

PCI TWEED LAKE M-47
Complete Mount Clark Sandstone
March , 2004

TIGHT HOLE

AFE: B783031
Amount: \$5,900,000
Grid Area: 67° 00'N; 125° 45' W
UWI: 300M4767000125450
ADW:
Working Interest: 100%
Latitude: N66° 56' 47.11"
Longitude: W125° 54' 9.42"

OBJECTIVE:

To complete the Lower Mount Clark Formation sandstone with a gelled oil frac and to perform a deliverability test on the zone.

RESPONSIBILITY

This program will be conducted by the Completions Group under the direction of Art Congdon (403) 296-6812.

Engineering support will be provided by Jennifer Taylor (403) 296-3537, cell # (403) 803-5535 or at home at (403) 731-2356.

SAFETY AND LOSS CONTROL REQUIREMENTS

1. Wellsite Supervisors must ensure that the applicable Petro-Canada Codes of Practice are observed, including the following.
 - a) **Safety Orientation**- All Onsite personnel must be oriented prior to commencing work.
 - b) **Safe Work Agreements** will be issued for hot work, and confined space entry.
 - c) **Ground Disturbance Attachments** must be used before any ground disturbance deeper than 30 cm (including rig anchors) is carried out.
 - d) **Hydrocarbon Exposure** LEL meters will be used on any job where hydrocarbon vapors may be present.
 - e) **H₂S Code of Practice** will be observed by providing H₂S detection equipment, trained personnel, and specified safety equipment.

2. Ensure 'up to date' MSDS sheets are onsite for all controlled products including produced fluids. Ensure that workers are made aware of the Hazards and Safeguards.
3. Event and near miss reports must be utilized for all dangerous occurrences.

RESERVOIR PARAMETERS:

Zones: Mount Clark Formation (0% H₂S, 0% CO₂)
 Pressure: 12.8 MPa
 Temperature: 12°C

Wellhead

See attached detailed sheet

KB: 435.22 m GL: 429.1 m KB-CF:
 TD: 1418 mKB PBD: 1406 mKB

Tubular Data

Description	Prod. Csg.	Prod. String
Size, mm.	178	73
Weight, kg/m	43	9.67
Grade	S0095	L-80
Collapse, MPa	53.92	76.95
Burst, MPa	66.81	72.68
Drift Dia., mm.	153.90	59.61
Capacity, m ³ /m	0.0194	0.0030
Annular Vol., m ³ /m		0.0164

Casing & Cementing Details

Surface Casing: 2 joints 508 mm 140 kg/m K-55 BT&C casing landed at 23 mKB. Cemented with 10.8 t Arctic Set

Intermediate Casing: 5 joints 340 mm 101 kg/m K-55 BT&C casing landed at 64 mKB. Cemented with 18 t Arctic Set

Intermediate Casing: 61 joints 244 mm (23 joints S0095 65 kg/m and 38 joints L80 60 kg/m). Float shoe landed at 760m, float collar at 749.34m, ECP at 48.5m and DV tool at 45m. Cemented with 64 t G neat (stage 1); displaced with 9.9 m³ water and annulus bridged off- unable to move cement with 30,000 kPa. Estimate cement to 340 m (lost circulation area). Cemented from 45m to surface with 4 t G+ 2% CaCl₂ (stage 2). Displaced with 1.8 m³ water; 1.5 m³ good cement returns to surface.

Production Casing: 2 joints 178 mm 43 kg/m N-80 casing with float shoe at 1418m and float collar at 1408m. Followed by 105 joints 178 mm 43 kg/m SOO95 casing. Followed by 2 joints 178 mm 43 kg/m N-80 casing. Cemented with 1 m³ H₂O preflush, 3 m³ light cement slurry + 46 t oilwell G cement, 3.5 m³ slurry, 7 t oilwell G + 2.5% CaCl₂, 5.3 m³ slurry. Displaced with 24 m³ drilling mud. Plug did not bump. Float held OK. 2 m³ cement to surface.

DRILLING HISTORY

This well was spud on January 11, 1985 and drilled as follows

Conductor 1

- Drilled 311 mm pilot hole to 24 m
- Pick up 610 mm hole opener
- Drill 610 mm open hole to 23 mKB with Visgel/XC Polymer mud
- Ran 2 joints 508 mm 140 kg/m K-55 BT&C conductor pipe
- Landed at 23 mKB
- Cemented in place with 10.8 tonnes Arctic Set

Conductor 2

- Drilled 445 mm conductor hole to 64 mKB with Visgel/XC Polymer mud
- Ran 5 joints 340 mm 101 kg/m K-55 BT&C casing
- Landed at 64 mKB.
- Cemented in place with 18 tonnes Arctic Set

Intermediate Hole

- Tripped for bit at 145 m, jars spearated, had to fish collars out of hole.
- Lost circulation when tripping for bit at 273 mKB.
- Rig up air drilling equipment and blow hole dry
- Drill ahead with foam from 273 mKB to 760 mKB
- Logged (DIL-GR, LDT-GR-CAL, BHSC LSS-GR) open hole to 760 mKB; casing shoe at 64 mKB
- Ran 245 mm 60&65 kg/m L-80&SOO95 LT&C casing (see casing record attached)
- Cemented with 64 tonnes class 'G' cement (stage 1); annulus bridged off with 9.9 m³ displaced. Pressure increased to 30 MPa with no results.
- Cemented with 4 tonnes class 'G' + 2% CaCl₂ (stage 2); stage tool at 45 mKB
 - 1.5 m³ good cement returns to surface
- Weld on casing bowl (10" 3000# x 9 5/8 "); pressure tested weld to 21 MPa.
- RIH with 216 mm bit and tagged DV closing plug at 44.4 m.
- Drilled out DV tool plug then continued to drill out cement from 204 m to 224 m with 216 mm bit.

- Continued to drill out cement to 760 m
- POOH and prepare to bond log
- Performed bond log and located cement top at 370 m. Good cement bond to 414 m. Logging tool unable to read bonding of cement to 45 m above DV tool.
- Ran Gyro; indicated hole deviating slightly

Main Hole

- Displaced hole to mud (Visgel/XC Polymer mud).
- Drilled 216 mm hole from 763-795 mKB. Chlorides climbing; drilling through salt zone with salt top at 764 mKB.
- Continued to drill from 795-997 mKB ; saturated mud system with 912 sks salt (350 kg/m³ mud)
- Drilled ahead with saturated salt mud system.
- Through zone of interest, salt concentration in mud ~155,000 ppm. Mud additives included salt, XC, FLR100, caustic, barite, Q broxin, D foamer, and soda ash.
- Cored 1217-1224, 1400-1409, and 34 sidewall cores
- Logged (DLL-MSFL, BHCS, CNL-LDT, NGT-AMS, SHDT, CST, WST)
- Performed 5 DSTs over Mt Clark and Mt Cap formations
- Ran 2 joints 178 mm 43 kg/m N-80 LT&C casing
- Ran 106 joints 178 mm 43 kg/m SOO95 LT&C casing
- Casing landed at 1418 mKB
- Cemented with 46 tonnes class 'G' neat cement
 - tailed in with 7 tonnes class 'G' with 2.5% CaCl₂
 - Displaced cement with drilling mud; DID NOT BUMP PLUG

PCI TWEED LAKE M-47
Complete Mount Clark Sandstone
March , 2004

TIGHT HOLE

PROGRAM

1. Notify NEB 24 hours prior to commencing program.
2. Record SIP on daily operations report.
3. Conduct a 10 minute bubble test on the surface casing vent. Shut in the surface casing vent for 24 hours and record any pressure buildup on the Daily Operations Report. Record SICP. Report on daily operations report.
4. Move in and rig up camp, service rig, testers and related equipment as per OH&S, NEB and PCOG specifications. **Note: ensure 10 x 1 m3 methanol totes are on site.**
5. Perform a detailed rig inspection and complete rig inspection report.

Note: ⇒ *A morning operational/safety meeting must be held with work crews every day outlining all safety hazards and planned procedures for the day. This must be recorded in the daily tour report.*

6. Rig in wireline unit c/w full lubricator. Pressure test lubricator to 1.4 and 18 MPa for 10 min each with water/methanol mixture.
7. RIH and perform a 154 mm gauge ring run to ~1250 mKB . POOH.
8. RIH and perform a temperature log from ~1000 mKB to surface. POOH.
9. Stump test 179 mm Class --- BOPs as follows:
 - Pressure test the blind rams to 1.4 MPa and 14 MPa for 10 minutes each.
 - Pressure test the 73 mm pipe rams to 1.4 MPa and 14 MPa for 10 minutes each.
 - Pressure test the annular preventor to 1.4 MPa and 14 MPa for 10 minutes each.
10. Ensure the well is dead. Remove wellhead top section and install a work hanger.
11. Install BOPs. Function and pressure test BOPs to 1.4 MPa and 18 MPa for 10 minutes each. **Note: Pressure test the BOPs against the tubing hanger not the wellbore**
12. Pick up and RIH with:

- 158.8 mm tooth bit
 - bit sub.
 - --- x 89 mm drill collars.
 - Crossover to 73 mm EUE.
 - 73 mm 9.7kg/m L-80 EUE tubing to surface
13. Tag the cement top (estimated top at 1256 mKB). Circulate the wellbore over to fresh water.
14. Rig up power swivel and pack-off head. Drill out the cement to 1408 mKB (float collar depth). POOH.
15. Rig out swivel and POOH.
16. Pressure test casing to 10 MPa for 10 min to ensure integrity.
17. Tally, drift, pick-up and RIH with following assembly:
- 154 mm tooth bit
 - 178 mm Baker Roto-Vert casing scraper.
 - 73mm 9.7 kg/m L-80 EUE tubing to surface.
18. Rotate and reciprocate scraper from **1180-1250 mKB**. Circulate the well clean using inhibited water.
19. POOH and stand the 73 mm tubing. Lay down the bit and scraper.
20. Rig in electric wireline unit and run a 154 mm gauge ring and junk basket to PBD at \pm 1408 mKB. Run a radial bond log (SBL-CCL-VDL-GR) and log the well from PBD up to 25 m above cement top or surface casing shoe (whichever is lower). Run a 7 MPa pressure pass if required. Correlate to ----- **log dated -----**. **Note: Send logs to Calgary for interpretation ASAP.**
21. RIH with 73 mm tubing to **1235 mKB**.
22. Rig in N₂ pump unit to the annulus and pressure test lines to 21 MPa. Circulate fluid out of the hole with N₂. Returns to be captured in the flowback equipment.
23. Rig out and release N₂ unit.
24. POOH and stand the 73 mm tubing.
25. Rig in electric line. Make up and RIH with 127 mm ERHSC guns loaded with 39 charges at 17 spm and 60° phasing. **Perforate the Lower Mount Clark interval 1221.5-1232.5 mKB MD.** Correlate to SBL ran previous. Ensure all shots fired and indicate so on the Daily Operations Report.

Note: if the cement job is poor, the Upper Mount Clark interval will be perforated as well. Consult with Calgary for final perforation intervals prior to perforating.

26. Flow well on cleanup to the flowback equipment.

27. Rig in wireline unit c/w full lubricator. Pressure test lubricator to 1.4 and 18 MPa for 10 min each with water/methanol mixture.

28. RIH and wireline set:

- 73 mm EUE wireline re-entry guide
- 73mm EUE Otis XN nipple w/ **58.75 mm profile, 56.01 mm no-go**
- 2 m pup 73 mm 9.7 kg/m L-80 EUE tubing
- 178 x 73 mm retrievable packer
- 178 m x 73 mm EUE On/Off slick joint w/ Otis PX plug in place pinned and pressure tested to 35 MPa

29. Set packer with tubing bottom at **+/- 1197 mKB** .

30. Bleed off any pressure from the wellbore and ensure wellbore is dead.

31. RIH with the following:

- on-off overshot
- 3 m x 73 mm 9.7 kg/m L-80 pup joint
- Halliburton Chemical Injection Sub Assembly
- 73 mm 9.7 kg/m L-80 tubing to surface c/w injection line attached

Note: follow Halliburton running program for installing the injection line and strapping it to the 73 mm tubing string.

32. Latch onto the slick joint and load the packer in compression as per packer representatives recommendations.

33. Remove the BOPs and install the dual string hanger (for 9.252 mm string and 73 mm string) and wellhead. Release the service rig.

34. Rig in slickline unit c/w lubricator and grease injection. Pressure test lubricator to 1.4 and 18 MPa for 10 min each with methanol/water mixture.

35. Rig in N₂ unit and pressure up on the tubing to equalize the pressure across the PX plug. Rig in N₂ unit to the casing annulus and apply **7 MPa** N₂ pressure to the annulus.

36. RIH and pull the PX plug from the on-off tool.

37. Flow the well back to testers to ensure a significant enough flow rate for sampling.
38. Rig in slickline unit c/w full lubricator and grease injection. Pressure test lubricator to 1.4 and 18 MPa for 10 min each with methanol/water mixture.
39. Set the clock on the Corelab CDS sampler to ---- hours.
40. RIH with Corelab Controlled Displacement Sampler (2 samplers to be ran). Land samplers across the perforations.
41. Catch fluid samples and POOH with slickline. **Note: samples are to be sent to CoreLab, attention Tom Martin.** Rig out slickline unit.
42. Remove wellhead and install the tree saver. Pressure test tree saver to --- MPa.
43. Rig in Halliburton sand units, pumpers, etc, to fracture stimulate the Lower Mount Clark zone. Rig in shower equipment and RA Tracer. **The fracture treatment is to be isotope traced to determine height growth. Max pressure as dictated in Halliburton treatment program. Inject RA Tracer tracers downstream of pumping equipment**
44. Pressure test all surface lines to ----MPa.
45. Perform a Mighty Oil and proppant fracture stimulation on the Lower Mount Clark zone as per Halliburton program. Rig out Halliburton and RA Tracers. **Note: if sand-off occurs, a coiled tubing cleanout will be performed.**
46. Flow well through flowback vessel for clean up. Clean-up period is well dependant, but should be approximately 1 day. **Note: inject methanol through all flowing periods; an injection rate guideline has been attached.**
47. Once well is flowing on its own, rig in slickline unit c/w lubricator and Protechnics Spectrascan memory tool. Pressure test lubricator to 1.4 and 18 MPa using methanol/water. RIH with a 56 mm gauge ring to bottom of tubing. Run a tracer memory tool after completing clean-up flow. Log +/- 35 m above and +/- 25 m below perforations. **Note: have data sent for processing ASAP to determine if the Upper Clark Lake zone will be perforated.**
48. Remove tree saver and install wellhead.
49. RIH and set 56 mm no-go dart in the no-go 'XN' profile.
50. RIH and land gauges on no-go dart c/w a top hold-down assembly.
51. Open the Mount Clark zone to flowback vessel and perform a flow test as per the attached program. **Note: A CoreLab representative will be on-site to collect fluid samples. Samples are to be collected according to the attached program as well as by request from Calgary. Send samples to CoreLab, attention Tom Martin.**

39. At the end of the flow test, shut-in the Mount Clark zone for an extended build-up.
40. Rig out the testing equipment and haul all fluids to disposal.
41. At the end of the build up period, Airborne will fly into site to retrieve the RTM lubricator, surface readout equipment, wireline and gauges. Retrieve the electronic gauges and perform a reverse static gradient with the following stops for 5 minutes each: 100 m above gauge set depth, 200 m above gauge set depth, and 3 equal spacings between the last gauge depth and surface. Rig out slickline unit.
42. Close all valves, chain and padlock wellhead.