.100	318.00	118.05	-90.51	148.69	2.76
936.43	906.75	36.300	318.80	122.35	-94.33	154.43	1.58
945.80	914.30	36.400	319.50	126.55	-97.96	159.98	1.37
955.89	922.42	36.400	319.40	131.10	-101.85	165.97	0.18
965.01	929.76	36.300	319.10	135.19	-105.38	171.37	0.67
974.10	937.09	36.300	319.20	139.26	-108.90	176.75	0.20
983.37	944.59	35.700	319.50	143.40	-112.45	182.20	2.02
993.24	952.62	35.400	320.60	147.80	-116.13	187.93	2.15
1,002.79	960.42	35.100	321.00	152.07	-119.62	193.45	1.19
1,012.58	968.42	35.200	320.10	156.42	-123.20	199.08	1.62
1,022.13	976.22	35.400	320.30	160.66	-126.73	204.60	0.73
1,031.49	983.85	35.300	319.90	164.82	-130.20	210.02	0.81
1,040.96	991.59	35.200	320.10	169.00	-133.72	215.48	0.48
1,050.36	999.26	35.400	320.40	173.18	-137.19	220.91	0.84
1,060.06	1,007.15	35.700	321.20	177.55	-140.76	226.55	1.71
1,069.61	1,014.88	36.100	321.90	181.93	-144.24	232.15	1.80
1,079.36	1,022.75	36.400	322.10	186.48	-147.79	237.92	0.99
1,088.58	1,030.14	36.900	322.10	190.82	-151.17	243.42	1.63
1,098.01	1,037.68	37.100	322.00	195.30	-154.66	249.09	0.66
1,107.72	1,045.42	37.100	322.10	199.91	-158.26	254.95	0.19
1,117.05	1,052.86	37.100	322.20	204.36	-161.71	260.57	0.19
1,126.87	1,060.71	36.700	321.60	209.00	-165.35	266.47	1.64
1,136.55	1,068.49	36.500	321.40	213.51	-168.94	272.24	0.72
1,146.06	1,076.12	36.700	321.50	217.95	-172.48	277.91	0.66

1,155.52	1,083.71	36.700	320.70	222.35	-176.03	283.56	1.52
1,165.04	1,091.34	36.700	320.60	226.75	-179.63	289.25	0.19
1,174.75	1,099.12	36.700	320.10	231.22	-183.34	295.05	0.92
1,184.19	1,106.70	36.600	319.60	235.52	-186.97	300.69	1.00
1,193.95	1,114.55	36.300	319.60	239.94	-190.73	306.49	0.92
1,203.74	1,122.43	36.500	319.30	244.35	-194.51	312.29	0.82
1,213.37	1,130.16	36.700	318.80	248.69	-198.27	318.03	1.12
1,222.88	1,137.76	37.100	318.50	252.98	-202.04	323.74	1.38
1,228.00	1,141.84	37.400	318.10	255.29	-204.10	326.84	2.26
1,252.00	1,160.82	38.100	319.80	266.37	-213.75	341.52	1.57
1,276.58	1,180.05	38.900	321.50	278.20	-223.45	356.82	1.62
1,285.72	1,187.16	39.000	321.30	282.69	-227.03	362.56	0.53
1,295.49	1,194.76	38.900	321.40	287.49	-230.87	368.71	0.36
1,304.55	1,201.82	38.800	321.30	291.93	-234.42	374.39	0.39
1,314.21	1,209.34	38.800	320.70	296.63	-238.23	380.44	1.17
1,323.73	1,216.77	38.600	320.10	301.22	-242.02	386.39	1.34
1,333.38	1,224.33	38.300	320.00	305.82	-245.88	392.39	0.95
1,342.78	1,231.71	38.200	320.10	310.28	-249.61	398.21	0.38
1,352.42	1,239.29	38.100	320.30	314.86	-253.42	404.17	0.49
1,362.11	1,246.92	38.000	321.10	319.48	-257.21	410.14	1.56
1,371.58	1,254.38	38.100	321.30	324.03	-260.87	415.98	0.50
1,381.24	1,261.99	38.000	321.50	328.68	-264.58	421.93	0.49
1,390.79	1,269.50	38.200	321.50	333.29	-268.25	427.82	0.63
1,400.21	1,276.93	37.800	321.20	337.82	-271.87	433.62	1.40
1,409.79	1,284.53	37.100	320.80	342.35	-275.54	439.45	2.32
1,419.52	1,292.34	36.200	320.40	346.84	-279.22	445.26	2.87
1,428.83	1,299.87	35.800	319.80	351.03	-282.73	450.73	1.72
1,437.92	1,307.24	35.900	319.80	355.10	-286.17	456.05	0.33
1,447.50	1,315.00	35.800	319.60	359.38	-289.80	461.66	0.48
1,456.84	1,322.58	35.800	318.90	363.52	-293.36	467.12	1.32
1,466.46	1,330.40	35.500	318.50	367.73	-297.06	472.72	1.18
1,476.27	1,338.38	35.500	318.10	371.98	-300.85	478.42	0.71
1,485.43	1,345.85	35.300	318.80	375.95	-304.37	483.72	1.48
1,494.81	1,353.52	35.000	321.10	380.09	-307.85	489.12	4.34
1,504.07	1,361.13	34.400	323.40	384.25	-311.08	494.38	4.67

1,513.45	1,368.88	34.200	324.30	388.52	-314.19	499.66	1.74
1,523.19	1,376.94	34.100	324.10	392.96	-317.39	505.12	0.46
1,532.81	1,384.92	33.800	323.70	397.30	-320.56	510.49	1.17
1,542.31	1,392.81	33.900	322.90	401.54	-323.72	515.77	1.44
1,552.05	1,400.88	34.200	322.20	405.87	-327.04	521.22	1.52
1,560.55	1,407.89	34.700	320.80	409.63	-330.03	526.03	3.31
1,571.35	1,416.76	34.900	321.10	414.42	-333.91	532.19	0.73
1,581.25	1,424.86	35.200	321.80	418.87	-337.46	537.88	1.52
1,590.91	1,432.76	35.200	321.20	423.22	-340.92	543.45	1.07
1,600.05	1,440.24	34.900	321.90	427.33	-344.19	548.70	1.65
1,609.30	1,447.85	34.400	322.60	431.49	-347.41	553.95	2.07
1,619.08	1,455.93	34.200	323.40	435.89	-350.72	559.46	1.51
1,628.67	1,463.88	33.800	324.80	440.24	-353.87	564.81	2.75
1,638.38	1,471.96	33.600	324.60	444.63	-356.98	570.19	0.71
1,647.79	1,479.82	33.100	325.40	448.87	-359.95	575.35	2.12
1,657.25	1,487.77	32.500	326.80	453.12	-362.81	580.45	3.07
1,666.40	1,495.47	32.900	327.70	457.28	-365.48	585.36	2.06
1,676.08	1,503.57	33.400	328.20	461.77	-368.29	590.61	1.77
1,685.74	1,511.62	33.900	328.10	466.32	-371.11	595.92	1.56
1,695.46	1,519.64	34.900	327.30	470.96	-374.05	601.37	3.39
1,705.22	1,527.60	35.800	326.30	475.68	-377.14	606.99	3.29
1,714.66	1,535.23	36.200	325.00	480.26	-380.27	612.52	2.74
1,724.01	1,542.77	36.400	323.60	484.76	-383.50	618.04	2.74
1,733.56	1,550.47	36.200	322.90	489.29	-386.88	623.69	1.45
1,743.03	1,558.10	36.300	322.10	493.73	-390.29	629.29	1.53
1,752.39	1,565.65	36.300	322.40	498.11	-393.68	634.83	0.57
1,761.79	1,573.24	36.000	322.10	502.50	-397.08	640.37	1.11
1,771.49	1,581.09	35.800	321.60	506.97	-400.59	646.06	1.10
1,780.98	1,588.81	35.500	320.70	511.28	-404.06	651.59	1.91
1,790.43	1,596.52	35.000	320.00	515.48	-407.54	657.04	2.04
1,799.72	1,604.14	34.800	319.80	519.54	-410.97	662.36	0.74
1,809.43	1,612.12	34.800	319.40	523.76	-414.56	667.90	0.71
1,818.43	1,619.51	34.800	319.20	527.66	-417.91	673.03	0.38
1,827.83	1,627.23	34.600	319.20	531.71	-421.40	678.38	0.64
1,837.46	1,635.17	34.500	320.10	535.87	-424.94	683.84	1.62

1,847.05	1,643.07	34.400	319.10	540.00	-428.46	689.27	1.80
1,856.77	1,651.08	34.700	318.90	544.16	-432.07	694.78	0.99
1,865.79	1,658.50	34.700	318.90	548.03	-435.45	699.91	0.00
1,875.53	1,666.50	34.700	317.40	552.16	-439.15	705.45	2.63
1,885.14	1,674.40	34.800	318.50	556.23	-442.82	710.92	1.98
1,894.54	1,682.12	34.700	318.00	560.22	-446.38	716.27	0.96
1,904.26	1,690.10	34.900	319.30	564.39	-450.05	721.81	2.37
1,914.06	1,698.13	35.200	318.40	568.63	-453.75	727.44	1.83
1,923.71	1,705.99	35.700	318.50	572.81	-457.46	733.03	1.56
1,933.37	1,713.83	35.800	317.00	576.99	-461.26	738.66	2.74
1,943.26	1,721.85	35.800	317.00	581.22	-465.20	744.44	0.00
1,953.05	1,729.79	35.900	317.60	585.44	-469.09	750.16	1.12
1,962.78	1,737.67	35.800	318.80	589.68	-472.89	755.85	2.19
1,972.47	1,745.54	35.600	317.40	593.89	-476.67	761.50	2.60
1,982.22	1,753.48	35.400	317.80	598.07	-480.48	767.15	0.94
1,991.61	1,761.14	35.200	317.90	602.10	-484.13	772.57	0.67
2,001.30	1,769.07	35.000	317.80	606.23	-487.86	778.14	0.64
2,010.70	1,776.78	34.700	317.80	610.21	-491.47	783.50	0.96
2,019.98	1,784.42	34.600	317.70	614.11	-495.02	788.77	0.37
2,029.52	1,792.29	34.200	317.30	618.09	-498.66	794.15	1.44
2,039.27	1,800.36	34.000	316.70	622.08	-502.39	799.60	1.20
2,046.07	1,806.01	33.800	316.20	624.83	-505.00	803.39	1.51
2,055.54	1,813.88	33.800	316.70	628.65	-508.63	808.64	0.88
2,065.27	1,821.95	34.000	316.80	632.60	-512.35	814.05	0.64
2,074.97	1,829.95	35.000	318.20	636.65	-516.06	819.54	3.95
2,084.67	1,837.89	35.100	318.50	640.82	-519.76	825.10	0.62
2,094.13	1,845.59	35.800	320.00	644.97	-523.34	830.59	3.54
2,103.65	1,853.30	36.100	321.70	649.31	-526.87	836.18	3.28
2,113.11	1,860.96	35.800	321.20	653.65	-530.33	841.73	1.33
2,122.57	1,868.64	35.600	320.70	657.94	-533.81	847.25	1.12
2,132.44	1,876.68	35.300	320.60	662.36	-537.44	852.97	0.93
2,142.11	1,884.59	35.000	320.80	666.67	-540.97	858.54	1.00
2,151.73	1,892.52	33.900	321.40	670.91	-544.38	863.98	3.59
2,161.50	1,900.68	32.900	321.50	675.11	-547.74	869.36	3.08
2,171.03	1,908.69	32.700	321.90	679.17	-550.94	874.52	0.93

2,180.30	1,916.50	32.500	322.20	683.10	-554.01	879.52	0.83
2,189.94	1,924.60	33.200	322.90	687.25	-557.19	884.74	2.48
2,199.21	1,932.34	33.400	323.20	691.32	-560.25	889.83	0.84
2,208.80	1,940.34	33.700	323.90	695.59	-563.39	895.12	1.53
2,218.37	1,948.26	34.500	322.30	699.88	-566.62	900.48	3.77
2,227.94	1,956.12	35.200	322.00	704.19	-569.97	905.95	2.26
2,237.54	1,963.93	35.800	321.80	708.58	-573.41	911.52	1.91
2,247.23	1,971.80	35.600	321.80	713.02	-576.91	917.18	0.62
2,256.81	1,979.63	34.700	322.10	717.37	-580.31	922.69	2.87
2,266.49	1,987.62	34.200	322.00	721.68	-583.67	928.17	1.56
2,275.62	1,995.18	33.900	322.10	725.72	-586.82	933.28	1.00
2,285.06	2,002.98	34.700	321.80	729.90	-590.10	938.59	2.60
2,294.64	2,010.84	35.100	321.30	734.20	-593.51	944.08	1.54
2,304.37	2,018.76	35.900	320.90	738.59	-597.05	949.73	2.57
2,313.83	2,026.39	36.600	320.90	742.94	-600.58	955.32	2.22
2,323.41	2,034.07	36.800	320.00	747.35	-604.23	961.04	1.80
2,332.98	2,041.70	37.400	320.00	751.77	-607.94	966.82	1.88
2,342.21	2,049.07	36.700	319.80	756.03	-611.52	972.38	2.31
2,351.92	2,056.87	36.400	319.30	760.43	-615.27	978.16	1.31
2,361.52	2,064.55	37.200	319.00	764.78	-619.03	983.91	2.56
2,371.25	2,072.34	36.400	319.10	769.18	-622.85	989.73	2.47
2,380.64	2,079.94	35.600	318.50	773.33	-626.49	995.25	2.79
2,390.35	2,087.89	34.400	318.70	777.51	-630.17	1,000.81	3.72
2,402.69	2,098.13	33.500	318.90	782.69	-634.71	1,007.70	2.20
2,412.28	2,106.13	33.400	318.80	786.67	-638.19	1,012.98	0.36
2,421.77	2,113.99	34.800	318.50	790.67	-641.70	1,018.30	4.46
2,431.45	2,121.85	36.700	320.00	794.95	-645.39	1,023.95	6.48
2,441.03	2,129.47	37.800	320.50	799.41	-649.10	1,029.75	3.57
2,450.81	2,137.22	37.500	321.90	804.07	-652.85	1,035.72	2.78
2,460.14	2,144.64	37.000	321.90	808.51	-656.33	1,041.37	1.61
2,469.70	2,152.35	35.600	323.40	813.01	-659.76	1,047.03	5.20
2,478.71	2,159.72	34.500	322.40	817.14	-662.88	1,052.20	4.13
2,488.33	2,167.68	33.900	322.30	821.42	-666.19	1,057.60	1.88
2,498.04	2,175.71	34.600	322.30	825.74	-669.53	1,063.07	2.16
2,507.64	2,183.58	35.100	321.30	830.05	-672.92	1,068.55	2.37

2,517.22	2,191.40	35.500	323.00	834.42	-676.32	1,074.08	3.32
2,526.97	2,199.36	35.000	321.90	838.88	-679.75	1,079.71	2.49
2,536.70	2,207.36	34.500	323.00	843.28	-683.13	1,085.25	2.47
2,546.30	2,215.26	34.800	321.80	847.60	-686.46	1,090.71	2.33
2,555.89	2,223.11	35.200	320.00	851.87	-689.93	1,096.21	3.46
2,565.10	2,230.62	35.600	320.20	855.97	-693.35	1,101.54	1.36
2,574.64	2,238.40	35.200	318.90	860.17	-696.93	1,107.07	2.68
2,584.25	2,246.25	35.100	320.20	864.38	-700.52	1,112.60	2.36
2,593.84	2,254.13	34.400	319.20	868.55	-704.06	1,118.06	2.82
2,603.43	2,262.06	34.200	320.50	872.68	-707.54	1,123.47	2.38
2,612.98	2,269.94	34.500	320.40	876.84	-710.97	1,128.86	0.96
2,622.70	2,277.93	34.900	321.70	881.14	-714.45	1,134.39	2.60
2,632.22	2,285.74	34.900	322.10	885.42	-717.81	1,139.83	0.72
2,641.80	2,293.63	34.300	320.90	889.68	-721.20	1,145.27	2.84
2,651.53	2,301.66	34.400	321.20	893.95	-724.65	1,150.76	0.61
2,661.12	2,309.58	34.200	320.30	898.14	-728.07	1,156.17	1.71
2,670.85	2,317.61	34.600	321.30	902.40	-731.54	1,161.66	2.13
2,680.41	2,325.46	34.900	322.10	906.67	-734.92	1,167.11	1.71
2,690.01	2,333.32	35.200	321.80	911.01	-738.32	1,172.63	1.08
2,699.60	2,341.16	35.300	322.20	915.38	-741.73	1,178.16	0.79
2,709.33	2,349.11	35.100	322.50	919.82	-745.15	1,183.77	0.82
2,718.68	2,356.78	34.500	322.60	924.05	-748.40	1,189.10	1.93
2,728.19	2,364.64	34.100	321.70	928.28	-751.69	1,194.46	2.04
2,737.54	2,372.39	34.000	322.50	932.42	-754.90	1,199.69	1.47
2,746.65	2,379.96	33.600	322.80	936.44	-757.98	1,204.76	1.43
2,756.21	2,387.94	33.100	321.80	940.60	-761.19	1,210.01	2.33
2,765.69	2,395.91	32.600	321.40	944.63	-764.38	1,215.15	1.72
2,775.22	2,403.96	32.100	321.50	948.62	-767.56	1,220.25	1.58
2,784.78	2,412.08	31.500	322.20	952.58	-770.67	1,225.29	2.21
2,794.34	2,420.26	30.800	321.90	956.48	-773.71	1,230.23	2.25
2,803.90	2,428.51	30.100	322.20	960.30	-776.69	1,235.07	2.25
2,813.45	2,436.79	29.600	322.50	964.07	-779.60	1,239.83	1.64
2,823.01	2,445.11	29.300	323.20	967.81	-782.44	1,244.52	1.43
2,832.59	2,453.48	29.000	322.10	971.52	-785.27	1,249.19	1.92
2,853.00	2,471.41	28.100	322.80	979.25	-791.21	1,258.94	1.41

2,865.74	2,482.67	27.600	323.30	984.01	-794.79	1,264.88	1.30
2,875.49	2,491.34	26.900	324.00	987.61	-797.44	1,269.34	2.37
2,881.00	2,496.26	26.500	324.40	989.61	-798.88	1,271.81	2.39
2,895.02	2,508.88	25.200	325.30	994.61	-802.40	1,277.91	2.91
2,903.00	2,516.13	24.300	326.20	997.37	-804.29	1,281.24	3.67
2,914.40	2,526.54	23.800	326.70	1,001.24	-806.85	1,285.86	1.42
2,924.12	2,535.47	22.700	327.00	1,004.46	-808.95	1,289.68	3.41
2,933.85	2,544.46	22.200	327.20	1,007.58	-810.97	1,293.37	1.56
2,943.59	2,553.46	22.900	327.70	1,010.72	-812.98	1,297.08	2.24
2,953.34	2,562.45	22.500	327.70	1,013.90	-814.99	1,300.82	1.23
2,963.12	2,571.51	21.600	326.80	1,016.99	-816.98	1,304.47	2.95
2,972.88	2,580.62	20.600	326.40	1,019.93	-818.91	1,307.96	3.11
2,982.62	2,589.77	19.600	326.10	1,022.71	-820.77	1,311.29	3.10
2,992.33	2,598.94	18.700	326.10	1,025.35	-822.55	1,314.46	2.78
3,002.07	2,608.19	17.800	325.70	1,027.88	-824.26	1,317.50	2.80
3,011.83	2,617.50	17.100	324.70	1,030.28	-825.92	1,320.42	2.34
3,021.58	2,626.84	16.400	324.80	1,032.58	-827.55	1,323.22	2.16
3,031.33	2,636.21	15.700	324.10	1,034.77	-829.11	1,325.91	2.23
3,041.04	2,645.57	14.800	323.90	1,036.84	-830.61	1,328.46	2.79
3,050.77	2,655.01	13.700	326.30	1,038.80	-831.99	1,330.85	3.85
3,060.50	2,664.46	13.400	326.60	1,040.70	-833.25	1,333.12	0.95
3,070.22	2,673.92	13.300	326.60	1,042.57	-834.48	1,335.35	0.31
3,079.97	2,683.41	13.300	326.10	1,044.44	-835.72	1,337.59	0.35
3,089.69	2,692.87	13.400	326.70	1,046.31	-836.97	1,339.82	0.53
3,099.46	2,702.37	13.300	325.90	1,048.19	-838.22	1,342.06	0.64
3,109.18	2,711.83	13.300	325.80	1,050.04	-839.47	1,344.29	0.07
3,118.91	2,721.30	13.400	325.10	1,051.89	-840.75	1,346.53	0.59
3,128.65	2,730.77	13.400	325.10	1,053.74	-842.04	1,348.78	0.00
3,138.38	2,740.24	13.400	325.20	1,055.59	-843.33	1,351.03	0.07
3,148.15	2,749.75	13.300	325.20	1,057.44	-844.62	1,353.28	0.31
3,157.89	2,759.22	13.400	325.20	1,059.29	-845.90	1,355.52	0.31
3,167.68	2,768.75	13.300	326.20	1,061.16	-847.17	1,357.77	0.77
3,177.43	2,778.24	13.200	325.30	1,063.00	-848.43	1,360.00	0.71
3,187.16	2,787.71	13.100	326.20	1,064.83	-849.68	1,362.21	0.70
3,196.89	2,797.19	13.000	325.90	1,066.65	-850.90	1,364.39	0.37

3,206.67	2,806.72	12.900	326.40	1,068.47	-852.12	1,366.58	0.46
3,216.42	2,816.23	12.700	326.00	1,070.27	-853.33	1,368.73	0.67
3,226.19	2,825.76	12.600	326.40	1,072.05	-854.52	1,370.86	0.41
3,235.94	2,835.28	12.500	326.20	1,073.81	-855.69	1,372.97	0.34
3,245.69	2,844.80	12.400	325.60	1,075.55	-856.87	1,375.06	0.50
3,255.42	2,854.31	12.300	325.30	1,077.27	-858.05	1,377.13	0.37
3,265.16	2,863.82	12.200	325.00	1,078.96	-859.23	1,379.19	0.37
3,274.89	2,873.33	12.200	325.30	1,080.65	-860.41	1,381.24	0.20
3,284.64	2,882.87	12.100	325.40	1,082.34	-861.57	1,383.29	0.31
3,294.37	2,892.38	12.100	325.30	1,084.01	-862.73	1,385.32	0.06
3,304.11	2,901.91	11.800	324.60	1,085.67	-863.89	1,387.33	1.03
3,313.83	2,911.43	11.700	324.60	1,087.28	-865.04	1,389.31	0.31
3,323.00	2,920.41	11.600	325.10	1,088.79	-866.10	1,391.16	0.46
3,350.00	2,946.87	11.300	326.60	1,093.23	-869.11	1,396.50	0.47

Drilling Fluid Summary

Storage Units: Metric

Drilling Fluid Type:	Gel Chemical	**From:**	0	**To:**	366
Drilling Fluid Type:	KCL Ultradrill	**From:**	366	**To:**	1,252
Drilling Fluid Type:	KCL Ultradrill	**From:**	1,252	**To:**	3,350

Formation Top Summary

Storage Units: Metric

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

**** All Depths measured from Kelly Bushing Elevation ****

Group *Formation* Member	Prognosis (TVD)	Sample Top (MD)	Sample Top (TVD)	Log Top (MD)	Log Top (TVD)	Subsea	Thickness
Eagle Plain ***Parkin*** Orange Marker	97.49	97.50	97.49	97.50	97.49	584.21	11.90
Whitetone River	109.38	109.40	109.38	109.40	109.38	572.32	26.60
Lower Cretaceous Mk	138.56	136.00	135.96	138.60	138.56	543.14	68.60
Jungle Creek	199.70	204.60	204.49	206.00	205.89	475.81	16.40
Carboniferous	220.87	221.00	220.87	221.00	220.87	460.83	25.00
Blackie HST	199.70	246.00	245.84	246.20	246.04	435.66	100.50
Hart River CD Sands	795.00	346.50	346.30	346.50	346.30	335.40	363.10
Hart River AB MFS Shale	755.00	709.60	703.83	710.30	704.50	-22.80	82.10
Hart River AB Sands	795.00	791.70	781.01	791.70	781.01	-99.31	144.90
Ford Lake Ford Lake MFS	929.00	936.60	906.89	936.00	906.40	-224.70	211.90
Imperial	1078.08	1148.50	1078.08	1148.50	1078.08	-396.38	62.50
Imperial Tuttle		1211.00	1128.26	1211.10	1128.34	-446.64	492.00
Imperial MFS	1469.00	1703.00	1525.79	1703.00	1525.79	-844.09	1341.80

Formation Top Summary

Storage Units: Metric

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

***** All Depths measured from Kelly Bushing Elevation *****

Group *Formation* Member	Prognosis (TVD)	Sample Top (MD)	Sample Top (TVD)	Log Top (MD)	Log Top (TVD)	Subsea	Thickness
Canol	2326.00	3044.80	2649.28	3044.40	2648.83	-1967.13	12.00
Ogilvie	2381.00	3056.80	2660.92	3056.60	2660.67	-1978.97	293.20
Total Depth	2581.00	3350.00	2946.87	3353.00	2949.81	-2268.11	

Formation Evaluations

Storage Units: Metric

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group: Eagle Plain
Formation: Parkin
Member: Orange Marker
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: upper
Period: Cretaceous
Stage: cenomanian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	97.50	97.49	584.21	11.90
Log Top	97.50	97.49	584.21	

Evaluation:

The Orange Marker could not be examined through drill cuttings due to the fact that it proved to be a zone of lost circulation. The interval between 97 nd 116 m (MD) was drilled "blind" with no drill cuttings returned to surface. Seven cement plugs were run at 99, 102, 104 and at 116 meters (MD) in order to heal losses.
Geophysical logs indicate porosities as high as 36% over the Orange Marker.
The Orange Marker is conformably overlain by an incomplete section of the Upper Parkin, occuring as a thick sequence of monotonous brown to grayish brown carbonaceous shale, with occasional siltstone laminations. The shales are believed to be relatively low in total organic carbon, and are not overly gassy.
Examination of the caliper over this section of the hole indicates extensive wash out. Hole erosion did not hamper drilling, logging, or casing operations at this location however.

Conclusion:

The absence of ice filling the pore space of this zone suggests a shallow permafrost depth at this location. In other wells (A-25 & H-28) drilled into this zone the Orange Marker was seen to be conglomeratic.
The overlying Upper Parkin is a monotonous section of carbonaceous shale, with occasional silty partings. The shales are thought to have moderate to low TOC, and have no potential for either conventional or unconventional hydrocarbon production at this location.

Formation Evaluations

Storage Units: Metric

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Whitetone River
Member:
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: early
Period: Cretaceous
Stage: albian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	109.40	109.38	572.32	26.60
Log Top	109.40	109.38	572.32	

Evaluation:

The Whitestone River is picked here at 109.4 m(MD) based on geophysical logs. The section below this down to 116 mMD was drilled blind. Between 116 and 138.6 mMD, the Whitestone River consists of light to medium gray, medium brown gray, carbonaceous, commonly slightly silty, non calcareous shale with ironstone nodules and minor light to medium brown, sandy, tight, salt and pepper siltstone.

Conclusion:

The stratigraphic relationships and boundaries require further study in this basin, so correlation between wells is more consistent.
The Whitestone River is a low TOC shale, and has no hydrocarbon production potential.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Lower Cretaceous Mkr
Member:
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: early
Period: Cretaceous
Stage: albian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	136.00	135.96	545.74	68.60
Log Top	138.60	138.56	543.14	

Evaluation:

The Lower Cretaceous Marker represents a facies change in the lower Whitestone River where basinal shales with occasional silty partings pass conformably into overlying blocky lower shoreface glauconite siltstones and sandy siltstones. These blocky siltstones have a sharp upper contact with a continuation of the Whitestone River basinal described above. As defined here, the "Marker" grades from these glauconitic sandstones vertically, below 165 m(D) into medium brown, light to medium gray, medium brown gray, commonly slightly silty, sandy, pyritic, locally glaucontic shales and finally into interbedded oil saturated conglomerate, coal and sandstone below 187 mMD. The base of the Lower Cretaceous Marker is an angular unconformity and overlies Permian strata of the Jungle Creek Formation which is located in logs at 206 mMD. The base of the unconformity was picked on the presence or absence of coal which is assumed to be of Cretaceous age.

Dark chert conglomerate between 187 and 190 m(D) was described as follows: predominately as unconsolidated & fractured medium to dark gray, dark brown, medium brown, rare black, rare off white or light gray, coarse to granular, subrounded to rounded chert grains with pressure solution pits or with occasional siliceous druse rims or rare euhedral quartz crystals. The conglomerate is clast supported with rare matrix rims consisting of upper fine to lower coarse grained, salt and pepper, moderately sorted, siliceous, angular to subrounded, non-calcareous sandstone. An estimated 10-24% intergranular porosity is saturated with medium brown oil, and samples generated a rapid milky green blooming cut fluorescence. Oil was observed as a film over the shakers.

Sandstone between 195 and 200 m(MD) is silty to very fine lower grained and displays floating upper medium quartz and chert grains and a light to medium brown argillaceous matrix. Spotty 1-21% visible intergranular porosity and a slow green blooming cut fluorescence was observed here. These sandstones differ from those between 205 and 210 mMD in that the latter are conglomeratic and matrix supported and contain a sandstone matrix which is fine to medium grained and commonly display a patchy orange brown argillaceous matrix and 1-24% visible intergranular porosity. This interval generated a rapid, good milky green blooming cut fluorescence.

Conclusion:

The basal 19 meters of the Lower Cretaceous Marker contain potentially productive oil, both within clast supported conglomerate, in matrix supported conglomeratic sandstone, as well as in fine grained sandstone. Further evaluation is required.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Jungle Creek
Member:
Boundary Type: nonconformable
Fault Type:

Era: paleozoic
Series: early
Period: Permian
Stage: asselian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	204.60	204.49	477.21	16.40
Log Top	206.00	205.89	475.81	

Evaluation:

The Jungle Creek is defined within geophysical logs and drill cuttings, between 206 and 221 mMD. At this location the Jungle Creek consists of interbedded conglomerate, sandstone and shale.

Sandstone occurs between 206 and approximately 215 mMD and is described as follows: occurring in part as fractured, unconsolidated, off white, light gray, brown, rare orange, gray brown, medium to coarse, subrounded to rounded, chert grains and chert granules and as rare subhedral quartz grains, in part as a matrix supported conglomeratic sandstone. The sandstone matrix is typically light yellow brown, orange brown, fine to medium grained, locally coarse lower grained, angular to subrounded, poor to moderately sorted, with a patchy orange brown argillaceous matrix, with rare massive pyrite, commonly siliceous and locally with overgrowths, carbonaceous, with spotty 1-24% visible intergranular porosity with spotty oil staining, which generates a rapid, good milky blooming cut fluorescence.

Conglomerate between 215 and 221 mMD is as follows: predominately occurring as fractured white, light gray, light to dark brown, chert granules, clast supported, with a light to medium brown, fine to occasionally lower medium grained, subangular to subrounded, salt and pepper sandstone matrix, commonly with medium brown, orange brown in part ferruginous argillaceous matrix, locally with coaly laminae, siliceous, locally with abundant dead carbonaceous matrix, spotty 1-8, rare 24% visible, commonly bitumen or rare oil plugged intergranular porosity which generated a spotty good green blooming cut fluorescence.

Conclusion:

The Jungle Creek contains oil and should be further evaluated.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Carboniferous
Member:
Boundary Type: nonconformable
Fault Type:

Era: paleozoic
Series: lower
Period: Pennsylvanian
Stage: bashkirian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	221.00	220.87	460.83	25.00
Log Top	221.00	220.87	460.83	

Evaluation:

The Carboniferous as defined here is of uncertain stratigraphic relation to the wells drilled previously and maybe equivalent in part to the Ettrain. It consists of light to medium brown, occasionally light gray, or light grayish-brown non fissile shale, which occurs as sub platy to blocky, slightly carbonaceous and micamiceous, very calcareous, locally pyritic or marly, hard, with marly limestone near its base.

Conclusion:

No gases were generated over this interval and the shales did not generate a cut fluorescence and are likely non productive.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Hart River
Member: CD Sands
Boundary Type: nonconformable
Fault Type:

Era: paleozoic
Series: early
Period: Mississippian
Stage: serpukhovian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	346.50	346.30	335.40	363.10
Log Top	346.50	346.30	335.40	

Evaluation:

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

The Hart River C & D sandstones were described as off white, light yellow brown, light to dark brown, locally gray brown, light gray, locally spicular, crptocrystalline to locally lower fine crystalline, translucent, calcareous, tight chert locally with brown argilaceous specks, and mainly light to medium brown, medium brown gray, off white, yellow white, cream, light yellow brown, cryptocrystalline, locally bioclastic, chalky, silty or sandy, argillaceous cherty, marly, locally fractured tight limestone.

Sandstone between 346.5 and 371.5 mMD general display porosity ranging between 9 (above 365 mMD) and 15% between 365 and 371.5 mMD. Between 345 and 355 mMD, sandstones are consolidated and occur as calcareous, angular to rounded, variously colored matrix supported conglomeratic sandstone with a fine to coarse sandstone matrix. Porosity is bitumen plugged and ranges between 1 and 8%. These sandstones generated a good, yellow green blooming cut fluorescence.

Between 360 and 365 mMD, sandstone is fine upper to coarse lower grained, salt and pepper, calcareous, with spotty orange brown or occasionally off white argillaceous matrix, slightly siliceous, and rare fragments show 1-6% black bitumen plugged intergranular porosity. This interval generated a weak, faint, yellow green blooming cut fluorescence.

Sandstone between 365 and 370 mMD is a follows: consolidated, off white, light orange brown, gray brown, subrounded to rounded, occasional angular fragments, fine to upper medium grained, locally with floating coarse lower quartz & chert grains, salt and pepper, with < 35% chert grains, very calcareous, consolidated fragments crush to a fine powder & diagenetically altered, slightly siliceous, abundant subhedral to euhedral quartz grains, commonly friable below 366 meters (MD), patchy off white, orange brown & questionable bitumen stained argillaceous cement, predominately tight, rare fragments with 1-6% black dead bitumen plugged intergranular porosity, becoming 1-10, trace 15% below 366m(MD), spotty white intergranular kaolin, spotty intergranular in part dead bitumen, spotty sticky tar plugged intergranular porosity, kaolin matrix porosity(?) weak, very poor, rapid yellow green blooming cut fluorescence.

Sandstone between 380 and 390 mMD is as follows: consolidated, salt and pepper, predominately very fine lower to very fine upper grained, argillaceous, very calcareous, & tight & with poor grain relief, rare fine to lower medium grained fragments with floating coarse chert grains, subangular to subrounded, locally rounded, slightly siliceous & with 1-6% black bitumen plugged intergranular porosity, no cut fluorescence.

Sandstone between 405 and 415 mMD is as follows: off white, light yellow brown, very fine lower to very fine upper grained, becoming conglomeratic below 408 and 420 mMD, calcareous, slighty siliceous, poor to moderately sorted, with fair grain relief, 1-6% bitumen plugged intergranular porosity, a rapid moderate, yellow green blooming cut fluorescence, was observed between 405 and 410 mMD only.

Sandstone between 415 and 425 mMD is as follows: off white, light yellow brown, light gray brown, gray orange brown, in part occurring as unconsolidated grains between 415-420 mMD & conglomeratic & matrix supported, salt and pepper, calcareous, slightly siliceous, with patchy light orange brown, off white argillaceous matrix, sandstone matrix largely very fine lower to very fine upper and occasionally fine upper grained. Between 415 and 420 mMD sandstones display 1-6% black, dead bitumen plugged intergranular porosity and do not generate a cut fluorescence.

Conclusion:

Sandstones of the Hart River C/D are porous but are plugged with bitumen.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Hart River
Member: AB MFS Shale
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series:
Period: Carboniferous
Stage:
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	709.60	703.83	-22.13	82.10
Log Top	710.30	704.50	-22.80	

Evaluation:

Several maximum flooding surfaces (MFS) are seen to occur over the lower Hart River between ~920-710mMD. As many as 6 separate depositional sequences overlain with lithologies consistent with an MFS are seen to occur over this interval. Some of these sequence boundaries are thin, and others are thick and prominent. Typically they present themselves as highly organic black shale, that may or may not include basinal mudstones (limestone) and thin (turbiditic) sandstones.
Where these MFS deposits attain significant thickness, they are candidates for unconventional shale gas exploitation given a complex set of criterion are present in regards to the chemistry, petrology, and mechanical properties of the shale. In general the black shales seen to occur in the flooding surfaces between 920-710mMD are anomalously radioactive and gassy. Several isotube gas samples were collected over these shales, where sample points are noted on the enclosed geologic striplog.

Conclusion:

Extensive cuttings, sidewall cores, and gas sampling over the flooding surface sequences was conducted over the lower Hart River, and will provide valuable information to ascertain the potential for these rocks as a viable shale gas exploration target.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Hart River
Member: AB Sands
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series:
Period: Carboniferous
Stage:
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	791.70	781.01	-99.31	144.90
Log Top	791.70	781.01	-99.31	

Evaluation:

The Lower Hart River is a complex sequence of interbedded sandstones, siltstones, limestone and shale. As many as 5 major sequences of predominantly clastic deposition are capped with basinal limestones and anomalously organic and radioactive shale sequences. In essence the "AB" designation is meaningless here, as it is unclear which sand could be called the "A" Sand, and which the "B". Once more is known about this basin, with further drilling, seismic, and mapping, a sequence stratigraphy study should be conducted to fully understand the complex relationships that are seen to occur here.
All sandstone deposits in the Hart River sequence are potential conventional targets for hydrocarbon exploitation, and therefore being able to predict the occurrence of the sands will aid in exploration for these targets. Porous sands in the lower Hart River at this location typically show evidence of containing hydrocarbons, being lightly stained with an oil residue, and giving a weak cut fluorescence. Porosity in sands at this location is largely occluded with silica and traces of calcite. Most sands are also poorly sorted, which limits insitu porosity before cementation.

Conclusion:

Hart River sands typically show evidence of containing traces non-commercial hydrocarbon. No significant shows were recorded while penetrating these sandstones, and this interval is not believed to have potential for economic hydrocarbon production at this location.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Ford Lake
Member: Ford Lake MFS
Boundary Type: unconformable
Fault Type:

Era: paleozoic
Series: upper
Period: Devonian
Stage: famennian
Age (Approx): 364 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	936.60	906.89	-225.19	211.90
Log Top	936.00	906.40	-224.70	

Evaluation:

The Ford Lake MFS is a thick section of shale in the uppermost Ford Lake occurring between 936-1000.0mMD (907-958mTVD). This interval consists of anomalously radioactive, highly organic and pyritic shales, with thin lime mudstone partings. The shales in this interval are also somewhat bituminous and anomalously gassy. The interval was extensively sampled, including a 4" diameter conventional core taken over the top of the interval where the radioactive signature is strongest, several isotube gas samples, and 12 sidewall cores, in addition to all the other cuttings sampling that was done. Several sections of the conventional core, and several sidewalls are currently undergoing desorption.

Conclusion:

The Ford Lake MFS is a section of anomalously gassy, radioactive, and pyritic shales that are the primary target for shale gas exploitation in this basin. Extensive petrography, petrology, geochemisty, and rock mechanics work will be necessary to ascertain the potential for these rocks to produce shale gas in economic quantities.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Imperial
Member:
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: late
Period: Devonian
Stage: frasnian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1148.50	1078.08	-396.38	62.50
Log Top	1148.50	1078.08	-396.38	

Evaluation:

The top of the Imperial is picked here where shales change in character from being basinal with a marine influence, having numerous thin mudstone (limestone) partings, to having more of a continental (clastic) component. The Imperial is a very thick section of variably carbonaceous shales, blocky sandstones, and predominantly shale with thin turbiditic sandstones deposited in prominent clinoforms. Turbiditic sandstones and siltstones appear to have been deposited in a somewhat rythmatic nature. Prominent blocky sandstones are collectively referred to as the Tuttle member, and are described in more detail below.

The level of shear observed in this section of the hole, was comparatively low relative to what was observed in the West Chance H-28 and McParlon A25 wells. Slickensides, which are the predominant shear feature here are likely the result of folding. Fractures present in core (full and sidewall) are typically vertical and healed with silica and locally with calcite cement.

The Imperial, as defined here, is1571m in vertical thickness. The Imperial shales do change in character over the sequence, with some sections having common sandy or silty partings, and some sections having greater (or lesser) amounts of total organic carbon and pyrite. Two cores were cut in the lower Imperial between 2908.6 and 2912.6 and between 2931.4 and 2949.4 mMD. Both cores contained Tuttle sands. Desorption testing is currently being conducted on both cores.

Conclusion:

The Imperial is a very thick accumulation of clinoformal successions of shale, with minor turbiditic sandstones and siltstones interspersed with blocky lower to upper shoreface sandstones. Sandstones are typically well cemented, but like the Hart River sandstones above, they show evidence of hydrocarbon migration, and where porous, have trace amounts of residual hydrocarbon trapped in interstitial pore space. No significant shows were seen to occur in these sandstone sequences at this location, however, these units may have good potential for developing into viable reservoirs regionally, and are a legitimate exploration target in the basin.

Formation Evaluations

Storage Units: Metric

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Imperial
Member: Tuttle
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: upper
Period: Devonian
Stage: famennian
Age (Approx): 366 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1211.00	1128.26	-446.56	492.00
Log Top	1211.10	1128.34	-446.64	

Evaluation:

The Tuttle member within the Imperial formation is a collection of poorly to moderately sorted, somewhat predominantly immature conglomerates, sandstone, siltstones and interbedded shales sandstones are lower to upper shoreface, and may in part be of turbiditic origin. Typically the clasts in the sandstone and conglomerates are angular and probably more importantly are somewhat feldspathic. Many of the conglomerates and sandstones show good porosity on logs and this is due to the presence of kaolinite which likely resulted from the diagenesis of feldspar.

Liberated gas responses from the Tuttle varied and may be in part a function of mud weight. Below 1360 mMD mud weights were maintained at or slightly above 1500 kg/m3. From 1207.5 to 1360 mMD mud weights were gradually increased from 1220 kg/m3.

Potentially Gas Productive Horizons

A) between 1362-1397 mMD: 1) 1363 mMD geophysical logs show 15% porosity with neutron-density crossover; liberated gas levels 90 units / 80 unit background; 2) 1375-1380 mMD: 15-18% log porosity with crossover with 170 units/ 80 unit background liberated gas; 3) 1385 mMD: 15-21% log porosity with crossover and 173 units over an 80 unit background liberated gas; 4) 1390-1398 mMD: 15-21% log porosity with cross over and 125 units over an 80 unit background. Sandstone associated with these intervals are light gray, light gray brown, off white, locally light to medium brown, salt and pepper, with 10-25% chert grains, predominantly fine to lower medium grained, angular to subrounded, moderately sorted, pyritic, siliceous, slightly calcareous and commonly with patchy gray brown, medium brown, light gray clay and white kaolinitic matrix. A weak, very poor slow yellow green blooming cut fluorescence was observed between 1380 and 1397 mMD only. Dead bitumen was observed in portion of this interval.

B) between 1420 and 1440 mMD: 1) 1420-1425 mMD: 6-15% log porosity with neutron & density cross over, with 137 units over a 90 unit background liberated gas; 2) 1425-1430 mMD: 12% log porosity with neutron density crossover, 103 units over a 90 unit background; 3) 1434 mMD: 12% log porosity with neutron density cross over, 105 units over a 90 unit background; 4) 1435-1440 m (MD): 12-18% log porosity with neutron density crossover and 109 units over a 90 unit background. Sandstone associated with this interval is as follows: off white, light gray, consolidated, salt and pepper, fine grained, locally with floating medium to coarse lower quartz and chert grains, poor to moderately sorted, subangular to subrounded, angular in part, commonly with off white kaolin argillaceous matrix, siliceous, pyritic, slightly calcareous, with < 20% chert grains, 12-15% kaolin plugged matrix porosity, with a very poor, slow yellow green cut fluorescence between 1420 and 1425 mMD only.

C) 1568 mMD: 6-9% log porosity with a liberated gas peak of 122 units over a 90 unit background. Associated sandstone is as follows: off white, light gray, light gray brown, light brown, consolidated, salt and pepper, with < 10-15% dark chert grains, fine grained, silty in part, poor to moderately sorted, subangular to subrounded, siliceous, trace calcite, argillaceous, patchy light brown, occasional white kaolin matrix, pyritic, no visible intergranular porosity, 6% kaolin matrix porosity.

D) 1691 mMD: logs show a neutron density porosity cross over and porosity near 12%. Liberated gas levels peaked at 118 units over a 90 unit background here. Sandstone is as follows: consolidated, quartzose to salt and pepper, light gray, light gray brown, medium brown, fine to occasionally upper medium grained, rare fragments with floating coarse light & dark chert grains, angular to subrounded, predominately with < 25% chert grains, medium grained fragments with < 30% chert grains, spotty calcareous cement, commonly siliceous & with silica overgrowths, with off white, gray brown argillaceous matrix, rare fragments with 1-9% black bitumen plugged intergranular porosity, poor to good grain relief, traces of 1-5% visible intergranular porosity, slow, poor, faint yellow green streaming cut fluorescence.

E) 1844 mMD: logs show a neutron density porosity cross over at 12-15% porosity and no significant rises in background gas were recorded. Associated sandstone is as follows: consolidated, salt and pepper, sideritic brown, off white, light gray, gray brown, fine to coarse lower grained, subangular to subrounded, angular in part, rare light gray chert granules, poor to moderately sorted,. with 20 to rare 80% white, gray, brown chert grains, slightly calcareous, sideritic, commonly siliceous, slightly pyritic, commonly with gray brown, light brown, occasionally off white kaolinitic argillaceous matrix, spotty disseminated medium brown dead bitumen staining, rare fragments with black intergranular dead bitumen, 1-12% black bitumen plugged & kaolin plugged intergranular porosity, no visible intergranular porosity & with poor grain relief, no cut fluorescence.

F) Between 1899 and 1958 mMD: logs show neutron density cross overs at 1899, 1901, 1906, 1911, 1917, 1918, 1922, 1924, 1930, 1944, 1954 and at 1958 with porosity ranging between 6 and 12%. There were no salient gas peaks generated in this interval. Instead background levels rose from between 50 and 60 units above the interval and rose to between 60 and 70 units between 1899 and 1915 m MD, rose between 1915 and 1933 between 80 and 100 units, and between 1933 and 1958 m (MD) rose between 90 and 140 units. Sandstone over this interval is commonly conglomeratic and matrix supported and is as follows: off white, light brown, consolidated, salt and pepper, fine to medium grained, rare coarse grained fragments, rare granules, conglomeratic in part & matrix supported, subangular to subrounded, angular in part, poor to moderately sorted, slightly calcareous, siliceous, soft & friable to firm, siliceous, pyritic, slightly carbonaceous, commonly with off white, light gray argillaceous matrix, with poor grain relief, poor reservoir, 1-12% kaolin matrix porosity, no visible intergranular porosity, locally with yellow green blooming cut fluorescence.

G) Between 1958 and 2046 mMD: logs show neutron density porosity cross overs at 1966, 1989, 2008, 2013, 2018, 2028, 2031 and at 2046 mMD, with porosities ranging between 3 and 9%. Liberated as peaks occur between 1975 and 1985 ranging between 92 and 108 units, 1990-1995 mMD at 101 units, 2008 mMD at 98 units, at 2028 m (MD) at 96 units, at 2047 mMD at 104 units and at 2053 mMD at 125 units. Background gas levels ranged between 70 and 85 units. This interval consists of interbedded sandstone, matrix supported conglomeratic sandstones and clast supported conglomerates. Clast supported conglomerates are as follows: 25-40% of fragments as white, gray, yellow, light blue, brown, rare black, unconsolidated coarse chert grains & granules, clast supported, sandstone matrix off white, light gray, light gray brown, fine to coarse lower grained, subangular to subrounded, angular in part, occasionally to very coarse upper, siliceous, commonly with off white, light gray argillaceous matrix, rare pyrite, predominately non calcareous, trace black dead intergranular bitumen, no visible intergranular porosity, very weak, 3-9% kaolin matrix porosity, very poor, yellow green blooming cut fluorescence, poor reservoir. Sandstone and matrix supported conglomeratic sandstone in this interval is as follows: consolidated, off white, light gray brown, salt and pepper, fine to occasionally medium grained, occasional fragments with floating coarse or rare granules, trace coarse grained fragments, in part conglomeratic & matrix supported, subangular to subrounded, angular in part, slightly calcareous, commonly siliceous, friable to firm, grains occasionally sutured, siliceous & with silica overgrowths, commonly with off white, occasionally light gray brown argillaceous matrix, clay swelling in acid, rare pyrite, 3-9% kaolin matrix porosity, commonly tight, with < 60% light to medium gray, light brown, off white chert grains, no visible intergranular porosity, weak slow yellow green blooming cut fluorescence.

H) The final interval to be discussed here occurs between 2075 and 2115 mMD. Geophysical logs show neutron density porosity cross overs at 2079, 2088, 2092 and 2115 mMD with associated porosity ranging between 3 and 9%. These originate from both clast supported conglomerates and matrix supported conglomeratic sandstones and sandstone.

Conclusion:

All indications show that the Tuttle Member contains gas and porosities ranging between 3 and 21%. Much of the section is kaolinitic.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Canol
Member:
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: middle
Period: Devonian
Stage: givetian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	3044.80	2649.28	-1967.58	12.00
Log Top	3044.40	2648.83	-1967.13	

Evaluation:

The Canol at this location measures 12.2 meters in thickness (MD) giving an approximate TVD thickness of 11.8 meters. Sidewall coring after open hole logs recovered cores at 3046.9, 3047, 3047.1, 3047.2, 3049.2, 3050, 3050.1, 3050.2, 3055.6, 3055.7, 3055.8,and 3055.9 mMD. Desorption analysis is currently being conducted on 3 sidewalls in the Canol section (cores 13, 15 and 18 in run #7). The section is lithologically unique here and is much thinner here than seen in offsetting wells. Bedded cherts are absent and the shale lacks silt, sand and chert as was expected based on regional studies.

In drill cuttings the samples were described wet as medium to dark brown, with 20% of fragments dark gray to black, predominantly soft, subfissile, slightly dolomitic, rare brittle fragments, predominantly as clay shale, rare silty or sandy fragments, poor yellow green blooming cut. Traces of dark chert were found near the base of the section.

In sidewall core, the samples were examined dry and are as follows: very dark gray to black, blocky, non calcareous, commonly pyritic, carbonaceous, bituminous, and were weakly to moderately jointed.

Conclusion:

The Canol is a black, anomalously radiactive highly organic shale. Desorption analysis is currently ongoing on 3 sidewall cores recovered over this interval. Sidewall cores taken from the Canol will be invaluable in ascertaining the nature of this shale, and its' potential for shale gas production.

Kelly Bushing Elevation: 681.70 **Casing Flange Elevation:**
Ground Elevation: 673.20

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Ogilvie
Member:
Boundary Type: nonconformable
Fault Type:

Era: paleozoic
Series: lower
Period: Devonian
Stage: emsian
Age (Approx): 374 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	3056.80	2660.92	-1979.22	293.20
Log Top	3056.60	2660.67	-1978.97	

Evaluation:

The Ogilvie is one of the oldest Devonian reefs known in western Canada. It is unique and its history is tied in with the early phases of the southward transgression or arctic Kaskaskia seas which ultimately led to the extensive development of Devonian carbonate reefs of Alberta. The zone is of primary interest here because it is suspected to have been dolomitized through a hydrothermal process, via the migration of magnesium rich fluids through fractures from a underlying intrusion.

This drowned reef platform was penetrated largely near the reef crest - reef front (laminar stromatoporoids, grainstones, tabulatan coral bafflestones) and facies changes with depth occur to back reef margin (Stachyoides) and finally change to a lagoon facies (Amphipora, calcisphere, ostracod). The Ogilvie was encountered at 3056.6 m (MD) and drilling stopped at a depth of 3353 m (MD) short of underlying Road River Shale. Approximately 291 metesTVD of the formation was drilled. No dolomitization was recorded in drill cuttings or in geophysical logs.

Lithologically, the Ogilvie has been recrystallized and exhibits a chalky texture. Limestones are typically cryptocrystalline and locally are lower fine crystalline. The limestone is tight, dead bitumen plugged locally and does not appear to be productive.

Several sidewall cores were taken over the Ogilvie, however only 2 allowed a reasonable estimation of facies. Those cores, at 3058 and 3088.6mMD both had fossil content and macroscopic properties indicative of a foreslope setting.

Conclusion:

Lithologically, the Ogilvie has been recrystallized and exhibits a chalky texture. Limestones are typically cryptocrystalline and locally are lower finely crystalline. The limestone is tight, dead bitumen plugged locally, and does not appear to have potential for hydrocarbon production at this location.

The Ogilvie appears to have been drilled in largely a foreslope to off reef basinal setting based on the few sidewall cores where facies determination was possible.

20.00 to 25.00 (5.00)	70%	**SHALE** dark gray, occasionally light gray, medium brown gray, predominately as clay shale, micromicaceous, occasionally pyritic, soft to medium hard, occasionally slightly silty & sandy.
	30%	**SANDSTONE** quartzose, fine lower to coarse lower grained, subangular to occasionally rounded, in part conglomeratic with rare quartz granules, siliceous, with 30% visible intergranular porosity, no cut, poor sample quality.
25.00 to 30.00 (5.00)	100%	**SHALE** light gray brown, sub platy to blocky, commonly cracking in water. micromicaceous, occasional silty or sandy fragments, non calcareous, soft, sub fissile.
30.00 to 35.00 (5.00)	100%	**SHALE** light to medium brown gray, light to medium gray, sub platy to occasionally blocky, commonly swelling or cracking in water, occasionally silty or sandy, <10% as light brown, argillaceous, micromicaceous, slightly carbonaceous, tight, non calcareous siltstone fragments.
35.00 to 45.00 (10.00)	85%	**SHALE** light to medium brown, light to medium brown gray, sub platy to commonly blocky, micromicaceous, occasionally slightly silty or carbonaceous, soft to medium hard, sub fissile to occasionally fissile, non calcareous.
	15%	**SILTSTONE** light yellow brown, argillaceous, micromicaceous, slightly carbonaceous, grading in part to sltty shale, tight, no shows.
45.00 to 50.00 (5.00)	70%	**SHALE** medium brown, medium brown gray, sub platy to blocky, micromicaceous, occasionally silty, slightly carbonaceous, occasional fragments crack in water, soft, sub fissile, non calcareous.
	30%	**SILTSTONE** light yellow brown, argillaceous, micromicaceous, carbonaceous, quartzose, firm, tight, no shows.
50.00 to 55.00 (5.00)	100%	**SHALE** medium brown, medium brown gray, sub platy to blocky, commonly montmorillonitic, commonly soft, fissile, occasionally silty or carbonaceous, with < 10% light yellow brown, firm, micromicaceous, slightly carbonaceous, tight siltstone fragments.
55.00 to 60.00 (5.00)	80%	**SHALE** medium brown, medium brown gray, sub platy to blocky, montmorillonitic, commonly cracking in water, soft to occasionally hard, predominately as clay shale, rare silty fragments.
	20%	**SILTSTONE** yellow brown, blocky, slightly siliceous, commonly argillaceous, carbonaceous, quartzose, micromicaceous, tight, no shows.

60.00 to 65.00 (5.00)	100%	**SHALE** medium brown gray, sub platy to blocky, micromicaceous, occasionally cracking in water, soft to occasionally hard, fissile to sub fissile, predominately as clay shale, with < 10% light yellow brown, carbonaceous, argillaceous, micromicaceous, tight quartzose siltstone fragments.
65.00 to 70.00 (5.00)	100%	**SHALE** medium brown gray, sub platy to blocky, soft, subfissile to fissile, montmorillonitic, micromicaceous, occasional fragments with sideritic or slightly cherty medium brown laminae, as clay shale.
70.00 to 75.00 (5.00)	100%	**SHALE** medium brown, medium brown gray, sub platy to blocky, micromicaceous, soft to hard, sub fissile, occasional silty fragments, predominately as clay shale, non calcareous, with < 10% light yellow brown, argillaceous, micromicaceous, slightly carbonaceous, quartzose, tight siltstone fragments.
75.00 to 80.00 (5.00)	100%	**SHALE** medium brown, medium gray, medium brown gray, sub platy to blocky, micromicaceous, soft to occasionally hard, sub fissile, non calcareous, rare silty fragments, trace gray quartzose, argillaceous, silty to very fine upper grained, tight, siliceous, glauconitic sandstone fragments.
80.00 to 85.00 (5.00)	100%	**SHALE** light to medium brown, light to medium brown gray, commonly swelling in water, predominately as clay shale, rare carbonaceous grains, locally with lower fine, subangular to subrounded, very argillaceous, locally micaceous, slightly glauconitic, quartzose to salt and pepper, tight sandstone stringers.
85.00 to 97.00 (12.00)	90%	**SHALE** medium brown gray, sub platy to blocky, micromicaceous, occasionally silty & sandy, commonly soft, sub fissile, slightly montmorillonitic.
	10%	**SANDSTONE** light gray brown, light yellow brown, salt and pepper with < 15% black chert & carbonaceous grains, silty to very fine grained, occasionally fine upper grained, subangular to subrounded, argillaceous, firm, slightly siliceous, tight, no shows, slightly sideritic.

Parkin, Orange Marker: 97.50 MD, 97.49 TVD, 584.21 SSL

97.00 to 116.00 (19.00)	100%	**No Sample** Drilled blind between 97 and 116 meters (MD), no samples coming accross the shakers.
116.00 to 120.00 (4.00)	90%	**SHALE** light to medium gray, occasionally medium brown, sub platy to blocky, micromicaceous, slightly silty, sandy or carbonaceous, occasional fragments crack in water, soft to firm, sub fissile, slightly calcareous, 25% cement cavings, 10% medium brown cryptocrystalline limonite, questionable chert fragments

116.00 to 120.00 (4.00)	10%	**SILTSTONE** light to medium brown, silty to occasionally very fine lower grained, consolidated, salt and pepper, locally slightly calcareous, slightly carbonaceous, commonly argillaceous, tight, no shows.
120.00 to 125.00 (5.00)	100%	**SHALE** light to medium gray, sub platy to subblocky, micromicaceous, commonly slightly silty, carbonaceous, soft to hard, sub fissile, 7-8% medium brown, cryptocrystalline ironstone fragments, 10-15% cement cavings.
125.00 to 130.00 (5.00)	100%	**SHALE** medium gray, sub platy to blocky, micromicaceous, slightly silty, sandy, carbonaceous, predominately non calcareous, rare pyrite, soft to hard, sub fissile, 8% cryptocrystalline ironstone fragments.
130.00 to 135.00 (5.00)	100%	**SHALE** medium gray, medium brown gray, sub platy to blocky, micromicaceous, locally slightly silty, sandy or slightly carbonaceous, fragments crack in water, predominately as clay shale, soft to occasionally hard, fissile in part, slightly calcareous, 3% light brown, medium brown ironstone fragments.

Lower Cretaceous Mkr: 136.00 MD, 135.96 TVD, 545.74 SSL

135.00 to 140.00 (5.00)	75%	**SHALE** medium gray, medium brown gray, sub platy to blocky, micromicaceous, commonly slightly silty or sandy, slightly carbonaceous, locally pyritic or glauconitic, soft to occasionally hard, commonly fissile, slightly swelling in water, slightly calcareous, trace ironstone.
	25%	**SANDSTONE** consolidated,light to medium brown gray, salt and pepper, very argillaceous & in part not clast supported, fine to occasionally lower medium grained, very glauconitic, micromicaceous, with rare dark chert grains, very poorly sorted, angular to subrounded, predominately with a light to medium brown gray argillaceous matrix, occasional calcareous fragments, tight, no shows.
140.00 to 145.00 (5.00)	100%	**SHALE** medium gray, medium brown gray, rare medium brown shale fragments, sub platy to blocky, micromicaceous, commonly silty, sandy, locally glauconitic, soft to hard, occasionally fissile, rare pyrite, rare calcareous fragments, 3% medium brown ironstone fragments.
145.00 to 150.00 (5.00)	75%	**SHALE** light to medium brown gray, light to medium gray, sub platy to blocky, micromicaceous, commonly slightly silty, sandy, glauconitic, pyritic, grading in part to very poorly sorted, very argillaceous, silty to fine lower grained, tight sandstone, no shows.

145.00 to 150.00 (5.00)	25%	**SANDSTONE** light gray, light gray brown, silty to fine lower grained, in part as stringers in sandy shale, moderately sorted, quartzose to salt and pepper, with < 15% dark chert & carbonaceous flakes & grains, commonly with light to medium gray brown argillaceous matrix, slightly pyritic, glauconitic, with spotty calcareous cement, tight, no shows.
150.00 to 155.00 (5.00)	80%	**SHALE** medium brown gray, medium gray, sub platy to blocky, micromicaceous, commonly silty, sandy, carbonaceous, glauconitic, soft to commonly brittle, non fissile, trace ironstone fragments, slightly calcareous.
	20%	**SANDSTONE** consolidated, light gray, light gray brown, silty to lower medium grained, subangular, salt and pepper, with 10-20% dark chert & carbonaceous grains & flakes, pyritic, micaceous, poorly sorted, commonly with medium brown gray, medium gray argillaceous cement, grading to silty, sandy shale in part, no shows.
155.00 to 160.00 (5.00)	70%	**SHALE** medium brown, medium brown gray, sub platy to blocky, micromicaceous, slightly pyritic, commonly silty or sandy, scattered glauconite grains, spotty calcareous cement, predominately non fissile.
	30%	**SANDSTONE** consolidated, medium brown, light gray, fine to medium grained, subangular to subrounded, poor to moderately sorted, commonly with abundant glauconite grains, quartzose, locally with dark chert grains, commonly with brown, medium brown gray argillaceous matrix, predominately poorly sorted & very argillaceous & in part grading to glauconitic, sandy shale, slightly pyritic, rare fragments with 1-8% dead bitumen plugged intergranular porosity, poor reservoir, no shows.
160.00 to 165.00 (5.00)	100%	**SHALE** medium brown, medium brown gray, sub platy to blocky, micromicaceous, micaceous, slightly pyritic, silty, sandy, locally glauconitic, soft, predominately non fissile.
165.00 to 170.00 (5.00)	100%	**SHALE** light to medium gray, medium brown, medium brown gray, sub platy to blocky, occasional fragments crack in water, micromicaceous, pyritic, commonly silty & sandy, soft, sub fissile, trace medium brown, cryptocrystalline ironstone fragments.
170.00 to 175.00 (5.00)	100%	**SHALE** medium brown, medium brown gray, occasionally light gray, light gray brown, sub platy to blocky, rare fragments crack in water, commonly slightly silty, sandy, pyritic, occasional glauconite grains, soft to hard, fissile in part, trace medium brown ironstone fragments, non calcareous.

170.00 to 175.00 (5.00)	10%	**SANDSTONE** medium brown gray, silty to fine lower grained, occasional fragments with upper fine to lower medium floating quartz grains, poorly sorted, with abundant medium brown argillaceous cement, slightly pyritic, occasional glauconite grains, poor grain relief, no shows.
175.00 to 180.00 (5.00)	100%	**SHALE** medium brown, medium brown gray, sub platy to blocky, micromicaceous, slightly pyritic, predominately as clay shale, occasional slightly silty & sandy fragments, slightly carbonaceous, occasional fragments crack in water, slightly carbonaceous, non calcareous.
180.00 to 185.00 (5.00)	100%	**SHALE** medium brown, occasionally light to medium brown gray, platy to predominately subblocky, micromicaceous, as clay shale, occasional carbonaceous flakes, occasional silty or sandy fragments, rare very pyritic fragments, non calcareous.
185.00 to 190.00 (5.00)	60%	**SHALE** medium brown, medium brown gray, sub platy to blocky, micromicaceous, locally slightly silty or sandy.
	40%	**DARK CHERT CONGLOMERATE** predominately as unconsolidated & fractured medium to dark gray, dark brown, medium brown, rare black, rare off white or light gray, coarse to granular subrounded to rounded chert grains, chert grains with pressure solution pits or with occasional siliceous druse rims, rare euhedral quartz crystals, as clast supported conglomerate, matrix rims rare & as fine upper to coarse lower grained, salt and pepper, moderately sorted, siliceous, angular to subrounded, non calcareous, commonly filled with ligiud medium brown oil, 10-18% intergranular porosity, rapid milky green blooming cut fluorescence, oil over shakers.
190.00 to 195.00 (5.00)	100%	**SHALE** medium to dark brown, sub platy to blocky, firm, non fissile, commonly silty, carbonaceous, micromicaceous, non calcareous, 6% light brown argillaceous, quartzose, tight siltstone fragments, rare coarse to granule chert grains & fine to occasionally lower medium grained, moderately sorted, siliceous salt and pepper sandstone fragments as conglomeratic sandstone matrix with < 15% oil saturated intergranular porosity, rapid green blooming cut fluorescence.
195.00 to 200.00 (5.00)	55%	**SHALE** dark brown, carbonaceous, with scattered coaly laminae, sub platy to blocky, micromicaceous, occasionally silty & sandy.

195.00 to 200.00 (5.00) 30% **SANDSTONE**
light brown, light gray brown, salt and pepper, fine grained, commonly silty, very fine lower to very fine upper grained, rare floating upper medium quartz & chert grains, subangular to subrounded, with < 20% dark brown, black, gray, chert grains, siliceous, commonly with light to medium brown argillaceous matrix, carbonaceous, brittle, slightly kaolinitic, poor to moderately sorted, poor to good grain relief, rare fragments with faint very fine coal laminae, in part tight, spotty 1-10% visible intergranular porosity, weak slow green blooming cut fluorescence.

15% **COAL**
black, vitreous, commonly interlaminated with dark brown shale.

Jungle Creek: 204.60 MD, 204.49 TVD, 477.21 SSL

200.00 to 205.00 (5.00) **SHALE**
20% dark brown, sub platy to blocky, micromicaceous, commonly with coal laminae or partings, pyritic, locally slightly silty & sandy, predominately as clay shale, commonly off white, rare light yellow brown, light brown, off white, pyritic, slightly silty, sandy, carbonaceous, with dark brown shale partings, soft to commonly hard, predominately non fissile, < 10% of fragments very sandy & grading to argillaceous, poorly sorted, fine to rare medium grained, salt and pepper sandstone & rare sandy siltstone.

205.00 to 210.00 (5.00) 75% **SANDSTONE**
10-15% as fractured, unconsolidated, off white, light gray, light brown, medium brown, rare orange, gray brown, medium to coarse chert grains & chert granules & rare sub hedral quartz grains, in part as matrix supported conglomeratic sandstone, matrix sandstone light yellow brown, orange brown, fine to medium grained, angular to subrounded, poor to moderately sorted, commonly with patchy orange brown argillaceous matrix, rare patchy massive pyrite, siliceous, locally with silica overgrowths, carbonaceous, spotty oil staining, spotty 1-12% visible intergranular porosity, rapid, good milky light green blooming cut fluorescence.

25% **SHALE**
medium to dark brown, occasionally orange brown, medium brown, sub platy to blocky, micromicaceous, occasionally silty & sandy, pyritic, locally coaly or carbonaceous.

210.00 to 215.00 (5.00) 100% **SANDSTONE**
predominately as in part fractured, unconsolidated, off white, gray, brown, medium to coarse subrounded to rounded chert grains & chert granules & rare sub hedral quartz grains, in part as matrix supported conglomeratic sandstone, matrix sandstone light yellow brown, orange brown, fine to medium, rare coarse lower grained, angular to subrounded, poor to moderately sorted, commonly with patchy orange brown argillaceous matrix, rare patchy massive pyrite, siliceous, locally with silica overgrowths, carbonaceous, rare faint coaly laminae, spotty oil staining, spotty 1-18% visible intergranular porosity, rapid, good milky light green blooming cut fluorescence.

215.00 to 220.00 (5.00) 100% **LIGHT CHERT PEBBLE CONGLOMERATE**
predominately as fractured white, light gray, light to dark brown, chert granules, clast supported, sandstone matrix light to medium brown, fine to occasionally lower medium grained, subangular to subrounded, salt and pepper, commonly with medium brown, orange brown in part ferruginous argillaceous matrix, locally with coaly laminae, siliceous, locally with abundant dead carbonaceous matrix, rare oil filled porosity, spotty 1-8, rare 12% visible intergranular porosity, weak rapid yellow green blooming cut fluorescence.

Carboniferous: 221.00 MD, 220.87 TVD, 460.83 SSL

220.00 to 225.00 (5.00) 70% **SHALE**
medium to dark brown, platy to blocky, occasionally calcareous, carbonaceous, predominately as clay shale, hard, semi fissile. occasionally silty & sandy.

30% **LIGHT CHERT PEBBLE CONGLOMERATE**
predominately as fractured white, light gray, light to dark brown, chert granules, clast supported, sandstone matrix light to medium brown, fine to occasionally lower medium grained, subangular to subrounded, salt and pepper, commonly with medium brown, orange brown in part ferruginous argillaceous matrix, locally with coaly laminae, siliceous, locally with abundant dead carbonaceous matrix, spotty 1-8, rare 12% visible, commonly bitumen or rare oil plugged intergranular porosity, spotty good green blooming cut fluorescence.

225.00 to 230.00 (5.00) 100% **SHALE**
poor sample quality, abundant LCM in sample, medium brown, occasionally light gray, sub platy, micromicaceous, very calcareous, micromicaceous, trace disseminated very fine pyrite, predominately as clay shale, firm, non fissile.

230.00 to 235.00 (5.00) 100% **SHALE**
35% light to medium brown, light gray brown, commonly dark brown, sub platy to blocky, micromicaceous, slightly carbonaceous & micromicaceous, very calcareous, hard, non fissile.

235.00 to 240.00 (5.00) 100% **SHALE**
light to dark brown, sub platy to blocky, micromicaceous, very calcareous, trace pyrite, rare carbonaceous flakes, marly.

240.00 to 245.00 (5.00) 100% **SHALE**
medium brown, medium brown gray, sub platy to blocky., calcareous, commonly grading to marlstone, rare argillaceous, tight mudstone limestone fragments, slightly carbonaceous, tight, no shows.

Blackie HST: 246.00 MD, 245.84 TVD, 435.86 SSL

245.00 to 250.00 (5.00) 90% **SANDSTONE**
white, white gray, consolidated, salt and pepper, fine grained, occasionally with floating medium to rare coarse lower quartz & chert grains, rare chert granules, conglomeratic & matrix supported, salt and pepper, with < 10-25% dark chert grains, calcareous, subangular to subrounded, locally with white argillaceous cement, moderately to well sorted, tight, no shows.

250.00 to 255.00 (5.00)	100%	**SANDSTONE** white, light gray, consolidated, conglomeratic & matrix supported, salt and pepper, 25% as unconsolidated coarse off white, medium to dark brown, light gray commonly rounded chert grains & fractured granules, sandstone matrix fine grained, locally lower medium grained or with floating medium to rare coarse lower chert grains, subangular to subrounded, matrix moderately to well sorted, very calcareous, patchy white, occasionally orange brown argillaceous matrix, tight, no shows.
255.00 to 260.00 (5.00)	100%	**LIMESTONE** off white, very light yellow brown, cryptocrystalline, commonly silty & sandy, locally chert replaced, as mudstone, locally argillaceous, tight, grading in part to calcareous chert, 7% light gray, off white, predominately fine grained, salt and pepper sandstone as above, no shows.
260.00 to 265.00 (5.00)	45%	**SANDSTONE** orange brown, yellow brown, salt and pepper, with 10-20% dark chert grains, consolidated, predominately very fine lower to very fine upper , occasionally fine lower to fine upper grained, with < 25% chert grains, subangular, argillaceous, very calcareous, tight, no shows.
	40%	**LIMESTONE** light yellow brown, cryptocrystalline, as mudstone, occasionally silty, sandy, locally cherty or argillaceous, tight, locally marly & grading to calcareous marlstone, no shows.
	15%	**CHERT** light gray, off white, spicular in part or with sand & silt grains, calcareous, locally argillaceous, with sand grains, tight, no shows.
265.00 to 270.00 (5.00)	100%	**LIMESTONE** light brown, off white, light gray, medium brown, cryptocrystalline, commonly argillaceous & marly in part, cherty, commonly silty & sandy, tight, rare fragments with 6% organic porosity, rare druse lined vugs or fractures.
270.00 to 275.00 (5.00)	100%	**MARLSTONE** orange brown, cryptocrystalline, calcareous, tight, with 25% light gray, lower gray brown, massive, calcareous, cryptocrystalline to occasional;upper lower fine crystalline or sandy silty, chert, 10-15% as off white, occasionally orange brown, fine grained, very calcareous, argillaceous, tight, salt and pepper sandstone, 30% light gray, calcareous tight chert fragments, grading in part to shale.
275.00 to 280.00 (5.00)	100%	**SANDSTONE** orange brown, light brown, off white, silty to very fine lower grained, salt and pepper, subangular, calcareous, commonly with off white, light orange brown argillaceous matrix, tight, no shows, minor chert, calcareous shale.

280.00 to 285.00 (5.00)	100%	**SANDSTONE** off white, orange brown, brown gray, consolidated, salt and pepper, very fine lower to very fine upper, locally with floating fine lower quartz & chert grains, subangular to subrounded, commonly with patchy ferric argillaceous matrix, locally with silica spicules. moderately sorted, very calcareous, tight, no shows, 30-40% light gray, light gray green massive calcareous chert, minor light yellow brown, commonly cherty, locally argillaceous, tight limestone, rare medium to dark brown, marly, locally cherty, carbonaceous, very calcareous tight shale.
285.00 to 290.00 (5.00)	40%	**SANDSTONE** off white, orange brown, mottled in part, salt and pepper, very calcareous & with poor grain relief, very fine lower to very fine upper grained, subangular to subrounded, with patchy white argillaceous cement, 15% dark chert, subangular to subrounded, tight, no shows.
	35%	**SHALE** medium to dark brown, very calcareous, cherty, silty, sandy, grading to very argillaceous, poor to moderately sorted, salt and pepper sandstone, tight.
	25%	**CHERT** light gray, light gray green, cryptocrystalline, locally silty or sandy, calcareous, with minor light yellow brown, light brown, predominately cryptocrystalline, locally marly, silty, sandy mudstone limestone fragments.
290.00 to 295.00 (5.00)	100%	**SANDSTONE** off white, light gray, orange brown, occasionally yellow brown, consolidated, very calcareous & with very poor grain relief, quartzose to salt and pepper, very fine lower to very fine upper grained, rare fine lower to lower medium grained fragments, subangular to subrounded, patchy white, orange brown argillaceous matrix, with < 20% chert grains, locally with sponge spicules, tight, no shows,, locally grading to sandy, argillaceous, cherty dense, argillaceous limestone,
295.00 to 300.00 (5.00)	100%	**SANDSTONE** light gray, light brown, light orange brown, consolidated, salt and pepper to quartzose, predominately very fine lower to very fine upper grained, silty in part, occasional porous fine upper to medium grained fragments, with < 25% chert grains, subangular to subrounded, calcareous, patchy white, orange brown argillaceous cement, moderately sorted, < 10% of fragments porous, with good grain relief, with oil bleeds, less calcareous, with white patchy argillaceous matrix, kaolin?, 1-6, occasional 8- rare 10l% oil plugged intergranular porosity, rapid yellow green blooming cut fluorescence, kaolin matrix porosity?, < 20% as calcareous shale & marlstone with brachiopods & Syringpopora, minor calcareous chert.
300.00 to 305.00 (5.00)	100%	**SHALE** medium to dark brown, sub platy to blocky, very calcareous, marly, cherty, silty, sandy, slightly carbonaceous, with occasional brachiopod & scattered Syringopora, interbedded with light to medium brown, commonly argillaceous Syringopora bafflestones, & floatstone, rare crinoids, tight.

305.00 to 310.00 (5.00)	100%	**SHALE** medium to dark brown, sub platy to blocky, very calcareous, marly in part, locally cherty, silty, sandy, slightly carbonaceous, with occasional brachiopods & Syringopora fragments, 25% as interbedded light to medium brown, commonly argillaceous, brachiopod, crinoid mudstone to wackestone, occasional Syringopora bafflestone & floatstone, tight, 10% medium brown, light gray, silty to very fine upper grained, locally fine lower to rare lower medium grained, consolidated, salt and pepper, subangular to subrounded argillaceous, calcareous, sandstone with rare 1-4% oil filled porosity, yellow green blooming cut fluorescence, poor reservoir.
310.00 to 315.00 (5.00)	60%	**SHALE** medium to dark brown, sub platy to blocky, very calcareous, marly in part, locally cherty, silty, sandy, slightly carbonaceous, with occasional brachiopods & Syringopora fragments, 25% as interbedded with light to medium brown, commonly argillaceous, brachiopod, crinoid mudstone to wackestone, tight.
	40%	**SANDSTONE** consolidated, salt and pepper, light to medium brown, silty to predominately very fine lower grained, locally very fine upper grained, subangular to subrounded, with < 30% dark chert grains, moderately to well sorted, calcareous, commonly with medium brown or light gray argillaceous matrix, micaceous, with poor grain relief, occasional dark brown bitumen & questionable oil laminae, predominately tight, trace 7% bitumen or oil plugged intergranular porosity, milky yellow green rapid blooming cut fluorescence, poor reservoir, minor interbedded medium brown, medium brown shale.
315.00 to 320.00 (5.00)	100%	**SANDSTONE** consolidated, salt and pepper, light to medium brown, silty to predominately very fine lower grained, locally with floating upper fine quartz & chert grains, subangular to subrounded, with < 30% dark chert grains, moderately to well sorted, calcareous, commonly with medium brown, spotty oil stained argillaceous matrix, locally bituminous or oil stained, micaceous, with poor grain relief, oil stained, trace 1-4 bitumen or oil filled intergranular porosity, milky yellow green rapid blooming cut fluorescence, poor reservoir.
320.00 to 325.00 (5.00)	100%	**SANDSTONE** consolidated, salt and pepper, light to medium brown, light gray, silty to predominately very fine lower grained, locally with floating very fine upper to upper fine quartz & chert grains, subangular to subrounded, with < 30% dark chert grains, moderately to well sorted, calcareous, commonly with medium brown spotty oil or bituminous stained argillaceous matrix, micaceous, with poor grain relief, trace poor intergranular porosity, milky yellow green rapid blooming cut fluorescence, poor reservoir, minor intebedded shale.
325.00 to 330.00 (5.00)	100%	**SANDSTONE** consolidated, salt and pepper, light to medium brown, light gray, silty to predominately very fine lower grained, locally with floating very fine upper to upper fine quartz & chert grains, subangular to subrounded, with < 30% dark chert grains, moderately to well sorted, calcareous, commonly with medium brown in part oil stained argillaceous matrix, micaceous, with poor grain relief, trace poor visible intergranular porosity, milky yellow green rapid blooming cut fluorescence, poor reservoir, minor intebedded shale.

330.00 to 335.00 (5.00) 70% **SHALE**
dark brown, blocky, calcareous, commonly silty & sandy, micromicaceous, locally with brown mica flakes, very firm, slightly pyritic.

30% **SANDSTONE**
consolidated, salt and pepper, light gray, light gray brown, silty to predominately very fine lower grained, locally with floating very fine upper grains, subangular to subrounded, with < 30% dark chert grains, moderately to well sorted, calcareous, commonly with medium brown in part oil stained argillaceous matrix, micaceous, with poor grain relief, oil stained, trace poor visible intergranular porosity, milky yellow green rapid blooming cut fluorescence, poor reservoir.

335.00 to 340.00 (5.00) 100% **SHALE**
medium to dark brown, sub platy to blocky, micromicaceous, pyritic, very calcareous, firm, brittle, rare brachiopods & crinoids, rare calcite lined fractures,, spicular, slightly silty, slightly bituminous.

340.00 to 345.00 (5.00) 100% **SHALE**
medium to dark brown, sub platy to blocky, micromicaceous, pyritic, very calcareous, marly, firm, brittle, slightly silty, bituminous.

Hart River, CD Sands: 346.50 MD, 346.30 TVD, 335.40 SSL

345.00 to 355.00 (10.00) 50% **SHALE**
dark brown, firm, non fissile, very calcareous, locally mrlsy, locally pyritic, non fissile.

25% **SANDSTONE**
consolidated, salt and pepper, light brown, occasionally off white, fine to coarse upper, rare very coarse upper or as granules, as matrix supported conglomeratic sandstone, angular to rounded, with varicolored chert grains, very calcareous, siliceous, fragments occasionally with off white translucent chert cement, poor to moderately sorted, spotty 6-8% soft intergranular bitumen plugged porosity, good yellow green blooming cut fluorescence.

25% **LIMESTONE**
light to medium brown, cryptocrystalline, as brachiopod mudstone, commonly cherty & in part grading to calcareous chert, occasionally argillaceous, marly, dense & tight, no shows.

355.00 to 360.00 (5.00) 100% **CHERT**
light yellow brown, light to dark brown, cryptocrystalline, translucent, calcareous, as replaced interlaminated marlstone, sandstone, shale, locally grading to cherty limestone, rare marlstone fragments, rare silica druse as vug or fracture linings, with < 10% consolidated, commonly argillaceous, salt and pepper , tight, lower fine grained argillaceous sandstone fragments.

360.00 to 365.00 (5.00)	70%	**SANDSTONE** predominately as unconsolidated, fine upper to coarse lower, subrounded to rounded, rare angular, white, light gray, light to dark brown, black chert & quartz grains, consolidated fragments salt and pepper, off white, orange brown, calcareous, with spotty orange brown or occasionally off white argillaceous matrix, slightly siliceous, moderately sorted, commonly tight & with poor grain relief, rare fragments with 1-8% black bitumen plugged intergranular porosity, weak faint yellow green blooming cut fluorescence from bituminous fragments, carryover?
365.00 to 370.00 (5.00)	70%	**SANDSTONE** consolidated, off white, light orange brown, gray brown, subrounded to rounded, occasional angular fragments, fine to upper medium grained, locally with floating coarse lower quartz & chert grains, salt and pepper, with < 35% chert grains, very calcareous, consolidated fragments crush to a fine powder & diagenetically altered, slightly siliceous, abundant sub hedral to euhedral quartz grains, commonly friable below 366 meters (MD), patchy off white , orange brown & questionable bitumen stained argillaceous cement, predominately tight, rare fragments with 1-6% black dead bitumen plugged intergranular porosity, becoming 1-10, trace 15% below 366m(MD), spotty white intergranular kaolin, spotty intergranular in part dead bitumen, spotty sticky tar plugged intergranular porosity, kaolin matrix porosity? weak, very poor, rapid yellow green blooming cut fluorescence, trip@366m(MD).
	30%	**CHERT** off white, yellow brown, cryptocrystalline to lower fine crystalline, calcareous, grading to tight cherty limestone, locally sandy or argillaceous, translucent.
370.00 to 375.00 (5.00)	100%	**CHERT** light to medium brown, dark brown, light yellow brown, off white, light gray, gray brown, translucent, occasionally with argillaceous spots or streaks, cryptocrystalline to lower fine crystalline, tight, calcareous, grading in part to cherty, tight limestone, 15% chalky white tight, limestone fragments, 10-15% as off white, orange brown, tight, very fine lower to fine lower grained, argillaceous, calcareous, salt and pepper sandstone fragments.
375.00 to 380.00 (5.00)	100%	**LIMESTONE** 15% off white, chalky, friable, commonly slightly silty & sandy, occasionally argillaceous, predominately light to medium yellow brown, as mudstone, commonly cherty, locally argillaceous or marly, grading in part to calcareous translucent chert, 15% off white, consolidated, salt and pepper, argillaceous, predominately very fine lower to very fine upper grained, tight sandstone with very poor grain relief, no shows, 4% medium to dark brown, hard, calcareous shale.
380.00 to 385.00 (5.00)	40%	**LIMESTONE** 40% off white, chalky in part, commonly argillaceous, silty & sandy, commonly light yellow brown, cryptocrystalline, as mudstone, rare brachiopods.

380.00 to 385.00 (5.00)	30%	**SANDSTONE** consolidated, salt and pepper, predominately very fine lower to very fine upper grained, argillaceous, very calcareous, & tight & with poor grain relief, rare fine to lower medium grained fragments with floating coarse chert grains, subangular to subrounded, locally rounded, slightly siliceous. & with 1-6% black bitumen plugged intergranular porosity, no cut fluorescence.
	30%	**CHERT** light yellow brown, calcareous, rare fragments with spicules, commonly cryptocrystalline, grading in part to cherty tight mudstone limestone.
385.00 to 390.00 (5.00)	100%	**CHERT** light gray, light to medium brown, calcareous, massive, rare spicular fragments, tight, 30% as chalky, commonly argillaceous, silty, sandy limestone or medium brown, yellow brown, chalky crinoid mudstone to wackestone, with < 10% off white, light gray, very fine lower to very fine upper grained, tight salt and pepper sandstone fragments.
390.00 to 395.00 (5.00)	100%	**LIMESTONE** 25% off white, chalky, predominately medium brown, medium yellow brown, cryptocrystalline, as brachiopod, coral mudstone, cherty, argillaceous, locally marly, tight, no shows.
395.00 to 400.00 (5.00)	100%	**LIMESTONE** 25% off white, very light brown, chalky, friable in part, as chalky argillaceous mudstone, locally marly, predominately medium brown, medium brown gray, medium yellow brown, cryptocrystalline, rare brachiopods, crinoids, cherty, marly, dense & tight, no shows.
400.00 to 405.00 (5.00)	100%	**CHERT** yellow brown, gray brown, calcareous, commonly with medium brown argillaceous or bitumen bands, calcareous, rare spicular chert fragments, grading in part to cherty, locally marly limestone, 20% off white, chalky, tight, occasionally argillaceous, marly, locally cherty limestone fragments, tight no shows.
405.00 to 410.00 (5.00)	60%	**LIMESTONE** off white, very light brown, chalky textured, friable in part, commonly silty or sandy, commonly cherty & grading in part to calcareous chert, commonly argillaceous & locally marly, tight.
	40%	**SANDSTONE** predominately off white, very fine lower to occasionally very fine upper grained, very calcareous, argillaceous, tight above 408m(MD), becoming fine to coarse grained & slightly granular below 408m(MD), Below 408m(MD) as predominately unconsolidated black, occasionally gray, off white, light to medium brown rounded chert grains, with off white, light to medium brown, consolidated, salt and pepper, calcareous, poor to moderately sorted, subangular to subrounded, slightly siliceous, sandstone matrix with amber brown intergranular bitumen, fair grain relief & rapid moderate yellow green blooming cut fluorescence, trip@408m(MD), no visible porosity, estimated 1-5% bitumen plugged porosity.

410.00 to 415.00 (5.00)	100%	**LIMESTONE** predominately off white, chalky, argillaceous, marly in part, cryptocrystalline to lower fine crystalline, rare stylolites, 20% yellow brown, predominately cryptocrystalline, argillaceous, marly, very cherty & grading to calcareous chert, 7% sandstone as above.
415.00 to 420.00 (5.00)	100%	**SANDSTONE** 40% as unconsolidated, subangular to rounded, fine to coarse, rare granular light & dark chert grains, consolidated fragments salt and pepper, off white, light yellow brown, with < 30& chert grains, calcareous, slightly siliceous, trace patchy white or orange brown intergranular argillaceous matrix, rare fragments with 1-6% black dead intergranular bitumen, commonly tight, no cut fluorescence.
420.00 to 425.00 (5.00)	100%	**SANDSTONE** consolidated, off white, light gray brown, gray orange brown, very fine lower to very fine upper, occasionally upper fine grained, salt and pepper, calcareous, commonly with light orange brown, off white argillaceous cement, slightly siliceous, tight, with poor grain elief, poor reservoir, no shows, 25% as chalky white, cryptocrystalline, commonly argillaceous, marly, occasionally silty & sandy, tight limestone fragments, 15% medium yellow brown commonly cherty, argillaceous mudstone limestone fragments & off white, light gray massive tight chert.
425.00 to 430.00 (5.00)	100%	**LIMESTONE** 20% off white, chalky textured, commonly argillaceous, locally cherty, tight, 10-15% medium yellow brown, cryptocrystalline, locally argillaceous, commonly cherty & grading to calcareous chert, 40% light gray, light yellow brown, brown gray, massive, calcareous, commonly with argillaceous streaks, rare quartz druse as vug or fracture linings, no shows.
430.00 to 435.00 (5.00)	100%	**LIMESTONE** 25% off white, chalky textured, comyly silty, sandy or argillaceous, grading in part to marlstone, 40% light yellow brown, sandy, silty, cherty, as mudstone, tight, minor gray brown, light brown, massive chert, 8% as medium brown gray, calcareous, commonly silty, sandy, shale and sandy marlstone.
435.00 to 440.00 (5.00)	100%	**LIMESTONE** 20% off white, chalky textured, predominately light yellow brown, gray brown, cryptocrystalline, argillaceous, rare calcite lined fractures, marly, cherty, 25% yellow brown, brown gray calcareous, massive chert, slightly silty & sandy.
440.00 to 445.00 (5.00)	100%	**CHERT** medium brown, medium brown gray, yellow brown, cryptocrystalline, commonly with argillaceous specks, calcareous, locally silty, sandy, 30% chalky textured & yellow brown, cryptocrystalline, commonly argillaceous, or marly tight limestone fragments.
445.00 to 450.00 (5.00)	100%	**LIMESTONE** 35% off white, chalky, slightly cherty, argillaceous, occasionally marly, tight, commonly yellow brown, medium brown gray, cherty, occasionally argillaceous & marly, as mudstone, tight, 25% of fragments in part chert replaced, 10% medium brown, calcareous, locally cherty, marly shale.

450.00 to 455.00 (5.00)	100%	**LIMESTONE** 30% off white, chalky textured, friable in part, predominately yellow brown, medium brown, cryptocrystalline, as mudstone, commonly argillaceous , marly, commonly cherty, rare stylolites, tight, no shows, 8% medium brown, calcareous, blocky shale fragments.
455.00 to 460.00 (5.00)	100%	**LIMESTONE** 50% off white, very light white brown, chalky textured, friable in part, 40% medium brown, medium yellow brown, cryptocrystalline, more cherty than chalky fragments, limestone as mudstone, commonly argillaceous & marly, with < 10% medium to dark brown, blocky calcareous shale.
460.00 to 465.00 (5.00)	100%	**LIMESTONE** 40% off white, very light white brown, chalky textured friable in part, 50% medium brown, medium yellow brown, cryptocrystalline, more cherty than chalky fragments, limestone as mudstone, commonly argillaceous & marly, with < 10% medium to dark brown, blocky calcareous shale, rare calcite lined fractures.
465.00 to 470.00 (5.00)	100%	**LIMESTONE** predominately off white, very light brown, chalky textured, < 30% yellow brown, medium brown, cryptocrystalline, commonly argillaceous & marly, non chalky fragments commonly more cherty, as mudstone, tight, no shows, 7% blocky, medium to dark brown, calcareous shale fragments.
470.00 to 475.00 (5.00)	100%	**LIMESTONE** 25% off white, chalky textured, 75% light yellow brown, medium to dark brown, cryptocrystalline to occasionally microcrystalline, commonly argillaceous or marly, more cherty than aboove, < 25% as calcareous, massive chert with medium brown argillaceous streaks, tight, no shows.
475.00 to 480.00 (5.00)	100%	**LIMESTONE** 65% off white, chalky textured, 35% light yellow brown, medium to dark brown, cryptocrystalline to occasionally microcrystalline, commonly argillaceous or marly, commonly cherty, 10-15% as calcareous, massive chert with medium brown argillaceous streaks, tight, no shows.
480.00 to 485.00 (5.00)	100%	**LIMESTONE** 70% off white, chalky textured, friable, argillaceous, occasionally silty & sandy, marly, occasionally cherty, 30% light yellow brown, medium brown, cryptocrystalline, grading to calcareous chert, occasional black, dark brown stylolites, 7% medium brown calcareous, firm, shale.
485.00 to 490.00 (5.00)	100%	**LIMESTONE** 70% of fragments chalky textured, cryptocrystalline, friable in part, slightly silty, sandy, occasionally cherty, commonly argillaceous & marly, 30% light yellow brown, cryptocrystalline, commonly argillaceous or marly, more cherty that chalky fragments, occasional stylolites, tight, no shows.

490.00 to 495.00 (5.00)	100%	**LIMESTONE** 55% off white, cream, chalky textured, commonly friable, slightly silty & sandy, commonly argillaceous & marly, 40% light yellow brown, medium brown, cryptocrystalline, commonly argillaceous, marly, more cherty than chalky fragments, rare stylolites, slightly silty & sandy, tight, no shows.
495.00 to 500.00 (5.00)	100%	**LIMESTONE** 60% of fragments off white, cream, chalky textured, friable in part, cryptocrystalline to microcrystalline, commonly slightly silty & sandy, commonly argillaceous, marly, occasionally cherty, 5% of fragments grading to very fine lower to very fine upper grained, argillaceous, calcareous, tight salt and pepper sandstone, 40% medium yellow brown, medium brown, cryptocrystalline, commonly argillaceous & more cherty than chalky fragments, as mudstone, rare calcite druse lined vugs or fractures, 7% dark brown, blocky, calcareous, shale.
500.00 to 505.00 (5.00)	100%	**LIMESTONE** 65% of fragments off white, occasionally mottled brown, cream,chalky textured, friable in part, commonly argillaceous, marly, slightly silty, sandy or cherty, 35% medium yellow brown, medium brown, cryptocrystalline, commonly cherty, argillaceous, locally marly, 3% medium brown calcareous, blocky shale, 20% of fragments chert replaced, no shows, rare black stylolites, rare off white, very fine lower to very fine upper grained, tight, argillaceous, calcareous, salt and pepper sandstone fragments.
505.00 to 510.00 (5.00)	100%	**LIMESTONE** 50% off white, cream, chalky textured, friable in part, occasionally mottled brown, commonly argillaceous & marly, occasionally cherty or silty & sandy, 50% of fragments light yellow brown, cryptocrystalline, argillaceous, marly, commonly cherty, as mudstone, rare fractures, rare black argillaceous stylolites, trace dark brown, calcareous, blocky shale, no shows.
510.00 to 520.00 (10.00)	55%	**LIMESTONE** off white to yellowish white, cryptocrystalline, common organic residue on digestion in Hydrochloric, occasional brachiopod fragment, dense, tight, mottled or interbedded cherty Limestone
	45%	**CHERTY LIMESTONE** predominately light brownish gray, ~ 5% medium grayish brown, cryptocrystalline, cherty, very hard, siliceous alteration throughout, dense, tight, finely laminated
520.00 to 535.00 (15.00)	65%	**CHERTY LIMESTONE** light yellowish brown to yellowish gray, cryptocrystalline, cherty siliceous alteration throughout, dense, tight, very hard, brittle, interbedded fossiliferous limestone
	35%	**LIMESTONE** off white to yellowish white, cryptocrystalline, common organic residue as above, scattered fossil fragments, occasional brachiopods, platy, mottled or interbedded cherty limestone, rrly sandy, trace calcite druse, dense, tight

535.00 to 550.00 (15.00)	60%	**LIMESTONE** off white, light to medium yellowish brown, cryptocrystalline, scattered fossil fragments, common organic residue on digestion, dense, tight, rarely sandy, mottled or interbedded cherty siliceous limestone
	40%	**CHERTY LIMESTONE** light to medium yellowish brown, cryptocrystalline, cherty, siliceous alteration throughout, rock is 90-95% silica, grading to 100% chert, weakly laminated, trace organic inclusions, very hard & brittle, dense, tight
550.00 to 570.00 (20.00)	60%	**LIMESTONE** off white, light yellowish brown, locally medium to dark grayish brown, cryptocrystalline, occasional stylolite or micro stylolite, locally with minor calcite druse, interbedded or mottled cherty Limestone, dense, tight, scattered brachiopod, common to abundant organic residue
	40%	**CHERTY LIMESTONE** light to medium yellowish brown, cryptocrystalline, siliceous cherty alteration throughout, dense, tight, hard, brittle, as above
570.00 to 575.00 (5.00)	50%	**CHERTY LIMESTONE** light to medium yellowish brown, cryptocrystalline, siliceous cherty alteration throughout, 90-95% siliceous alteration, dense, tight, hard
	50%	**LIMESTONE** light to medium yellowish brown to yellowish gray, cryptocrystalline, sandy in part, occasional brachiopod fragments,
575.00 to 585.00 (10.00)	70%	**LIMESTONE** medium yellowish brown to yellowish gray, cryptocrystalline, slightly argillaceous, increasingly sandy, rare brachiopod fragments, organic residue as above, interbedded or mottled cherty Limestone as above, rare stylolite, dense, tight
	30%	**CHERTY LIMESTONE** light to medium yellowish brown, cryptocrystalline, siliceous cherty alteration throughout, 90-95% siliceous alteration, dense, tight, hard, mottled or interbedded with sandy fossiliferous Limestone
585.00 to 600.00 (15.00)	100%	**LIMESTONE** predominately light to medium yellowish brown to yellowish gray, medium to dark yellowish brown in part, cryptocrystalline, slightly argillaceous, occasional brachiopods, locally slightly sandy, minor cherty Limestone as above, dense, tight, rare drusy calcite filled fracture with trace pyrobitumen
600.00 to 610.00 (10.00)	100%	**LIMESTONE** predominately light to medium yellowish brown to yellowish gray, minor interbedded medium to dark yellowish brown, argillaceous in part, common to abundant organic residue, minor silicification in 25-30% of grains, cryptocrystalline, scattered brachiopods, dense, tight, rare calcite filled microfracture

610.00 to 630.00 (20.00)	100%	**LIMESTONE** predominately medium yellowish brown to yellowish gray, minor light yellowish brown and interbedded dark yellowish brown, argillaceous in part, occasional sandy bed, locally silty, rare stylolite, rare calcite filled fracture, locally cherty with patchy or mottled silicification, dense, tight
630.00 to 650.00 (20.00)	100%	**LIMESTONE** increasingly dark yellowish brown to grayish brown, cryptocrystalline, argillaceous in part, increasingly cherty, 5-10% scattered chert, common silicification (10-20% silicified grains), locally sandy & silty in part, scattered brachiopods, dense, tight, hard
650.00 to 660.00 (10.00)	100%	**LIMESTONE** predominately medium yellowish brown to grayish brown, minor light yellowish minor & dark brown, cryptocrystalline, slightly argillaceous in part, locally silty to very fine grained sandy in part, rare brachiopod fragments, trace chert, dense, tight, Mudstone
660.00 to 665.00 (5.00)	90%	**LIMESTONE** predominately medium to dark brown to grayish brown, minor light yellowish brown, cryptocrystalline, argillaceous, scattered brachiopod fragment, occasional shale parting, dense, tight
	10%	**SHALE** dark grayish brown to black, blocky, calcareous, locally silty
665.00 to 670.00 (5.00)	60%	**LIMESTONE** dark grayish brown, minor light to medium yellowish brown, cryptocrystalline, argillaceous, locally silty, scattered fossil fragments, dense, tight, Mudstone to Wackestone
	40%	**SHALE** dark grayish brown, non fissile, blocky, silty in part, trace pyrite, calcareous, grading to calcareous Mudstone
670.00 to 680.00 (10.00)	45%	**SHALE** medium to dark brown, black, blocky, silty in part, slightly bituminous, calcareous, petroliferous odor, moderately slow dead oil blooming cut
	40%	**LIMESTONE** medium to dark brown, cryptocrystalline, silty & argillaceous in part, blocky, bituminous in part, petroliferous odor, dense, tight, moderately slow blooming dead oil cut
	15%	**SANDSTONE** medium gray, predominately variously gray to black chert and minor quartz, upper fine to upper coarse grained, subrounded to rounded, poorly sorted, calcite cement, tight

680.00 to 690.00 (10.00)	80%	**LIMESTONE** medium to dark brown, light yellowish brown in part, cryptocrystalline, argillaceous in part, locally sandy, silty in part, scattered brachiopod fragments, rare calcite lined fracture, rare stylolite, small trace chert, dense, tight, slightly bituminous
	20%	**SHALE** dark grayish brown, subblocky, calcareous, silty in part, thin stringers
690.00 to 700.00 (10.00)	100%	**LIMESTONE** predominately medium yellowish brown, minor light yellowish brown & dark brown, cryptocrystalline, argillaceous in part, commonly silty, trace calcite druse, scattered fossil, dense, tight
700.00 to 705.00 (5.00)	50%	**LIMESTONE** medium to dark brown to grayish brown, cryptocrystalline, argillaceous in part, silty, cherty (5-10% chert), scattered fossil, rare calcite filled microfracture, slightly bituminous
	50%	**SHALE** dark brown to black, blocky, calcareous, silty, grading to siltstone, bituminous in part, moderate blooming cut, small trace pyrite

Hart River, AB MFS Shale: 709.60 MD, 703.83 TVD, -22.13 SSL

705.00 to 715.00 (10.00)	80%	**SHALE** very dark brown to black, silty throughout, subblocky, slightly to non calcareous, bituminous, Limestone stringers, moderate blooming dead oil cut
	20%	**LIMESTONE** medium to dark brown, grayish brown, cryptocrystalline, argillaceous & silty, occasional brachiopod, dense, tight, slightly bituminous, moderate blooming dead oil cut
715.00 to 720.00 (5.00)	75%	**SHALE** dark brown, grading to black, subblocky, silty, sandy in part, slightly calcareous, bituminous, petroliferous odor, moderate blooming cut, dead oil
	25%	**LIMESTONE** medium to dark grayish brown, cryptocrystalline, silty, sandy in part, fragmental, occasional brachiopod spine, slightly bituminous, rare calcite cemented microfracture, tight
720.00 to 740.00 (20.00)	90%	**SHALE** very dark brown to black, subblocky, silty throughout, sandy in part, calcareous in part, bituminous, small trace pyrite, petroliferous odor, moderate blooming dead oil cut, Limestone stringers
	10%	**LIMESTONE** dark brown, cryptocrystalline, argillaceous & silty in part, bituminous in part, dense, tight, thin beds

740.00 to 745.00 (5.00)	90%	**SHALE** 30% medium gray to greenish gray, subfissile, slightly calcareous, silty in part, very low total organic carbon, 60% mottled & interbedded high total organic carbon dark brown to black shale, sbbly, slightly calcareous, bituminous, silty, very fine grained sandy in part, moderate slow blooming dead oil cut
	10%	**LIMESTONE** medium to dark brown, cryptocrystalline, slightly argillaceous, rare fossil brachiopod, thin beds, slightly bituminous, dense, tight, slow blooming cut
745.00 to 750.00 (5.00)	60%	**LIMESTONE** medium to dark yellowish brown, patchy light yellowish brown, cryptocrystalline, silty in part, slightly bituminous, dense, tight
	40%	**SHALE** 10% medium gray, subfissile to subblocky, slightly calcareous, trace finely disseminated pyrite, micromicaceous in part, very low total organic carbon, as above; 30% dark brown to black, subblocky, silty to sandy, bituminous, petroliferous odor, slow blooming cut
750.00 to 755.00 (5.00)	70%	**SHALE** predominately dark brown, 3-5% medium gray, non fissile, silty throughout, slightly calcareous, bituminous in part, moderate slow blooming dead oil cut, strong "swampy" odor (mercaptan)
	20%	**LIMESTONE** medium to dark brown, grayish brown, patchy light yellowish brown, cryptocrystalline, argillaceous in part, locally silty, dense, tight, bituminous in part
	10%	**SILTSTONE** light to medium brownish gray, sandy in part, calcareous, grading to silty Limestone, thin beds
755.00 to 760.00 (5.00)	50%	**SHALE** dark grayish brown to black, subfissile to subblocky, silty throughout, calcareous, bituminous in part, weak dead oil cut, trace finely disseminated pyrite
	40%	**LIMESTONE** dark grayish brown, cryptocrystalline, argillaceous & silty throughout, earthy, platy, slightly bituminous, dense, tight, slow blooming dead oil cut
	10%	**SANDSTONE** medium to dark gray, brownish gray, very coarse to coarse grained, subrounded to rounded, poorly sorted, calcite cement, tight
760.00 to 765.00 (5.00)	70%	**LIMESTONE** dark grayish brown, cryptocrystalline, earthy, silty & argillaceous, scattered brachiopods, dense, tight, bituminous, slow blooming dead oil cut
	15%	**SHALE** as above

760.00 to 765.00 (5.00)	15%	**SANDSTONE** medium gray, predominately various gray & light brown chert, minor quartz, upper fine to coarse grained, subrounded, ply sorted, calcite cement, tight
765.00 to 775.00 (10.00)	90%	**SILTY LIMESTONE** medium to dark grayish brown, cryptocrystalline, earthy, silty throughout, sandy in part, occasional sandstone partings, scattered brachiopods, argillaceous, slightly bituminous, dense, tight, no fluorescence, weak slow dead cut
	10%	**SANDSTONE** light to medium gray, brownish gray, quartz & gray & brown chert, lower fine to upper medium grained, subrounded, moderate to poorly sorted, calcite cement, tight
775.00 to 785.00 (10.00)	60%	**SHALE** dark brown to black, subfissile to subblocky, silty throughout, slightly calcareous, bituminous, non visible fluorescence, moderate blooming dead oil cut, heavy residue, occasional sandy parting, occasional Limestone stringer
	25%	**SILTSTONE** medium brown to grayish brown, sandy, calcareous, bituminous in part, tight, slow dead oil cut
	15%	**SANDSTONE** medium brownish gray, quartz & chert, very fine to lower medium grained, subrounded, moderate sorting, calcite cement, slightly bitumen, very weak patchy intergranular porosity (2-3%), slow streaming dead oil cut

Hart River, AB Sands: 791.70 MD, 781.01 TVD, -99.31 SSL

785.00 to 795.00 (10.00)	45%	**SHALE** dark brown to black, subblocky, silty, slightly calcareous, bituminous, slow dead oil cut
	35%	**SILTSTONE** medium brown, medium to dark grayish brown, calcareous, sandy in part, bituminous
	20%	**SANDSTONE** light to medium gray, grayish brown, quartz & variously gray chert, predominately very fine to fine grained, locally medium grained, subrounded, moderately sorted, calcite cement, moderate to well indurated, tight
795.00 to 805.00 (10.00)	35%	**SANDSTONE** light to medium gray to brownish gray, quartz & subordinate gray chert, predominately upper very fine to upper fine grained, 3-5% lower medium grained, subrounded, moderate sorting, calcite cement, patchy hydrocarbon stg, moderately well indurated, tight to very poor patchy weak porosity (<5%), trace weak streaming dead oil cut

795.00 to 805.00 (10.00)	35%	**SHALE** medium to dark brown, locally very dark brown to black, subblocky, silty, slightly calcareous, bituminous in part
	15%	**SILTSTONE** medium to dark brown, sandy in part, calcareous, bituminous
	15%	**LIMESTONE** medium to dark grayish brown, cryptocrystalline, silty & argillaceous, nds, tight, slightly bituminous
805.00 to 820.00 (15.00)	80%	**SHALE** dark brown to black, subfissile to subblocky, silty, calcareous, bituminous throughout, high total organic carbon, no visible fluorescence, moderate slow blooming dead oil cut, sandy stringers, silty Limestone partings, trace pyrite
	15%	**LIMESTONE** medium to dark grayish brown, minor light to medium yellowish brown, cryptocrystalline, silty & argillaceous, earthy, slightly bituminous, dense, tight
	5%	**SANDSTONE** light to medium gray, brownish gray, predominately quartz with common gray chert, very fine to fine grained, subrounded, moderately sorted, calcite cement, well indurated, tight, trace bitumen, thin stringers
820.00 to 830.00 (10.00)	90%	**SHALE** dark brown to black, subblocky, silty, bituminous, high total organic carbon, slightly calcareous, slow moderate blooming dead oil cut, occasional sandy stringer, occasional thin Limestone parting
	10%	**LIMESTONE** medium to dark grayish brown, minor light to medium yellowish brown, cryptocrystalline, silty & argillaceous, earthy, slightly bituminous, dense, tight, trace chert, rare brachiopod fragment
830.00 to 835.00 (5.00)	65%	**SHALE** dark brown to black, subblocky, silty, calcareous, bituminous, as above
	25%	**SANDSTONE** medium gray, predominately medium to dark gray & minor light brown chert, minor quartz, predominately upper fine to upper medium grained, 3 to 5 % lower coarse grained, subrounded, moderate sorting, calcite cement, predominately tight, locally with 10-12% intergranular porosity, trace to minor brown interstitial hydrocarbon staining, trace spotty dull yellow fluorescence, slow streaming cut, poor to questionable show
	10%	**SILTSTONE** medium to dark yellowish brown, calcareous, bituminous, sandy in part
835.00 to 840.00 (5.00)	45%	**SANDY LIMESTONE** medium yellowish brown to grayish brown, cryptocrystalline, sandy, fine to very coarse grained chert clasts common throughout, silty in part, dense, tight, small trace pyrite, very slightly bituminous, hard

835.00 to 840.00 (5.00)	40%	**SANDSTONE** medium gray, predominately variously gray chert, minor quartz, fine to lower very coarse grained, subrounded, poorly sorted, calcite cement, common interstitial brown hydrocarbon staining, poor intergranular porosity (0-5%), moderate to well indurated, friable in part
	15%	**SHALE** dark brown to black, subfissile to subblocky, silty in part, slightly calcareous, bituminous, as above, possible late returns or cavings
840.00 to 845.00 (5.00)	60%	**SILTY LIMESTONE** medium grayish brown, cryptocrystalline, commonly silty, grading to calcareous siltstone, floating sand clasts to lower coarse grained, dense, tight, hard, trace hydrocarbon staining
	35%	**SANDSTONE** medium brownish gray, gray chert, minor light brown chert & quartz, very fine to lower coarse grained, subrounded, poorly sorted, calcite cement, moderate to well indurated, hard, minor interstitial medium to dark brown hydrocarbon staining, tight to poor porosity (0-5%), spotty dull fluorescence, weak streaming cut, questionable show
	5%	**SHALE** dark grayish brown to black, subblocky, silty, bituminous, small trace pyrite
845.00 to 855.00 (10.00)	90%	**LIMESTONE** medium to dark grayish brown, cryptocrystalline, commonly silty, occasional sandy laminae, dense, tight, hard, trace finely disseminated pyrite
	5%	**SHALE** as above, thin partings
	5%	**SANDSTONE** light to medium brownish gray, predominately very fine grained, coarse grained stringer in 855 sample, subrounded, moderately sorted, calcite cement, tight, thin stringers
855.00 to 865.00 (10.00)	50%	**SANDSTONE** light to medium gray to brownish gray, abundant gray chert throughout, common quartz, minor brown chert, upper fine to lower very coarse grained clasts in very fine to fine grained silty calcareous matrix, subrounded to rounded, poorly sorted, calcite cement, spotty brown interstitial hydrocarbon staining in weak intergranular porosity, predominately tight (0-5%), trace weak cut, no show
	40%	**SILTY LIMESTONE** medium to dark grayish brown, cryptocrystalline, increasingly silty & argillaceous, grading to calcareous siltstone, sandy, very fine to medium grained clasts common, dense, tight, hard, sandy partings, occasional silty shale laminations

855.00 to 865.00 (10.00)	10%	**SHALE** dark brown to black, subblocky, silty, slightly bituminous, thin laminations, slightly calcareous
865.00 to 870.00 (5.00)	80%	**SANDSTONE** medium yellowish brown, patchy light gray, 10-12% medium to coarse grained clasts floating in very fine to fine grained calcareous silty & argillaceous matrix, matrix grades to sandy argillaceous Limestone, calcite cement, well indurated, tight, slightly bituminous
	10%	**SHALE** dark brown to black, subfissile to non fissile, silty in part, bituminous, slightly calcareous
870.00 to 880.00 (10.00)	85%	**SHALE** medium to dark brown, black, subfissile to non fissile, silty to very fine grained sandy throughout, common sandy laminations, occasional floating coarse grained chert clasts, moderate blooming dead oil cut
	15%	**SANDSTONE** medium brown, light grayish brown in part, very fine to upper fine grained, silty in part, predominately quartz with minor gray chert, subangular to subrounded, moderate to poor stringer, calcite cement, bituminous, spotty dull fluorescence, weak blooming dead oil cut, small trace finely disseminated pyrite
880.00 to 885.00 (5.00)	50%	**LIMESTONE** medium to dark brownish gray, light yellowish brown in part, cryptocrystalline, silty & argillaceous in part, scattered shell fragments, dense, tight
	30%	**SANDSTONE** medium gray to brownish gray, predominately gray & minor brown chert, minor quartz, very coarse grained, grading to granules or small pebbles, locally with calcite cement, locally with very fine to fine grained calcareous matrix, subrounded, poorly sorted, predominately tight, trace amber brown hydrocarbon staining with very weak porosity (<6%), spot dull fluorescence, weak streaming cut, no show
	20%	**SHALE** dark brown to black, subfissile, silty, bituminous, slightly calcareous
885.00 to 890.00 (5.00)	70%	**SANDSTONE** as above
	30%	**LIMESTONE** as above

890.00 to 905.00 (15.00)	85%	**SANDSTONE** medium gray, grayish brown, predominately variously gray and brown chert, minor opaque quartz, medium to coarse grained, occasional pebbles or granules, very fine to fine grained matrix, subrounded, occasional well rounded polished clasts, poorly sorted, calcite cement, tight to locally fair intergranular porosity (0-8%), common medium amber hydrocarbon staining, spotty fluorescence, weak to moderate streaming cut, questionable show, occasional sandy Limestone partings
	15%	**LIMESTONE** medium to dark brown, locally light yellowish brown, cryptocrystalline, silty & argillaceous, sandy in part, dense, tight, hard
905.00 to 910.00 (5.00)	65%	**SANDSTONE** medium gray to brownish gray, predominately variously gray chert, common quartz, minor brown chert, upper fine to very coarse grained, calcite cement, locally with very fine to fine grained matrix, subrounded, poorly sorted, predominately tight, patchy weak porosity (6-8%) with light amber hydrocarbon staining, spotty dull yellow fluorescence, fair blooming & streaming cut, weak show
	30%	**LIMESTONE** light to medium yellowish brown, grayish brown in part, cryptocrystalline, argillaceous, silty, locally sandy, rare shell fragments
	5%	**SHALE** dark brown to dark grayish brown, subfissile to subblocky, calcareous, bituminous
910.00 to 915.00 (5.00)	70%	**SANDSTONE** 30% light to medium gray, abundant gray to black chert, minor brown chert, common quartz, lower fine to lower very coarse grained, subrounded, poorly sorted, calcite cement, tight to locally weak porosity with minor bitumen cement; 30% light to medium brown, quartz & common gray to black chert, upper very fine to upper fine grained, subrounded, moderately well sorted, calcite cement, minor bitumen cement, light amber hydrocarbon staining throughout, poor to fair intergranular porosity (6-10%), spotty yellow fluorescence, fair blooming & streaming cut; 20% medium gray to brownish gray, very fine to fine grained, silty in part, subrounded, poorly sorted, calcite cement, tight to very weak porosity, trace bitumen, spotty hydrocarbon staining, weak streaming cut
	15%	**LIMESTONE** medium brownish gray, cryptocrystalline, argillaceous in part, trace finely disseminated pyrite, dense, tight
	15%	**SHALE** dark brown to black, blocky to subfissile, calcareous, bituminous, slow dead oil cut

915.00 to 920.00 (5.00)	85%	**SANDSTONE** light to medium brownish gray, quartz & common gray chert, very fine to upper medium grained, subrounded, moderate to poorly sorted, calcite cement, very poor intergranular porosity (2-7%), trace to locally minor bitumen cement, patchy dull yellow fluorescence, fair blooming & streaming cut, poor to questionable show
	15%	**LIMESTONE** as above
920.00 to 925.00 (5.00)	40%	**CHERTY LIMESTONE** yellowish white, light to medium yellowish brown, medium brownish gray in part, cryptocrystalline, cherty, 5-7% light yellowish brown chert throughout, locally silty to very fine grained sandy in part, rare brachiopod fragment, dense, tight
	40%	**SHALE** dark grayish brown to black, blocky to subblocky, calcareous, silty, bituminous, fair slow blooming dead oil cut
	20%	**SANDSTONE** light to medium gray, brownish gray, quartz & common gray chert, minor light brown chert, very fine to fine grained, subrounded, moderately sorted, calcite cement, trace amber hydrocarbon staining, tight to very poor porosity (0-4%), weak streaming cut, no show
925.00 to 930.00 (5.00)	70%	**LIMESTONE** light yellowish brown, medium to dark grayish brown, cryptocrystalline, increasingly argillaceous & silty, earthy lustre, dense, tight, occasional sandy stringers, occasional brachiopod fragments, trace pyrite
	30%	**SHALE** dark grayish brown to black, blocky to subblocky, calcareous, silty, bituminous, fair slow blooming dead oil cut, trace finely disseminated pyrite
930.00 to 935.00 (5.00)	50%	**LIMESTONE** as above, increasingly argillaceous & silty throughout, occasional very fine grained sandy laminae, scattered fossil fragments
	50%	**SHALE** as above, increasingly silty, minor finely disseminated pyrite, bituminous in part

Ford Lake, Ford Lake MFS: 936.60 MD, 906.89 TVD, -225.19 SSL

935.00 to 940.00 (5.00)	70%	**SHALE** dark brown to black, subfissile to subblocky, silty, calcareous, strong petroliferous odor, slow hazy dead oil cut, trace finely disseminated pyrite
	25%	**LIMESTONE** light to dark brown, light to medium gray in part, cryptocrystalline, commonly silty & argillaceous with earthy lustre & brachiopod remains as above, locally glassy & clean with occasional chert nodule, occasional sandy stringer

935.00 to 940.00 (5.00)	5%	**SANDSTONE** light to medium brownish gray, very fine to fine grained, occasional lower to upper medium grained gray chert clasts, subrounded, moderate to poorly sorted, calcite cement, spotty bitumen cement, very poor porosity (0-4%), trace dull yellow fluorescence, weak streaming cut, questionable show
940.00 to 942.00 (2.00)	90%	**SHALE** increasingly black, dark brown, subfissile to subblocky, increasingly bituminous, calcareous, moderately firm, moderately brittle, very high total organic carbon, no fluorescence, slow hazy dead oil cut, rare calcite cemented microfracture
	10%	**CAVINGS** predominately argillaceous sandstone & minor very fine grained sandstone, cavings?
942.00 to 956.00 (14.00)		**CORED INTERVAL** See Core Report for lithologic detail
956.00 to 965.00 (9.00)	75%	**SHALE** very dark brown to black, subblocky, silty in part, bituminous, very slightly to non calcareous, trace pyrite, common pyritic silvers, weak blooming dead oil cut, occasional slickenside, high angle jointing
	25%	**LIMESTONE** medium to dark brown to grayish brown, cryptocrystalline, earthy, silty in part, thin beds, tight, bituminous, slow blooming cut, rare fossil fragments
965.00 to 975.00 (10.00)	85%	**SHALE** predominately black, very dark brown in part, subblocky, non to slightly calcareous, bituminous, strong odor, slow blooming dead oil cut, firm, moderately brittle, occasional to locally common slickenside, high angle joints
	15%	**LIMESTONE** as above
975.00 to 995.00 (20.00)	100%	**SHALE** black, very dark brown, subfissile to subblocky, non calcareous, silty in part, bituminous, slow blooming dead oil cut, occasional calcareous stringer, common slickenside, firm, moderately brittle
995.00 to 1,020.00 (25.00)	100%	**SHALE** black, very dark brown, subfissile, non calcareous, occasional calcareous stringer, occasional calcareous micro inclusions, trace finely disseminated pyrite, rare small pyrite nodules, bituminous, slow blooming dead oil cut, occasional slickenside, moderately brittle
1,020.00 to 1,040.00 (20.00)	100%	**SHALE** very dark gray to black, dark grayish brown in part, subfissile to subblocky, predominately non calcareous, occasional calcareous stringers, rare dark grayish brown Limestone stringers, bituminous, slow blooming dead oil cut, occasional slickenside, weak high angle jointing

1,040.00 to 1,060.00 100% (20.00) **SHALE**
very dark gray to black, dark grayish brown in part, subfissile to subblocky, predominately non calcareous, occasional calcareous stringers, rare dark grayish brown Limestone stringers, bituminous, slow blooming dead oil cut, occasional slickenside, weak high angle jointing

1,060.00 to 1,080.00 100% (20.00) **SHALE**
very dark grayish brown, decreasing black, subfissile, non calcareous, occasional dark calcareous or Limestone stringers, decreasing bituminous content, slow weak dead oil cut, rare slickenside, weak high angle jointing, minor finely disseminated pyrite, occasional pyritic laminae

1,080.00 to 1,100.00 100% (20.00) **SHALE**
very dark brownish gray, locally grading to black, subfissile, occasional dark grayish brown argillaceous Limestone stringer, common finely disseminated microcrystalline pyrite, occasional pyritic laminae, non calcareous, moderately high total organic carbon, no visible slickenside, weak high angle jointing, moderately firm

1,100.00 to 1,120.00 100% (20.00) **SHALE**
very dark brownish gray, grading to black, subfissile, non calcareous, pyritic, common finely disseminated microcrystalline pyrite throughout, occasional dark grayish brown Limestone stringer, rare silty stringer, moderately firm, becoming moderately fragile in water, carbonaceous, moderately high total organic carbon

1,120.00 to 1,140.00 100% (20.00) **SHALE**
very dark gray, locally grading to black, subfissile, non calcareous, pyritic, occasional yellowish brown hard brittle siliceous laminations or concretions, rare pyrite nodules, moderately firm, no visible slickenside, weak high angle jointing, moderately firm, becoming somewhat fragile in water

Imperial: 1,148.50 MD, 1,078.08 TVD, -396.38 SSL

1,140.00 to 1,150.00 100% (10.00) **SHALE**
very dark gray, grading to black, non calcareous, occasional medium to dark yellowish brown hard siliceous stringers, rare pyrite nodule, moderately firm, carbonaceous, moderate total organic carbon

1,150.00 to 1,170.00 100% (20.00) **SHALE**
very dark gray, grading to black, dark brownish gray in part, subfissile, non calcareous, occasional light yellowish white Limestone stringer, rare medium brown siliceous stringer, occasional poorly sorted sandy stringers, very fine to lower medium grained, Quartz with minor to common gray chert, calcite cement, trace pyrite cement, tight

1,170.00 to 1,190.00 100% (20.00) **SHALE**
very dark gray to black, dark brownish gray, subfissile, non calcareous, pyritic, common finely disseminated microcrystalline pyrite throughout, occasional very fine grained calcite cemented sandstone laminations, occasional silty laminae, occasional slickenside, weak high angle jointing, moderately soft, becoming increasingly fragile, softens in water

1,190.00 to 1,205.00 (15.00) 100% **SHALE**
very dark gray, locally black, subfissile, non calcareous, carbonaceous, moderate total organic carbon, minor finely disseminated pyrite throughout, moderately firm, softening in water, rare sheared grain, weak high angle jointing

1,205.00 to 1,210.00 (5.00) 95% **SHALE**
as above, occasional sandy parting

5% **SANDSTONE**
light gray, light brownish gray, quartzose with minor gray chert, very fine to fine grained, coarse silt in part, subrounded, moderately sorted, silica +/- pyrite + trace to minor secondary calcite cement, tight, no visible show

Imperial, Tuttle: 1,211.00 MD, 1,128.26 TVD, -446.56 SSL

1,210.00 to 1,220.00 (10.00) 60% **SHALE**
dark gray to grading to black, subfissile, non calcareous, carbonaceous, moderate total organic carbon as above, rare slickenside, occasional high angle joint, moderately firm, pyritic as above, intbdd very fine to fine grained sandstone

40% **SANDSTONE**
light to medium brownish gray, quartz with common gray chert & occasional dark lithics, common to abundant white to off white siliceous clasts, predominately very fine to fine grained, 2-3% lower to upper medium grained clasts, subrounded, moderately sorted, silica + minor patchy pyrite cement, trace to minor secondary calcite cement, predominately tight, patchy weak porosity (4-7%) with light amber hydrocarbon staining, dull yellow fluorescence, weak slow blooming cut, poor to questionable show, 1220 sample has decreasing sand content & increasing argillaceous content & pyrite

1,220.00 to 1,225.00 (5.00) 65% **SHALE**
dark gray, grading to black, subfissile, common very finely disseminated microcrystalline pyrite throughout, non calcareous, moderately firm, no visible slickenside

35% **SANDSTONE**
light to medium gray, light yellowish brown in part, quartzose with minor gray chert, predominately very fine to lower fine grained, locally silty & argillaceous in part, subrounded to subangular, moderate sorting, silica cement, trace pyrite cement, trace to minor secondary calcite cement, predominately tight, occasional thin bed with 5-8% intergranular porosity & light brown hydrocarbon staining with dull yellow fluorescence & weak blooming cut, questionable show

1,225.00 to 1,230.00 (5.00) 60% **SHALE**
dark gray to black, subfissile to fissile, non calcareous, carbonaceous, locally silty, pyritic, moderately firm

1,225.00 to 1,230.00 (5.00)	40%	**SANDSTONE** subequal light gray & light amber brown, quartzose with minor gray chert, & occasional potassium lithic grain, scattered white siliceous grains, very fine to fine grained, subangular to subrounded, silica overgrowths, moderately well sorted, silica cement, trace secondary calcite cement, brown sandstone is oil stained throughout & has poor to locally fair porosity (6-10%), common dull yellow fluorescence, moderate slow blooming cut, gray sandstone is tightly cemented
1,230.00 to 1,235.00 (5.00)	80%	**SHALE** as above, rare slickenside, occasional high angle joint
	20%	**SANDSTONE** as above, increasingly gray, silty & argillaceous in part, predominately tight, locally cemented with abundant pyrite, commonly with amber brown oil staining & moderate blooming cut as above
1,235.00 to 1,255.00 (20.00)	85%	**SHALE** dark gray, dark brownish gray, grading to black, subfissile, non calcareous, pyritic, carbonaceous, moderately firm, occasional high angle joint, below 1252 meters (MD) sample is casing cement.
	15%	**SANDSTONE** light to medium gray, light yellowish brown, quartzose with minor gray chert, very fine to fine grained, locally silty & argillaceous, subangular to subrounded, moderate to locally poorly sorted, silica cement, patchy pyrite cement, predominately tight, commonly with weak porosity (2-6%) & light brown hydrocarbon staining, spotty dull yellow fluorescence, weak slow streaming cut, very poor show, below 1252 meters (MD) cement.
1,255.00 to 1,260.00 (5.00)	100%	**SHALE** medium brown gray, sub platy to blocky, micromicaceous, slightly pyritic, predominately as clay shale, medium hard, rare fine to medium grained, consolidated, salt and pepper, subangular to subrounded, siliceous, very pyritic, tight sandstone fragments, cuttings sticking to shaker, questionable sample quality.
1,260.00 to 1,265.00 (5.00)	100%	**SHALE** dark gray brown to black, commonly medium hard, sub fissile to fissile, predominately as clay shale, slightly pyritic, occasional fragments with pyrite laminae, predominately light brown, bit-ground, slightly montmorillonitic & cracking in water, shale sticking to shaker screens, micromicaceous, slightly pyritic, rare medium brown, hard ironstone fragments, trace fine to lower medium grained, siliceous, tight, salt and pepper sandstone fragments, rare sandy fragments.

1,265.00 to 1,270.00 100% **SHALE**
(5.00) predominately light to medium brown, sub platy to blocky, bit-ground in part & commonly soft, slightly montmorillonitic & fissile, micromicaceous, slightly pyritic, as clay shale, 40% of fragments medium to dark gray brown, grading to black, micromicaceous, medium hard to occasionally firm, rare slickenslides, slightly pyritic, non calcareous, trace medium brown ironstone & fine to lower medium grained, locally argillaceous, siliceous, pyritic, tight salt and pepper sandstone fragments.

1,270.00 to 1,275.00 90% **SHALE**
(5.00) 30% medium to dark gray brown, sub platy to blocky, micromicaceous, slightly pyritic, occasional massive pyrite laminae, rare calcareous fragments, predominately light to medium brown, soft, bit-ground in part, soft, fissile in part, trace medium brown ironstone fragments, trace light brown cryptocrystalline limestone fragments.

10% **SANDSTONE**
consolidated, salt and pepper, light gray, fine grained, subangular to subrounded, moderately sorted, siliceous & with siliceous overgrowths, with patchy pyritic or light gray or light brown argillaceous cement, with 25% dark chert grains, poor grain relief, tight, no shows.

1,275.00 to 1,280.00 100% **SHALE**
(5.00) medium to dark brown, platy to blocky, micromicaceous, occasional disseminated & massive pyrite, predominately as clay shale, 50% of fragments light brown, soft, bit-ground in part, slightly swelling in water, soft, fissile, sub platy to blocky, micromicaceous, trace medium brown ironstone & rare fine grained, siliceous, hard, locally argillaceous, pyritic, tight salt and pepper sandstone fragments, adding graphite mud additive.

1,280.00 to 1,285.00 100% **SHALE**
(5.00) medium to dark brown gray, sub platy to blocky, micromicaceous, pyritic, predominately as clay shale, rare silty & sandy fragments, medium hard to firm, sub fissile, 5% as off white, light gray, occasionally light brown, fine to lower medium grained, moderately sorted, subangular to subrounded, commonly siliceous, locally argillaceous or pyritic, tight, firm salt and pepper sandstone fragments, 3% medium brown ironstone fragments.

1,285.00 to 1,290.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, sub platy to subblocky, micromicaceous, as clay shale,slightly pyritic, rare carbonaceous flakes, rare slickensides, non calcareous, rare fragments that crack in water, rare medium brown ironstone fragments, trace fine to lower medium grained, consolidated, siliceous, tight, salt and pepper sandstone stringers.

1,290.00 to 1,295.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, sub platy to subblocky, micromicaceous, medium hard to hard, sub fissile to fissile, as clay shale, commonly with disseminated & massive pyrite, rare carbonaceous flakes, as clay shale, trace fine to lower medium grained, subangular to subrounded, siliceous, argillaceous, pyritic, tight sandstone stringers.

1,295.00 to 1,300.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark brown gray, sub platy to subblocky, micromicaceous, commonly soft, sub fissile to fissile, as clay shale, pyritic, locally with massive pyrite specks, rare strecthed pyrite, trace fragments with high angled joints, occasional fragments crack in water.

1,300.00 to 1,305.00 100% **SHALE**
(5.00) medium to dark gray brown, sub platy to subblocky, micromicaceous, pyritic, as clay shale, rare shear features, trace medium brown ironstone fragments, non calcareous.

1,305.00 to 1,310.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark brown, sub platy to subblocky, micromicaceous, occasionally with disseminated very fine or massive pyrite, rare greasy fragments, as clay shale, 5% as light gray, off white, light brown, consolidated, fine to medium grained, subangular to subrounded, siliceous, pyritic, argillaceous, tight sandstone stingers.

1,310.00 to 1,315.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, platy to subblocky, micromicaceous, medium hard, fissile, as clay shale, trace light gray, fine to lower medium grained, moderately sorted, siliceous, argillaceous, pyritic, tight salt and pepper sandstone stringers.

1,315.00 to 1,320.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, platy to subblocky, micromicaceous, medium hard, sub fissile to fissile, micromicaceous, as clay shale, 3% light gray, light gray brown, predominately fine grained, tight, subangular to subrounded, siliceous, pyritic, locally argillaceous, well consolidated tight, salt and pepper sandstone fragments.

1,320.00 to 1,325.00 90% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, sub platy to subblocky, micromicaceous, commonly silty & sandy. slightly carbonaceous, trace disseminated & massive pyrite, rare shear features, non calcareous.

10% **SANDSTONE**
consolidated, salt and pepper, off white, light gray, silty to very fine upper grained, rare fine upper grained fragments, poor to moderately sorted, argillaceous, locally siliceous or pyritic, tight, no shows.

1,325.00 to 1,330.00 100% **SHALE**
(5.00) medium brown, medium to dark gray, sub platy to subblocky, micromicaceous, slightly carbonaceous, micromicaceous, rare fragments cracking in water, occasionally slightly silty or sandy, medium hard, sub fissile to occasionally fissile, 6% as medium brown non calcareous ironstone fragments, 4% off white, light gray, poor to moderately sorted, silty to upper medium grained, argillaceous, siliceous, locally pyritic, tight salt and pepper sandstone fragments.

1,330.00 to 1,335.00 100% (5.00) **SHALE**
medium to dark brown, sub platy subblocky, micromicaceous, locally with carbonaceous grains or flakes, medium hard, locally very hard, sub fissile, occasional fragments crack or swell in water, difficult to wash, 5% light gray, off white, silty to fine upper grained, subangular to subrounded, moderately sorted, commonly argillaceous, siliceous, slightly pyritic, firm, tight salt and pepper sandstone fragments, 3% medium brown ironstone fragments.

1,335.00 to 1,340.00 100% (5.00) **SHALE**
medium brown, medium brown gray, platy to subblocky, micromicaceous, as clay shale, occasional disseminated very fine & occasional massive pyrite, occasional fragments crack in water, rare carbonaceous flakes, 8% as medium brown non calcareous ironstone fragments, 4% as tight, silty to very fine upper grained, off white, light gray, argillaceous, siliceous, pyritic, slightly carbonaceous tight salt and pepper sandstone fragments.

1,340.00 to 1,345.00 100% (5.00) **SHALE**
medium to dark gray, medium to dark gray brown, sub platy to blocky, micromicaceous, predominately as clay shale, locally silty & sandy, occasional fragments cracking or swelling in water, soft to medium hard, commonly fissile, trace disseminated or massive pyrite, rare slickensides, rare shear structures, 6% medium brown, locally pyritic, non calcareous ironstone fragments, 3% light gray, off white, silty to fine upper, locally lower medium grained, subangular to subrounded, poor to moderately sorted, siliceous, argillaceous, pyritic, tight salt and pepper sandstone fragments.

1,345.00 to 1,350.00 100% (5.00) **SHALE**
medium to dark gray brown, dark gray, sub platy to blocky, micromicaceous, predominately as clay shale, micromicaceous, rare fragments with carbonaceous flakes, trace disseminated & massive pyrite, rare fragments with sheared pyrite, 4% as medium brown, cryptocrystalline, locally sandy, non calcareous ironstone fragments, 3% as light gray, gray brown, medium brown, predominately silty to very fine lower grained, argillaceous, siliceous, pyritic, tight salt and pepper sandstone fragments.

1,350.00 to 1,355.00 100% (5.00) **SHALE**
medium to dark gray, medium to dark gray brown, sub platy to subblocky, micromicaceous, trace disseminated very fine or massive pyrite, biotubated?, predominately as clay shale, rare fragments swelling in water, difficult to wash, medium hard to hard, sub fissile to occasionally fissile, 4% off white, light gray, silty to fine grained, moderately sorted, subangular to subrounded, consolidated, argillaceous, siliceous, locally pyritic, tight, salt and pepper to occasionally quartzose sandstone fragments.

1,355.00 to 1,360.00 100% (5.00) **SHALE**
medium to dark gray, medium to dark gray brown, platy to subblocky, micromicaceous, occasionally carbonaceous, predominately as clay shale, rare silty fragments, occasional fragments crack or swell in water, difficult to wash, trace disseminated & massive pyrite, 3% off white, light gray, silty to fine , rare lower medium grained, subangular to subrounded, siliceous, argillaceous, pyritic, tight salt and pepper to quartzose sandstone fragments, no shows.

1,360.00 to 1,365.00 (5.00) 60% **SHALE**
medium to dark brown gray, platy to subblocky, micromicaceous, carbonaceous, locally slightly silty, predominately as clay shale, occasional fragments swell or crack in water, occasional disseminated very fine or massive pyrite, rare shear features.

40% **SANDSTONE**
predominately as unconsolidated, subrounded, fine upper to upper medium quartz & chert grains, consolidated fragments light gray, off white, salt and pepper with 10-20% dark chert grains, moderately sorted, subangular to subrounded, siliceous & commonly with silica overgrowths, patchy white or light gray argillaceous matrix, occasional fragments with 15% white kaolin plugged matrix porosity, slightly pyritic, with poor grain relief, tight, rare fragments with 1-5% black, dead plugged intergranular porosity, poor reservoir, no shows.

1,365.00 to 1,370.00 (5.00) 100% **SHALE**
medium to dark brown, sub platy to subblocky, micromicaceous, predominately as clay shale, soft to hard, occasionally fissile, trace disseminated & massive pyrite, rare shear structures, occasional fragments swell in water, 4% non calcareous ironstone fragments with sandstone partings, 5% as off white, light gray, fine to lower medium grained, moderately sorted, subangular to subrounded, argillaceous, siliceous, locally pyritic, tight salt and pepper sandstone fragments.

1,370.00 to 1,375.00 (5.00) 100% **SHALE**
medium to dark brown gray, medium to dark gray, sub platy to blocky, commonly with very fine disseminated carbonaceous flakes, predominately as clay shale, occasional fragments with silty to very fine upper grained, argillaceous, off white sandstone partings, commonly with very fine disseminated or massive pyrite, occasional fragments crack or swell in water, soft to firm, occasionally fissile, rare shear structures, 3-4% as medium brown non calcareous ironstone fragments, 3% off white, light gray, consolidated, salt and pepper, subangular to subrounded, fine grained, argillaceous, siliceous, slightly pyritic, tight, salt and pepper sandstone fragments.

1,375.00 to 1,380.00 (5.00) 90% **SHALE**
medium to dark brown, sub platy to blocky, micromicaceous, as clay shale, micromicaceous, occasional fragments swell or crack in water, occasional fragments with pyrite laminae, soft to firm, fissile in part.

10% **SANDSTONE**
consolidated, off white, light gray, light to medium brown, fine to rare lower medium grained, subangular to subrounded, with < 20% dark & white chert grains, moderately sorted, commonly with patchy white or gray brown argillaceous matrix, siliceous, slightly pyritic, firm to friable, with poor grain relief, 15-18% kaolin plugged matrix porosity, poor grain relief, pyritic, trace poor dead bitumen plugged intergranular porosity, no shows, poor reservoir.

1,380.00 to 1,385.00 (5.00) 90% **SHALE**
medium to dark brown, sub platy to blocky, micromicaceous, predominately as clay shale, occasional fragments crack in water.

1,380.00 to 1,385.00 (5.00) 10% **SANDSTONE**
off white, light gray brown, light gray, consolidated, quartzose to salt and pepper, with < 25% white & dark chert grains, fine to occasionally lower medium grained, slightly calcareous, friable to firm. siliceous with silica overgrowths, abundant white intergranular kaolin, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, rare fragments with 1-5% dead bitumen plugged intergranular porosity, rare fragments with 1-6% visible intergranular porosity, 15-21% kaolin matrix porosity, very poor weak slow yellow green blooming cut fluorescence.

1,385.00 to 1,390.00 (5.00) 75% **SHALE**
medium brown, sub platy to blocky, micromicaceous, as clay shale, soft to hard, pyritic, rare shear features.

25% **SANDSTONE**
off white, light gray brown, light gray, consolidated, quartzose to salt and pepper, with < 25% white & dark chert grains, fine to occasionally lower medium grained, subangular to subrounded, angular in part, slightly calcareous, siliceous, friable to firm. siliceous with silica overgrowths, abundant white intergranular kaolin, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, rare fragments with 1-6% visible intergranular porosity, 9-12% kaolin matrix porosity?, very poor cut fluorescence.

1,390.00 to 1,395.00 (5.00) 60% **SANDSTONE**
off white, light gray brown, light gray, consolidated, quartzose to salt and pepper, with < 25% white & dark chert grains, fine to occasionally lower medium grained, subangular to subrounded, angular in part, slightly calcareous, siliceous, friable to firm. siliceous with silica overgrowths, abundant white intergranular kaolin, slightly pyritic, or with medium brown argillaceous cement, with poor to rare good grain relief, moderately sorted, rare fragments with 1-6% visible intergranular porosity, 9-21% kaolin matrix porosity, very poor, slow weak yellow green blooming cut fluorescence.

40% **SHALE**
medium brown, sub platy to blocky, micromicaceous, slightly pyritic, as clay shale.

1,395.00 to 1,400.00 (5.00) 80% **SHALE**
medium brown, platy to blocky, micromicaceous, slightly pyritic, as clay shale, occasional fragments swell in water, trace ironstone fragments.

20% **SANDSTONE**
consolidated, off white, light gray, fine to lower medium grained, subangular to subrounded, moderately sorted, quartzose to salt and pepper, with < 20% dark chert grains, non calcareous, commonly with light brown argillaceous cement, siliceous, pyritic, patchy white kaolin matrix porosity, poor to fair grain relief, occasional 1-3% visible intergranular porosity, 15-21% kaolin matrix porosity, very weak, very poor slow yellow green blooming cut fluorescence.

1,400.00 to 1,405.00 (5.00) 100% **SHALE**
medium to dark brown, soft to medium hard, platy to blocky, micromicaceous, predominately as clay shale, occasional very fine pyrite laminae, occasional fragments swelling or cracking in water, rare slickensides.

1,405.00 to 1,410.00 (5.00) 100% **SHALE**
medium to dark brown, sub platy to blocky, micromicaceous, pyritic, occasional pyrite laminae, occasional slickensides in part questionable bit-generated, 5% of fragments swelling or cracking in water.

1,410.00 to 1,415.00 (5.00) 100% **SHALE**
medium to dark gray, medium to dark brown, sub platy to occasionally blocky, micromicaceous, as clay shale, sample difficult to wash, slightly carbonaceous, pyritic, occasional fragments split or crack in water, trace disseminated & massive pyrite.

1,415.00 to 1,420.00 (5.00) 100% **SHALE**
medium to dark gray, medium to dark brown, sub platy to occasionally blocky, micromicaceous, as clay shale, pyritic, occasional fragments split or crack in water, trace disseminated & massive pyrite., occasional slickensides.

1,420.00 to 1,425.00 (5.00) 90% **SHALE**
medium to dark brown, sub platy to blocky, as clay shale, occasional fragments crack or swell in water, occasional slickensides, locally carbonaceous.

10% **SANDSTONE**
light gray, off white, light gray brown, fine grained, rare fragments with medium to coarse lower floating quartz grains, subangular to subrounded, salt and pepper to quartzose, with 25% white & light & dark chert grains, slightly calcareous, siliceous & commonly with silica overgrowth, commonly with light gray brown, locally off white & with kaolinitic argillaceous matrix, rare pyrite, occasional shale partings, with poor grain relief, no visible intergranular porosity, 12-15% kaolin matrix porosity, very poor, very slow yellow green blooming cut fluorescence.

1,425.00 to 1,430.00 (5.00) 65% **SHALE**
medium to dark brown, sub platy to commonly blocky, micromicaceous, commonly with disseminated fine or massive pyrite, occasional swelling fragments, as clay shale, rare slickensides, trace medium brown ironstone fragments.

35% **SANDSTONE**
consolidated, salt and pepper, off white, light gray, very light gray brown, predominately fine grained, occasionally fragments with floating medium to coarse lower chert grains, subangular to subrounded, poor to moderately sorted, with < 25% dark chert grains, predominately non calcareous, siliceous, commonly with white kaolinitic argillaceous matrix, siliceous, brittle & commonly with silica overgrowths, rare pyrite, poor grain relief, no visible intergranular porosity, no cut fluorescence,12-15 % kaolin matrix porosity.

1,430.00 to 1,435.00 (5.00)	90%	**SHALE** medium to dark brown, medium to dark gray, sub platy to blocky, micromicaceous, slightly swelling in water, as clay shale, slightly carbonaceous, medium hard, fissile, rare shear features.
	10%	**SANDSTONE** off white, light gray, consolidated, salt and pepper, fine grained, moderately sorted, subangular to subrounded, commonly with off white argillaceous matrix, siliceous, pyritic, slightly calcareous, with < 20% chert grains, tight, no shows.
1,435.00 to 1,440.00 (5.00)	75%	**SHALE** medium to dark brown, sub platy to blocky, micromicaceous, rare pyrite laminae, locally with disseminated very fine pyrite, occasional fragments that crack of swell in water, medium hard, fissile, rare slickenside surfaces.
	25%	**SANDSTONE** off white, light gray, consolidated, salt and pepper, fine grained, locally with floating medium grains, poor to moderately sorted, subangular to subrounded, angular in part, commonly with off white kaolin argillaceous matrix, siliceous, pyritic, slightly calcareous, with < 20% chert grains, trace 1-3% visible intergranular porosity, 15% kaolin pluggd matrix porosity, no cut fluorescence.
1,440.00 to 1,445.00 (5.00)	75%	**SHALE** medium to dark brown, sub platy to blocky, micromicaceous, rare pyrite laminae, locally with disseminated very fine pyrite, occasional fragments that crack or swell in water, medium hard, fissile, rare slickenside surfaces.
	25%	**SANDSTONE** off white, light gray, consolidated, salt and pepper, fine grained, locally with floating medium grains, poor to moderately sorted, subangular to subrounded, angular in part, commonly with off white argillaceous matrix, kaolin?, siliceous, pyritic, slightly calcareous, with < 25% chert grains, trace 1-3% visible intergranular porosity, no shows.
1,445.00 to 1,450.00 (5.00)	100%	**SHALE** medium to dark brown, platy to subblocky, micromicaceous, as clay shale, commonly swelling or cracking in water, rare pyrite, rare shear structures, medium hard, commonly fissile.
1,450.00 to 1,455.00 (5.00)	100%	**SHALE** medium to dark brown, platy to occasionally blocky, micromicaceous, as clay shale, occasional fragments which crack or swell in water, trace disseminated pyrite, locally with very fine pyrite laminae, rare shear structures.
1,455.00 to 1,460.00 (5.00)	100%	**SHALE** medium brown, medium brown gray, sub platy to subblocky, micromicaceous, medium hard commonly fissile, as clay shale, occasional fragments swelling or cracking in water, rare slickensides, slightly pyritic.

1,460.00 to 1,465.00 (5.00)	100%	**SHALE** medium to dark gray, medium to dark brown, platy to blocky, micromicaceous, as clay shale, soft to medium hard, commonly fissile, rare shear features, occasional fragments swelling in water, trace ironstone, non calcareous.
1,465.00 to 1,470.00 (5.00)	100%	**SHALE** medium to dark brown gray, medium to dark gray, platy to occasionally subblocky, micromicaceous, as clay shale, commonly fissile, soft to hard, rare pyrite laminae, occasional swelling fragments, trace ironstone, trace off white, fine grained, consolidated, salt and pepper sandstone fragments, rare shear features.
1,470.00 to 1,475.00 (5.00)	100%	**SHALE** medium to dark gray, medium to dark gray brown, sub platy to subblocky, micromicaceous, soft, fissile, occasional fragments swell in water, trace disseminated & massive pyrite, rare ironstone fragments, rare shear structures.
1,475.00 to 1,480.00 (5.00)	100%	**SHALE** medium to dark gray, medium to dark gray brown, sub platy to subblocky, micromicaceous, soft, fissile, occasional fragments swell in water, trace disseminated & massive pyrite, rare ironstone fragments, occasional slickenside surfaces, rare carbonaceous fragments.
1,480.00 to 1,485.00 (5.00)	90%	**SHALE** light to medium brown, medium gray brown, sub platy to subblocky, micromicaceous, soft, fissile, occasional swelling fragments, non calcareous, rare shear structures.
	10%	**SANDSTONE** off white, very light brown, silty to very fine lower grained, argillaceous, slightly siliceous, carbonaceous, tight.
1,485.00 to 1,490.00 (5.00)	100%	**SHALE** medium gray, medium to dark gray brown, platy, micromicaceous, as clay shale, soft, fissile, occasional fragments crack in water, slightly pyritic, rare shear structures.
1,490.00 to 1,495.00 (5.00)	100%	**SHALE** medium to dark brown gray, medium gray, platy to subblocky, micromicaceous, as clay shale, trace disseminated & massive pyrite, commonly soft & fissile, slightly carbonaceous, trace ironstone, rare slickensides.
1,495.00 to 1,500.00 (5.00)	100%	**SHALE** medium gray, medium to dark gray brown, platy to subblocky, micromicaceous, as clay shale, soft to medium hard, commonly fissile, occasional fragments with very fine pyrite laminae, trace ironstone, rare shear features, occasional fragments crack in water.

1,500.00 to 1,505.00 100% (5.00) **SHALE**
medium gray, medium to dark brown gray, sub platy, micromicaceous, as clay shale, soft to medium hard, commonly fissile, occasional fragments swell or crack in water, occasional pyrite laminae,. occasional fragments crack or swell in water, rare slickensides.

1,505.00 to 1,510.00 100% (5.00) **SHALE**
medium to dark gray, medium to dark gray brown, sub platy to occasionally blocky, micromicaceous, occasional fragments with pyrite laminae, as clay shale, occasional fragments crack or swell in water, soft to medium hard, commonly fissile, rare shear structures, trace ironstone.

1,510.00 to 1,515.00 100% (5.00) **SHALE**
medium to dark brown gray, medium gray, platy to subblocky, micromicaceous, as clay shale, occasional pyrite laminae, fragments occasionally crack or swell in water, difficult to wash, rare slickenside surfaces.

1,515.00 to 1,520.00 100% (5.00) **SHALE**
medium to dark gray brown, medium to dark gray, platy to subblocky, micromicaceous, predominately as clay shale, occasional fragments swell or crack in water, soft to occasionally medium hard, commonly fissile, occasional irregular pyrite laminae, occasional massive pyrite, no really obvious shear features.

1,520.00 to 1,525.00 100% (5.00) **SHALE**
medium to dark gray, medium to dark gray brown, platy to sub platy, occasionally blocky, as clay shale, soft to medium hard, commonly fissile, slightly pyritic, occasional fragments swell or crack in water, non calcareous, slightly pyritic.

1,525.00 to 1,530.00 100% (5.00) **SHALE**
medium to dark gray, medium to dark gray brown, platy to subblocky, micromicaceous, as clay shale, occasional fragments swell or crack in water, slightly pyritic, soft to medium hard, commonly fissile, rare slickensides, trace off white, fine grained, argillaceous, quartzose to salt and pepper sandstone fragments.

1,530.00 to 1,535.00 100% (5.00) **SHALE**
medium to dark gray, medium to dark gray brown, platy to subblocky, occasionally blocky, micromicaceous, predominately as clay shale, occasional sandy or silty fragments or fragments which swell or crack in water, slightly pyritic, soft to medium hard, commonly fissile, rare slickensides, 3% off white, light gray, fine grained, locally lower medium grained, poor to moderately sorted, argillaceous, quartzose to salt and pepper, tight sandstone fragments.

1,535.00 to 1,540.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, black, platy to subblocky, micromicaceous, predominately as clay shale, occasional sandy or silty fragments or fragments which swell or crack in water, slightly pyritic, soft to medium hard, commonly fissile, trace off white, light gray, fine grained, locally lower medium grained, poor to moderately sorted, argillaceous, quartzose to salt and pepper, tight sandstone fragments.

1,540.00 to 1,545.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, platy to sub platy, micromicaceous, as clay shale, occasional fragments which swell or crack in water, slightly pyritic, soft to medium hard, commonly fissile, rare slickensides.

1,545.00 to 1,550.00 100% **SHALE**
(5.00) medium to dark brown, medium to dark gray, platy to blocky, micromicaceous, as clay shale, occasional fragments swell or crack in water, slightly carbonaceous, trace disseminated very fine pyrite, pyrite laminae or massive pyrite, soft to hard, commonly fissile, rare shear structures.

1,550.00 to 1,555.00 100% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, sub platy, occasionally subblocky to blocky, micromicaceous, as clay shale, locally with disseminated very fine or massive pyrite, rare fine grained, argillaceous, quartzose sandstone stingers.

1,555.00 to 1,560.00 100% **SHALE**
(5.00) medium to dark gray, platy to subblocky, micromicaceous, as clay shale, 5% of fragments silty & sandy, trace disseminated & massive pyrite, occasional fragments swell or crack in water, trace ironstone fragments, rare very fine pyrite laminae, trace light gray, white, consolidated, silty to very fine upper grained, tight sandstone fragments as stringers.

1,560.00 to 1,565.00 100% **SHALE**
(5.00) medium to dark brown gray, medium to dark gray, sub platy to subblocky, micromicaceous, as clay shale, occasional fragments crack or swell in water, soft to medium hard, commonly fissile, rare shear structures.

1,565.00 to 1,570.00 80% **SHALE**
(5.00) medium to dark gray, medium to dark gray brown, sub platy to subblocky, micromicaceous, carbonaceous,as clay shale, rare silty or sandy fragments, micromicaceous, trace disseminated or massive pyrite, 3% as cryptocrystalline ironstone fragments, non calcareous.

20% **SANDSTONE**
off white, light gray, light gray brown, light brown, consolidated, salt and pepper, with < 10-15% dark chert grains, fine grained, silty in part, poor to moderately sorted, subangular to subrounded, siliceous,trace calcite, argillaceous, patchy light brown, occasional white kaolin matrix, pyritic, no visible intergranular porosity, 6% kaolin matrix porosity.

1,570.00 to 1,575.00 100% **SHALE**
(5.00) medium to dark brown, medium to dark gray, sub platy to blocky, micromicaceous, predominately as clay shale, rare silty or sandy fragments, trace lower fine grained, off white, light gray, silty to fine upper grained, tight sandstone fragments & rare medium brown, cryptocrystalline ironstone fragments.

1,575.00 to 1,580.00 100% **SHALE**
(5.00) medium to dark brown commonly soft to medium hard, sub fissile to fissile, commonly medium to dark gray or black, platy to blocky, micromicaceous, carbonaceous, commonly firm, brittle, siliceous in part, slightly pyritic, 3% fine grained, light gray, siliceous, subangular to subrounded, moderately to well sorted, siliceous, tight, salt and pepper sandstone fragments.

1,580.00 to 1,585.00 90% **SHALE**
(5.00) medium to dark brown, medium to dark gray, sub platy to blocky, micromicaceous, occasional fragments swell in water, predominately as clay shale, 10% of fragments black & cherty.

10% **SANDSTONE**
light gray, off white, light brown, fine grained, occasional fragments with floating medium to very coarse lower quartz & chert grains, rare granules, conglomeratic in part, poor to moderately sorted, subangular to subrounded, siliceous & with silica overgrowths, slightly pyritic, spotty white or medium brown argillaceous cement, with < 20-30% chert grains, poor grain relief, slightly calcareous or dolomitic, tight, no shows.

1,585.00 to 1,590.00 90% **SHALE**
(5.00) predominately dark brown gray, occasionally black, platy to blocky, commonly firm & brittle, sub fissile, occasional medium hard & fissile fragments, occasional slickensides & stretched pyrite, trace medium brown ironstone fragments.

10% **SANDSTONE**
consolidated, light gray, light gray brown, fine grained, occasional fragments with floating lower medium grains, silty in part, subangular to subrounded, quartzose to salt and pepper, with< 20% chert grains, siliceous, pyritic, spotty light gray, light gray brown, off white argillaceous matrix, pyritic, dense & tight, poor grain relief, no shows.

1,590.00 to 1,595.00 100% **SHALE**
(5.00) medium to dark brown, sub platy to commonly blocky, commonly firm, brittle, occasionally sub fissile to fissile, micromicaceous, as clay shale, rare silty & sandy fragments, pyritic, occasional fragments with lense shaped pyrite, trace ironstone, 3-7% off white, light gray, fine grained, locally with floating medium to coarse quartz or chert grains, siliceous, pyritic, occasionally argillaceous, tight, salt and pepper sandstone fragments.

1,595.00 to 1,600.00 100% **SHALE**
(5.00) medium to dark brown gray, sub platy to commonly blocky, micromicaceous, occasionally greasy, as clay shale, commonly hard, brittle, sub fissile, scattered very fine disseminated & massive pyrite, 4% light gray, fine grained, siliceous, quartzose to salt and pepper, tight sandstone fragments, trace medium brown ironstone fragments.

1,600.00 to 1,605.00 100% **SHALE**
(5.00) medium to dark gray, occasionally blocky, sub platy to commonly blocky, soft to firm, fissile in part, predominately as clay shale, occasional fragments silty & sandy, occasional fragments crack or swell in water, micromicaceous, greasy, 2% fine grained, siliceous, hard, consolidated, tight, sandstone fragments.

1,605.00 to 1,610.00 100% **SHALE**
(5.00) medium to dark gray, black, micromicaceous, sub platy to blocky, commonly cracking or swelling in water, pyritic, as clay shale, occasional silt or sand grains, slightly carbonaceous, commonly soft & fissile in water.

1,610.00 to 1,615.00 100% **SHALE**
(5.00) medium brown gray, medium gray, dark brown gray, commonly very soft & fissile in water, commonly cracks & swell in water, as clay shale, rare slickenside surfaces, micromicaceous, greasy in part, trace medium brown ironstone fragments & light gray, predominately fine grained, salt and pepper, siliceous, sandstone fragments.

1,615.00 to 1,620.00 100% **SHALE**
(5.00) dark gray to blocky, platy to blocky, micromicaceous, commonly hard & brittle, 60% of fragments light brown gray, commonly bit-ground or swelled, friable, very soft, fissile in part, pyritic, non calcareous.

1,620.00 to 1,625.00 100% **SHALE**
(5.00) medium to dark gray, black, platy to blocky, micromicaceous, occasionally greasy, as clay shale, commonly soft & sub fissile to fissile, occasionally hard & brittle, commonly cracking or swelling in water, pyritic, scattered slickensides.

1,625.00 to 1,630.00 100% **SHALE**
(5.00) medium to dark gray, black, platy to blocky, micromicaceous, occasionally greasy, as clay shale, commonly soft & sub fissile to fissile, occasionally hard & brittle, commonly cracking or swelling in water, pyritic, trace fine grained, siliceous, tight sandstone stringers.

1,630.00 to 1,635.00 100% **SHALE**
(5.00) medium to dark gray, micromicaceous, occasionally greasy, as clay shale, occasional pyrite laminae, occasional slickensides, rare deformed pyrite inclusions, trace medium brown ironstone fragments, soft to hard, sbfi to brittle.

1,635.00 to 1,640.00 100% **SHALE**
(5.00) medium to dark brown gray, medium to dark gray, black, micromicaceous, rare greasy fragments, occasional fragments swell or crack in water, occasional slickenside surfaces, trace medium brown cryptocrystalline ironstone fragments, commonly soft to occasionally firm in water, sub fissile to fissile, occasionally brittle.

1,640.00 to 1,645.00 100% **SHALE**
(5.00) medium to dark gray, black, platy to subblocky, occasionally blocky, micromicaceous, occasional greasy fragments, as clay shale, commonly swelling or cracking in water, rare pyrite, occasional slickensides.

1,645.00 to 1,650.00 70% **SHALE**
(5.00) medium to dark gray, sub platy to occasionally blocky, micromicaceous, rare greasy fragments, slightly pyritic, occasional fragments crack or swell in water, trace medium brnn, cryptocrystalline ironstone fragments.

30% **SANDSTONE**
off white, very light brown, fine grained, rare fragments with floating lower medium grains, quartzose, subangular to subrounded, siliceous, with < 15% chert grains, commonly with light gray or off white argillaceous cement, rare carbonaceous grains, tight, very poor grain relief, no shows.

1,650.00 to 1,655.00 100% **SHALE**
(5.00) medium to dark gray, grading to black, micromicaceous, fragments crack or swell in water, trace disseminated & massive pyrite, 7% off white, fine grained, tight, siliceous, predominately quartzose, argillaceous, slightly pyritic. sandstone fragments.

1,655.00 to 1,660.00 100% **SHALE**
(5.00) medium to dark gray, grading to black, medium to dark brown, platy to blocky, micromicaceous, fragments commonly swelling or cracking in water, trace disseminated & massive pyrite, rare slickensides.

1,660.00 to 1,665.00 100% **SHALE**
(5.00) dark gray to black, platy to sub platy, rare blocky fragments, micromicaceous, slightly pyritic, carbonaceous, commonly firm & brittle, rare slickesides, rare light gray, silty to fine upper grained, consolidated, tight, siliceous, sandstone stringers or partings.

1,665.00 to 1,670.00 100% **SHALE**
(5.00) medium to dark gray, grading to black, dark gray brown, platy to subblocky, micromicaceous, as clay shale, soft to occasionally hard & fissile in water, slightly swelling or cracking in water, pyritic, rare shear structures.

1,670.00 to 1,675.00 100% **SHALE**
(5.00) medium to dark gray, occasionally blocky, platy to subblocky, micromicaceous, as clay shale, commonly soft, fissile, commonly cracking or swelling in water, rare hard & brittle fragments, trace pyrite, rare shear structures.

1,675.00 to 1,680.00 (5.00) 100% **SHALE**
medium to dark gray, black, platy to blocky, micromicaceous, rare greasy fragments, commonly soft & fissile, occasional hard & brittle fragments, as clay shale, fragments commonly cracking or welling in water, rare slickenside surfaces, trace medium brown ironstone fragments & rare quartzose, light gray, very fine siliceous siltstone fragments.

1,680.00 to 1,685.00 (5.00) 100% **SHALE**
medium to dark gray, grading to black, micromicaceous, rare greasy fragments, sub platy to subblocky, micromicaceous, soft to hard, fissile to brittle, abundant bit-ground light medium brown clay in sample.

1,685.00 to 1,690.00 (5.00) 80% **SHALE**
medium to dark gray, black, sub platy to blocky, micromicaceous, slightly pyrite, soft to hard, fissile to brittle, commonly cracking or swelling in water, rare slickensides.

20% **SANDSTONE**
consolidated, quartzose to salt and pepper, light gray, light gray brown, rare medium brown fragments, fine to occasionally upper medium grained, rare fragments with floating coarse light & dark chert grains, angular to subrounded, predominately with < 25% chert grains, medium grained fragments with < 30% chert grains, spotty calcareous cement, commonly siliceous & with silica overgrowths, with off white, gray brown argillaceous matrix, slightly bituminous, no visible intergranular porosity, slow, poor, faint yellow green streaming cut fluorescence.

1,690.00 to 1,695.00 (5.00) 90% **SHALE**
medium to dark gray, black, sub platy to blocky, micromicaceous, slightly pyrite, soft to hard, fissile to brittle, commonly cracking or swelling in water, rare slickensides.

10% **SANDSTONE**
consolidated, quartzose to salt and pepper, light gray, light gray brown, medium brown, fine to occasionally upper medium grained, rare fragments with floating coarse light & dark chert grains, angular to subrounded, predominately with < 25% chert grains, medium grained fragments with < 30% chert grains, spotty calcareous cement, commonly siliceous & with silica overgrowths, with off white, gray brown argillaceous matrix, rare fragments with 1-9% black bitumen plugged intergranular porosity, poor to good grain relief, traces of 1-5% visible intergranular porosity, slow, poor, faint yellow green streaming cut fluorescence.

1,695.00 to 1,700.00 (5.00) 100% **SHALE**
medium to occasionally dark gray,, sub platy to occasionally blocky, post-trip sample, as clay shale, rare silty or sandy fragments, micromicaceous, to occasionally greasy, soft to predominately hard & brittle, trace disseminated & massive pyrite, occasional fragments swell or crack in water, 5% off white, light gray, medium brown gray, very fine lower to fine lower grained, siliceous, argillaceous, tight, quartzose to salt and pepper sandstone fragments.

Imperial, MFS: 1,703.00 MD, 1,525.79 TVD, -844.09 SSL

1,700.00 to 1,705.00 100% (5.00) **SHALE**
medium to dl gray, medium to dark gray brown, platy to blocky, micromicaceous, as clay shale, rare silty or sandy fragments, fragments commonly crack or swell in water, carbonaceous, soft to hard, fissile to brittle, trace disseminated & massive pyrite, rare slickensides, trace gray, white, fine grained, subangular to subrounded, siliceous, argillaceous, tight quartzose to salt and pepper sandstone fragments.

1,705.00 to 1,710.00 100% (5.00) **SHALE**
medium to dark gray brown, medium to dark gray, platy to blocky, micromicaceous, fragments commonly crush easily, sub fissile to fissile, occasional hard & brittle fragments, slightly carbonaceous & as clay shale, rare slightly calcareous ironstone fragments, trace disseminated & massive pyrite, occasional fragments swell or crack in water, occasional greasy fragments, trace off white, light gray, silty to fine upper grained, tight, siliceous, argillaceous, salt and pepper sandstone fragments.

1,710.00 to 1,715.00 100% (5.00) **SHALE**
medium to dark gray, occasionally black, platy to subblocky, micromicaceous, as clay shale, trace disseminated & massive pyrite, occasional fragments crack in water, rare slickensides, commonly soft & sub fissile to fissile. trace medium brown ironstone fragments.

1,715.00 to 1,720.00 100% (5.00) **SHALE**
medium to dark gray, platy to subblocky, micromicaceous, as clay shale, soft to medium hard, sub fissile to fissile, trace disseminated & massive pyrite, micromicaceous, greasy in part, fragments commonly crack or swell in water, 6% as off white, light gray, very fine lower to very fine upper grained, locally to fine upper grained, moderately sorted, subangular to subrounded, tight, siliceous, argillaceous, sandstone fragments.

1,720.00 to 1,725.00 100% (5.00) **SHALE**
medium to dark gray, platy to subblocky, micromicaceous, as clay shale, commonly soft, fissile, sub fissile, slightly carbonaceous, trace disseminated & massive pyrite, no shear structures.

1,725.00 to 1,740.00 100% (15.00) **SHALE**
medium to dark gray, medium to dark brown gray, platy to occasionally subblocky, micromicaceous, as clay shale, rare greasy fragments, commonly soft, fissile to semi fissile, occasional fragments swell or crack in water, rare pyritic fragments.

1,740.00 to 1,745.00 100% (5.00) **SHALE**
medium to dark gray, platy to occasionally subblocky, micromicaceous, as clay shale, rare pyrite, soft, sub fissile to fissile, no shear structures, occasional fragments crack or swell in water.

1,745.00 to 1,750.00 100% (5.00) **SHALE**
medium to dark gray, 15% light gray brown, micromicaceous, carbonaceous, slightly pyritic, predominately as clay shale, commonly soft, fissile to subfissile, occasional fragments slightly silty or sandy, rare siltstone & ironstone fragments.

1,750.00 to 1,755.00 100% (5.00) **SHALE**
medium to dark gray, sub platy to occasionally subblocky, micromicaceous, as clay shale, trace disseminated & massive pyrite, occasional fragments crack or swell in water, soft, sub fissile to fissile, 3-4% ironstone & rare off white, light gray, siliceous siltstone & silty to very fine lower grained, tight, quartzose sandstone fragments.

1,755.00 to 1,760.00 100% (5.00) **SHALE**
light to dark gray, platy to occasionally subblocky, micromicaceous, as clay shale, occasional silty fragments, slightly carbonaceous, slightly swelling or crackng in water, rare light gray siltstone & medium brown ironstone fragments.

1,760.00 to 1,765.00 100% (5.00) **SHALE**
medium to dark gray, platy to occasionally subblocky, micromicaceous, 20% of fragments silty or sandy, commonly soft, sub fis- to fissile, trace off white, silty to very fine upper grained, siliceous, very fine sandstone stringers,.

1,765.00 to 1,770.00 100% (5.00) **SHALE**
medium to dark gray, platy, sub platy, rare blocky fragments, soft, commonly fissile, semi fissile, fragments swell or crack in water, slightly carbonaceous, no shear structures, non calcareous.

1,770.00 to 1,780.00 100% (10.00) **SHALE**
medium to dark gray,15-25% light gray brown, sub platy to subblocky, micromicaceous, as clay shale, commonly soft, sub fissile to fissile, trace disseminated & massive pyrite, trace ironstone or light gray, silty to very fine lower grained silty sandstone fragments, slightly carbonaceous, non calcareous.

1,780.00 to 1,785.00 100% (5.00) **SHALE**
medium to dark gray, platy to subblocky, micromicaceous, soft, fissile to sub fissile, trace disseminated & occasional massive pyrite, 3% fractured ironstone fragments & rare light gray, off white siltstone fragments.

1,790.00 to 1,795.00 100% (5.00) **SHALE**
medium to dark gray, platy to subblocky, micromicaceous, as clay shale, occasional slightly silty, sandy, locally chalky & slightly calcareous, or carbonaceous fragments, 10-15% light gray, argillaceous, commonly soft siltstone fragments & rare medium brown ironstone fragments, no shear structures, rare pyrite.

1,795.00 to 1,800.00 100% (5.00) **SHALE**
medium to dark gray, platy to subblocky, micromicaceous, as clay shale, trace very fine disseminated carbonaceous flakes, soft, fissile, occasional fragments swell or crack in water, trace light gray, commonly soft, argillaceous, siltstone fragments, slightly chalky & calcareous.

1,800.00 to 1,805.00 100% **SHALE**
(5.00) medium to dark gray, platy to occasionally subblocky, micromicaceous, carbonaceous, slightly silty or sandy, trace light gray, off white, commonly argillaceous, tight, soft siltstone fragments, rare ironstone.

1,805.00 to 1,810.00 100% **SHALE**
(5.00) medium to dark gray, platy to subblocky, micromicaceous, as clay shale, rare silty or sandy fragments, soft fissile, trace pyrite, occasional fragments crack or swell in water, trace ironstone, siltstone & rare very fine lower grained, tight sandstone fragments.

1,810.00 to 1,815.00 100% **SHALE**
(5.00) light to dark gray, sub platy to subblocky, micromicaceous, as clay shale, slightly swelling in water, soft, sub fissile to fissile, 5% as off white, sandy, argillaceous, tight siltstone.

1,815.00 to 1,820.00 100% **SHALE**
(5.00) light to dark gray, platy to blocky, micromicaceous, as clay shale, trace disseminated very fine carbonaceous flakes, soft, sub fissile to fissile, trace massive & disseminated pyrite, slightly calcareous, 4% as light gray, light gray brown, off white, silty to very fine upper grained, sandstone & sandy siltstone fragments.

1,820.00 to 1,825.00 100% **SHALE**
(5.00) light to dark gray, platy to blocky, micromicaceous, as clay shale, trace disseminated very fine carbonaceous flakes, soft, sub fissile to fissile, trace massive & disseminated pyrite, slightly calcareous, 5% as light gray, light gray brown, off white, silty to fine upper grained, sandstone & sandy siltstone fragments, trace ironstone.

1,825.00 to 1,830.00 90% **SHALE**
(5.00) light to dark gray, platy to blocky, micromicaceous, as clay shale, trace disseminated very fine carbonaceous flakes, soft, sub fissile to fissile, trace massive & disseminated pyrite, slightly calcareous.

10% **SANDSTONE**
medium brown, quartzose, fine to medium grained, subangular to subrounded, siliceous, with overgrowths, moderately sorted, commonly with brown argillaceous, bitumen stained matrix, slightly pyritic, no visible porosity, matrix porosity?, weak yellow green rapid blooming cut fluorescence.

1,830.00 to 1,835.00 90% **SHALE**
(5.00) light to dark gray, platy to subblocky, micromicaceous, as clay shale, soft to medium hard, commonly fissile, slightly pyritic.

1,830.00 to 1,835.00 10% (5.00) **SANDSTONE**
light gray, light to medium brown, consolidated, salt and pepper, fine grained, occasional fine to coarse lower grained fragments, subangular to subrounded, angular in part. poor to moderately sorted, slightly calcareous & dolomitic, sideritic, siliceous, commonly with rare white, commonly medium brown in part bitumen stained argillaceous matrix, slightly pyritic, siliceous, no visible intergranular porosity, rare fragments with 1-4% trapped intergranular dead bitumen, very weak, very poor, slow yellow green blooming curt fluorescence, poor resevoir.

1,835.00 to 1,840.00 90% (5.00) **SHALE**
light to dark gray, sub platy to subblocky, micromicaceous, slightly carbonaceous, occasional fragments crack or swell in water, occasional slightly silty, sandy or carbonaceous fragments, commonly soft & fissile, trace disseminated & massive pyrite.

10% **SANDSTONE**
consolidated, light gray, occasionally medium brown bitumen stained, fine grained, commonly very fine lower to very fine upper grained, subangular to subrounded, angular in part, moderately to well sorted, commonly with gray brown, off white, light to medium brown dead bitumen stained argillaceous matrix, siliceous, slightly calcareous, dolomitic or sideritic, no visible intergranular porosity, occasional 1-5% brown dead bitumen plugged intergranular porosity with very weak, poor yellow green blooming cut fluorescence, poor reservoir.

1,840.00 to 1,845.00 85% (5.00) **SHALE**
light to dark gray, sub platy to subblocky, micromicaceous, slightly carbonaceous, occasional fragments crack or swell in water, occasional slightly silty, sandy or carbonaceous fragments, commonly soft & fissile, trace disseminated & massive pyrite.

15% **SANDSTONE**
consolidated, salt and pepper, sideritic brown, off white, light gray, gray brown, fine to coarse lower grained, subangular to subrounded, angular in part, rare light gray chert granules, poor to moderately sorted,. with 20 to rare 80% white, gray, brown chert grains, slightly calcareous, sideritic, commonly siliceous, slightly pyritic, commonly with gray brown, light brown, occasionally off white kaolinitic argillaceous matrix, spotty disseminated medium brown dead bitumen staining, rare fragments with black intergranular dead bitumen, 1-12% black bitumen plugged & kaolin plugged intergranular porosity, no visible intergranular porosity & with poor grain relief, no cut fluorescence.

1,845.00 to 1,850.00 40% (5.00) **SANDSTONE**
consolidated, salt and pepper, off white, light brown, light gray brown, fine to coarse lower grained, subangular to subrounded, angular in part, rare chert granules & in part as matrix supported conglomeratic sandstone, poor to moderately sorted, siliceous, slightly calcareous, predominately with light gray, light gray brown,medium brown, occasionally white & kaolinitic argillaceous matrix, poor reservoir, occasional fragments with 1-9% black bitumen plugged intergranular porosity, kaolin matrix porosity? very poor, weak yellow green blooming cut fluorescence.

1,845.00 to 1,850.00 (5.00)	25%	**SHALE** light to dark gray, sub platy to subblocky, micromicaceous, slightly carbonaceous, occasional fragments crack or swell in water, occasionally slightly silty, sandy or carbonaceous fragments, commonly soft & fissile, trace disseminated & massive pyrite.
1,850.00 to 1,855.00 (5.00)	80%	**SHALE** light to dark gray, medium brown, platy to subblocky, micromicaceous, slightly carbonaceous, as clay shale, commonly soft & fissile.
	20%	**SANDSTONE** off white, light to medium brown, predominately silty to very fine upper grained, occasionally fine upper to coarse lower grained, silty in part, poorly sorted, commonly with light brown, brown gray argillaceous matrix, siliceous, slightly calcareous, sideritic, pyritic, carbonaceous, with no visible intergranular porosity, no cut fluorescence.
1,855.00 to 1,860.00 (5.00)	75%	**SANDSTONE** consolidated, light gray brown, salt and pepper, predominately silty to fine lower grained, commonly with floating medium to coarse lower quartz or chert grains, poor to moderately sorted, subangular to subrounded, angular in part, slightly calcareous, siliceous, commonly with off white, light gray, light to medium brown in part dead bitumen stained argillaceous matrix, no visible intergranular porosity, weak rapid yellow green blooming cut fluorescence,
	25%	**SHALE** light to dark gray, medium to dark brown, sub platy, micromicaceous, slightly pyritic.
1,860.00 to 1,865.00 (5.00)	90%	**SHALE** medium brown, dark gray, sub platy to blocky, micromicaceous, firm, brittle, sub fissile, trace disseminated & massive pyrite, rare pyrite laminae, trace medium brown ironstone fragments.
	10%	**SANDSTONE** post-trip sample, off white, light gray, silty to fine upper grained, subangular to subrounded, quartzose, with poor grain relief, spotty calcareous cement, commonly with light gray, off white argillaceous matrix, siliceous, locally pyritic, tight, no shows.
1,865.00 to 1,870.00 (5.00)	100%	**SHALE** 35% medium to dark gray, platy to subblocky, micromicaceous, soft to firm, brittle to sub fissile, slightly pyritic, as clay shale, predominately light to medium brown, silty, sandy, grading to poorly sorted, silty to fine lower grained, very argillaceous, silty sandstone, carbonaceous, slightly pyritic, tight, no shows.

1,870.00 to 1,875.00 100% **SHALE**
(5.00) 10-15% dark gray, platy to occasionally blocky, micromicaceous, predominately medium brown, platy to blocky, micromicaceous, locally pyritic, commonly silty, sandy, carbonaceous, soft, grading in part to poorly sorted, very argillaceous, silty to fine lower grained, carbonaceous, predominately soft sandstone, rare light to medium brown, fine to medium grained, very firm, consolidated, salt and pepper, subangular to subrounded, angular in part, tight, argillaceous, pyritic, slightly calcareous,, siliceous, sandstone fragments.

1,875.00 to 1,880.00 100% **SHALE**
(5.00) medium brown, 7% dark brown or medium to dark gray, commonly silty & sandy, slightly carbonaceous, non swelling, 10% as light to medium gray brown, silty to predominately fine lower grained, argillaceous, tight, commonly soft sandstone fragments.

1,880.00 to 1,885.00 100% **SHALE**
(5.00) medium brown, 7% dark brown or medium to dark gray, commonly silty & sandy, slightly carbonaceous, non swelling, 10% as light to medium gray brown, silty to predominately fine lower grained, argillaceous, tight, commonly soft sandstone fragments, rare ironstone fragments.

1,885.00 to 1,890.00 100% **SHALE**
(5.00) medium brown, platy to blocky, micromicaceous, sub platy, slightly pyritic, soft to commonly medium hard, brittle to sub fissile, slightly pyritic, commonly slightly silty, sandy or carbonaceous, 7% light gray, silty to very fine upper grained, argillaceous, tight, quartzose sandstone fragments, rare slickensides (PDC generated?).

1,890.00 to 1,895.00 75% **SHALE**
(5.00) medium to dark brown, sub platy to blocky, micromicaceous, occasional slightly silty & sandy fragments, predominately as clay shale, trace pyrite, no visible shear structures.

25% **SANDSTONE**
light gray, light to medium brown, silty to coarse lower grained, subangular to subrounded, angular in part, poor to moderately sorted, quartzose to salt and pepper, occasional fragments with 40% light & dark chert grains, calcareous, siliceous, slightly pyritic, commonly with light gray, gray brown, light to medium brown in part dead bitumen stained argillaceous matrix, no visible intergranular porosity, no cut fluorescence.

1,895.00 to 1,900.00 75% **SANDSTONE**
(5.00) light to medium brown gray, occasionally light gray, silty to coarse lower grained, subangular to subrounded, angular in part, poor to moderately sorted, quartzose to salt and pepper, occasional fragments with 40% light & dark chert grains, calcareous, siliceous, slightly pyritic, commonly with light gray, gray brown, light to medium brown in part dead bitumen stained argillaceous matrix, no visible intergranular porosity, no cut fluorescence.

25% **SHALE**
medium to occasionally dark brown, rare black fragments, micromicaceous, slightly carbonaceous, occasional silty or sandy fragments, no visible shear structures, slightly carbonaceous, rare fragments crack in water.

1,900.00 to 1,905.00 (5.00) 60% **SANDSTONE**
consolidated, salt and pepper, light gray brown, medium brown, light gray, silty to fine upper grained, occasional medium grained fragments, occasional fragments with floating coarse chert grains, trace granules, subangular to subrounded, angular in part, with < 35% off white, medium brown, gray chert grains, commonly with light gray, off white (kaolin?), argillaceous matrix, slightly calcareous, siliceous, pyritic, spotty 1-6% black intergranular black dead bitumen, no visible porosity, weak, rapid yellow green, blooming cut fluorescence, very poor reservoir, kaolin matrix porosity?

40% **SHALE**
medium to occasionally dark brown, platy to subblocky, micromicaceous, trace disseminated & massive pyrite, occasionally slightly silty or sandy, soft to medium hard, commonly fissile.

1,905.00 to 1,910.00 (5.00) 80% **SANDSTONE**
consolidated, salt and pepper, light gray, light gray brown, fine to medium grained, occasional fragments with floating coarse quartz & chert grains, rare granules, conglomeratic in part, subangular to subrounded, angular in part, siliceous, firm, non calcareous, commonly with light gray, light brown, off white argillaceous matrix, kaolin matrix porosity?, slightly pyritic, fragments commonly with 1-7% black, dead, bitumen plugged intergranular porosity, no visible porosity, slow poor, yellow green blooming cut fluorescence.

20% **SHALE**
medium brown, sub platy to occasionally blocky, micromicaceous, occasional fragments swell in water, slightly carbonaceous, trace disseminated & massive pyrite.

1,910.00 to 1,915.00 (5.00) 80% **SANDSTONE**
consolidated, light brown, light gray brown, quartzose to salt and pepper, fine to medium grained, rare floating coarse chert grains, trace granules, slightly calcareous, siliceous & with silica overgrowths, slightly pyritic, commonly with off white, light gray, light gray brown argillaceous matrix, carbonaceous, occasional fragments with 1-6% black bitumen plugged intergranular porosity, poor reservoir, weak, rapid, yellow green blooming cut fluorescence.

20% **SHALE**
medium brown, sub platy to subblocky, micromicaceous, pyritic, carbonaceous, occasionally slightly silty or sandy.

1,915.00 to 1,920.00 (5.00) 70% **SANDSTONE**
consolidated, off white, very light brown, quartzose to salt and pepper, fine to upper medium grained, occasional fragments with floating coarse chert grains, subangular to subrounded, angular in part, slightly calcareous, siliceous, slightly pyritic, commonly with off white, very light gray brown argillaceous matrix, friable to firm, with silica overgrowths, poor grain relief, 9-12% kaolin matrix porosity, no visible intergranular porosity, very slow poor yellow green blooming cut fluorescence.

30% **SHALE**
medium brown, platy to blocky, micromicaceous, occasional fragments silty & sandy, trace disseminated & massive pyrite, no visible shear structures.

1,920.00 to 1,925.00 (5.00) 80% **SANDSTONE**
consolidated, salt and pepper, off white, light brown, fine to medium grained, commonly with floating coarse light & dark chert grains, rare granules, conglomeratic in part & matrix supported, subangular to subrounded, angular in part, with poor grain relief, slightly calcareous, siliceous & locally with silica overgrowths, slightly pyritic, commonly with off white, light gray, light gray brown argillaceous (in part kaolinitic) matrix, rare fragments swelling and falling apart in water, poor grain relief, no visible intergranular porosity, 6-9% kaolin matrix porosity, weak yellow green, rapid blooming & streaming cut fluorescence.

20% **SHALE**
medium brown, platy to blocky, micromicaceous, occasional fragments silty & sandy, trace disseminated & massive pyrite, no visible shear structures.

1,925.00 to 1,930.00 (5.00) 90% **SANDSTONE**
off white, light brown, consolidated, salt and pepper, fine to medium grained, occasional fragments with floating coarse quartz & chert grains, rare chert granules, conglomeratic & in part matrix supported, subangular to subrounded, angular in part, poor to moderately sorted, slightly calcareous, soft to firm, siliceous, slightly pyritic, commonly with off white, light gray brown, occasionally swelling argillaceous matrix, kaolinitic, slightly carbonaceous, no visible intergranular porosity, predominately with poor grain relief, very weak poor yellow green blooming cut fluorescence, 9-12% kaolin matrix porosity.

1,930.00 to 1,935.00 (5.00) 80% **SANDSTONE**
off white, light brown, consolidated, salt and pepper, fragments commonly swell & fall apart in water, fine to medium grained, rare coarse grained fragments, rare granules, conglomeratic in part & matrix supported, subangular to subrounded, angular in part, poor to moderately sorted, slightly calcareous, siliceous, soft & friable to firm, siliceous, pyritic, slightly carbonaceous, commonly with off white swelling or light gray argillaceous matrix, with poor grain relief, poor reservoir, 1-12% kaolin matrix porosity, no visible intergranular porosity, no cut fluorescence.

20% **SHALE**
medium brown, occasional medium to dark gray fragments, sub platy to blocky, micromicaceous, pyritic, occasional silty & sandy fragments.

1,935.00 to 1,940.00 (5.00) 80% **SANDSTONE**
off white, light brown, consolidated, salt and pepper, fine to medium grained, rare silty fragments or fragments with floating coarse chert grains, subangular to subrounded, angular in part, poor to moderately sorted, slightly calcareous, siliceous, soft & friable to firm, siliceous, pyritic, slightly carbonaceous, commonly with off white or light gray argillaceous matrix, occasional fragments swell in water, spotty questionable white kaolin, rare carbonaceous grains, with poor grain relief, poor reservoir, kaolin matrix?, no visible intergranular porosity, no cut fluorescence.

20% **SHALE**
medium brown, occasional medium to dark gray fragments, sub platy to blocky, micromicaceous, pyritic, occasional silty & sandy fragments.

1,940.00 to 1,945.00 (5.00) 80% **SANDSTONE**
off white, light brown, consolidated, salt and pepper, silty to lower medium grained, occasional fragments with floating upper medium to coarse quartz & chert grains, trace fractured chert granules, conglomeratic in part & matrix supported, subangular to subrounded, angular in part, poor to moderately sorted, slightly calcareous, siliceous, soft & friable to firm, siliceous, pyritic, slightly carbonaceous, commonly with off white or light gray, light gray brown argillaceous matrix, spotty questionable white kaolin, rare carbonaceous grains, predominately with poor grain relief, rare fragments with silica druse, poor reservoir, spotty 9% kaolin matrix porosity, no visible intergranular porosity,very weak, poor rapid, yellow green blooming cut fluorescence.

20% **SHALE**
medium brown, platy, occasionally subblocky, micromicaceous, commonly slightly silty, sandy, commonly carbonaceous, soft, sub fissile to fissile., micromicaceous, occasionally cracking in water.

1,945.00 to 1,950.00 (5.00) 90% **SANDSTONE**
off white, light brown, consolidated, salt and pepper, fine to upper medium grained, silty in part, occasional fragments with floating coarse quartz & chert grains, trace fractured chert granules, conglomeratic in part & matrix supported, subangular to subrounded, angular in part, poor to moderately sorted, slightly calcareous, siliceous, soft & friable to firm, pyritic, slightly carbonaceous, commonly with off white or light gray, light gray brown argillaceous matrix, spotty questionable white kaolin, rare carbonaceous grains, with poor grain relief, poor reservoir, 9% kaolin matrix porosity, no visible intergranular porosity, no cut fluorescence.

10% **SHALE**
medium to dark brown, platy to occasionally subblocky, micromicaceous, greasy, pyritic, carbonaceous, occasionally silty & sandy, occasional fragments crack in water.

1,950.00 to 1,955.00 (5.00) 80% **SANDSTONE**
off white, light brown, consolidated, salt and pepper, silty to lower medium grained, occasional upper medium grained fragments or fragments with floating coarse quartz & chert grains, trace fractured chert granules, conglomeratic in part & matrix supported, subangular to subrounded, angular in part, poor to moderately sorted, slightly calcareous, siliceous, soft & friable to firm, siliceous, pyritic, slightly carbonaceous, commonly with off white or light gray, light gray brown argillaceous matrix, spotty white kaolin, rare carbonaceous grains, with poor grain relief, poor reservoir, 1-9% kaolin matrix porosity, no visible intergranular porosity,very weak, poor rapid, yellow green blooming cut fluorescence.

20% **SHALE**
medium to occasionally dark brown, sub platy to subblocky, micromicaceous, carbonaceous, pyritic, slightly swelling in water, occasional silty & sandy fragments.

1,955.00 to 1,960.00 (5.00) 70% **LIGHT CHERT CONGLOMERATE**
40% of fragments as white, gray, yellow, light blue, brown, rare black, unconsolidated coarse chert grains & granules, clast supported, sandstone matrix off white, light gray, light gray brown, fine to coarse lower grained, subangular to subrounded, angular in part, occasionally to very coarse upper, siliceous, commonly with off white, light gray argillaceous matrix, rare pyrite, predominately non calcareous, trace black dead intergranular bitumen, no visible intergranular porosity, very weak, 6-9% kaolin matrix porosity, very poor, yellow green blooming cut fluorescence, poor reservoir.

30% **SHALE**
medium to occasionally dark brown, sub platy to subblocky, micromicaceous, carbonaceous, pyritic, slightly swelling in water, occasional silty & sandy fragments.

1,960.00 to 1,965.00 (5.00) 25% **SHALE**
medium to dark gray, sub platy to blocky, as clay shale, non swelling, pyritic, 5% medium brown, sub platy to blocky, micromicaceous, occasionally silty & sandy, pyritic.

1,965.00 to 1,970.00 (5.00) 100% **SHALE**
medium brown, platy to subblocky, 7% dark brown, carbonaceous, & commonly blocky, micromicaceous, trace disseminated pyrite, 5-10% of fragments crack or swell in water, soft to medium hard, fissile to occasionally brittle, non calcareous, < 10% of fragments silty & sandy, grading in part to very poorly sorted, medium brown gray, silty to very fine lower grained, locally fine lower grained, argillaceous, tight, pyritic, slightly carbonaceous, pyritic, salt and pepper sandstone & sandy siltstone, no shows.

75% **LIGHT CHERT CONGLOMERATE**
25% as fractured off white, light gray, rare yellow, coarse chert grains & chert granules, conglomeratic, clast supported in part, sandstone matrix off white, light gray brown, fine to occasionally medium grained, rare fragments with floating coarse chert grains, subangular to subrounded, angular in part, slightly calcareous, siliceous, rare pyrite, commonly with off white, light gray brown, light gray argillaceous matrix, friable to occasionally firm, occasionally with carbonaceous grains, no visible intergranular porosity, rare fragments with 6-9% kaolin matrix porosity?, very weak, very poor yellow green blooming cut fluorescence.

1,970.00 to 1,975.00 (5.00) 80% **LIGHT CHERT CONGLOMERATE**
25% as fractured off white, light gray, coarse chert grains & chert granules, conglomeratic, clast supported in part, sandstone matrix off white, light gray brown, fine to occasionally medium grained, rare fragments with floating coarse chert grains, subangular to subrounded, angular in part, slightly calcareous, siliceous, rare pyrite, commonly with off white, light gray brown, light gray argillaceous matrix, friable to occasionally firm, occasionally with carbonaceous grains or flakes, predominately with no visible intergranular porosity, rare silica druse crystals, trace 6-9% kaolin matrix porosity & rare intergranular porosity, very weak, very poor yellow green blooming cut fluorescence.

1,970.00 to 1,975.00 (5.00) 20% **SHALE**
medium to dark gray, black, sub platy to commonly blocky, firm, micromicaceous, greasy, as clay shale, very firm, slightly siliceous, in part medium brown, platy to blocky, micromicaceous, carbonaceous, pyritic, occasionally silty & sandy.

1,975.00 to 1,985.00 (10.00) 80% **CONGLOMERATE**
25% as fractured off white, light gray, occasionally medium brown, rare black, coarse chert & chert granules, conglomeratic, clast supported in part, sandstone matrix off white, light gray brown, fine to occasionally medium grained, rare fragments with floating coarse chert grains, subangular to subrounded, angular in part, slightly calcareous, siliceous, rare pyrite, commonly with off white, light gray brown, light gray argillaceous matrix, friable to occasionally firm, occasionally with carbonaceous grains or flakes, predominately with no visible intergranular porosity, rare silica druse crystals, 6-9% intergranular & kaolin plugged matrix porosity, very weak, very poor yellow green blooming cut fluorescence.

20% **SHALE**
dark gray to black, sub platy to blocky, micromicaceous, greasy, hard, brittle, in part medium brown, sub platy to blocky, micromicaceous, occasionally silty & sandy, soft, sub fissile to fissile.

1,985.00 to 1,990.00 (5.00) 100% **CONGLOMERATE**
20-25% as unconsolidated subrounded to rounded coarse chert & granules, conglomeratic, matrix to clast supported, sandstone matrix off white, light brown gray, salt and pepper, fine to occasionally medium to coarse lower grained, subangular to subrounded, angular in part, slightly calcareous, locally siliceous & with silica overgrowths, commonly with off white, light to occasionally medium brown argillaceous matrix, rare pyrite, questionable glauconite, poor grain relief, rare druse and large twinned euhedral quartz crystals, 6-9% intergranular & kaolin matrix porosity, weak, slow yellow green blooming cut fluorescence, predominately as poor reservoir, 10% medium brown, rare dark brown gray, platy to blocky, shale fragments.

1,990.00 to 1,995.00 (5.00) 100% **CONGLOMERATE**
20-25% as unconsolidated subrounded to rounded, white, occasionally light gray, yellow, rare black coarse chert grains & granules, conglomeratic, matrix to clast supported, sandstone matrix off white, light brown gray, salt and pepper, fine to occasionally medium to coarse lower grained, subangular to subrounded, angular in part, slightly calcareous, locally siliceous & with silica overgrowths, commonly with off white, light to occasionally medium brown argillaceous matrix, rare pyrite, poor grain relief, rare siliceous druse, fragments commonly with no visible intergranular porosity, 6-9% rare intergranular & kaolin matrix porosity, very weak, slow yellow green blooming cut fluorescence, predominately as poor reservoir, 20% medium brown, rare dark brown gray, platy to blocky, shale fragments.

1,995.00 to 2,000.00 100% (5.00) **CONGLOMERATE**
30-35% as unconsolidated subrounded to rounded, white, occasionally light gray, yellow, rare black coarse chert grains & granules, conglomeratic, matrix to clast supported, sandstone matrix off white, light brown gray, salt and pepper, fine to occasionally medium to coarse lower grained, subangular to subrounded, angular in part, slightly calcareous, locally siliceous & with silica overgrowths, commonly with off white, light to occasionally medium brown argillaceous matrix, rare pyrite, poor grain relief, fragments commonly with no visible intergranular porosity, 6-9% kaolin matrix porosity, very weak, slow yellow green blooming cut fluorescence, predominately as poor reservoir, 20% medium brown, rare dark brown gray, platy to blocky, shale fragments.

2,000.00 to 2,005.00 100% (5.00) **SANDSTONE**
consolidated, off white, light gray brown, salt and pepper, fine to occasionally medium grained, occasional fragments with floating coarse or rare granules,trace coarse grained fragments, in part conglomeratic & matrix supported, subangular to subrounded, angular in part, slightly calcareous, commonly siliceous, friable to firm, grains occasionally sutured, siliceous & with silica overgrowths, commonly with off white, occasionally light gray brown argillaceous matrix, clay swelling in acid, rare pyrite, 3-7% kaolin matrix porosity, commonly tight, with < 60% light to medium gray, light brown, off white chert grains, no visible intergranular porosity, weak slow yellow green blooming cut fluorescence, 15% medium brown, platy to blocky, silty, sandy, carbonaceous shale fragments.

2,005.00 to 2,010.00 100% (5.00) **LIGHT CHERT CONGLOMERATE**
50% of fragments as fractured white, light gray, light brown coarse chert grains & chert granules, commonly clast supported, sandstone matrix off white, light gray brown, fine to medium, rare coarse lower grained, subangular to subrounded, angular in part, salt and pepper, slightly calcareous, siliceous, slightly pyritic, with off white, light gray brown argillaceous matrix, kaolinitic, trace black carbonaceous grains, flakes, 3-9% kaolin matrix porosity, no visible intergranular porosity, poor reservoir, no cut fluorescence.

2,010.00 to 2,015.00 100% (5.00) **SANDSTONE**
consolidated, off white, light to medium brown, salt and pepper, fine to occasionally medium grained, occasional fragments with floating coarse chert grains, 10% as chert granules & conglomeratic, trace coarse grained fragments, in part conglomeratic & matrix supported, subangular to subrounded, angular in part, slightly calcareous, commonly siliceous, friable to firm, grains occasionally sutured, siliceous & with silica overgrowths, commonly with off white, occasionally light gray brown argillaceous matrix, rare pyrite, 3-7% white kaolin matrix porosity, commonly tight, with < 60% light to medium gray, light brown, off white chert grains, no visible intergranular porosity, weak slow yellow green blooming cut fluorescence, 15-20% medium brown, platy to blocky, silty, sandy, carbonaceous shale fragments.

2,015.00 to 2,020.00 100% **CONGLOMERATE**
(5.00) 35% of fragments as fractured white, light gray, rare light brown, coarse chert grains & chert granules, clast to matrix supported, sandstone matrix off white, predominately light gray brown, fine to medium, rare coarse lower grained, subangular to subrounded, angular in part, salt and pepper, slightly calcareous, siliceous, slightly pyritic, with off white, light gray brown argillaceous matrix, trace black carbonaceous grains, flakes, no visible intergranular porosity, 3-7% kaolin matrix porosity, poor reservoir, very weak, poor yellow green blooming cut fluorescence, 20% medium brown, platy to subblocky, commonly silty, sandy shale.

2,020.00 to 2,025.00 70% **CONGLOMERATE**
(5.00) predominately as fractured white, light gray, coarse chert grains & chert granules, clast to matrix supported, sandstone matrix off white, predominately light gray brown, fine to medium, rare coarse lower grained, subangular to subrounded, angular in part, salt and pepper, slightly calcareous, siliceous, slightly pyritic, with off white, light gray brown argillaceous matrix, trace black carbonaceous grains, flakes, kaolinitic, no visible intergranular porosity, poor reservoir, 3-9% kaolin matrix porosity, very weak, poor yellow green blooming cut fluorescence.

30% **SHALE**
light to medium brown, carbonaceous, silty, sandy, pyritic, occasional fragments crack in water, commonly light gray brown, carbonaceous, very silty & sandy & grading to silty to sandy, very argillaceous, carbonaceous shale.

2,025.00 to 2,030.00 75% **CONGLOMERATE**
(5.00) predominately as fractured white, light gray, coarse chert grains & chert granules, clast to matrix supported, sandstone matrix off white, predominately light gray brown, fine to medium, rare coarse lower grained, subangular to subrounded, angular in part, salt and pepper, slightly calcareous, siliceous, slightly pyritic, with off white, light gray brown argillaceous matrix, kaolinitic, trace black carbonaceous grains, flakes, no visible intergranular porosity, 3-9% kaolin matrix porosity, poor reservoir, very weak, poor yellow green blooming cut fluorescence.

25% **SHALE**
medium brown, platy to blocky, micromicaceous, carbonaceous, commonly silty, sandy, pyritic, occasionally swelling in water.

2,030.00 to 2,035.00 100% **SHALE**
(5.00) medium brown, platy to blocky, micromicaceous, carbonaceous, commonly with very fine disseminated pyrite, slightly carbonaceous, fragments commonly crack or swell in water, 8% very light gray brown, occasionally off white, very fine lower to fine upper grained, subangular to subrounded, soft, argillaceous, tight salt and pepper sandstone fragments.

2,035.00 to 2,040.00 100% **SHALE**
(5.00) medium brown, platy to blocky, micromicaceous, commonly soft & fissile, trace very fine disseminated pyrite, commonly cracking or swelling in water, carbonaceous, slightly silty & sandy, 8% light gray brown, silty to very fine upper grained, carbonaceous, argillaceous, soft, tight, quartzose to salt and pepper sandstone fragments, trace conglomeratic sandstone carryover.

2,040.00 to 2,045.00 (5.00) 90% **SHALE**
medium brown, platy to blocky, micromicaceous, commonly soft & fissile, trace very fine disseminated pyrite, commonly cracking or swelling in water, carbonaceous, slightly silty & sandy.

10% **SANDSTONE**
light to medium brown gray, consolidated, salt and pepper, silty to fine lower grained, subangular to subrounded, commonly with light gray, light gray brown argillaceous cement, soft, friable, non calcareous, tight.

2,045.00 to 2,050.00 (5.00) 70% **SHALE**
medium brown, platy to subblocky, micromicaceous, carbonaceous, trace disseminated very fine pyrite, occasional fragments crack in water, occasional silty or sandy fragments.

30% **SANDSTONE**
consolidated, salt and pepper, with < 20% chert grains, off white, light gray, silty to fine upper grained, subangular to subrounded, slightly calcareous, siliceous, slightly pyritic, with light gray, off white kaolin argillaceous matrix, 6% kaolin matrix porosity, no visible porosity, poor grain relief, no shows.

2,050.00 to 2,055.00 (5.00) 50% **SHALE**
medium brown, sub platy, micromicaceous, slightly pyritic, carbonaceous, occasionally silty & sandy, commonly as clay shale, occasional fragments crack in water.

50% **SANDSTONE**
consolidated, salt and pepper, with < 20% chert grains, off white, light gray, silty to fine upper grained, subangular to subrounded, slightly calcareous, siliceous, slightly pyritic, with light gray, off white argillaceous matrix, tight, poor grain relief, no shows, rare off white, salt and pepper, medium to coarse lower grained, moderately sorted, siliceous, slightly calcareous, slightly argillaceous sandstone fragments with 1-5% visible intergranular porosity & rare silica druse, weak, poor, slow yellow green blooming cut fluorescence.

2,055.00 to 2,060.00 (5.00) 80% **SHALE**
medium brown, sub platy, micromicaceous, slightly pyritic, carbonaceous, occasionally silty & sandy, commonly as clay shale, occasional fragments crack in water.

20% **SANDSTONE**
consolidated, salt and pepper, with < 20% chert grains, off white, light gray, silty to fine upper grained, subangular to subrounded, slightly calcareous, siliceous, slightly pyritic, with light gray, off white argillaceous matrix, tight, poor grain relief, no shows.

2,060.00 to 2,065.00 (5.00) 85% **SHALE**
dark gray to black, sub platy to blocky, micromicaceous, predominately as clay shale, rare pyrite, commonly firm, sub fissile, 30% medium brown, sub platy to blocky, micromicaceous, commonly soft, sub fissile to fissile, slightly pyritic or carbonaceous.

2,060.00 to 2,065.00 (5.00) 15% **SANDSTONE**
light gray, fine grained, subangular to subrounded, salt and pepper, with very poor grain relief, argillaceous, slightly siliceous, rare calcite cement, with rare floating coarse white chert grains, tight, no shows.

2,065.00 to 2,070.00 (5.00) 90% **SHALE**
medium brown, medium brown gray, sub platy to platy, occasionally blocky, micromicaceous, predominately as clay shale, occasional silty or sandy fragments, slightly pyritic, soft to medium hard, fissile to sub fissile, rare carbonaceous flakes, occasional fragments crack or swell in water, 7% dark gray to black, blocky, firm shale fragments, rare slickensides.

10% **SANDSTONE**
consolidated, salt and pepper, light gray, light gray brown, silty to fine lower, occasionally fine upper grained, rare fragments with floating medium to coarse chert grains, with < 15% chert grains, subangular to subrounded, siliceous, predominately with light gray argillaceous cement, rare pyrite, tight, poor grain relief, no shows.

2,070.00 to 2,080.00 (10.00) 85% **SHALE**
medium brown, sub platy to blocky, micromicaceous, trace disseminated & massive pyrite, slightly carbonaceous, occasional fragments crack & swell in water, soft to medium hard, brittle to fissile, 4% medium to dark gray blocky dark gray to black shale fragments.

15% **SANDSTONE**
light gray, consolidated, salt and pepper, silty to fine grained, rare medium grained fragments, argillaceous, kaolinitic, siliceous, subangular to subrounded, moderately sorted, carbonaceous, slightly pyritic, with poor grain relief, dense & tight, rare medium to coarse lower grained, subangular to angular, tight sandstone fragments, trace euhedral quartz grains, 3-6% intergranular & kaolinitic matrix porosity, no cut fluorescence.

2,080.00 to 2,085.00 (5.00) 75% **CONGLOMERATE**
50% as fractured, coarse chert grains & chert granules, sandstone matrix silty to very fine lower grained, locally silty to fine upper grained, locally with floating medium quartz & chert grains or medium grained, subangular to angular, siliceous, slightly calcareous, slightly carbonaceous, pyritic, commonly with light gray, light gray brown, rare white argillaceous matrix, slightly kaolinitic, firm, matrix with poor grain relief, no shows.

25% **SHALE**
medium brown, platy to blocky, micromicaceous, trace disseminated pyrite, occasional fragments crack or swell in water, 5% dark gray, waxy to greasy in part, rare slickensides.

2,085.00 to 2,090.00 100% (5.00) **CONGLOMERATE**
predominately as fractured white, light gray, fine upper to coarse chert grains & chert granules, matrix to clast supported, sandstone matrix off white, light gray, light gray brown, fine to medium grained, subangular to subrounded, angular in part, siliceous, spotty white, light gray argillaceous matrix, slightly pyritic, kaolinitic in part, calcareous, with poor to fair grain relief, no visible intergranular porosity,6-9% kaolin matrix porosity, very weak, poor yellow green blooming cut fluorescence, 5-20% platy to subblocky, medium brown shale fragments, poor reservoir.

2,090.00 to 2,095.00 100% (5.00) **CONGLOMERATE**
predominately as fractured white, light gray, rare green, medium to coarse chert grains & chert granules, matrix to clast supported, sandstone matrix off white, light gray, light gray brown,medium brown, fine to medium grained, occasionally with floating coarse chert grains, subangular to subrounded, angular in part, siliceous, spotty white, light gray, light brown argillaceous matrix, slightly pyritic, calcareous, with poor to fair grain relief, kaolinitic, no visible intergranular porosity, 6-12% kaolin matrix porosity, very weak, poor yellow green blooming cut fluorescence, 15% platy to subblocky, medium brown or dark gray shale fragments, poor reservoir.

2,095.00 to 2,100.00 100% (5.00) **CONGLOMERATE**
predominately as fractured white, light gray, medium to coarse chert grains & chert granules, matrix to clast supported, sandstone matrix off white, light gray, light gray brown, friable to firm, fine to medium grained, occasionally with floating coarse chert grains, subangular to subrounded, angular in part, siliceous, spotty white, light gray, light brown commonly swelling argillaceous matrix, slightly pyritic, calcareous, with poor to fair grain relief, no visible intergranular porosity, very weak, poor yellow green blooming cut fluorescence, 15% platy to subblocky, medium brown or dark gray shale fragments, poor reservoir.

2,100.00 to 2,105.00 100% (5.00) **CONGLOMERATE**
predominately as fractured white, light gray, rare black, medium to coarse chert grains & chert granules, matrix to clast supported, sandstone matrix off white, light gray, light gray brown, fine to medium grained, occasionally with floating coarse chert grains, subangular to subrounded, angular in part, siliceous, spotty white, light gray, light brown, in part swelling or very soft in water argillaceous matrix, slightly pyritic, calcareous, kaolinitic in part, with poor to fair grain relief, trace druse druse, 6-9% kaolin matrix porosity & rare visible intergranular porosity, very weak, poor yellow green blooming cut fluorescence, 15% platy to subblocky, medium brown or dark gray shale fragments, poor reservoir.

2,105.00 to 2,110.00 100% (5.00) **SANDSTONE**
light gray, off white, light gray brown, consolidated, salt and pepper, silty to fine upper to trace medium grained, occasional fragments with floating medium to rare coarse chert grains,rare granules & in part as matrix supported conglomeratic sandstone, subangular to subrounded, commonly friable, siliceous, carbonaceous, slightly pyritic, non calcareous, commonly with off white, light gray argillaceous matrix which commonly gets soft in water, poor grain relief, no visible intergranular porosity, very weak, poor yellow green blooming cut fluorescence, rare euhedral quartz grains, poor reservoir.

2,110.00 to 2,115.00 100% (5.00) **SANDSTONE**
40% as fractured off white, very light gray ,rare yellow, trace black, fine upper to coarse chert & occasional chert granules, as matrix supported conglomeratic sandstone, sandstone matrix off white, light gray, light gray brown, salt and pepper, predominately fine to occasionally medium to coarse lower grained, subangular to subrounded, angular in part, siliceous, carbonaceous, slightly pyritic, slightly calcareous, commonly friable, poor grain relief, no visible intergranular porosity, very weak, poor, yellow green blooming cut fluorescence, 15% medium to occasionally dark brown, platy to blocky shale fragments, rare slickensides, poor reservoir.

2,115.00 to 2,120.00 100% (5.00) **SANDSTONE**
45% as unconsolidated, fractured in part, off white, very light gray, fine upper to coarse chert & rare chert granules, in part as matrix supported conglomeratic sandstone, sandstone matrix off white, light gray, light gray brown, friable, salt and pepper, silty to fine, occasionally medium to coarse lower grained, poor to moderately sorted, subangular to subrounded, angular in part, siliceous, carbonaceous, slightly pyritic, slightly calcareous, commonly with off white, light gray argillaceous matrix, kaolinitic, with poor grain relief, no visible intergranular porosity, 3-6% kaolin matrix porosity, very weak, poor, yellow green blooming cut fluorescence, 15-20% medium to occasionally dark brown, platy to blocky shale fragments, poor reservoir.

2,120.00 to 2,125.00 100% (5.00) **SANDSTONE**
40-60% as unconsolidated, fractured in part, off white, very light gray, trace light green, fine upper to coarse chert & rare chert granules, in part as matrix supported conglomeratic sandstone, sandstone matrix off white, light gray, light gray brown, friable, salt and pepper, silty to fine, occasionally medium to coarse grained, poor to moderately sorted, subangular to subrounded, angular in part, siliceous, carbonaceous, slightly pyritic, slightly calcareous, commonly with off white, light gray argillaceous matrix, rare fragments with intergranular dead black bitumen, fragments commonly with poor grain relief, no visible intergranular porosity, very weak, poor, yellow green blooming cut fluorescence, 10% medium to occasionally dark brown, platy to blocky, commonly silty or sandy, carbonaceous shale fragments, poor reservoir.

2,125.00 to 2,130.00 100% (5.00) **SANDSTONE**
predominately as unconsolidated, fractured in part, off white, very light gray, trace light green, fine upper to coarse chert & rare chert granules, in part as matrix supported conglomeratic sandstone, sandstone matrix off white, light gray, light gray brown, friable, salt and pepper, fine, occasionally medium to coarse grained, poor to moderately sorted, subangular to subrounded, angular in part, siliceous, carbonaceous, slightly pyritic, slightly calcareous, commonly with off white, light gray argillaceous matrix, kaolinitic in part, with poor grain relief, no visible intergranular porosity, 3-7% kaolin matrix porosity?, very weak, poor, yellow green blooming cut fluorescence, < 10% medium to occasionally dark brown, platy to blocky, commonly silty or sandy, carbonaceous shale fragments, poor reservoir.

2,130.00 to 2,135.00 (5.00) 100% **SANDSTONE**
predominately as unconsolidated, fractured in part, off white, very light gray, trace light green, fine upper to coarse upper chert grains, consolidated fragments off white, light gray, predominately light brown or light gray brown, friable, salt and pepper, silty to fine lower grained, rare medium to coarse grained fragments, moderately sorted, subangular to subrounded, angular in part, siliceous, carbonaceous, slightly pyritic, slightly calcareous, commonly with off white, light gray argillaceous matrix, with poor grain relief, no visible intergranular porosity, very weak, poor, yellow green blooming cut fluorescence, < 10-15% medium to occasionally dark brown, platy to blocky, shale fragments, poor reservoir.

2,135.00 to 2,140.00 (5.00) 100% **SANDSTONE**
35% as unconsolidated, fractured in part, off white, very light gray, fine upper to very coarse upper chert grains, consolidated fragments off white, light gray, predominately light brown or light gray brown, friable, salt and pepper, silty to fine upper grained, occasional fragments with floating medium to coarse grains, poor to moderately sorted, subangular to subrounded, angular in part, siliceous, carbonaceous, slightly pyritic, slightly calcareous, commonly with off white, light gray argillaceous matrix, kaolinitic, with poor grain relief, no visible intergranular porosity, 3-6% kaolin matrix porosity?, very weak, poor, yellow green blooming cut fluorescence, < 10-15% medium to occasionally dark brown, platy to blocky, shale fragments, poor reservoir.

2,140.00 to 2,145.00 (5.00) 60% **SHALE**
medium brown, 6% dark brown, platy to blocky, occasionally silty, sandy, carbonaceous, occasional fragments crack or swell in water, pyritic, commonly soft, sub fissile to fissile.

40% **SANDSTONE**
off white, light gray, silty to fine upper grained, subangular to subrounded, angular in part, occasionally with floating medium to rare coarse chert grains, friable to firm, commonly with off white argillaceous matrix, slightly carbonaceous & siliceous, very poor reservoir, rare medium to coarse lower grained predominately siliceous, angular to subrounded, firm fragments, with varicolored chert, sandstone tight, no shows, poor reservoir.

2,145.00 to 2,150.00 (5.00) 80% **SHALE**
medium brown, medium brown gray, sub platy to blocky, micromicaceous, slightly pyritic, slightly carbonaceous, occasional fragments crack in water, occasional silty or sandy fragments.

20% **SANDSTONE**
consolidated, salt and pepper, off white, light gray, silty to fine lower grained, rare fine upper grained fragments, subangular to subrounded, moderately well sorted, with < 15-20% dark chert carbonaceous grains & carbonaceous flakes, spotty calcareous cement, siliceous, commonly with off white, light gray argillaceous matrix, predominately tight, no shows, rare fragments with silica druse.

2,150.00 to 2,155.00 (5.00) 90% **SHALE**
medium brown, platy to blocky, micromicaceous, commonly soft & fissile, commonly cracking or swelling in water, predominately as clay shale, rare silty or sandy fragments.

10% **SANDSTONE**
light gray, off white, consolidated, salt and pepper, silty to fine grained, subangular to subrounded, fine upper grained fragments angular, argillaceous, carbonaceous, siliceous, slightly calcareous, tight, no shows.

2,155.00 to 2,160.00 (5.00) 90% **SHALE**
medium brown, platy to sub platy , occasionally blocky, micromicaceous, commonly soft & fissile, commonly cracking or swelling in water, predominately as clay shale, rare silty or sandy fragments, no visible shear structures.

10% **SANDSTONE**
light gray, off white, consolidated, salt and pepper, silty to fine grained, subangular to subrounded, carbonaceous, siliceous, slightly calcareous, very argillaceous, tight, no shows.

2,160.00 to 2,165.00 (5.00) 80% **SHALE**
medium brown, platy to occasionally blocky, micromicaceous, commonly soft & fissile, commonly cracking or swelling in water, predominately as clay shale, rare silty or sandy fragments, rare slickensides.

20% **SANDSTONE**
light gray, off white, consolidated, salt and pepper, silty to fine lower grained, subangular to subrounded, carbonaceous, siliceous, slightly calcareous, very argillaceous, tight, no shows.

2,165.00 to 2,170.00 (5.00) 50% **SHALE**
medium brown, 5% dark gray to black, platy to blocky, micromicaceous, predominately as clay shale, rare silty sandy fragments, rare slickensides.

50% **SANDSTONE**
consolidated, salt and pepper, light gray, light gray brown, predominately silty to very fine lower grained, occasional upper fine to trace upper medium grained fragments, subangular to subrounded, rare unconsolidated coarse chert grains, commonly with light gray, light gray brown argillaceous matrix, siliceous, slightly pyritic, slightly calcareous, fine upper to medium grained fragments predominately siliceous, very firm, no visible intergranular porosity, no shows.

2,170.00 to 2,175.00 (5.00) 100% **SANDSTONE**
light gray, off white, light gray brown, predominately silty to very fine lower grained, grading in part to sandy siltstone, occasionally fine upper grained, trace medium to coarse lower grained fragments, subangular to subrounded, rare angular grains, moderately sorted, commonly with off white, light gray argillaceous matrix, slightly carbonaceous, micaceous, commonly siliceous, trace pyrite, non calcareous, tight, no shows, 15% as light to medium brown, platy to sub platy shale fragments, rare slickesides.

2,175.00 to 2,180.00 100% **SANDSTONE**
(5.00) light gray, off white, light gray brown, 50% of fragments silty to very fine lower grained, grading in part to sandy siltstone, commonly silty to fine lower, occasionally fine upper to trace medium grained fragments or fragments with floating medium to coarse lower quartz & chert grains, subangular to subrounded, rare angular grains, moderately sorted, commonly with off white, light gray argillaceous matrix, slightly carbonaceous, micaceous, commonly siliceous, trace pyrite, non calcareous, tight, no shows, 15% as light to medium brown, platy to sub platy shale fragments.

2,180.00 to 2,185.00 100% **SHALE**
(5.00) light to medium brown, rare dark brown fragments, platy to sub platy, micromicaceous, occasional fragments crack or swell in water, trace disseminated very fine pyrite & carbonaceous flakes, soft, fissile, 20% light gray, off white, silty to very fine lower grained, argillaceous, tight, siliceous, carbonaceous, silty sandstone fragments.

2,185.00 to 2,190.00 100% **SHALE**
(5.00) medium brown, 5% dark brown, platy to blocky, as clay shale, fragments commonly cracking or swelling in water, as clay shale, 10-15% light gray, consolidated, siliceous, salt and pepper, silty to very fine lower grained, argillaceous, tight sandstone fragments.

2,190.00 to 2,195.00 100% **SHALE**
(5.00) medium brown, medium brown gray, platy to subblocky, micromicaceous, trace disseminated very fine pyrite, commonly swelling or cracking in water, commonly soft, fissile, 15-20% of fragments silty, slightly sandy, grading to off white, light gray, carbonaceous, quartzose siltstone & rare very fine lower grained, silty tight sandstone.

2,195.00 to 2,200.00 60% **SHALE**
(5.00) light gray brown, medium brown, rare dark brown fragments, platy to blocky, micromicaceous, commonly silty, fragments commonly crack in water, rare slickensides

40% **SILTSTONE**
light gray, light gray brown, very argillaceous, friable to hard, commonly sandy & very fine lower grained, subangular to subrounded, commonly with very fine disseminated pyrite & carbonaceous flakes, siliceous, tight, no shows, grading in part to silty very fine lower grained quartzose sandstone.

2,200.00 to 2,205.00 80% **SILTSTONE**
(5.00) light gray, light gray brown, argillaceous, quartzose, locally with very fine lower quartz grains & sandy, carbonaceous, micromicaceous, pyritic, slightly calcareous, commonly soft, grading to silty, sandy shale.

20% **SHALE**
light to medium brown, 7% of fragments dark brown to black, platy to subblocky, micromicaceous, pyritic, commonly silty & sandy.

2,205.00 to 2,210.00 (5.00) 50% **SHALE**
light to medium brown, 7% of fragments dark brown to black, platy to subblocky, micromicaceous, pyritic, commonly silty & sandy., occasional slickensides.

50% **SILTSTONE**
light gray, light gray brown, argillaceous, quartzose, locally with very fine lower quartz grains & sandy, carbonaceous, micromicaceous, pyritic, slightly calcareous, commonly soft, grading to silty, sandy shale.

2,210.00 to 2,215.00 (5.00) 60% **SHALE**
light to medium gray brown, sub platy to blocky, micromicaceous, trace disseminated very fine pyrite, occasionally silty, rare fragments crack in water, scattered questionable bit-generated slickensides.

40% **SILTSTONE**
light gray, light gray brown, argillaceous, quartzose, locally with very fine lower quartz grains & sandy, carbonaceous, micromicaceous, pyritic, slightly calcareous, commonly soft, grading to silty, sandy shale.

2,215.00 to 2,220.00 (5.00) 100% **SHALE**
40% light gray, light gray brown, platy to subblocky, micromicaceous, trace disseminated very fine pyrite, soft, fissile, 60% medium to dark brown, slightly pyritic, predominately as clay shale, fragments commonly swelling & cracking in water, rare light gray, argillaceous, siltstone fragments.

2,220.00 to 2,225.00 (5.00) 100% **SHALE**
45 % light gray, platy to blocky, micromicaceous, pyritic, predominately as clay shale, rare silty & sandy fragments, commonly swelling in water, 55 % medium to dark brown, pyritic, predominately as clay shale, occasionally with interlaminated light gray shale, scattered slickenside surfaces in part bit-generated?

2,225.00 to 2,230.00 (5.00) 100% **SHALE**
predominately light gray brown, 20% of fragments medium to dark brown, platy to blocky, micromicaceous, commonly slightly silty, sandy, trace disseminated very fine pyrite or carbonaceous flakes, commonly cracking & swelling in water, soft & fissile when wet, 7% light gray, argillaceous, siltstone fragments, occasional slickensides, bit-generated?

2,230.00 to 2,235.00 (5.00) 100% **SHALE**
light gray, light gray brown, 10-15% medium to dark brown, platy to blocky, micromicaceous, commonly soft & fissile, fragments commonly cracking or swelling in water, trace disseminated & massive pyrite, rare slightly silty & sandy fragments, trace light gray argillaceous siltstone fragments, occasional slickensides, in part bit-generated?

2,235.00 to 2,240.00 100% **SHALE**
(5.00) light gray brown, 20% dark brown to black, sub platy to occasionally blocky, micromicaceous, soft to medium hard, fissile, brittle in part, trace disseminated very fine carbonaceous flakes & pyrite, 20% of fragments silty, grading to argillaceous, tight, very fine siltstone., fragments commonly crack or swell in water, occasional slickensides, 4% light gray, sandy, argillaceous, tight, siltstone fragments.

2,240.00 to 2,245.00 100% **SHALE**
(5.00) light gray brown, 20% medium brown, platy to blocky, micromicaceous, commonly soft & fissile in water, predominately as clay shale, occasionally slightly silty. trace disseminated & massive pyrite, trace light gray, argillaceous, sandy, tight siltstone fragments, scattered slickensides.

2,245.00 to 2,255.00 100% **SHALE**
(10.00) predominately light to medium gray, 30-35% dark gray carbonaceous shale, fissile to subfissile, non to slightly calcareous, occasional silty laminations, micromicaceous, trace pyrite, moderately soft

2,255.00 to 2,265.00 100% **SHALE**
(10.00) predominately very dark gray to dark brownish gray, subfissile, increasingly carbonaceous, moderate total organic carbon, occasional pyritic laminae, 15-20% light to medium gray shale as above, moderately soft, becoming increasingly soft in water, rare micro faulted grain

2,265.00 to 2,275.00 100% **SHALE**
(10.00) subequal light to medium gray & dark gray carbonaceous shale, fissile to subfissile, non calcareous, decreasing total organic carbon, occasional silty laminations, rare sandy stringer, trace finely disseminated pyrite, micromicaceous, moderately soft

2,275.00 to 2,285.00 80% **SHALE**
(10.00) 30-35% medium to dark gray to dark brownish gray, fissile to subfissile, non calcareous, carbonaceous in part, 65-70% light to medium gray, low total organic carbon, fissile to subfissile, non calcareous, silty in part, moderately soft, micromicaceous

20% **SILTSTONE**
light to medium gray, quartzose & common lithics, very slightly calcareous, trace pyrite, micromicaceous in part

2,285.00 to 2,300.00 85% **SHALE**
(15.00) light to medium gray, fissile, non calcareous, small trace scattered pyrite, occasional dark carbonaceous beds, locally silty, micromicaceous, moderately soft

15% **SILTSTONE**
light to medium gray, predominately quartz, locally grading to very fine grained sandstone, small trace pyrite

2,300.00 to 2,320.00 (20.00)	90%	**SHALE** predominately light to medium gray, locally dark brownish gray & carbonaceous in part, fissile to subfissile, non calcareous, locally silty, siltstone laminations, trace pyrite, trace micromicaceous, soft
	10%	**SILTSTONE** light to medium gray, predominately quartz, locally grading to very fine grained sandstone, small trace pyrite
2,320.00 to 2,330.00 (10.00)	100%	**SHALE** subequal light to medium gray micaceous shale & dark brownish gray carbonaceous shale, fissile to subfissile, non to very slightly calcareous, rare silty stringers, locally pyritic, rare calcite cemented micro fracture, rare grain showing folding, moderately firm
2,330.00 to 2,340.00 (10.00)	100%	**SHALE** predominately dark brownish gray, 10-15% light to medium gray micaceous shale as above, subfissile, increasingly carbonaceous, occasional silty stringers, trace pyrite, occasional micro pyrite slivers, rare coloform pyrite, slightly calcareous, soft
2,340.00 to 2,345.00 (5.00)	100%	**SHALE** 70% medium to dark brownish gray, subfissile, non to slightly calcareous, carbonaceous in part, 30% interlaminated & interbedded light gray, slightly calcareous, silty in part, occasional silty laminations, scattered trace pyrite, micromicaceous in part, soft, fragile
2,345.00 to 2,355.00 (10.00)	100%	**SHALE** 60% medium to dark brownish gray, subfissile, non to slightly calcareous, carbonaceous in part, 40% interlaminated & interbedded light gray, slightly calcareous, increasingly silty, occasional silty laminations, scattered trace pyrite, micromicaceous in part, soft, fragile, rare sandy laminae
2,355.00 to 2,360.00 (5.00)	80%	**SHALE** subequal light to medium gray & medium to dark brownish gray, subfissile, non to very slightly calcareous, dark shale is carbonaceous, light colored shale has low total organic carbon, silty in part, micromicaceous, occasional silty laminations, trace to minor pyrite, moderately soft
	10%	**SILTSTONE** light to medium gray, non to very slightly calcite, micromicaceous, thin laminae, trace pyrite
	10%	**SANDSTONE** light to medium brownish gray, quartz with abundant dark lithics, very fine to lower fine grained, silty in part, angular to subangular, poorly sorted,
2,360.00 to 2,365.00 (5.00)	80%	**SHALE** predominately medium brownish gray, 10-15% dark gray to black, subfissile to fissile, non to very slightly calcareous, occasional sandy & silty laminae, locally carbonaceous, moderately soft, micromicaceous, trace finely disseminated pyrite

2,360.00 to 2,365.00 (5.00)	20%	**SANDSTONE** light to medium grayish brown, quartz with common to abundant dark lithics, predominately very fine grained & silty, 5-7% lower fine grained, subrounded to subangular, moderately sorted, silica cement, trace secondary calcite cement, moderately indurated, tight to very weak porosity (0-4%), light amber brown hydrocarbon staining throughout, no visible fluorescence, very slow weak hazy cut, weak residual show
2,365.00 to 2,380.00 (15.00)	85%	**SHALE** medium brownish gray, fissile to subfissile, non calcareous, trace micromicaceous, trace finely disseminated pyrite, occasional silty laminations, moderately firm, becoming soft in water, carbonaceous in part
	15%	**SANDSTONE** medium gray to brownish gray, very fine grained, silty in part, quartz, dark lithics & occasional carbonaceous fragments, subangular, poorly sorted, silica + trace secondary calcite cement, tight, trace spotty amber hydrocarbon staining, no visible fluorescence, no show, thin beds
2,380.00 to 2,395.00 (15.00)	100%	**SHALE** medium to dark gray to brownish gray, fissile to subfissile, very slightly calcareous, occasional calcareous silty laminations, carbonaceous in part, low total organic carbon, trace mica, trace finely disseminated pyrite as above, moderately soft
2,395.00 to 2,405.00 (10.00)	85%	**SHALE** medium to dark gray to brownish gray, common light gray laminae, subfissile to fissile, very slightly calcareous, trace micro mica, occasional silty laminations, soft
	10%	**SILTSTONE** light to medium gray, sandy in part, micromicaceous, slightly calcareous, thin stringers, weak to moderately indurated
	5%	**CONTAMINATION** G-Seal Plus graphite-based lead gray metallic substance.
2,405.00 to 2,417.00 (12.00)	60%	**SHALE** predominately medium gray to brownish gray, ~10% dark gray & carbonaceous, subfissile to fissile, very slightly calcareous, small trace pyrite, moderately soft, sandy & silty laminae, micromicaceous
	15%	**SILTSTONE** light to medium gray, slightly calcareous, locally sandy, small trace pyrite, micromicaceous, scattered carbonaceous fragments, moderately soft
	15%	**SANDSTONE** light to medium gray to slightly brownish gray, very fine to lower fine grained, locally grading to upper fine grained, silty matrix, angular to subangular, quartz, lithics & common carbonaceous fragments, slightly calcareous, tight to locally very weak porosity, no visible show, moderately well indurated, friable in part

2,405.00 to 2,417.00 (12.00)	10%	**CONTAMINATION** G-Seal Plus graphite-based lead gray metallic mud additive.
2,417.00 to 2,430.00 (13.00)	60%	**SHALE** medium to dark gray, locally grading to black, subfissile to subblocky, non calcareous, locally pyritic, carbonaceous in part, moderate total organic carbon, firm to hard, brittle
	20%	**SANDSTONE** light to medium gray, quartz & common to abundant gray chert, very fine to upper fine grained, silty in part, subrounded to subangular, poorly sorted, silica + minor secondary calcite cement, trace pyrite cement, tight, moderately well indurated, hard, brittle
	10%	**CONTAMINATION** G-Seal lead gray submetallic mud additive
	10%	**SILTSTONE** medium gray, sandy in part, trace pyrite, very slightly calcareous, micromicaceous in part
2,430.00 to 2,445.00 (15.00)	70%	**SHALE** predominately medium brownish gray, fissile to subfissile, micmicas, non to slightly calcareous, soft, common to abundant dark gray to black shale, non calcareous, moderately hard, brittle, carbonaceous in part, occasional sheared grain
	15%	**SANDSTONE** light to medium brownish gray, silty to very fine grained, locally grading to fine grained, silty argillaceous matrix, silica + minor calcite cement, trace pyrite, moderately well indurated, tight, thin beds
	10%	**SILTSTONE** as above
	5%	**CONTAMINATION** G-Seal lead gray submetallic mud additive
2,445.00 to 2,455.00 (10.00)	50%	**SHALE** predominately medium to dark bnrsh gray, locally black, subfissile to subblocky, non calcareous, firm, brittle, carbonaceous in part
	30%	**SILTSTONE** light to medium gray, sandy in part, calcareous, weakly indurated, fragile rounded clasts
	15%	**SANDSTONE** medium gray to slightly brownish gray, very fine to lower fine grained, locally grading to upper fine grained, silty matrix, subrounded to subangular, poorly sorted, silica + trace to minor calcite cement, trace pyrite cement, tight
	5%	**CONTAMINATION** G-Seal lead gray submetallic mud additive

2,455.00 to 2,465.00 (10.00)	55%	**SHALE** predominately medium brownish gray, subfissile to fissile, micromicaceous, commonly dark gray to black, subblocky, non calcareous, carbonaceous in part, firm, brittle, trace pyrite
	15%	**CONTAMINATION** G-Seal lead gray submetallic mud additive
	15%	**SILTSTONE** light to medium gray, locally sandy, slightly calcareous, trace carbonaceous matter, trace pyrite, moderately indurated
	15%	**SANDSTONE** light to medium gray, predominately quartz with minor chert & lithics, very fine to lower fine grained, silty, subrounded, poorly sorted, well indurated, silica + calcite cement, tight, thin beds
2,465.00 to 2,470.00 (5.00)	75%	**SHALE** predominately light to medium brownish gray, fissile to subfissile, micromicaceous, non calcareous, moderately soft, commonly dark gray to black, subblocky, non calcareous, carbonaceous in part, firm, hard, brittle, trace pyrite
	10%	**SILTSTONE** light to medium gray, locally sandy, slightly calcareous, trace carbonaceous matter, trace pyrite, moderately indurated
	10%	**CONTAMINATION** G-Seal lead gray submetallic mud additive
	5%	**SANDSTONE** light to medium gray, predominately quartz with minor chert & lithics, very fine to lower fine grained, silty, subrounded, poorly sorted, well indurated, silica + calcite cement, tight, thin beds
2,470.00 to 2,485.00 (15.00)	55%	**SHALE** predominately medium gray, fissile to subfissile, non calcareous, ~10% dark gray to black & carbonaceous in part
	25%	**SANDSTONE** medium gray, vfg, silty & argillaceous in part, subangular, moderate to poorly sorted, silica + trace to minor calcite cement, moderately well indurated, tight
	15%	**SILTSTONE** medium gray, locally sandy, micromicaceous in part, very slightly calcareous
	5%	**CONTAMINATION** as above

2,485.00 to 2,500.00 (15.00)	65%	**SANDSTONE** light to medium brownish gray, very fine to fine grained, silty in part, occasional silty laminations, quartz, minor to common chert, occasional lithics & minor carbonaceous fragments, subrounded to subangular, moderately sorted, silica + trace secondary calcite cement, moderate to well indurated, tight to very weak porosity (0-4%), slight trace hydrocarbon staining, no visible fluorescence, very slow faint cut, no show
	20%	**SHALE** predominately medium gray, fissile to subfissile, non calcareous, ~10% dark gray to black & carbonaceous in part as above
	15%	**CONTAMINATION** G-Seal lead gray submetallic mud additive as above
2,500.00 to 2,505.00 (5.00)	65%	**SHALE** predominately medium brownish gray, medium to dark gray, subfissile, non calcareous, common sheared grain, cavings in part
	35%	**SANDSTONE** medium gray to slightly brownish gray, very fine to fine grained, silty in part, subrounded to subangular, poorly sorted, silica + trace calcite cement, trace hydrocarbon staining, very slow faint cut as above, tight to very weak porosity, moderate to well indurated
		POOR SAMPLE Caught after bit-trip with extensive reaming
2,505.00 to 2,510.00 (5.00)	70%	**SANDSTONE** light to medium gray, slightly brownish gray, quartz, chert & common dark carbonaceous fragments, silty in part, subrounded to subangular, poorly sorted, silica + calcite cement, moderate to well indurated, tight, occasional shale parting
	30%	**SHALE** medium gray to brownish gray, subfissile, non calcareous, firm, brittle, micromicaceous in part, trace pyrite
2,510.00 to 2,525.00 (15.00)	70%	**SHALE** medium gray to brownish gray, fissile to subfissile, non clcs, micromicaceous in part, trace pyrite, silty laminations
	20%	**SANDSTONE** light to medium gray, slightly brownish gray, quartz, chert & common dark carbonaceous fragments, silty in part, subrounded to subangular, poorly sorted, silica + calcite cement, moderate to well indurated, tight, thin beds
	10%	**SILTSTONE** medium gray, slightly calcareous, thin laminae, micromicaceous

2,525.00 to 2,545.00 (20.00)	75%	**SHALE** medium to dark gray, fissile to subfissile, non calcareous, silty & sandy stringers throughout, slightly carbonaceous, low total organic carbon, small trace pyrite, trace micromicaceous, moderately soft
	15%	**SANDSTONE** light to medium gray to brownish gray, quartz, minor chert, occasional lithic grain, occasional carbonaceous fragment, predominately very fine to lower fine grained, locally upper fine grained, silty in part, subrounded, poorly sorted, silica + minor secondary calcite cement, trace pyrite, thin beds, well indurated, trace hydrocarbon staining, tight
	10%	**SILTSTONE** medium gray, sandy in part, slightly calcareous, thin laminations, micromicaceous in part, trace carbonaceous matter, small trace pyrite
2,545.00 to 2,565.00 (20.00)	95%	**SHALE** predominately medium gray with occasional dark gray to black carbonaceous beds, fissile to subfissile, non calcareous, occasional silty laminae, trace pyrite, weakly to moderately micromicaceous, moderately soft, rare calcite filled microfracture, occasional high angle joint
	5%	**SILTSTONE** medium gray, sandy in part, grading to very fine grained sandstone, slightly calcareous, trace pyrite, micromicaceous in part, trace carbonaceous matter
2,565.00 to 2,580.00 (15.00)	75%	**SHALE** medium to dark gray, occasionally black, fissile to subfissile, non calcareous, carbonaceous in part, trace poorly, common very fine grained sandy stringers, silty laminations, moderately soft
	15%	**SANDSTONE** light to medium gray, quartz common to abundant chert occasional lithics & carbonaceous fragments, predominately very fine grained, 5-7% lower fine grained, silty matrix, primary silica & trace to minor secondary calcite cement, trace patchy pyrite cement, moderate induration, tight, thin beds
	10%	**SILTSTONE** medium gray, slightly calcareous, trace carbonaceous matter, trace pyrite, micromicaceous
2,580.00 to 2,590.00 (10.00)	50%	**SHALE** medium to dark gray, locally black, fissile to subfissile, carbonaceous in part, non calcareous, small trace pyrite, micromicaceous in part, silty laminae
	35%	**SANDSTONE** light to medium gray, quartz common to abundant chert occasional lithics & carbonaceous fragments, predominately very fine grained, 5-7% lower fine grained, silty matrix, primary silica & trace to minor secondary calcite cement, moderate induration, tight to locally very weak porosity, possible fracture porosity, rare white microcrystalline calcite filled microfracture, rare drusy euhedral quartzose crystals, trace spotty brown hydrocarbon staining, no visible fluorescence, trace very faint slow weak cut, increasing pyrite cement

2,580.00 to 2,590.00 (10.00)	15%	**SILTSTONE** medium gray, slightly calcareous, trace carbonaceous matter, trace pyrite, micromicaceous
2,590.00 to 2,610.00 (20.00)	80%	**SHALE** medium to dark gray, locally dark grayish brown to black, fissile to subfissile, non calcareous, weakly micromicaceous, carbonaceous in part, small trace pyrite, moderately soft to soft, silty & sandy stringers
	10%	**SILTSTONE** medium gray, slightly calcareous, sandy in part, micromicaceous, trace carbonaceous matter, thin stringers
	10%	**SANDSTONE** medium gray, silty to lower fine grained, subrounded, poorly sorted, silica + trace calcite cement, tight, thin stringers
2,610.00 to 2,625.00 (15.00)	75%	**SHALE** medium to dark gray,locally black, subfissile, non calcareous, silty laminae, occasional sandy partings, carbonaceous in part, micromicaceous in part, moderately soft to soft, trace pyrite
	15%	**SANDSTONE** medium gray, very fine to lower fine grained, 3-5% upper fine grained, coarse silt throughout, quartz, chert, lithics & carbonaceous fragments as above, subrounded, poorly sorted, silica + minor calcite cement, moderate induration, thin beds, tight
	10%	**SILTSTONE** medium gray, locally sandy, slightly calcareous, micmioca in part
2,625.00 to 2,640.00 (15.00)	50%	**SANDSTONE** medium brownish gray, predominately coarse silt to very fine grained, locally grading to fine grained, subangular to subrounded, moderate sorting, silica + calcite cement, trace pyrite, moderately indurated, moderately friable, tight to very weak porosity, trace light brown hydrocarbon staining, very faint slow hazy cut, very poor show
	30%	**SHALE** medium to dark brownish gray, fissile to subfissile, non calcareous, micromicaceous in part, slightly carbonaceous, silty laminae, small trace pyrite, soft
	20%	**SILTSTONE** medium gray, fine to coarse silt, locally grading to very fine grained sandstone, slightly calcareous, small trace pyrite, micromicaceous in part, slightly carbonaceous
2,640.00 to 2,645.00 (5.00)	60%	**SANDSTONE** medium gray to slightly brownish gray, quartz, chert, lithics & carbonaceous frgas, predominately silty to very fine grained, 7-10% lower fine grained, trace upper fine grained, subrounded, moderately sorted, silica + trace secondary calcite cement, trace pyrite, moderate induration, tight

2,640.00 to 2,645.00 (5.00)	30%	**SHALE** predominately medium to dark gray, fissile to subfissile, non calcareous, soft, micromicaceous in part, silty laminae, locally dark gray to black, fissile to subfissile, non calcareous, carbonaceous in part, trace pyrite, firm, brittle
	10%	**SILTSTONE** medium gray, sandy in part, carbonaceous in part, slightly calcareous
2,645.00 to 2,650.00 (5.00)	75%	**SHALE** medium to dark gray, brownish gray, fissile to subfissile, non calcareous, occasional sandy stringer, silty laminae, weakly micromicaceous, low total organic carbon, moderately soft
	15%	**SILTSTONE** medium gray, sandy in part, slightly calcareous, trace carbonaceous matter, laminations
	10%	**SANDSTONE** medium gray to brownish gray, very fine grained, locally grading to fine grained, silty, subrounded, moderate to poorly sorted, silica + trace calcite cement, locally micromicaceous, trace carbonaceous matter, trace pyrite, tight
2,650.00 to 2,670.00 (20.00)	85%	**SHALE** medium brownish gray, fissile to subfissile, non calcareous, silty & sandy laminations, trace to minor micromicaceous matter, slightly carbonaceous, low total organic carbon, moderately soft
2,670.00 to 2,700.00 (30.00)	90%	**SHALE** medium to dark brownish gray, fissile to subfissile, non calcareous, occasional silty & sandy laminations, rare pyrite, carbonaceous in part, moderately soft
	5%	**SILTSTONE** medium gray, sandy in part, slightly calcareous, trace carbonaceous matter, laminations
	5%	**SANDSTONE** medium gray to brownish gray, very fine grained, locally grading to fine grained, silty, subrounded, moderate to poorly sorted, silica + trace calcite cement, locally micromicaceous, trace carbonaceous matter, small trace pyrite, moderately well indurated, tight, thin stringers
2,700.00 to 2,715.00 (15.00)	65%	**SHALE** medium brownish gray, fissile to subfissile, non calcareous, weakly micromicaceous, trace carbonaceous matter, scattered carbonized plant remains, moderately soft
	25%	**SANDSTONE** medium brownish gray, predominately very fine grained to coarse silt, locally grading to lower fine grained, subrounded, moderate sorting, silica cement, trace calcite cement, quartz, chert & common carbonaceous fragments, moderately well indurated, predominately tight, patchy weak porosity (0-5%), trace light brown hydrocarbon staining, no visible fluorescence, faint slow hazy cut, questionable show, small trace pyrite

2,700.00 to 2,715.00 (15.00)	10%	**SILTSTONE** light to medium brownish gray, sandy in part, very slightly calcareous, slightly carbonaceous, micromicaceous
2,715.00 to 2,730.00 (15.00)	70%	**SHALE** medium to dark brownish gray, fissile to subfissile, non calcareous, silty laminations, sandy partings, carbonaceous in part, low total organic carbon
	20%	**SANDSTONE** medium grayish brown, quartz, chert, lithics & occasional carbonaceous fragments, very fine to fine grained, silty matrix, subrounded, poorly sorted, silica cement, trace secondary calcite cement, moderate induration, predominately tight, scattered weak porosity (0-4%), trace brown hydrocarbon staining, no visible fluorescence, very slow faint cut, very poor show
	10%	**SILTSTONE** medium gray to brownish gray, sandy in part, non to very slightly calcareous, carbonaceous in part
2,730.00 to 2,735.00 (5.00)	90%	**SHALE** very dark brownish gray to black, subblocky, non calcareous, carbonaceous, trace pyrite, firm, moderately brittle, occasional joint, occasional sandy stringer, no visible fluorescence, extremely slow faint dead oil cut, silty laminae
	10%	**SANDSTONE** medium brownish gray, very fine to fine grained in part, silty matrix, subangular, poorly sorted, small trace glauconite, silica cement, slightly calcareous, moderately indurated, tight, trace light brown hydrocarbon staining, no fluorescence, slow weak hazy cut
2,735.00 to 2,742.00 (7.00)	70%	**SHALE** predominately dark gray to black, subblocky to subfissile, medium to dark brownish gray, firm, carbonaceous in part, medium to dark brownish gray in part, non calcareous, slightly carbonaceous, moderately soft
	20%	**SANDSTONE** medium grayish brown, quartz, minor light chert & dark lithics, occasional carbonaceous grain, small trace glauconite, predominately very fine to fine grained, rare lower medium grained clasts, subrounded to subangular, poorly sorted, silica + trace calcite cement, weak patchy amber hydrocarbon staining, very weak slow hazy cut, residual show
	10%	**SILTSTONE** medium gray, sandy in part, very slightly calcareous, sandy in part, trace pyrite, weakly micromicaceous
2,742.00 to 2,750.00 (8.00)	90%	**SHALE** medium to dark brownish gray, fissile to subfissile, non calcareous, silty laminae, occasional sandy stringers, weakly micromicaceous, moderately soft, occasional sheared grain

2,742.00 to 2,750.00 (8.00)	10%	**SANDSTONE** light to medium brownish gray, very fine to fine grained, silty matrix, small trace glauconite, trace pyrite, subrounded, poorly sorted, silica cement, trace calcite cement, moderate induration, tight
2,750.00 to 2,765.00 (15.00)	85%	**SHALE** medium to dark brownish gray, fissile to subfissile, non calcareous, silty laminations, occasional sandy stringer, weakly micromicaceous, trace scattered pyrite, carbonaceous in part
	10%	**SILTSTONE** medium gray, sandy in part, very slightly calcareous, carbonaceous in part, micromicaceous
	5%	**SANDSTONE** medium brownish gray, very fine grained, silty & argillaceous matrix, subangular to subrounded, poorly sorted, silica cement, small trace secondary calcite cement, carbonaceous in part, tight
2,765.00 to 2,785.00 (20.00)	85%	**SHALE** predominately medium to dark brownish gray as above, 5-10% dark gray to black, subfissile, non calcareous, locally pyritic, firm, increasingly carbonaceous
	10%	**SILTSTONE** medium gray, sandy in part, very slightly calcareous, carbonaceous in part, micromicaceous
	5%	**SANDSTONE** medium brownish gray, very fine grained, silty & argillaceous matrix, subangular to subrounded, poorly sorted, silica cement, small trace secondary calcite cement, carbonaceous in part, tight
2,785.00 to 2,795.00 (10.00)	100%	**SHALE** medium to dark gray, fissile to subfissile, non calcareous, carbonaceous in part, occasional pyritic laminae, locally silty, moderately firm, micromicaceous in part
2,795.00 to 2,815.00 (20.00)	60%	**SHALE** medium to dark gray to brownish gray, fissile to subfissile, non calcareous, carbonaceous in part, occasional pyritic laminae, locally silty, moderately firm, interbedded sandstone
	30%	**SANDSTONE** medium brownish gray, predominately very fine grained, 7-10% fine grained angular to subangular floating clasts, silty argillaceous matrix, subrounded, poorly sorted,silica cement, moderate induration, tight, no visible fluorescence, trace very faint slow hazy cut, residual show, small trace glauconite
	10%	**SILTSTONE** medium to dark gray, non calcareous, sandy, carbonaceous in part, micromicaceous

2,815.00 to 2,825.00 (10.00)

70% **SHALE**
medium to dark gray, dark brownish gray, locally grading to black, fissile to subfissile, non calcareous, increasingly carbonaceous, trace scattered pyrite, moderately firm & brittle

20% **SANDSTONE**
medium gray, very fine grained, silty argillaceous matrix, subrounded, poorly sorted, quartz, chert, lithics & occasional carbonaceous fragments, 7-10% fine grained angular to subangular clasts, silica cement, moderate induration, tight, no visible show

10% **SILTSTONE**
medium to dark gray, non calcareous, sandy in part, carbonaceous in part

2,825.00 to 2,835.00 (10.00)

50% **SHALE**
medium to dark gray, locally grading to black, fissile to subfissile, non calcareous, carbonaceous in part, firm

35% **SANDSTONE**
medium gray to brownish gray, quartz & common light colored chert, occasional dark lithics, very fine grained, 7-10% fine grained, rare floating medium grained subangular clasts, subrounded, poorly sorted, silica cement, trace calcite, trace hydrocarbon staining, slow weak cut, redl dead oil show, tight to very weak porosity (0-3%), moderately indurated, friable in part

15% **SILTSTONE**
medium gray, sandy, non calcareous, micromicaceous in part, carbonaceous in part

2,835.00 to 2,850.00 (15.00)

80% **SHALE**
medium to dark brownish gray, fissile to subfissile, non calcareous, micromicaceous in part, carbonaceous in part, silty & sandy laminations, moderately soft

10% **SILTSTONE**
medium to dark gray, sandy in part, non calcareous, carbonaceous in part, micromicaceous

10% **SANDSTONE**
medium to dark gray to brownish gray, very fine grained, silty & argillaceous matrix, non calcareous, tight, thin beds

2,850.00 to 2,855.00 (5.00)

50% **SHALE**
medium to dark brownish gray, fissile to subfissile, non calcareous, micromicaceous in part, carbonaceous in part, interbedded very fine grained sandstone, silty laminations, moderately firm

30% **SANDSTONE**
medium to dark brownish gray, very fine to fine grained, silty matrix, subangular to subrounded, poorly sorted, quartz, light chert and occasional dark lithics, silica cement, non calcareous, moderate induration, tight to weak porosity (0-4%), trace amber brown hydrocarbon stg, no visible fluorescence, very slow faint residual dead oil cut

2,850.00 to 2,855.00 (5.00) 10% **SILTSTONE**
medium to dark gray, sandy in part, non calcareous, carbonaceous in part, micromicaceous

10% **CONTAMINATION**
G-Seal mud product (lead grey submetallic graphite-based slag material).

2,855.00 to 2,860.00 (5.00) 70% **SHALE**
medium brown, 5% dark brown, platy to occasionally subblocky, micromicaceous, soft to medium hard, commonly fissile, commonly as clay shale, occasional silty & sandy fragments, predominately non swelling, sample above 2857.5 meters (MD) predominately as casing cement.

30% **SANDSTONE**
consolidated, light to medium brown, silty to fine grained, salt and pepper, commonly with medium brown argillaceous cement, grading in part to sandy, silty shale, poorly sorted, subangular to subrounded, angular in part, pyritic, carbonaceous, locally very siliceous, occasional fragments with floating medium quartz grains, tight, no shows.

2,860.00 to 2,865.00 (5.00) 100% **SHALE**
medium brown, 4% dark brown, platy to sub platy, rare blocky fragments, micromicaceous, soft to medium hard, sub fissile to fissile, predominately as clay shale, 20% of fragments silty & sandy, grading in part to very argillaceous sandy siltstone or silty to fine lower grained, very argillaceous, pyritic, medium brown gray, carbonaceous, slightly siliceous sandstone, trace disseminated & massive pyrite, rare swelling fragments, trace slickensides, non calcareous.

2,870.00 to 2,875.00 (5.00) 100% **SHALE**
medium brown, sub platy to occasionally subblocky, micromicaceous, soft to medium hard, fissile, occasionally brittle, trace very fine disseminated pyrite, occasional fragments crack or swell in water, rare slickenside surfaces, 7% dark brown, blocky, slightly swelling, carbonaceous shale fragments, 7% medium brown, argillaceous, silty ironstone fragments .rare massive pyrite fragments, rare massive pyrite, trace calcite.

2,875.00 to 2,880.00 (5.00) 75% **SHALE**
medium brown, medium brown gray, 10-15% dark brown gray, platy to blocky, micromicaceous, trace disseminated pyrite, occasionally silty, commonly soft & fissile in water, occasional fragments crack or swell in water, rare fractures, rare slickensides.

25% **SANDSTONE**
consolidated, predominately medium brown, rare white & medium brown fragments, friable to commonly firm, silty to very fine lower grained, locally very fine upper to trace fine lower grained, angular to subrounded, rare floating fine upper to lower medium angular quartz grains, slightly calcareous or sideritic, slightly siliceous, rare pyrite, commonly with medium brown argillaceous matrix, tight, no shows, commonly grading to sandy argillaceous, tight siltstone.

2,880.00 to 2,885.00 85% **SHALE**
(5.00) medium brown, platy to blocky, micromicaceous, trace disseminated very fine pyrite, commonly as clay shale, rare slickesides, < 10% black, very dark gray, blocky, locally cherty or siliceous, rare silica fracture fills.

15% **SANDSTONE**
consolidated, medium brown, occasionally white & medium brown, consolidated, with very poor grain relief, friable to predominately firm, subangular to subrounded, angular in part, predominately silty to very fine upper grained & with floating fine lower to rare upper quartz grains, slightly carbonaceous, micaceous, pyritic, slightly sideritic, commonly with medium brown argillaceous matrix, slightly siliceous, grading in part to sandy tight siltstone or sandy silty shale, tight, no shows.

2,885.00 to 2,890.00 100% **SHALE**
(5.00) medium brown, 10-15% dark brown, black, sub platy to occasionally blocky, micromicaceous, trace disseminated pyrite, soft to medium hard, brittle in part, commonly fissile, trace disseminated very fine pyrite, predominately as clay shale, 10-15% of fragments as silty, to very fine lower, argillaceous, tight, slightly siliceous, slightly pyritic, slightly carbonaceous, tight sandstone & sandy siltstone fragments, dark brown shale fragments occasionally dull, siliceous, very hard.

2,890.00 to 2,895.00 100% **SHALE**
(5.00) medium brown, 7-8% dark brown to black, platy to sub platy, occasionally blocky, micromicaceous, trace disseminated pyrite, predominately as clay shale, occasional fragments swell or crack in water, < 5% of fragments silty & sandy & grading to very argillaceous, tight, siltstone & silty sandstone, dark brown fragments greasy, scattered slickensides, bit-balling.

2,895.00 to 2,900.00 100% **SHALE**
(5.00) medium brown, 10-15% dark brown, dark gray, platy to occasionally blocky, micromicaceous, commonly cracking or swelling in water, slightly pyritic, predominately as clay shale, 10% of fragments silty & sandy & grading to very argillaceous, commonly medium brown, silty to fine lower grained, slightly pyritic, carbonaceous, tight sandstone, dark gray fragments dull, occasional fragments with slickensides.

2,900.00 to 2,905.00 100% **SHALE**
(5.00) 60% medium brown, sub platy to blocky, commonly swelling in water, micromicaceous, trace disseminated very fine pyrite, predominately as clay shale, slow yellow green blooming cut fluorescence, trace siltstone & argillaceous, silty to very fine lower grained, subangular to subrounded, argillaceous, poorly sorted sandstone fragments, 40% of fragments dark gray, very dark gray brown, blocky, cherty, very hard & non fissile, commonly grading to hard chert, rare fragments with silica healed fractures, weak yellow green blooming cut fluorescence.

2,905.00 to 2,908.00 50% (3.00) **CHERT & SHALE MINOR SANDSTONE**
40% black, dark gray, commonly rounded, irregular, occasionally blocky, cryptocrystalline, commonly argillaceous, hard, brittle, chert, 50% as medium to dark brown, sub platy to blocky, locally splintery, slightly pyritic firm shale, weak poor yellow green blooming cut fluorescence, rare light brown swelling shale fragments, 10% medium brown, silty to fine lower grained, angular to srdd, pyrite sorted silty sandstone & sandy siltstone fragments.

2,912.00 to 2,915.00 100% (3.00) **SHALE**
predominately medium to dark brown, blocky, firm, brittle to sub fissile, non swelling in water, slightly pyritic, occasional fragments with white silica filled fractures, slightly carbonaceous, trace silt grains, 10% black, carbonaceous, blocky, cherty, hard, brittle, non fissile, trace medium brown, silty to very fine lower grained, siliceous, tight, slightly pyritic, poorly sorted, salt and pepper sandstone fragments, very weak poor slow yellow green blooming cut fluorescence.

2,915.00 to 2,920.00 (5.00) **CHERTY SHALE**
predominately dark gray to black, hard, blocky, brittle, dull, cherty, occasionally sandy, carbonaceous, fragments irregular in shape, micromicaceous, in part as fissile shale, rare silty & sandy fragments, 25% as light to medium brown swelling shale fragments, very weak poor, slow yellow green blooming cut fluorescence.

2,922.00 to 2,925.00 (3.00) **CHERTY SHALE**
predominately dark gray to black, hard, blocky, brittle, dull, cherty, fragments irregular or blocky in shape, micromicaceous, carbonaceous, in part as fissile soft shale, rare silty & sandy fragments, 25% as light to medium brown swelling shale fragments, very weak poor, slow yellow green blooming cut fluorescence.

2,927.00 to 2,930.00 (3.00) **CHERTY SHALE**
black, very dark gray, sub platy to blocky, soft to hard, fissile to brittle, commonly cherty & grading to argillaceous chert, carbonaceous, in part fractured, 30% of fragments light to medium brown, rare dark brown, bit-ground, swelling, rare medium brown silty to very fine lower grained, argillaceous, tight silty sandstone fragments, weak slow yellow green blooming cut fluorescence.

2,948.00 to 2,950.00 (2.00) **SHALE**
medium brown, sub platy to blocky, micromicaceous, commonly cracking or swelling in water, pyritic, commonly as clay shale, soft to commonly firm & brittle sub fissile in part, rare white silica lined fractures, rare silty & sandy fragments, 5% medium brown gray, consolidated. salt and pepper, angular to subrounded, silty to very fine lower grained, tight, argillaceous, slightly sis sandstone fragments.

2,950.00 to 2,955.00 80% (5.00) **SHALE**
medium brown, medium brown gray, dark brown, sub platy to blocky, micromicaceous, slightly pyritic, occasional carbonaceous, slightly swelling in water, commonly soft & fissile in water, weak, very poor, slow, yellow green blooming cut fluorescence.

2,950.00 to 2,955.00 (5.00) 20% **SANDSTONE**
light gray, medium brown gray, consolidated, salt and pepper, fragments occasionally swell in water, silty to very fine lower grained, subangular to subrounded, grading to silty, sandy shale, commonly with a light gray, medium brown gray argillaceous matrix, slightly kaolinitic, rare spotty white argillaceous matrix, slightly kaolinitic?, very weak, slow, very poor yellow green blooming cut fluorescence.

2,955.00 to 2,960.00 (5.00) 85% **SHALE**
medium brown, medium brown gray, sub platy to blocky, micromicaceous, slightly pyritic, slightly swelling in water, occasional carbonaceous grains, rare black cherty fragments, occasional slightly silty & sandy fragments, very weak, poor slow yellow green bloming cut fluorescence.

15% **SANDSTONE**
light gray,predominately medium brown gray, consolidated, salt and pepper, silty to very fine lower grained, trace very fine upper grained fragments, subangular to subrounded, poorly sorted, grading to silty, sandy shale, commonly friable, commonly with a light gray, medium brown gray argillaceous matrix, pyritic, slightly siliceous, rare spotty white argillaceous matrix, slightly kaolinitic?, no cut fluorescence.

2,960.00 to 2,965.00 (5.00) 80% **SHALE**
medium brown, medium brown gray, sub platy to blocky, micromicaceous, slightly pyritic, slightly swelling in water, rare silica lined fractures, occasional slightly silty & sandy fragments, very weak, poor slow yellow green blooming cut fluorescence.

20% **SANDSTONE**
light gray, predominately medium to dark brown gray, consolidated, salt and pepper, silty to very fine upper grained, subangular to subrounded, angular in part, poorly sorted, grading to silty, sandy shale, commonly friable, commonly with a light gray, medium brown gray argillaceous matrix, pyritic, occasionally micaceous, slightly siliceous, rare spotty white argillaceous matrix, slightly kaolinitic?, no cut fluorescence.

2,965.00 to 2,970.00 (5.00) 75% **SHALE**
medium brown, medium brown gray, sub platy to blocky, micromicaceous, slightly pyritic, slightly swelling in water, rare silica lined fractures, rare carbonaceous flakes, occasional slightly silty & sandy fragments, very weak,very poor slow yellow green blooming cut fluorescence.

25% **SANDSTONE**
light gray, predominately medium to dark brown gray, consolidated, salt and pepper, silty to very fine lower grained, subangular to subrounded, angular in part, poorly sorted, grading to silty, sandy shale, commonly friable, commonly with a light gray, medium brown gray argillaceous matrix, carbonaceous, pyritic, occasionally micaceous, slightly siliceous, very poor reservoir, no cut fluorescence, occasional fragments with white lined silica fractures, non calcareous.

2,970.00 to 2,975.00 (5.00) 80% **SHALE**
medium brown, medium brown gray, sub platy to occasionally subblocky, micromicaceous, trace disseminated very fine pyrite, predominately as clay shale, rare silty & sandy fragments, soft to medium hard, sub fissile, occasionally brittle, occasionally carbonaceous, rare silica lined fractures.

20% **SANDSTONE**
light to medium brown gray, soft to firm & brittle, consolidated, salt and pepper, silty to very fine lower grained, angular to subrounded, commonly with light gray, medium brown argillaceous matrix, slightly pyritic, siliceous, rare fragments swell in water, very poor reservoir, poor grain relief, no visible porosity, no cut fluorescence.

2,975.00 to 2,980.00 (5.00) 85% **SHALE**
medium brown, light to medium brown gray, sub platy to occasionally subblocky, micromicaceous, trace disseminated very fine pyrite, predominately as clay shale, rare silty & sandy fragments, soft to medium hard, sub fissile, occasionally brittle, occasionally carbonaceous, rare silica lined fractures, very weak slow yellow green blooming cut fluorescence, slightly dolomitic.

15% **SANDSTONE**
light gray, predominately light to medium gray brown, very argillaceous & poorly sorted, silty to very fine lower grained, grading to sandy siltstone, subangular to subrounded, angular in part, with medium brown, gray, argillaceous cement, carbonaceous, siliceous, pyritic, tight, no cut fluorescence., slightly dolomitic.

2,980.00 to 2,985.00 (5.00) 70% **SHALE**
medium brown, light to medium brown gray, sub platy to occasionally subblocky, micromicaceous, trace disseminated very fine pyrite, predominately as clay shale, rare silty & sandy fragments, soft to medium hard, sub fissile, occasionally brittle, rare silica lined fractures, very weak slow yellow green blooming cut fluorescence, slightly dolomitic.

30% **SANDSTONE**
consolidated, salt and pepper, light to medium brown gray, occasionally gray & very carbonaceous, silty to very fine lower grained, subangular to subrounded, angular in part, poorly sorted, commonly very argillaceous, carbonaceous, slightly pyritic, siliceous, no visible porosity, no cut fluorescence, slightly dolomitic.

2,985.00 to 2,990.00 (5.00) 90% **SHALE**
medium brown, medium brown gray, rare dark gray to black fragments, slightly pyritic, sub platy to blocky, micromicaceous, soft to medium hard, sub fissile, rare silty & sandy fragments, slightly dolomitic.

10% **SANDSTONE**
consolidated, salt and pepper, silty to very fine lower grained, light to medium gray brown, dark brown, gray, poorly sorted, argillaceous, carbonaceous, slightly siliceous, with light gray brown, off white, argillaceous matrix, tight, no shows, slightly dolomitic.

2,990.00 to 2,995.00 90% **SHALE**
(5.00) medium brown gray, platy to subblocky, micromicaceous, predominately as clay shale, soft to medium hard, sub fissile, brittle in part, rare carbonaceous flakes, fragments commonly swell or crack in water, slightly dolomitic.

10% **SANDSTONE**
light gray brown, medium brown gray, consolidated, silty to very fine lower grained, poorly sorted, subangular to subrounded, angular in part, locally grading to silty & sandy shale, carbonaceous, slightly pyritic, with light gray, medium brown gray argillaceous matrix, tight, no shows.

2,995.00 to 3,000.00 80% **SHALE**
(5.00) medium brown, dark brown, platy to subblocky, micromicaceous, as clay shale, rare white silica lined fractures, rare fragments crack or swell in water.

20% **SANDSTONE**
off white, light to medium brown gray, consolidated, salt and pepper, silty to very fine lower grained, poorly sorted, subangular to subrounded, angular in part, with off white, light gray, medium brown argillaceous matrix, carbonaceous, slightly siliceous, friable, carbonaceous, slightly dolomitic, tight, no shows.

3,000.00 to 3,005.00 85% **SHALE**
(5.00) medium brown, medium brown gray, platy to blocky, micromicaceous, trace disseminated very fine pyrite, slightly carbonaceous, soft to medium hard, sub fissile, brittle in part.as clay shale, rare fragments crack in water, rare dolomitic or slightly calcareous fragments.

15% **SANDSTONE**
off white,rare light to medium brown gray fragments, consolidated, salt and pepper, silty to very fine lower grained, poorly sorted, grading to sandy siltstone, subangular to subrounded, angular in part, with off white, light gray, medium brown argillaceous matrix, carbonaceous, slightly siliceous, friable, carbonaceous, slightly dolomitic, tight, no shows.

3,005.00 to 3,010.00 100% **SHALE**
(5.00) medium brown, medium brown gray, platy to subblocky, micromicaceous, slightly pyritic, soft to medium hard, trace pyrite, as clay shale, rare fragments crack in water. with < 10% off white, light gray, very light gray brown, locally dark gray & carbonaceous, silty to very fine grained, argillaceous, tight, salt and pepper sandy siltstone & silty sandstone fragments, slightly dolomitic.

3,010.00 to 3,015.00 85% **SHALE**
(5.00) medium brown, medium brown gray, sub platy to subblocky, micromicaceous, occasionally slightly silty or sandy, predominately as clay shale, occasional fragments swell or crack in water, weak, poor yellow green blooming cut fluorescence, slightly dolomitic.

3,010.00 to 3,015.00 15% **SANDSTONE**
(5.00) light gray, off white, locally dark gray & carbonaceous, silty to very fine lower grained, subangular to subrounded, with < 25% dark chert grains, carbonaceous, slightly siliceous, slightly dolomitic, poorly sorted, grading to sandy siltstone, tight, poor grain relief, firm, occasionally very friable, with off white, light gray argillaceous matrix, tight, no shows.

3,015.00 to 3,025.00 90% **SHALE**
(10.00) medium brown gray, medium brown, rare dark brown to black fragments, as clay shale, soft to medium hard, fissile to brittle, rare carbonaceous flakes, slightly swelling in water, slightly pyritic, slow, poor yellow green blooming cut fluorescence, contamination by mud additive? slightly dolomitic.

10% **SANDSTONE**
off white, commonly dark brown, black, carbonaceous, silty to very fine lower grained, poorly sorted, very argillaceous, with light gray, dark brown argillaceous matrix, carbonaceous, slightly siliceous, pyritic, slightly dolomitic, friable to firm, tight, very weak, slow, poor yellow green blooming cut fluorescence.

3,025.00 to 3,030.00 80% **SHALE**
(5.00) medium to dark brown, sub platy to occasionally blocky, micromicaceous, trace disseminated very fine pyrite, rare carbonaceous flakes, predominately as clay shale, rare silty or sandy fragments, dolomitic.

20% **SANDSTONE**
light gray, predominately dark gray, consolidated, friable to firm, silty to very fine lower grained, subangular to subrounded, very poorly sorted & grading to sandy, silty shale, slightly dolomitic, slightly siliceous, predominately with dark brnarg matrix, tight, very poor grain relief, very weak, very faint, slow yellow green blooming cut fluorescence, no visible porosity.

3,030.00 to 3,035.00 100% **SHALE**
(5.00) medium to dark brown, sub platy to blocky, micromicaceous, dul, occasionally greasy, carbonaceous, soft to occasionally firm, commonly fissile, dolomitic, as clay shale, trace disseminated very fine pyrite, occasional slightly silty & sandy fragments,10% of fragments dark gray, very silty, sandy, carbonaceous, commonly brittle, grading to poorly sorted, silty to very fine lower grained, very argillaceous, poorly sorted sandstone, weak, poor, slow yellow green blooming cut fluorescence.

3,035.00 to 3,040.00 85% **SHALE**
(5.00) medium to dark brown, sub platy to blocky, micromicaceous, soft to occasionally medium hard, commonly fissile, dolomitic, predominately as clay shale, rare carbonaceous or sandy & silty fragments, weak poor, slow yellow green blooming cut fluorescence.

15% **SANDSTONE**
light gray, off white, dark gray, silty to occasionally very fine lower grained, grading in part to sandy siltstone, subangular to subrounded, slightly pyritic, spotty dolomitic cement, with light gray, medium to dark brown argillaceous matrix, poorly sorted, tight, no cut fluorescence.

Canol: 3,044.80 MD, 2,649.28 TVD, -1,967.58 SSL

3,040.00 to 3,045.00 100% (5.00) **SHALE**
dark brown, dark brown gray, sub platy to blocky, dull, greasy, commonly soft, sub fissile, pyritic, slightly swelling in water, carbonaceous, occasionally slightly silty & sandy, slow, poor, yellow green blooming cut fluorescence.

3,045.00 to 3,050.00 100% (5.00) **SHALE**
medium to predominately dark brown, 15-20% of fragments black, predominately soft, subfissile, pyritic, very carbonaceous, slightly dolomitic, rare brittle fragments, occasional fragments swell or crack in water, predominately as clay shale, rare silty & sandy fragments or rare brittle fragments, slow, poor yellow green blooming cut fluorescence.

3,050.00 to 3,055.00 100% (5.00) **SHALE**
medium to predominately dark brown, 20% of fragments black or dark gray, predominately soft, subfissile, pyritic, very carbonaceous, slightly dolomitic, trace dark brown chert fragments, rare brittle fragments, occasional fragments swell or crack in water, predominately as clay shale, rare silty & sandy fragments or rare brittle fragments, slow, poor yellow green blooming cut fluorescence.

Ogilvie: 3,056.80 MD, 2,660.92 TVD, -1,979.22 SSL

3,055.00 to 3,060.00 100% (5.00) **LIMESTONE**
off white, light gray brown, rare medium brown fragments, cryptocrystalline, recrystallized, mottled, commonly chalky, bit-ground in part, argillaceous, locally marly, as chalky mudstone,no visible porosity, no cut fluorescence.

3,060.00 to 3,065.00 100% (5.00) **LIMESTONE**
off white, mottled black, chalky, recrystallized, bit-ground, as cryptocrystalline mudstone, commonly with black argillaceous bituminous clay lined sty;limestone, tight, no shows, slow yellow green milky blooming cut fluorescence.

3,065.00 to 3,070.00 100% (5.00) **LIMESTONE**
off white, light brown, mottled light brown off white, 30% with black, bituminous & argillaceous inclusions, recrystallized, chalky textured, cryptocrystalline to very fine lower crystalline, as mudstone, rare crinoid & brachiopod ghost, black bituminous fragments with slow yellow green blooming cut fluorescence, no visible porosity, chalky porosity? rare sand grains in acid residue.

3,070.00 to 3,075.00 100% (5.00) **LIMESTONE**
light brown, off white, mottled, 25% of fragments with black argillaceous, & bituminous inclusions or stylolites, cryptocrystalline to occasionally very fine lower crystalline, recrystallized, chalky textured, recrystallized peloidal mudstone, wackestone, rare brachiopods, crinoids, weak, slow, yellow green flash cut fluorescence, no visible porosity.

3,075.00 to 3,080.00 100% (5.00) **LIMESTONE**
off white, light to medium yellow brown, mottled, 30% of fragments with black argillaceous & bitumen stylolites & inclusions, chalky textured, recrystallized, predominately cryptocrystalline, questionable brachiopod, crinoid & rugosan coral ghosts, non dolomitic, argillaceous & bituminous fragment with slow yellow green blooming cut fluorescence, earthy porosity?, no visible porosity.

3,080.00 to 3,085.00 100% (5.00) **LIMESTONE**
off white, light brown, mottled, chalky textured, recrystallized, cryptocrystalline, scattered black bitumen & argillaceous lined stylolites, friable in part, earthy porosity?, 15% of fragments argillaceous, no visible porosity, stylolitic fragments with slow yellow green blooming cut fluorescence.

3,085.00 to 3,090.00 100% (5.00) **LIMESTONE**
off white, light brown, rare white opalescent fragments, mottled, chalky textured, recrystallized, cryptocrystalline, scattered black bitumen & argillaceous lined stylolites, occasional ghosts of crinoids, rugosan corals, brachiopods, non dolomitic, friable in part, earthy porosity?, 15-20% of fragments argillaceous, stylolitic, as questionable organic porosity infill, no visible porosity, stylolitic fragments with slow yellow green blooming cut fluorescence, fragments in part bit-ground

3,090.00 to 3,095.00 100% (5.00) **LIMESTONE**
off white, light brown, rare white opalescent fragments, mottled, chalky textured, recrystallized, cryptocrystalline, scattered black bitumen & argillaceous lined stylolites & black marlstone partings, occasional ghosts of crinoids, rugosan corals, non dolomitic, friable in part, earthy porosity?, 15-20% of fragments argillaceous, stylolitic, bituminous, no visible porosity, black fragments with slow yellow green blooming cut fluorescence, fragments in part bit-ground, rare calcite healed microfractures.

3,095.00 to 3,100.00 100% (5.00) **LIMESTONE**
off white, light yellow brown, mottled, 25% of fragments with disseminated black, slightly bituminous argillaceous inclusions, or as interparticle fill between recrystallized allochems, chalky textured, cryptocrystalline to locally lower fine crystalline, in part as recrystallized bioclastic grainstone, packstone, occasional crinoid ghosts, trace white & light brown chert in acid residue, earthy porosity?, argillaceous fragments with slow yellow green poor blooming cut fluorescence.

3,100.00 to 3,105.00 100% (5.00) **LIMESTONE**
off white, very light yellow brown, light brown gray, commonly mottled, cryptocrystalline to occasionally lower fine crystalline, recrystallized & commonly chalky textured, 35% of fragments with black, medium brown argillaceous in part dead bitumen inclusions or partings, occasional dark brown questionable dead bitumen lined organic porosity, earthy porosity, scattered tabulatan coral bafflestones, trace chert in acid residue, argillaceous or bituminous fragments with slow yellow green blooming cut fluorescence, bitumen plugged organic porosity? trace chert in acid residue, rare fragments with rhombohedral dolomite crystals.

3,105.00 to 3,110.00 100% (5.00) **LIMESTONE**
off white, very light yellow brown, commonly mottled, cryptocrystalline to occasionally lower fine crystalline, recrystallized & commonly chalky textured, 35% of fragments with black (dead bitumen?) , medium brown argillaceous inclusions or partings, earthy porosity, scattered stromatoporoids & tabulatan coral bafflesones & bindstones, bitumen lined organic porosity?, trace chert in acid residue, argillaceous fragments with slow yellow green blooming cut fluorescence, trace chert in acid residue.

3,110.00 to 3,115.00 100% (5.00) **LIMESTONE**
off white, very light yellow brown, light gray brown, commonly mottled, cryptocrystalline to occasionally lower fine crystalline, recrystallized & commonly chalky textured, 15-20% of fragments with black in part dead bitumen, medium brown argillaceous inclusions or partings, 3% as marly fragments earthy porosity?, trace chert , predominately as tabulatan bafflestone & mudstone, wackestone, rare organic porosity, argillaceous fragments with slow yellow green blooming cut fluorescence, trace chert in acid residue.

3,115.00 to 3,120.00 100% (5.00) **LIMESTONE**
off white, very light yellow brown, light brown gray, commonly mottled, cryptocrystalline to occasionally lower fine crystalline, recrystallized & commonly chalky textured, 35% of fragments with black (in part dead bitumen) , argillaceous inclusions, lined stylolites, partings or as interallochem fill, earthy porosity?, rare brachiopods, crinoids, tabulatan coral bafflestone, predominately as recrystallized bioclastic mudstone to wackestone, occasional fragments with 1-8% black dead bitumen lfilled organic porosity? trace chert, argillaceous fragments with slow yellow green blooming cut fluorescence.

3,120.00 to 3,125.00 100% (5.00) **LIMESTONE**
off white, very light yellow brown, rare dark brown fragments, commonly mottled, cryptocrystalline to lower fine crystalline, recrystallized & commonly chalky textured, 30% of fragments with black, (in part dead black bitumen) light to medium brown gray argillaceous inclusions, lined stylolites, partings or as interallochem fill, occasional crinoid, brachiopod or coral ghosts, predominately as mudstone, wackestone, tabulatan coral bafflestone, earthy porosity?, with dead bitumen lines organic porosity, trace chert, no cut fluorescence.

3,125.00 to 3,130.00 100% (5.00) **LIMESTONE**
off white, very light yellow brown, rare dark brown fragments, commonly mottled, cryptocrystalline to occasionally lower fine crystalline, recrystallized & commonly chalky textured, 20% of fragments with black in part dead bitumen, light to medium brown gray argillaceous inclusions, as rare lined stylolites or partings or as marly fragments, occasional crinoid, brachiopod or coral ghosts, earthy porosity?, spotty 1-12% organic & rare interparticle bitumen plugged porosity?, trace chert, argillaceous fragments with weak, slow yellow green blooming cut fluorescence.

3,130.00 to 3,135.00 100% (5.00) **LIMESTONE**
off white, very light yellow brown, gray brown, rare dark brown fragments, commonly mottled, cryptocrystalline to lower fine crystalline, recrystallized & commonly chalky textured, 50% of fragments with black, light to medium brown gray argillaceous inclusions, rare lined stylolites, as partings or as interallochem infill, occasional crinoid, brachiopod or coral ghosts, rare coral bafflestone fragments, earthy porosity?, dead bitumen lined orgnic porosity? trace chert, argillaceous fragments with weak, slow yellow green blooming cut fluorescence.

3,135.00 to 3,140.00 100% (5.00) **LIMESTONE**
off white, very light yellow brown, gray brown, rare dark brown fragments, commonly mottled, cryptocrystalline to lower fine crystalline, recrystallized & commonly chalky textured, 50% of fragments with black, light to medium brown gray argillaceous inclusions, with rare lined stylolites, as marly partings or as interallochem infill, occasional crinoid, brachiopod or coral ghosts, rare stromatoporoids, in part as recrystallized grainstone, packstone, questionable bafflestone or bindstone, earthy porosity?, 1-9% black dead bitumen plugged organic & occasional interparticle porosity?, trace chert, argillaceous fragments with weak, slow yellow green blooming cut fluorescence.

3,140.00 to 3,150.00 100% (10.00) **LIMESTONE**
off white, light yellow brown, light gray brown, commonly mottled, predominately recrystallized, chalky textured & cryptocrystalline, commonly soft, brittle, rare non recrystallized crinoid, peloid grainstone fragments, 25% of fragments with mottled black dark brown, slightly bituminous argillaceous inclusions, stylolites, & occasionally as inter allochem infill, rare fragments with calcite sparite, occasional crinoid ghosts, rare stromatoporoids & tabulatan corals, bindstone, bafflestone, rare pyrite, no visible interparticle porosity, no visible druse, 10% black bitumen plugged interparticle & organic porosity?, very poor faint yellow green blooming cut fluorescence, trace chert.

3,150.00 to 3,155.00 100% (5.00) **LIMESTONE**
off white, light yellow brown, predominately light gray brown, commonly mottled, predominately recrystallized, chalky textured & cryptocrystalline, commonly soft, brittle, rare non recrystallized crinoid, peloid grainstone & stromatoporoid fragments, 25% of fragments with mottled black dark brown, slightly bituminous argillaceous inclusions, stylolites,or as marlstone partings, rare as allochem infill, rare sparite, occasional crinoid ghosts, rare stromatoporoids & tabulatan corals, bindstone, bafflestone, rare pyrite, no visible interparticle porosity, no visible druse, 10% black bitumen plugged interparticle & organic porosity?, very poor faint yellow green blooming cut fluorescence, trace chert.

3,155.00 to 3,160.00 100% (5.00) **LIMESTONE**
off white, light gray brown, commonly mottled, cryptocrystalline to occasionally lower fine crystalline, recrystallized & commonly chalky textured, 35% of fragments with black, argillaceous . slightly bituminous (dead) inclusions, lined stylolites, partings or as interallochem fill, earthy porosity?, occasional stromatoporoids, rare brachiopods & crinoids, in part as bindstone trace chert, argillaceous fragments with slow yellow green blooming cut fluorescence.

3,160.00 to 3,165.00 100% (5.00) **LIMESTONE**
off white, occasionally very light yellow brown, light brown, commonly mottled, cryptocrystalline to occasionally lower fine crystalline, recrystallized & commonly chalky textured, 25% of fragments with black, in part bitumen (predominately dead) argillaceous inclusions, lined stylolites, partings or as interallochem fill, scattered recrystallized stromatoporoids, earthy porosity?, rare brachiopods, crinoids, tabulatan coral bafflestone, trace chert, non dolomitic, argillaceous & bituminous fragments with slow, poor yellow green blooming cut fluorescence, 10-15% organic, interparticle dead bitumen plugged porosity?

3,165.00 to 3,170.00 100% (5.00) **LIMESTONE**
off white, light gray brown, mottled, trace medium brown fragments, recrystallized, commonly chalky textured, cryptocrystalline to occasionally lower fine crystalline, 25% of fragments with black in part dead bitumen & dark brown partings, stylolite fils, & locally as inter allochem fillings, predominately as mudstone, rare brachiopods, questionable corals & stromatoporoids, predominately tight, 6-7% bitumen plugged interparticle plugged porosity?, no cut fluorescence.

3,170.00 to 3,175.00 100% (5.00) **LIMESTONE**
predominately light brown, light yellow brown, occasionally off white, occasionally mottled, in part recrystallized & chalky, predominately as mudstone, rare tabulatan coral & stromatoporoid fragments, rare off white calcite sparite, 10-15% of fragments with black argillaceous & slightly bituminous lined stylolites, rare pyrite, no visible porosity, weak slow, poor yellow green blooming cut fluorescence.

3,175.00 to 3,180.00 100% (5.00) **LIMESTONE**
off white, light brown gray, commonly mottled, recrystallized in part & chalky textured, cryptocrystalline, rare lower fine crystalline fragments, predominately as mudstone limestone, occasional black bitumen or argillaceous lined stylolites, occasional calcite sparite, rare pyrite, tight, no shows.

3,180.00 to 3,190.00 100% (10.00) **LIMESTONE**
off white, light brown gray, light yellow brown, commonly mottled, recrystallized in part & chalky textured, cryptocrystalline, rare lower fine crystalline fragments, predominately as mudstone limestone, occasional black bitumen or argillaceous lined stylolites, occasional calcite sparite, rare pyrite, tight, trace chert, no shows.

3,190.00 to 3,195.00 100% (5.00) **LIMESTONE**
off white, light brown, commonly chalky textured & recrystallized, predominately as mudstone, rare stromatoporoids, 40% of fragments with black commonly disseminated dead bitumen & clay , in part as black marly fragments, rare white calcite sparite, non dolomitic, very weak yellow green blooming cut fluorescence, 10% black bitumen plugged porosity?

3,195.00 to 3,200.00 100% (5.00) **LIMESTONE**
off white, light brown, 5% medium brown, commonly chalky textured & recrystallized, predominately as mudstone, rare stromatoporoids, 40% of fragments with black commonly disseminated dead bitumen & clay ,10-15% black marly shale, rare white calcite sparite, non dolomitic, very weak yellow green blooming cut fluorescence, black dead bitumen plugged porosity?

3,200.00 to 3,205.00 100% (5.00) **LIMESTONE**
off white, light brown, recrystallized & chalky textured in part, mottled, as Amphipora mudstone to floatstone, commonly recrystallized & chalky, scattered black bitumen & argillaceous lined stylolites, 10-15% black, dark brown marly fragments, predominately tight, very weak, poor yellow green blooming cut fluorescence.

3,205.00 to 3,210.00 100% (5.00) **LIMESTONE**
off white, light brown, recrystallized & chalky textured in part, mottled, as Amphipora mudstone to floatstone, scattered black bitumen & argillaceous lined stylolites, 10-15% black, dark brown marly fragments, predominately tight, very weak, poor yellow green blooming cut fluorescence, scattered microfractures, occasional white sparite, no visible porosity.

3,210.00 to 3,215.00 100% (5.00) **LIMESTONE**
off white, very light brown, chalky textured, recrystallized, 10-15% dark brown, black, marly, rare white calcite sparite, as Amphipora mudstone to floatstone, common;ly with black argillaceous or bitumen lined stylolites, no visible porosity, weak, slow poor, yellow green blooming cut fluorescence.

3,215.00 to 3,225.00 100% (10.00) **LIMESTONE**
off white, light gray brown, chalky textured, recrystallized, predominately cryptocrystalline, occasional Amphipora & Stachyoides ghosts, mudstone to floatstone, occasional black bitumen or argillaceous lines stylolites, rare microfractures, 5-6%dark brown, marly limestone fragments, no visible porosity, weak, slow, poor yellow green blooming cut fluorescence.

3,225.00 to 3,230.00 100% (5.00) **LIMESTONE**
off white, mottled light brown, chalky textured, recrystallized, as mudstone, occasional Stachyoides, scattered black, argillaceous & dead bitumen lined stylolites, rare dark brown marly limestone fragments, scattered white calcite sparite, no visible porosity, very poor, weak, slow yellow green blooming cut fluorescence.

3,230.00 to 3,235.00 100% (5.00) **LIMESTONE**
off white, mottled light yellow brown, light brown, chalky textured, recrystallized, predominately cryptocrystalline, predominately as mudstone, occasional tabulatan coral bafflestone, questionable floatstone, rudstone, scattered black bitumen & black clay lined stylolites, trace medium brown marly fragments, slow, poor weak yellow green blooming cut fluorescence.

3,235.00 to 3,240.00 100% (5.00) **LIMESTONE**
off white, mottled light brown, chalky textured, recrystallized, cryptocrystalline, questionable Stachyoides & Amphipora ghosts, scattered black lined stylolites, no visible porosity, earthy porosity?, very weak, poor yellow green blooming cut fluorescence.

3,240.00 to 3,245.00 100% (5.00) **LIMESTONE**
off white, mottled light brown, chalky textured, recrystallized, cryptocrystalline, as recrystallized Stachyoides, Amphipora rudstone to floatstone, in part as mudstone, scattered black lined stylolites, no visible porosity, earthy porosity?, very weak, poor yellow green blooming cut fluorescence.

3,245.00 to 3,250.00 100% (5.00) **LIMESTONE**
off white, mottled light brown, chalky textured, recrystallized, cryptocrystalline, as recrystallized Stachyoides, Amphipora rudstone to floatstone, in part as mudstone, scattered black lined stylolites, no visible porosity, earthy porosity?, very weak, poor yellow green blooming cut fluorescence.

3,250.00 to 3,255.00 100% (5.00) **LIMESTONE**
off white, mottled light brown, chalky textured, recrystallized, cryptocrystalline, as recrystallized Stachyoides, Amphipora rudstone to floatstone, in part as mudstone, scattered black lined stylolites, no visible porosity, earthy porosity?, very weak, poor yellow green blooming cut fluorescence.

3,255.00 to 3,265.00 100% (10.00) **LIMESTONE**
off white, mottled light brown, chalky textured, recrystallized, cryptocrystalline, as recrystallized Stachyoides, Amphipora rudstone to floatstone, in part as mudstone, scattered black lined stylolites, no visible porosity, earthy porosity?, very weak, poor yellow green blooming cut fluorescence.

3,265.00 to 3,275.00 100% (10.00) **LIMESTONE**
off white, light brown mottled, chalky textured, recrystallized, predominately cryptocrystalline, as Stachyoides floatstone, rudstone,. occasional black argillaceous, slightly bituminous lined stylolites, trace black organic plugged dead bitumen, no visible porosity, very poor, weak, yellow green blooming cut fluorescence.

3,275.00 to 3,285.00 100% (10.00) **LIMESTONE**
off white, light brown or light yellow brown mottled, chalky textured, recrystallized, predominately cryptocrystalline, scattered Stachyoides, as rudstone, floatstone, rare fragments with black organic plugged porosity, occasional argillaceous or bituminous lined stylolites, no cut fluorescence.

3,285.00 to 3,290.00 100% (5.00) **LIMESTONE**
off white, light brown mottled, chalky textured, recrystallized, predominately cryptocrystalline, scattered Stachyoides, as rudstone, floatstone, rare fragments with black organic plugged porosity, occasional argillaceous or bituminous lined stylolites, no cut fluorescence, rare Amphipora.

3,290.00 to 3,300.00 100% (10.00) **LIMESTONE**
off white, light brown mottled, chalky textured, recrystallized, cryptocrystalline, as Amphipora, Stachyoides floatstone, rudstone, scattered black argillaceous & dead bitumen lined stylolites, no visible porosity, no cut fluorescence, minor dead bitumen plugged organic porosity.

3,300.00 to 3,305.00 100% (5.00) **LIMESTONE**
off white, commonly light brown mottled, predominately recrystallized & with chalky textured, fragments commonly friable, cryptocrystalline, as Amphipora, Stachyoides rudstone, floatstone, with disseminated black organic bitumen plugged porosity, no cut fluorescence, occasional black stylolites.

3,305.00 to 3,310.00 100% (5.00) **LIMESTONE**
off white, light brown mottled, chalky textured, recrystallized, predominately cryptocrystalline, 15% medium brown, light gray, no recrystallized, with abundant Amphipora, Stachyoides, in part as mudstone, no visible porosity, occasional bitumen fillied organic porosity, no cut fluorescence.

3,310.00 to 3,315.00 100% (5.00) **LIMESTONE**
predominately off white, light brown mottled, chalky textured, recrystallized, commonly soft & friable & with questionable eathy porosity, 15% medium brown, dark brown & non recrystallized, as peloidal, mudstone to wackestone, Amphipora & Stachyoides (Idiostroma) rudstone to floatstone, spotty black argillaceous stylolites & organic lined black dead bitumen, rare druse, predominately with no visible porosity, no cut fluorescence.

3,315.00 to 3,320.00 100% (5.00) **LIMESTONE**
predominately off white, mottled yellow brown, light brown, chalky textured, recrystallized, cryptocrystalline, commonly friable, predominately as Stachyoides, Amphipora floatstone, 15-20% as medium brown, non recrystallized mudstone with floating calcipheres, ostracods & rare Amphipora,, trace peloidal grainstone, no visible porosity, no cut fluorescence.

3,320.00 to 3,325.00 100% (5.00) **LIMESTONE**
predominately off white, light brown mottled, chalky textured, recrystallized, cryptocrystalline, commonly friable, as mudstone, Stachyoides, Amphipora floatstone, 20% of fragments medium brown, no recrystallized, with fragments of Stachyoides, Amphipora, calcispheres, in part as mudstone, no visible porosity, no cut fluorescence, 3% calcareous, black marlstone.

3,325.00 to 3,330.00 100% (5.00) **LIMESTONE**
less recrystallized than above, 20% light gray, commonly argillaceous, marly, cryptocrystalline, dense & tight, trace light green calcareous shale, 40% light yellow brown, medium brown, as mudstone, Amphipora rudstone & floatstone, as ostracod wackestone, dense & tight, 50% of fragments chalky textured, recrystallized, off white, mottled light brown, predominately friable, as mudstone, rare Stachyoides, tight, no shows.

3,330.00 to 3,335.00 100% (5.00) **LIMESTONE**
25% of fragments light gray, very light gray brown, cryptocrystalline, commonly argillaceous, marly, dense & tight, 40% of fragments medium brown, cryptocrystalline, non recrystallized, as mudstone, Amphipora floatstone, calcisphere wackestone, 25% of fragments chalky, recrystallized, friable, chalky textured, trace dark gray slightly argillaceous tight fragments, no cut fluorescence.

3,335.00 to 3,340.00 100% (5.00)	**LIMESTONE** 10-15% of fragments light gray, very light gray brown, cryptocrystalline, commonly argillaceous, marly, dense & tight, 50% of fragments medium brown, cryptocrystalline, non recrystallized, as mudstone, Amphipora floatstone, calcisphere wackestone, mudstone, 25% of fragments chalky, recrystallized, friable, chalky textured, trace dark gray slightly argillaceous tight fragments, no cut fluorescence, 10% black, dark gray, calcareous, shale & marlstone.
3,340.00 to 3,345.00 100% (5.00)	**LIMESTONE** off white, medium brown, as mudstone, wackestone, rare Amphipora floatstone, recrystallized & chalky textured in part, scattered calcite druse, 1-6%? interparticle, vug & micro vug porosity, no cut fluorescence, rare light gray argillaceous limestone fragments, rare micro fractures, no cut fluorescence.
3,345.00 to 3,350.00 100% (5.00)	**LIMESTONE** off white, medium brown, as mudstone, wackestone, rare Amphipora floatstone, recrystallized & chalky textured in part, scattered calcite druse, 1-6%? interparticle, vug & micro vug porosity, no cut fluorescence, rare light gray argillaceous limestone fragments, rare micro fractures, no cut fluorescence.