PCI ET AL TWEED LAKE M-47

DRILLING PROGRAM

A. CONDUCTOR BARREL SECTION

I. Conductor barrel hole: 610 mm to 10 m (below G.L.)

1) A 445 mm bit will be used followed by a 610 mm hole opener. Some gravel and unconsolidated sediments could be encountered in this section of hole. The 445 mm bit should be run with large nozzles and both pumps will be required. The drilling fluid should be a gel-lime slurry with a 50 sec/l or greater viscosity. If circulation losses are encountered, slugging with gel and sawdust should be adequate.

2) Check plumbness with a level every 3 m and take a Totco survey at kelly down. The deviation angle should not exceed 1 degree.

3) After reaming to the barrel setting depth (kelly down), circulate the hole a minimum of two complete circulations.

II. Conductor barrel: 508 mm, 140 kg/m, K-55, BT&C

Capacity:	0.1854 cubic metres/metre
75% Displacement:	2.8 cubic/metres
Annular Volume:	0.0892 cubic metres/metre
Accessories:	1 - 508 mm, 140 kg/m, K-55, BT&C landing joint

1) Drift both the conductor barrel and the landing joint on the racks and clean the threads. The drift diameter is 481.0 mm and the inside diameter is 485.7 mm.

2) Install the 508 mm circulating swage and slowly break circulation. Reciprocate the barrel using short strokes (1 m) for a minimum of two complete circulations. Chain down the barrel prior to cementing.

III. Cementing the Conductor Barrel:

Cement: "Arctic Set" Permafrost cement
Density: 1860 kg/m^3
Yield: 0.750 m^3/tonne
Water: 0.361 m^3/tonne

The recommended mix water temperature should be calculated on site based on ambient or cement temperature and mix water temperature. (Refer to the Engineering Data section for details) Check with Engineering prior to job for any changes in cement properties. Slurry temperature should be approximately 5°C (40°F)

1) Rig up a pressure recorder and ensure that it works. Do not mount it on the cementing unit.

2) Pump a 1.5 m^3 fresh water preflush, and follow that with approximately 4 tonnes of permafrost cement. If there is evidence of wash outs, increase this volume as necessary, as it is based on gauge hole + 100% excess. If lost circulation has occured, add 2 kg/m^3 of celloflake.

3) Remove the 508 mm swage and install the top plug. The plug should be displaced at a maximum rate of 0.5 m^3/min. The estimated 75% displacement volume for the landing joint and the conductor barrel is 2.8 m^3 (to be re-calculated on-site using 75% of actual casing lengths).

4) Slow the displacement rate to 0.2 m^3/minute after 2.0 m^3 have been displaced and stop displacing after 75% displacement volume is reached. Hold back-pressure for 8-10 hours.

5) After W.O.C., cut off the landing joint below the table and weld on the flow nipple. The length of cut-off will be determined to ensure a proper slope on the mud return line.

B. CONDUCTOR CASING SECTION

I. Conductor hole: 445 mm to 60 m K.B.

1) A 311 mm bit will be used followed by a 445 mm hole opener. Some gravel and unconsolidated sediments could be encountered in this section of hole. The 311 mm bit should be run with the largest available nozzles. The drilling fluid should be a gel-lime slurry with a 50 sec/l or greater viscosity. If circulation losses are encountered, slugging with gel and sawdust should be adequate.

2) Check plumbness with a level every 3 m and take a Totco survey at each connection. The deviation angle should not exceed 1 degree.

3) After reaming to the casing setting depth, circulate the hole a minimum of two complete circulations.

II. Conductor casing: 340 mm, 101 kg/m, K-55, BT&C

Capacity:	0.0781 cubic metres/metre (4.9 m^3 in 60 m)
Annular Volume:	0.0645 cubic metres/metre
Accessories:	1 x 340 mm BT&C float shoe 2 x 340 mm centralizer 2 x 340 mm stop collar 2 x threadlock kit

1) Drift the conductor casing on the racks and clean the threads. The drift diameter is 311.4 mm and the inside diameter is 315.3 mm.

2) Threadlock and tack weld the float shoe in place, using three 75 mm welds spaced 120 degrees apart. Preheat the weld area and allow the welds to cool before running into the hole.

3) One centralizer is to be mounted 3 m above the shoe with the stop collar. The second centralizer is to be mounted on a stop collar on the third joint of casing.

4) Install the 340 mm circulating swage and slowly break circulation. Reciprocate the casing using short strokes (1 m) for a minimum of two complete circulations. Chain down the casing prior to cementing.

III. Cementing the Conductor Casing:

Cement: "Arctic Set" Permafrost cement
Density: 1860 kg/m^3
Yield: 0.750 m^3/tonne
Water: 0.361 m^3/tonne

The recommended mix water temperature should be calculated on site based on ambient or cement temperature and mix water temperature. (Refer to the Engineering Data section for details) Check with Engineering prior to job for any changes in cement properties. Slurry temperature should be approximately 5°C (40°F)

1) Rig up a pressure recorder and ensure that it works. Do not mount it on the cementing unit.

2) Pump a 3 m^3 fresh water preflush, and follow that with approximately 14 tonnes of permafrost cement. If there is evidence of wash outs, increase this volume as necessary, as it is based on gauge hole + 150% excess. If lost circulation has occured, add 2 kg/m^3 of celloflake.

3) Remove the 340 mm swage and install the top plug. The plug should be displaced at a maximum rate of 0.5 m^3/min. The estimated displacement volume for the conductor casing is 4.7 m^3.

4) Stop pumping after 4.3 m^3 have been displaced; this will leave approximately 0.4 m^3 or 5 m of cement in the bottom joint. Hold back-pressure for 5 minutes then check to see if the float is holding; if not, hold back-pressure for 8-10 hours.

IV. Diverter Head-Up and Pressure Testing

1) After WOC 12 hours, cut off the 340 mm conductor casing, and weld on a 346 mm, 21,000 kPa x 340 mm casing bowl. Install a 346 mm, 21,000 kPa mud cross, a 346 mm, 21,000 kPa Hydril GK annular preventer and a 346 mm, 21,000 kPa Grant rotating head as a diverter system. Refer to the Well Control Equipment Section for a schematic of the diverter stack and for equipment details.

2) The HCR valve must be rigged up to open when the annular is closed (use the closing pressure to the Hydril as the pilot pressure for the HCR valve).

3) The diverter will be pressure tested with glycol/water to a pressure of 700 kPa, which is to be held for 10 minutes. The valve downstream of the HCR will have to be closed, and reopened after the testing. The test should be carried out after running in with a 311 mm bit and 228 mm collars. The closing pressure on the annular should be less than 4500 kPa. Full piston stroke is 180 mm.

The packing element should be a Hydril natural rubber (all black with a serial number ending with "NR") or a Hydril neoprene Rubber (green band and a serial number ending with "CR"). The neoprene elements are recommended for low temperature service. A Hydril nitrile rubber (red band and a serial number ending in "NBR") should not be used.

C. SURFACE HOLE SECTION

I. Surface Hole: 311 mm to 500 m KB

1) This section of hole will encounter the Ronning which consists of dolomite with interbedded chert. Based on offset wells, it is likely that serious problems with lost circulation could occur. Also, water producing formations could be encountered.

2) Deviation should be monitored with Totco surveys every 30 m. The maximum allowable hole angle is 3 degrees. A magnetic gyro survey will be run after the surface casing is set.

3) A Gel/X-C Polymer mud will be used on this section of hole. The recommended viscosity is 45 - 55 sec/l. Drilling with mud will allow the anticipated massive lost circulation zones to be identified immediately.

Bits:	Hughes X3A, J11, J22 (IADC 1-1-4, 4-3-7, 5-1-7)
Nozzles:	3-12.7 mm
Circulation Rate:	2530 l/min
Pump Strokes:	2 x 55 SPM (152 mm liners/85% efficiency)

4) Drill a 311 mm hole to 490 m K.B., strap out to confirm the depth, then trip in and drill to 500 m K.B. After reaching casing point, circulate and condition the hole for a minimum of two complete circulations.

II. Potential Problems:

1) If either a water flow or a shallow gas zone is encountered, close the annular preventer. ENSURE THAT THE HCR IS OPEN - DO NOT SHUT THE WELL IN. Weight up the mud as conditions allow and attempt to kill the well.

2) Minor lost circulation may occur while drilling the upper section of the surface hole and should be treated by slugging with gel and sawdust.

NOTE: Massive lost circulation is anticipated based on offset wells. If and when this occurs change to the ALTERNATE PROGRAM A which is described in detail following the remainder of this program.

III. Surface Casing: 245 mm, 60 kg/m, L-80, LT&C

csg capacity:	0.0396 m^3/m
	(19.8 m^3 in 500 m)
annular volume:	0.0290 m^3/m
accessories:	1 x 245 mm LT&C float shoe
	1 x 245 mm LT&C float collar
	8 x 245 mm centralizers
	8 x 245 mm stop collar

1) Clean all the threads while on the racks and drift all the casing while lifting with the elevators. The drift diameter of the casing is 224.4 mm and the internal diameter is 220.4 mm.

2) Threadlock and tack weld both the float shoe and float collar, spacing them one joint apart. Use three 75 mm welds at each connection, spaced 120 degrees apart. Preheat the weld area and allow the welds to cool before running in the hole.

Make up a second joint of casing into the float collar, and threadlock and tack weld this connection.

3) The first centralizer is to be mounted with a stop collar 3 m above the shoe. Centralizers are to be placed over stop collars on the 2nd, 3rd, 8th, 15th, 22nd, 29th and 36th joints.

4) Install a circulating swage and slowly break circulation. Reciprocate the casing using 1 metre strokes initially increasing to 9 m, and continue to circulate for at least two complete circulations.

IV. Cementing the Casing:

Cement:	"Arctic Set" Permafrost Cement
Density:	1860 kg/m^3
Yield:	0.750 m^3/tonne
Water:	0.361 m^3/tonne

The recommended mix water temperature should be calculated on site based on ambient or cement temperature and mix water temperature. (Refer to the Engineering Data section for details) Check with Engineering prior to the job for any changes in cement properties. Slurry temperatures should be approximately 5°C (40°F)

1) Rig up a pressure recorder and make sure it works. Do not mount it on the cementing unit.

2) Remove the circulating swage, install the bottom wiper plug, and mount the cementing head with the top plug in place. THE DRILLING SUPERVISOR MUST WITNESS ALL PLUG LOADING AND PLUG RELEASING OPERATIONS.

3) Pump a 6 m^3 fresh water preflush ahead, and follow with 39 tonnes of permafrost cement. If any freeze point depressants or other additives are required, they will be determined as hole conditions dictate. This cement volume is based on gauge hole + 100% excess.

4) The casing is to be reciprocated 1 - 2 m while pumping cement. Release the top plug and displace with fresh water as rapidly as possible (a minimum of 1.0 m^3/min). The estimated displacement volume is 19.8 m^3. Slow the displacement rate to less than 0.3 m^3/m after 18 m^3 have been pumped. Bump the plug with 3500 kPa more than the final pumping pressure, but do not exceed 21,000 kPa at any time. Hold pressure for 5 min. then check that the floats are holding; if they are not, re-pressure the casing and hold for 6 hours.

5) Open the valve on the casing bowl to drain and wash the diverter stack.

6) Set the 245 mm casing in slips in the 346 mm casing bowl. Cut off the 245 mm casing and install a 346 mm, 21,000 kPa casing spool on top of the casing bowl.

7) Head up the BOP stack as shown in the Well Control Equipment section and pressure test. The Grant rotating will be required for the foam drilling of the main hole section.

V. Pressure testing of the BOP stack:

1) The BOP stack and the manifold lines, valves and chokes are to be pressure tested to 1500 kPa, and then to 21,000 kPa. The tests are to be conducted with glycol/water. Under no circumstances is diesel fuel to be used for testing.

2) Pressure test the manifold and blind rams as one unit. Check each valve and each choke in the manifold separately, and circulate through the chokes to ensure that they are functioning properly. Check the function and accuracy of each gauge.

3) Install the wear bushing, and run in the hole with a 216 mm X3A bit, ported float, and slick BHA. Record the PBTD in the tour book. Pressure test the Hydril annular to 1500 kPa, using a closing pressure of 5600 kPa. Increase the test pressure to 10,500 kPa, reduce the closing pressure necessary to maintain a seal, and record this pressure.

4) Pressure test the pipe rams, the kelly cocks, stabbing valves, and the inside BOP's.

5) Operate the remote motor shut-offs, and function check the remote accumulator controls. Record the cycling and recharge times for the accumulators.

6) Retighten the bolts in the BOP stack 2 days after pressure testing.

D. MAIN HOLE SECTION

I. Main Hole: 216 mm to 1483 m

1) Drill out the surface casing shoe plus 5 m of new hole with a 216 mm X3A bit. Conduct a pressure integrity test using a pumping rate of at least 40 l/min. Forward the results to the Calgary office.

2) Convert to a stable foam system to maximize penetration rates. Also, the Saline River salt section (estimated top at 993 m) can be drilled effectively using the foam system. This will delay the conversion to a saturated salt mud system until the possibility of encountering hydrocarbons exists (just prior to core point).

Bits: Hughes X3A, J11, J22; Smith F2
Hughes JD4 (ream after coring)

A PORTED FLOAT WITH A TUNGSTEN CARBIDE INSERT MUST BE RUN AT ALL TIMES.

3) Drill ahead until samples indicate the shale section of the Saline River formation (estimated top at 863 m) has been penetrated, then drill another 20 meters. Load the hole and test wellbore integrity with an 1,100 kg/m^3 equivalent mud weight.

4) If there is no indication of lost circulation, blow the hole clean and continue drilling ahead with the stable foam system to 1,268 m (20 m above the anticipated top of the Mt. Clark formation).

5) Convert to a mud system, salt saturated if necessary, and begin control drilling. After the Mt. Clark is established, strap out prior to coring.

6) Run in with a 146 mm x 102 mm x 18 m core barrel with a 171 mm x 102 mm core bit and cut one 18 m core. Transport the core to Core Labs in Calgary as soon as possible after field description. Advise Patti Shannon of Core Labs (250-5600) as to the arrival time.

7) One bottom-hole drill stem test may be run after coring, as directed by the Calgary Office.

8) Ream the cored interval with a 216 mm JD4 bit then drill ahead (J22 or F2 bit) to TD at 1483 m, 150 m into the Proterozoic Clastic Sequence (estimated top at 1333 m).

9) Subject to sample evaluation and/or shows, one 18 m core may be cut in the Proterozoic. If coring is required, strap out then run in with a 146 mm x 102 mm x 18 m core barrel with a 171 mm x 102 mm core bit and cut one 18 m core. Transport the core to Core Labs in Calgary as soon as possible after field description. Advise Patti Shannon of Core Labs (250-5600) as to the arrival time.

10) One bottom-hole drill stem test may be run after coring, as directed by the Calgary Office. Run the following logs, or as directed by the wellsite geologist, at TD:

i) DLL-MSFL-GR
ii) CNL-LDT-NGT-AMS/ML-CAL
iii) BHCS-WF-GR-CAL
iv) SHDT, Directional Survey

11) After completion of the logging program, run back in the hole and circulate while waiting on orders to either abandon the well, or complete it with 178 mm production casing.

II. Production Casing: 178 mm, 43 kg/m, SOO-95, LT&C

casing capacity: 0.0194 cubic metres/metre
(28.8 m^3 in 1483 m)
annular volume: 0.0118 cubic metres/metre

optimum make up torque: 9,260 N-m

accessories: 1 x 178 mm LT&C float shoe
1 x 178 mm LT&C float collar
16 x 178 mm centralizers
16 x 178 mm stop collar
20 x 178 mm scratchers (if required)
1 x threadlock kit

1) Clean all the threads while on the racks and drift all the casing while lifting with the elevators. The drift diameter of the casing is 153.9 mm and the inside diameter is 157.1 mm.

2) Make up the float shoe and float collar spaced one joint apart, and threadlock these connections. Mount the first centralizer with a stop collar 3 m above the float shoe. The other centralizers are to be mounted on stop collars as follows:

- one on each of the 2nd, 3rd, 5th, 7th, 9th and 12th joints
- four are to be spaced through the Mt. Clark formation, one on each joint through the interval.
- five are to be spaced through the Mt. Cap formation, one on every second joint through the interval.

The scratchers, if required, are to be placed on every second of the first 12 joints, and on every joint through the Mt. Clark and Mt. Cap formations.

3) Install a circulating swage and break circulation slowly. Reciprocate the casing slowly using one metre strokes then increase to 9 m, and continue to circulate for at least two complete circulations. Reciprocation should be continued throughout the cementing operation until the plug is bumped.

III. Cementing the Casing:

Cement: Dowell Class "G" + 0.5% friction reducer (D-65) + 0.1% retarder (D-13)
Density: 1893 kg/m^3
Yield: 0.758 m^3/tonne
Water: 0.440 m^3/tonne

The mix water temperature should be at least 25 degrees Celsius.
(Refer to the Engineering Data section for details)
Check with Engineering prior to the job for any changes in cement properties.

1) Rig up the pressure recorder and make sure it works. Do not mount it on the cementing unit.

2) Remove the circulating swage, install the bottom wiper plug, and mount the cementing head with the top plug in place. THE DRILLING SUPERVISOR MUST WITNESS ALL PLUG LOADING AND PLUG RELEASING OPERATIONS.

3) Mix and pump 3 m^3 of water ahead, and follow it with approximately 33 tonnes of Class "G" cement + 0.5% turbulence inducer (D-65) + 0.1% retarder (D-13). The amount of cement is based on gauge hole + 50% excess in open hole, and should be sufficient to bring the cement to surface. The actual amount of cement required is to be recalculated onsite using the integrated caliper from the sonic log plus 40% excess.

4) Release the top plug and displace the cement with water at a rate of at least 1.0 m^3/min. The approximate displacement volume is 28.8 m^3. The casing should be reciprocated slowly during displacement. Ensure that there is no casing collar in the slip area.

5) Slow the displacement rate to 0.2m^3/min after 28 m^3 have been pumped. Bump the plug with 3500 kPa in excess of the final circulating pressure. Do not exceed a pressure of 21,000 kPa.

6) Hold back-pressure on the floats for 5 minutes, then open the valve and confirm that the floats are holding. If not, hold back pressure for at least 6 hours.

7) Land the casing in the slips (with the complete string weight in tension) and energize the primary mechanical seals.

8) Cut off the 178 mm casing leaving a 0.3 m - 0.6 m (1' - 2') stub and weld a cap on the casing. The wellhead will be installed and the secondary seals energized by Completions personnel.

9) The logging unit is to be left in place to enable Completions to run a C.E.T. log.

10) Release the rig.

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ALTERNATE PROGRAM A

NOTE: In the event of massive lost circulation while drilling the 311 mm surface hole, this ALTERNATE PROGRAM A is to be followed.

I. Surface Hole: 311 mm to 883 km KB

1) Convert to a stable foam system and continue drilling ahead until samples indicate the shale section of the Saline River formation (estimated top at 863 m) has been penetrated.

2) Drill another 20 m then strap out to log. Run the following logs from the surface casing point (approximately 883 m) to the 340 mm conductor casing shoe (60 m):

° Dual Induction Log
° Sonic (Acoustilog)
° Compensated Neutron-Density-Gamma Ray

The appropriate tools for logging in air will be required due to the lost circulation problems.

3) After logging, condition the hole as necessary prior to running the 245 mm surface casing.

II. Surface Casing: 245 mm, 60 kg/m, L-80, LT&C

Csg Capacity:	0.0396 m^3/m (35.0 m^3 in 883 m)
Annular Volume:	0.0290 m^3/m
Accessories:	1 x 245 mm LT&C float shoe
	1 x 245 mm LT&C float collar
	8 x 245 mm centralizers
	8 x 245 mm stop collar
	1 x 245 mm External Casing Packer
	1 x 245 mm DV tool

1) Clean all the threads while on the racks and drift all the casing while lifting with the elevators. The drift diameter of the casing 224.4 mm and the internal diameter is 220.4 mm.

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2) Threadlock and tack weld both the float shoe and float collar, spacing them one joint apart. Use three 75 mm welds at each connection, spaced 120 degrees apart. Preheat the weld area and allow the welds to cool prior to running in the hole. Make up a second joint of casing into the float collar, and threadlock and tack weld this connection.

3) The first centralizer is to be mounted with a stop collar 3 m above the shoe. Centralizers are to be placed over stop collars on the 2nd, 3rd, 8th, 15th, 22nd, 29th and 36th joints.

4) The External Casing Packer (ECP) is to be situated at or above the 340 mm conductor casing shoe (60 m) and the DV tool is to be placed in the string immediately above the ECP.

5) Install a circulating swage and slowly break circulation. Reciprocate the casing using 1 meter strokes initially, increasing to 9 m, and continue to circulate at least two complete circulations.

III. Cementing the Casing:

First Stage:

Cement:	Class "G" + 0.5% Turbulence Inducer (D-65) + 0.1% Retarder (D-13)
Density:	1893 kg/m^3
Yield:	0.758 m^3/tonne
Water:	0.440 m^3/tonne

The mix water temperature should be at least 25 degrees Celsius.
(Refer to the Engineering Data section for details)
Check with Engineering prior to the job for any changes in cement properties.

1) Rig up a pressure recorder and make sure it works.

2) Remove the circulating swage, install the bottom wiper plug, and mount the cementing head with the top plug in place. THE DRILLING SUPERVISOR MUST WITNESS ALL PLUG LOADING AND PLUG RELEASING OPERATIONS.

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3) Establish circulation to surface through the DV tool.

4) Mix and pump about 8 tonnes of "Arctic Set" permafrost cement through the DV tool to surface. The amount of cement is based on a 340 mm conductor casing setting depth of 60 m + 20% excess. This may be recalculated on site based on the actual setting depth of the 340 mm conductor casing and the location of the DV tool in the 245 mm surface casing string.

5) Set the 245 mm casing in slips in the 346 mm casing bowl. Cut off the 245 mm casing and install a 346 mm, 21,000 kPa casing spool on top of the casing bowl.

6) Head up the BOP stack as shown in the Well Control Equipment section and pressure test.

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V. Pressure testing of the BOP stack:

1) The BOP stack and the manifold lines, valves and chokes are to be pressure tested to 1500 kPa, and then to 21,000 kPa. The tests are to be conducted with glycol/water. Under no circumstances is diesel fuel to be used for testing.

2) Pressure test the manifold and blind rams as one unit. Check each valve and each choke in the manifold separately, and circulate through the chokes to ensure that they are functioning properly. Check the function and accuracy of each gauge.

3) Install the wear bushing, and run in the hole with a 216 mm 6-2-7 bit, ported float, and slick BHA. Record the PBTD in the tour book. Pressure test the Hydril annular to 1500 kPa, using a closing pressure of 5600 kPa. Increase the test pressure to 10,500 kPa, reduce the closing pressure necessary to maintain a seal, and record this pressure.

4) Pressure test the pipe rams, the kelly cocks, stabbing valves, and the inside BOP's.

5) Operate the remote motor shut-offs, and function check the remote accumulator controls. Record the cycling and recharge times for the accumulators.

6) Retighten the bolts in the BOP stack 2 days after pressure testing.

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D. MAIN HOLE SECTION

I. Main Hole: 216 mm to 1483 m

1) Drill out the surface casing shoe plus 5 m of new hole with a 216 mm X3A bit. Conduct a pressure integrity test using a pumping rate of at least 40 l/min. Forward the results to the Calgary office.

2) Continue drilling with the stable foam system to maximize penetration rates. Also, the Saline River salt section (estimated top at 993 m can be drilled effectively using the foam system. This will delay the conversion to a mud system until the possibility of encountering hydrocarbons exists (just prior to core point).

Bits: Hughes X3A, J11, J22; Smith F2
Hughes JD4 (ream after coring)

A PORTED FLOAT WITH A TUNGSTEN CARBIDE INSERT MUST BE RUN AT ALL TIMES.

3) Drill ahead to 1268 m (20 m above the anticipated top of the Mt. Clark formation). Convert to a mud system, salt saturated if necessary, and begin control drilling. After the Mt. Clark is established strap out prior to coring.

4) Run in with a 146 mm x 102 mm x 18 m core barrel with a 171 mm x 102 mm core bit and cut one 18 m core. Transport the core to Core Labs in Calgary as soon as possible after field description. Advise Patti Shannon of Core Labs (250-5600) as to the arrival time.

5) One bottom-hole drill stem test may be run after coring, as directed by the Calgary Office.

6) Ream the cored interval with a 216 mm JD4 bit then drill ahead (6-2-7 bit) to TD at 1483 m, 150 m into the Proterozoic Clastic Sequence (estimated top at 1333 m).

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7) Subject to sample evaluation and/or shows, one 18 m core may be cut in the Proterozoic. If coring is required, strap out then run in with a 146 mm x 102 mm x 18 m core barrel with a 171 mm x 102 mm core bit and cut one 18 m core. Transport the core to Core Labs in Calgary as soon as possible after field description. Advise Patti Shannon of Core Labs (250-5600) as to the arrival time.

8) One bottom-hole drill stem test may be run after coring, as directed by the Calgary Office. Run the following logs, or as directed by the wellsite geologist, at TD:

i) DLL-MSFL-GR
ii) CNL-LDT-NGT-AMS/ML-CAL
iii) BHCS-WF-GR-CAL
iv) SHDT, Directional Survey

9) After completion of the logging program, run back in the hole and circulate while waiting on orders to either abandon the well, or complete it with 178 mm production casing.

II. Production Casing: 178 mm, 43 kg/m, SOO-95, LT&C

casing capacity: 0.0194 cubic metres/metre
(28.8 m^3 in 1483 m)
annular volume: 0.0118 cubic metres/metre

optimum make up torque: 9,260 N-m

accessories:
1 x 178 mm LT&C float shoe
1 x 178 mm LT&C float collar
16 x 178 mm centralizers
16 x 178 mm stop collar
20 x 178 mm scratchers (if required)
1 x threadlock kit

1) Clean all the threads while on the racks and drift all the casing while lifting with the elevators. The drift diameter of the casing is 153.9 mm and the inside diameter is 157.1 mm.

2) Make up the float shoe and float collar spaced one joint apart, and threadlock these connections. Mount the first centralizer with a stop collar 3 m above the float shoe. The other centralizers are to be mounted on stop collars as follows:

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- one on each of the 2nd, 3rd, 5th, 7th, 9th and 12th joints
- four are to be spaced through the Mt. Clark formation, one on each joint through the interval.
- five are to be spaced through the Mt. Cap formation, one on every second joint through the interval.

The scratchers, if required, are to be placed on every second of the first 12 joints, and on every joint through the Mt. Clark and Mt. Cap formations.

3) Install a circulating swage and break circulation slowly. Reciprocate the casing slowly using one metre strokes then increase to 9 m, and continue to circulate for at least two complete circulations. Reciprocation should be continued throughout the cementing operation until the plug is bumped.

III. Cementing the Casing:

Cement: Dowell Class "G" + 0.5% friction reducer (D-65) + 0.1% retarder (D-13)
Density: 1893 kg/m^3
Yield: 0.758 m^3/tonne
Water: 0.440 m^3/tonne

The mix water temperature should be at least 25 degrees Celsius.
(Refer to the Engineering Data section for details)
Check with Engineering prior to the job for any changes in cement properties.

1) Rig up the pressure recorder and make sure it works. Do not mount it on the cementing unit.

2) Remove the circulating swage, install the bottom wiper plug, and mount the cementing head with the top plug in place. THE DRILLING SUPERVISOR MUST WITNESS ALL PLUG LOADING AND PLUG RELEASING OPERATIONS.

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3) Mix and pump 3 m^3 of water ahead, and follow it with about 16 tonnes of Class "G" cement + 0.5% turbulence inducer (D-65) + 0.1% retarder (D-13). The amount of cement is based on gauge hole + 50% excess, and should be sufficient to bring the cement to 783 m (100 m above the surface casing shoe). The actual amount of cement required is to be recalculated onsite using the integrated caliper from the sonic log plus 40% excess.

4) Release the top plug and displace the cement with water at a rate of at least 1.0 m^3/min. The approximate displacement volume is 28.8 m^3. The casing should be reciprocated slowly during displacement. Ensure that there is no casing collar in the slip area.

5) Slow the displacement rate to 0.2 m^3/min after 28 m^3 have been pumped. Bump the plug with 3500 kPa in excess of the final circulating pressure. Do not exceed a pressure of 21,000 kPa.

6) Hold back-pressure on the floats for 5 minutes, then open the valve and confirm that the floats are holding. If not, hold back pressure for at least 6 hours.

7) Land the casing in the slips (with the complete string weight in tension) and energize the primary mechanical seals.

8) Cut off the 178 mm casing leaving a 0.3 m - 0.6 m (1' - 2') stub and weld a cap on the casing. The wellhead will be installed and the secondary seals energized by Completions personnel.

9) The logging unit is to be left in place to enable Completions to run a C.E.T. log.

10) Release the rig.

W. E. Roeske
Area Drilling Engineer

B. E. Jurassa
Drilling Superintendent