



**ABANDONMENT PROGRAM**  
**OROGO LEVEL I WELLBORE**  
**PARAMOUNT et al LIARD 2K-29**  
**WID # 1980**  
**POTENTIAL H<sub>2</sub>S: 0.5%**

**PROCEDURE APPROVAL & DISTRIBUTION**

**DATE:** November 28, 2022  
**WELL NAME:** PARAMOUNT et al LIARD 2K-29  
**SURFACE LOCATION:** L-29-6030-12330  
Latitude: 60° 28' 40.831"  
Longitude: 123° 35' 05.338"  
**BOTTOM LOCATION:** Latitude: 60° 29' 41.386"  
Longitude: 123° 36' 4.363"  
**UWID:** 302/K-29-6030-12330/2  
**WID:** 1980  
**OPERATIONS AREA:** 60° 30' N, 123° 30' W **PROVINCE:** NWT  
**OBJECTIVE:** Abandon wellbore in accordance with OROGO guidelines.  
**PARAMOUNT WI (%):** **88.00%**  
**AFE No:** **TBD**  
**PRL Supplier Coding:** **PR-210-9231-xxx (Abandonment program)**

**REGULATORY APPROVALS:**  
**REQUIRED: YES**  
**TYPE: OROGO Operations Authorization and ACW.**

**AUTHORIZATION RECEIVED by:** **DATE:**  
**PROCEDURE COMPLIES WITH CONDITIONS OF AUTHORIZATION:** YES  NO

**TYPE OF WORKOVER: (Abandonment):**

**PROCEDURE COMPLIES WITH PARAMOUNT CANADA LTD. POLICIES ON:**

- 1) Paramount Well Control Manual
- 2) **OROGO** Suspension/Abandonment Guideline Level I

**DISTRIBUTION:** **FIELD:** **CALGARY:** Richard Bean/Well Files

**PREPARED BY:** **Steven Ong**, Rotational E.I.T. **DATE:** November 29, 2022

**REVIEWED AND** **Richard Bean**, Superintendent, ARO **DATE:** November 29, 2022

**APPROVED BY:** **Tim Wood**,   
Manager, ARO & Wellsite Construction **DATE:** November 30, 2022

# ABANDONMENT PROGRAM

## OBJECTIVE

There is no potential for reactivation and the well is to be abandoned. Abandon production zones and ensure porous intervals and BGW are isolated as per approved ACW and OROGO guidelines. Cut and cap well.

## REPORTING

- All rig calls and Daily Reports are to be directed to Corey Thomson (Superintendent, ARO)
  - Office: (403) 261-1250
  - Cell: (403) 835-4447
  - E-mail: [Corey.Thomson@paramountres.com](mailto:Corey.Thomson@paramountres.com)

## PROGRAM SUMMARY

- Read & record SIP(s).
- Confirm status of SCVF/GM.
- Check for H<sub>2</sub>S content.
- Move in class III coiled tubing unit and mill out upper plug set within the tubing at 50 mKB.
- Rig off coil and MIRU service rig and support equipment.
- Stump test and function test BOPs.
- Kill well with fresh water and ensure well is dead
- Remove wellhead top section, install BOPs and pressure test.
- Pick up on tubing unlatch from "Baker latch seal assembly" (~3029.74 mKB).
- MIRU with wireline. Pressure test lubricator with N<sub>2</sub>.
- Run in and perforate tubing above lower plug at 3015 mKB. Laydown wireline.
- Circulate clean and kill well (ensure well is dead). POOH and laydown 114.3 mm tubing.
- Pick up wireline and RIH with permanent bridge plug for 177.8mm casing and set within 15m above the Baker packer (~3030.04). Pressure test casing & bridge plug to 7 MPa x 10 min. Laydown wireline.
- Run 73mm work string or coiled tubing and tag top of bridge plug
- Rig in cement services. Mix & pump 1m<sup>3</sup> of thermal cement down tubing & balance on top of PBP.
- Pull tubing out of cement and back wash clean and lay down.
- Pick up wireline. RIH with noise temperature and cement bong log (CBL) to evaluate existing cement behind casing string for porous intervals and potential SCVF sources.
- If necessary, conduct remedial cementing operations for all porous intervals and SCFV repairs requiring cement isolation as per log.
- Confirm no SCVF or GM present.
- Winterize well bore.
- Rig out services and equipment.
- Cut and cap well at surface.

## SAFETY

A safety meeting is to be held with all service company personnel prior to each job. Wellsite supervisor must notify Contractors of known hazards of which Contractor(s) may be unaware. Wellsite supervisor must ensure that workers are aware of their responsibilities and duties under OH&S regulations and that workers comply with regulations. All service companies supplying materials will review Material Safety Data Sheets at this meeting for all products supplied and maintain these Material Safety Data Sheets available for worker's examination on location in compliance with WHIMIS regulations. All safety meetings will be recorded on the Paramount daily report and on the daily tour sheet.

Whenever possible, plan and conduct all workover procedures in a manner which will avoid the mixing of air & hydrocarbons in the well bore and connected surface piping. If mixing does occur, purge prior to pressurizing or exposing mixture to any other possible source of ignition.

Rig anchor locations if required will be approved by Paramount Wellsite Supervisor prior to installation.

## **REGULATIONS**

All applicable regulations, including, but not limited to the specific approved OROGO ACW approval, OROGO Well Suspension and Abandonment Guidelines, Oil and Gas Occupational Safety and Health Regulations (NWT) and Occupational Health and Safety (OHS) Regulations (NWT) are to be strictly adhered to. Written instructions must be posted in doghouse or other conspicuous area prior to the wellsite supervisor leaving the lease. Wellsite supervisor must designate, in writing (see attached Form), a competent person to carry out principal contractor's responsibilities. All verbal notifications and approvals from government regulatory agencies will be recorded on Paramount's daily report tour sheet. The name of the individual contacted, and the subject matter of approval or notification should be recorded on same.

Paramount shall provide all staff and contractors for this program with the OROGO 24-hour incident reporting phone number (867-445-8551) prior to commencing any work or activity.

Paramount shall submit to OROGO an updated operator contact list for this program prior to any work or activity by email at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca).

Paramount shall submit to OROGO certificates and inspection documents for any service rig, well control and associated equipment (including boilers) at least 10 days prior to the rig commencing work by e mail at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca).

Paramount shall submit to OROGO all reports required under the Oil and Gas Drilling and Production Regulations in a timely manner to OROGO by email at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca).

Paramount shall submit to OROGO, completed Change of Well Status form 30 days after the service rig release date or when the abandonment operation has been finished.

## **WORK ORDERS/FIELD TICKETS**

Delivery and field tickets for all work, services performed, or materials purchased must be signed by a Company wellsite supervisor. Record the AFE number and well location on all purchase and work tickets.

## **MATERIAL TRANSFERS**

All materials shipped to this location that are not used must be transferred to an appropriate warehouse point. Transfers of any tubular materials must include complete tally. Company wellsite supervisor will complete such transfers and forward both copies to Calgary office for approval and further handling.

## **WELL HISTORY:**

<b>2003-Mar</b>	Weatherford installed completions consisting of an UltraPak HU hydraulic set permanent packer in the well (Liard 2K-29). There was a problem setting the packer/seal assembly but passed the pressure test. However, shortly after the tubing hanger was landed the well was put on production test where it was quickly determined that the tubing and annulus were in direct communication. This indicated a failure of either the tubing, packer or seal assembly (likely the packer did not properly set). WF prepared to correct and reset packer.
<b>2004-Apr</b>	Remove fish from packer tailpipe using coil tubing. Repair tubing to annulus communication.
<b>2004-Oct</b>	Packer Leak Repair

2008-Mar Weatherford DB-10K PBP set at 50mKB and  
DB-10K PBP with 8m thermal cement capped at 3015mKB.  
- Suspend well  
2018-2021 Yearly well inspection. Evidence of SCVF observed (bubbles).

**POROUS ZONES DEPTHS MD (mKB)**  
Intervals separated by not more than 10m are within ( )

Formation	Porous Zones MD (mKB)
Besa River Nahanni	2864.0m – 2866.0m MD 3091.7m – 3125.3m MD 3139.8m – 3172.5m MD
Logged cement top	<b>To surface:</b> Surface Casing: <b>8.0 m3 cement returns to surface.</b> Production Casing <b>2.0 – 3.0 m3 cement returns.</b>
Base of Groundwater (-) 183.4 m above sea level	600 mKB (default)

No data is available on the salinity of the groundwater. Therefore, protection must extend to 600 m below the surface.

- **BGWP @ 600 mKB (default)**
- **Please Note:** Cement top is above BGWP and the surface casing shoe.

**PARAMOUNT ET AL LIARD 2K-29  
ABANDONMENT**

**WELL DATA AND WELLBORE CONFIGURATION**

<b>Surface Location:</b>	Latitude: 60° 28' 40.831" Longitude : 123° 35' 05.338"
<b>Bottomhole Location:</b>	Latitude: 60° 29' 41.386" Longitude : 123° 36' 4.363"
<b>Profile:</b>	DEVIATED
<b>KOP:</b>	285m
<b>BGWP:</b>	600 mKB (default)
<b>SCVF:</b>	Yes
<b>OPERATING LICENCE#</b>	NWT-OL-2014-014
<b>LAND USE PERMIT#</b>	MV2020A0009
<b>WATER LICENCE #</b>	MV2020L1-0006
<b>OROGO OA#</b>	POA 2620-D-12-23,2520-D-12-4
<b>OROGO ACW#</b>	ACW-2022-PAR-2K-29-WID1980
<b>Spud Date:</b>	January 26, 2003
<b>Rig Release Date:</b>	March 21, 2003 (released to completion operations)
<b>KB:</b>	416.60 m
<b>GL:</b>	409.90 m
<b>KB-GL:</b>	6.70 m
<b>Casing Shoe:</b>	3074 mMD
<b>TD/PBTD:</b>	3599 mMD
<b>TVD:</b>	2619 mTVD

**CONDUCTOR:** 660 mm, 11.0 kg/m. Set at **20.0m**.

**SURFACE HOLE:** **349 mm** hole drilled vertically to **276 mKB**. **311 mm** hole drilled directionally to **738 mKB**.

**SURFACE CASING:** **244.5 mm**, 59.53 kg/m, K-55, LT&C set at **734 mKB**. Cemented with 43 t 1:4:1 + 0.5% D-65 + 0.2% D-46 + 4.0% D-20 and 10 t 'G' + 1.0% S-1 + 0.2% D-46. **8.0 m3 cement returns to surface**.

**MAIN HOLE:** **222 mm** to **3075 mKB**. Drilled directionally with an inclination of approximately 36° at **738 mKB** to an inclination of approximately 70° at the casing shoe.

**PROD. CASING:** **177.8 mm**, 38.69 kg/m L-80 Hydril SLX casing set at **3074 mKB**. Cemented with 40 t HiLite 1400 0.3% D-66 + 0.2% D-46 + 0.5% D-65 + 0.5% D-167 + 0.5% D-128. **2 - 3 m3 cement returns**.

**PROD. TUBING:** **114.3 mm**, 18.97 kg/m L-80. Landed at **3088 mKB**.

**OPEN HOLE:** **156 mm** to **3599 mMD (2619 mTVD)**. Drilled directionally from the liner shoe to an inclination of approximately 92° at TD.  
**Open Hole Section: Nahanni:** 3074 mMD - 3599 mMD

**CORES:** NONE  
**DST's:** NONE

**WELLHEAD:** ABB Vetco, 11" x 7 1/16", 5000# (35 MPa)

**PERFORATIONS:**

Zones	Intervals
N/A	N/A

**Formation Tops**  
**geoSCOUT Ref Elev(m): +1416.6**

Formation	TVD (m)	Elev (m)	MD (m)
Mmattson	Cased	Cased	Cased
Mflett	138	278.6	138
Mbesa_r_U	890.2	-473.6	961
Mexshaw	1766.5	-1349.9	2054
Dbesa_rVL	2148.4	-1731.8	2534
Dmuskwa	2568.3	-2151.7	3172
Dnahanni	2608.9	-2192.3	3423

**TUBING/CASING DATA:**

	Surface Casing	Production Casing	Production Tubing
<b>Size O.D. (mm)</b>	244.5	177.8	114.3
<b>Weight (kg/m)</b>	59.53	38.69	18.75
<b>Grade</b>	K-55	L-80 Hydril SLX	L-80
<b>Connection</b>	LT&C		
<b>Drift I.D. (mm)</b>	220.45	156.24	97.358

<b>I.D.</b>	<b>(mm)</b>	224.410	159.410	100.50
<b>Capacity</b>	<b>(m<sup>3</sup>/m)</b>	0.039553	0.019958	0.007933
<b>Collapse</b>	<b>(MPa)</b>	18	37	39.4
<b>Burst</b>	<b>(MPa)</b>	27	47	40.0
<b>Joint Yield</b>	<b>(1000 daN)</b>	249	227	64
<b>Depth</b>	<b>(mKB)</b>	734	3074	3087.76

**RESERVOIR DATA:**

<b>Formation</b>	Nahani
<b>Open Hole (mKB)</b>	3074.0 – 3599.0m
<b>Estimated BH Pressure</b>	22 MPa
<b>Shut-in Pressures</b>	SITP 0 = kPa, SICP 0 = kPa
<b>Estimated BH Temp.</b>	155°C
<b>Kill Fluid density (kg/m<sup>3</sup>)</b>	1000 (~935)
<b>Estimated H<sub>2</sub>S %</b>	0.50
<b>Estimated CO<sub>2</sub> %</b>	21

**CAPACITIES:**

Capacity of 244.5 mm 59.53 kg/m surface casing (0.0395\*734m): 29 m<sup>3</sup>  
Capacity of 177.8 mm 38.69 kg/m production casing (0.0199\*3074m): 61.2 m<sup>3</sup>  
**Capacity of 114.3 mm 18.97 kg/m production tubing (0.0079\*3088m): 24.4 m<sup>3</sup>**  
**Capacity of 156.0 mm open hole (3599 – 3088 = 511m\*0.0190): 9.7 m<sup>3</sup>**  
  
**Capacity of annulus 177.8 mm / 114.3 mm (0.009697m<sup>3</sup>/m x 3074m): 29.8 m<sup>3</sup>**

**SCVF:**

**2018-2021:** Tested SCVF during well inspection. Evidence of SCVF observed (bubbles).  
**2022:** Test SCVF during well inspection. No evidence of SCVF (bubbles)

**DOWNHOLE DIAGRAM**

**PARAMOUNT RESOURCES LTD.**

Paramount et al Liard  
2K-29  
Wellbore Diagram  
Well License # 1980

March 24, 2008

DB-10K perm. bridge  
plug at 50mKB

734.00 mKB

KB elev. 416.60 m  
GL elev. 409.90 m  
KB to CF 6.70 m  
KB to TSP 6.26 m

Surface Casing: 244.5mm 69.53kg/m K-55 LT&C

Wellbore Deviation:		
500 mKB	1.0 deg	3 DLS
510 mKB	22.0 deg	3 DLS
740 mKB	16.4 deg	0 DLS
2020 mKB	37.8 deg	3 DLS
2040 mKB	51.6 deg	3 DLS
3090 mKB	69.3 deg	3 DLS
3120 mKB	72.8 deg	4 DLS
3240 mKB	64.9 deg	2 DLS
3599 mKB	97.2 deg	0 DLS

Production tubing (as run Oct 13, 2004)

- 1) Profcoast 114.3mm "R" nipple c/w 96.85mm profile & 94.42mm Ni
- 2) 4 joints 114.3mm 18.75kg/m New Vam L-80 tubing.
- 3) 114.3mm 18.75kg/m L-80 New Vam perforated pup joint.
- 4) 114.3mm 18.75kg/m L-80 New Vam pup joint.
- 5) Profcoast 114.3mm "R" nipple c/w 96.85mm profile, Incoloy 925.
- 6) 114.3mm 18.75kg/m L-80 New Vam pup joint.
- 7) WCS 177.8mm Ultra-Pak Seal-fore Packer, Incoloy 925, HNBR Elements.
- 8) WCS Ultra-Pak Seal Assembly. Note Latch Removed.
- 9) 152mm Centralizer Sub, Incoloy 925
- 10) 114.3mm 18.75kg/m Incoloy 925 New Vam pup joint.
- 11) Cross over Sub, 114.3mm New Vam pin X 114.3mm Eye Box.
- 12) 114.3mm "R" nipple c/w 96.85mm profile, Incoloy 925.
- 13) 114.3mm 18.75kg/m Incoloy 925 Vam Ace pup joint.
- 14) 114.3mm "R" nipple c/w 96.85mm profile, Incoloy 925.
- 15) 114.3mm 18.75kg/m Incoloy 925 Vam Ace pup joint.
- 16) Baker 177.8mm "FAB-1" packer, Model 85 FA 47x40, Incoloy 925.
- 17) Baker Latch / Seal assembly.
- 18) 114.3mm 18.97kg/m L-80 Hydril 533 pup joint c/w SR-222 coating
- 19) 314 joints 114.3mm 18.97kg/m L-80 Hydril 533 tubing.
- 20) 4 114.3mm 18.97kg/m L-80 Hydril 533 pup joints (2.95, 2.33, 1.13 & 0.9m)
- 21) Cross over sub 114.3mm Hydril 533 pin X 127mm 26.79kg/m Hydril 513 box
- 22) 127mm 26.79kg/m L-80 Hydril 513 pin X pin pup joint
- 23) ABB Veloc tubing hanger. Type CWC-FSH, 127mm Hydril 513 suspension thread & 5.675" MCA 88 threads
- 24) 5000 daN compression

Length (m)	Top Depth (mkb)
	3087.76
0.81	3087.26
35.72	3051.53
3.10	3048.43
2.95	3045.38
0.38	3045.00
3.98	3042.92
1.75	3041.17
0.40	3040.77
0.20	3040.57
2.77	3037.80
0.28	3037.52
0.36	3037.16
2.82	3034.34
0.47	3033.87
2.82	3031.05
1.01	3030.04
0.20	3029.74
3.00	
3012.20	
6.91	
0.37	
0.96	
0.24	
6.26	
3081.51	
6.25	
	3087.76

Total Tubing Length:  
KB to TSP:

Landed Depth (mkb):

Inhibited Fresh Water in Annulus  
1% Baker Petrolite CRW-122.

March 24 2008

Weatherford DB-10K  
permanent bridge plug  
w/ 8 m Thermal cement cap  
@ 3015 mKB

3036.04 mKB

3032.67 mKB

3037.16 mKB

3041.17 mKB

3048.00 mKB

3074.0mKB  
70deg

3087.25 mKB

177.8mm 38.89kg/m L-80 Hydril SLK Production Casing  
Landed @ 3074.00 mkb 2532.08m TVD

3240.00 mKB

PBTD 3599.0 mKB  
TD 3599.0 mKB

2619m TVD

## **GENERAL REQUIREMENTS**

- **Daily reports shall be e-mailed to the Operator's office by 7:00am each day.**
- Before commencing operations, the Wellsite Supervisor will complete a list of nearest available emergency services. This list along with a detailed and accurate description of directions to the location is to be posted in a conspicuous and accessible location known to all personnel.
- Emergency contact list should be completed, posted and available to all on site.
- Ensure that all personnel receive a Paramount orientation, are briefed on the wellsite hazards, safety and first aid equipment locations, escape routes and muster points upon their arrival to the lease. All personnel must be signed in after receiving their briefing and all personnel must sign out when departing the work site.
- Safety and well plan meeting to be held with all service company personnel prior to each job and meetings must be recorded on the Paramount's daily report and on the daily tour sheet.
- All applicable regulations, including, but not limited to the specific approved OROGO ACW approval, OROGO Well Suspension and Abandonment Guidelines, Oil and Gas Occupational Safety and Health Regulations (NWT) and Occupational Health and Safety (OHS) Regulations (NWT) are to be strictly adhered to. Written instructions must be posted in doghouse or other commonly visited area prior to Wellsite Supervisor leaving lease.
- The Wellsite Supervisor is responsible for assessing all worker's competency and ability to perform work.
- All service companies supplying materials will provide Material Safety Data Sheets for all products supplied and maintain these Material Safety Data Sheets available for worker's examination on location in compliance with WHIMIS regulations.
- The Wellsite Supervisor will ensure that dangerous goods shipped or received are classified, packaged, marked, labelled and documented in compliance with the Transportation of Dangerous Goods Regulations. If required, placards must be attached to vehicles transporting dangerous goods. All shipping documents must be forwarded to the Calgary office for filing.
- All operations carried out on behalf of the Operator shall be conducted in a safe and efficient manner in compliance with the Operator's safety regulations and all applicable acts and regulations.
- The Operator expects that all operations conducted will be designed to protect and maintain the quality and integrity of the environment and comply with all environmental acts and regulations.
- BOP equipment will be tested at least once daily, and any equipment found defective should be made serviceable before operations are resumed. Blowout prevention and man-down drills are to be performed weekly and are to be recorded on both the morning reports and tour reports.
- Whenever possible, plan and conduct all completion / workover procedures in a manner which will avoid the mixing of air & hydrocarbons in the wellbore and connected surface piping. If mixing does occur, purge prior to pressurizing or exposing mixture to any other possible source of ignition.
- During the absence of the Wellsite Supervisor, a qualified and competent alternate shall be designated, in writing, to carry out the principal Contractor's responsibilities. Written instructions must be posted in a conspicuous and accessible location known to all personnel prior to the Wellsite Supervisor leaving the location.
- All verbal notifications and approvals received on location from any regulatory agency must be documented and recorded on both morning reports and tour reports and should include a contact name from the agency, phone number and details of the subject matter.
- All field tickets and other supporting documentation submitted for materials purchased and/or services rendered require a correct AFE#, G/L number and accurate identification of the well location along with the Wellsite Supervisor's signature indicating acceptance to the same.



# PARAMOUNT ET AL LIARD 2K-29 ABANDONMENT

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## **COMPLETION (ABANDONMENT) PROGRAM**

1. Submit certificates and inspection documents for any service rig, well control and associated equipment (including boilers) at least 10 days prior to the rig commencing work by e mail at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca)
2. **The Wellsite Supervisor is responsible** to notify (or verify notification has been completed) the OROGO, a **minimum of 24 hrs prior** to any well servicing abandonment operation.
3. **The Wellsite Supervisor shall** request from OROGO, a variation to this well approval from the Regulator if it intends to conduct controlled venting and flaring as a part of well kill operations (ACW-2022-PAR-2K-29-WID1980). The request for variation should include the maximum daily flow rate and daily duration of the flaring or venting and should be submitted no later than December 15, 2022. Any flaring or venting not approved by the Regulator shall be reported to OROGO as an incident under section 75 of the Oil and Gas Drilling and Production Regulations
4. **Wellsite Supervisor is responsible to** verify notifications have been completed to all applicable residents, industrial operators, trappers & guiders within the categorized radius and/or within the emergency planning zone (EPZ) if applicable **a minimum of 24 hours prior** to any flaring operation.
5. Paramount shall provide all staff and contractors for this program with the OROGO 24-hour incident reporting phone number (867-445-8551) prior to commencing any work or activity.
6. **Ensure all PRL and vendor COVID 19 protocols are reviewed, understood and followed by all personnel. PRL COVID protocols and information are available in Comply Works**
7. Complete lease access and well handover process. Complete lease inspection, program review and obtain well access permit with the production operator. Note the condition of the lease, record any clean-up operations required to address any spills and record any other noteworthy findings on the first morning report. Discuss the transportation arrangements for the tanks and fluid with respect to other activity in the surrounding field area.
8. Prepare location for Service Rig & support equipment.
9. Perform SCVF bubble-test, **ensure SCV piping is exposed to determine if it is open and intact**, read and record SIP's. Fill-out the 'Surface Casing Vent Flow / Gas Migration Data Sheet 'and examine surface casing vent for blow or suction. Check and monitor LEL and H<sub>2</sub>S levels at wellhead and investigate for evidence of gas migration at surface.
10. Check for the presence of and confirm there is no H<sub>2</sub>S.
11. Ensure Operations has disconnected the flowline, cathodic protection, chemical lines and removed any surface facilities as necessary.
12. Wellhead Pressure Test:
  - If a surface casing vent flow exists, then pressure test the primary and secondary seals.
  - Confirm & document the stamped working pressure of the wellhead on the morning report.
  - Conduct a pressure test on the primary and secondary wellhead seals, to the working pressure, for 15 minutes each.
  - Ensure the test pressure remains below the production casing collapse pressure rating.
  - Check, record and report the tubing and casing pressures.
  - Ensure the valves are not frozen and the gauges are accurate.

13. Conduct daily pre-job safety meeting and equipment inspection.
14. Move in class III coiled tubing unit. Rig in equipment and injector to tubing c/w 72.8mm bit and motor, hydraulic disconnect and cross over. Pressure test all surface equipment to 3.0 MPa low and 35 MPa high.
15. In accordance with OROGO-SB-1 (sent with program files) conduct and record an on-site risk assessment and hazard analysis associate with shallow plug milling. **No less than 1 hour prior to running in hole to commence this operation** submit to OROGO the above JSA and Hazard Analysis at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca)
16. Record well pressures and bleed off any tubing pressure to test vessel. Establish circulation with fresh water through coiled tubing. Run in and mill out DB-10K permanent bridge plug set at 50.0 mKB. Monitor for well pressure once plug integrity is breached and bleed off gas as required.
17. Run down +/- 100m past plug to ensure bull nose is free. Ensure tubing is dead. **Send summary of operations related to the milling of plug in accordance with OROGO-SB-1 within one hour of completion to [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca)**
18. Continue in hole with coiled tubing milling assembly and proceed to mill out Thermal Cement and DB-10k bridge plug located at 3015mKB. Run down +/- 15m past plug to ensure bull nose is free. Ensure tubing is dead.
19. Pull to surface and rig off coiled tubing unit and MIRU service rig complete with a 179.4 mm 35 MPa Class III BOP stack and **114.3 mm** pipe rams, kill spool, rig pump, clean tank, and related auxiliary equipment to OROGO, OH&S and PRL regulations and guidelines. Ensure Corporate Policies and Procedures are followed prior to commencing operations (see attached). Space out equipment in accordance with OROGO and OH&S requirements.
  - Ensure all necessary safety equipment is strategically positioned, on site and tested to ensure proper operating condition prior to commencing with the workover operations.
  - All personnel must be familiar with the operation of all emergency equipment. Safety and BOP drills are to be conducted on a regular basis and recorded on the "Daily Completion / Workover Report"
  - Conduct a complete inspection of the service rig per requirements of OROGO and PRL guideline policy. Identify and remediate any deficiencies prior to initiating completion operations
  - Conduct an operational and safety meeting prior to installing BOPs onto the wellhead and pressure testing.
20. If necessary, install temporary rig anchors and conduct pull tests on each anchor to 20000 lbs. Install escape line anchor and pull test to 3000 lbs. Ensure PRL ground disturbance procedures are followed.
21. Haul in **~90 m<sup>3</sup>** fresh water for abandonment operations.
22. Read and record pressures. Rig in and secure circulating lines, pressure test to 1.4 MPa (low) and 21 MPa (high) for 10 min each.
23. Rig up to casing and bleed off. Fill casing with fresh water and pressure test to 7 MPa for 10min.
24. Install the working spool and BOPs onto the BOP test stump. If required warm up the BOP stack with steam. Function test the blind rams and pipe rams on the test stump. Close the blind rams and pressure test the working spool, the blind rams and BOP flange to 1.4 and 34.5 MPa for 10 minutes each. Install a ported tubing pup and stabbing valve through the BOPs on the BOP test stump. Pressure test the pipe rams and stabbing valve to 1.4 MPa and 21.0 MPa for 10 minutes each.
25. Conduct an accumulator function test. Recharge the accumulator, shut off the pump and record the accumulator pressure. Close each ram and record the start and end pressures and the time to close each ram. Recharge the accumulator and record the time for the accumulator to recharge to the original pressure.

Ensure that hand wheels are available and are the correct type and size for all the BOP rams. Record the number of turns to close each ram manually.

26. Rig in pump line to tubing, pump a sufficient volume of fluid to ensure well kill. Monitor and confirm static.
27. Remove wellhead top section and install a 114.3 mm landing pup and open stabbing valve. Close the stabbing valve.
28. Strip the BOPs over the landing pup and nipple up the stack. Close the pipe rams on the landing pup and pressure test the BOP connection to the wellhead to 1.4MPa (low) and 21.0 MPa (high) for 10 minutes each.
29. Rig in work floor and **60.3 mm** handling equipment.
30. Make up and run in hole with work 60.3mm work string equipped with shaved collar and 'X' profile 1 joint off of bottom
31. Move in and tie in cementers with single pumping unit, squeeze manifold and chart recorder. Conduct a pre-job treatment safety/orientation meeting with all personnel on location detailing the program, pressure limitations, personnel responsibilities, and safety precautions. Pressure test surface lines and equipment to 1,400kPa (low) and 14,000kPa (high) and hold each for 10 mins
32. Pump cement to squeeze off existing open hole portion of wellbore as per vendor program, back wash tubing and wait on cement
33. Tag and pressure test cement top to 7MPa for 10 minutes, confirm the cement plug is at least 15m inside intermediate casing,
34. POOH with 60.3mm work string and lay down sideways
35. Pickup on tubing and unlatch from "Baker latch seal assembly" (#17 @3029.74 mKB).
36. While on bottom, circulate clean and kill well (ensure well is dead) and POOH and laydown 114.3 mm tubing.
37. Pickup wireline and run-in hole with a 69 MPa permanent bridge plug for **177.8 mm casing** and set within 15m above permeant Baker packer (#16 @3030.04 mKB). Log bridge plug into position ensuring plug is not positioned across a casing collar. Pressure test to 7 MPa for 10 minutes. Laydown wireline.
38. Run 73mm work string or coil tubing and tag top of bridge plug.
39. Rig in cement services. Mix & pump 1m<sup>3</sup> of thermal cement down tubing & balance on top of bridge plug. This will exceed the minimum 30m of cement above successfully tested PBP.
40. Pull tubing out of cement and back wash clean and lay down.
41. SCVF is evident from the well history. Pick up wireline. RIH with noise temperature and cement bong log (CBL) to evaluate existing cement behind casing string for porous intervals and potential SCVF sources.
42. If necessary, conduct remedial cementing operations for porous intervals & potential SCFV source requiring cement isolation as per log. Follow steps outlined in the section below for "porous interval remedial interval attempts".

#### **POROUS INTERVAL REMEDIAL INTERVAL ATTEMPTS:**

43. **Cement top is to surface. This covers the BGWP and the surface casing shoe. Bond log required to identify porous intervals and potential SCVF source. Discuss bond log results with Calgary prior to**

**perforating.**

44. See “Porous Zones Depths” section above. Logging results show that the following intervals for perforating and cement squeezing may be required. **Geology has identified the only porous zones above Nahanni is the Besa River.**

Formations	Intervals (mKB MD)	Perforation (mKB MD)
Besa River	2864.0m – 2866.0m MD	TBD

45. Makeup and RIH with 1.0m, **127mm** 26gm BH ERHSC 20SPM 60° phased and, correlated to the GR-CCL log from the previous step and ensuring gun is not positioned across a collar, position gun and perforate, overbalanced, the remedial intervals as required.
46. POOH with perf assembly & inspect same for performance.
47. Pump down casing with fresh water and record feed rate or circulation results.
48. RIH on wireline with cement retainer for **177.8 mm casing** and set retainer within ~2.0m above the perforations. Fill casing with fresh water and pressure test casing and retainer to 7.0MPa and hold for 10.0mins. Rig out and release wireline unit.
49. Pick up and RIH with stinger on tallied and drifted **60.3 mm work string** equipped with a PSN one joint from bottom, or on coil tubing (tubular TBD). Sting into retainer and perform function and pressure tests.
50. Fill tubing with fresh water and attempt to break circulation to surface; otherwise perform a feed rate test. Note and record results of same. Contact Calgary Superintendent with results.
51. Move in and tie in cementers with single pumping unit, squeeze manifold and chart recorder. Conduct a pre-job treatment safety/orientation meeting with all personnel on location detailing the program, pressure limitations, personnel responsibilities, and safety precautions. Pressure test surface lines and equipment to 1,400kPa (low) and 14,000kPa (high) and hold each for 10 mins.
52. Fill tubing with fresh water and re-establish circulation/feed rate and check to ensure string is free of debris. Note and record same.
53. Pull stinger from retainer, mix, pump and circulate the prescribed cement design to tubing bottom. Sting back into the retainer and perform remedial cement treatment. Catch and retain a minimum of 3 samples (beginning, middle & end of mixing) to monitor surface samples for “setting” conditions. Record and report same.
54. Pull stinger from retainer, circulate a 30m balanced cement plug over the retainer and backwash string clean with fresh water. POOH sideways with 73 mm tubing and stinger.
55. **Repeat procedure until porous intervals BGWP and SCVF intervals are completed.**
56. Ensure the fluid level is down at least 3 m to prevent freezing and to facilitate the cut and cap.
57. Remove BOPs. Install wellhead. Rig out.
58. Cut and cap the casing strings with vented cap as per the attached procedure in the Appendix.



Cut & Cap  
Schematic.xlsx



Form 03-01 - Notice  
of Worksite Supervi:

## CORPORATE CONTACTS

Paramount Resources Ltd.  
2800, 421 - 7<sup>th</sup> Avenue, SW  
Calgary, AB  
T2P 4K9

### IWT (Calgary):

	<u>Business</u>	<u>Residence</u>	<u>Cellular</u>	<u>Fax</u>
Tim Wood Abandonment Manager E-mail: <a href="mailto:Tim.Wood@paramountres.com">Tim.Wood@paramountres.com</a>	(403) 290-2919		(403) 803-8410	(403) 261-1349
Richard Bean Abandonment Supt-Consult E-mail: <a href="mailto:Richard.Bean@paramountres.com">Richard.Bean@paramountres.com</a>	(403) 303-1929		(403) 793-4586	(403) 261-1349
Steven Ong Rotational Engineer-in-Training E-mail: <a href="mailto:Steven.Ong@paramountres.com">Steven.Ong@paramountres.com</a>	(403) 817-5089		(780) 286-9752	(403) 261-1349

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### PRODUCTION (District Office):

	<u>Business</u>	<u>Residence</u>	<u>Cellular</u>	<u>Fax</u>
Completions Sub-Surface Foremen				
Martin Doll /	(780) 683-8037		403 926-7192	

## CORPORATE POLICY & PROCEDURES

- All operations carried out on behalf of the Operator shall be conducted in a safe and efficient manner in compliance with the Operator's safety regulations and all applicable acts and regulations.
- The Operator expects that all operations conducted will be designed to protect and maintain the quality and integrity of the environment and comply with all environmental acts and regulations.
- All contractors on location must have as a minimum a valid H2S ticket (if necessary), WHMIS, and be fully covered by the NWT Worker's Compensation Board (WCB) where applicable, carry a minimum of \$2,000,000 liability insurance.
- Before commencing operations, the Wellsite Supervisor will complete a list of nearest available emergency services. This list along with a detailed and accurate description of directions to the location is to be posted in a conspicuous and accessible location known to all personnel.
- Any excavation or installation of rig anchors on location shall follow Paramount's Ground Disturbance Requirements:
  - a. Contact 1<sup>st</sup> Call (Review Paramount's Grey book)
  - b. Prior to excavation – obtain Ground Disturbance Permit
    - i. If pipeline in area, arrange for Hydrovac and hand expose lines within 5 meters of excavation.
- Prior to commencing operations, the Wellsite Supervisor shall:
  - Read and record SIP(s). Examine surface casing vent for blow or suction, record and report findings. Check and monitor LEL and H<sub>2</sub>S levels at wellhead and investigate for evidence of gas migration at surface.
  - Bleed off SISCVP. Shut in SCV, install chart recorder, monitor 24-hour build-ups, report same and complete AER's "Surface Casing Vent Flow/Gas Migration" form (*OROGO does not have a form, so we fill it out on the AER form*).
- Before commencing operations, the Wellsite Supervisor in conjunction with the Rig Manager will conduct an initial rig inspection using a CAODC or equivalent inspection form. A detailed rig inspection is to be completed weekly thereafter. Confirmation of these inspections is to be recorded on both the morning report and tour report.
- Have on-site a access to the AER Drilling/ Servicing Regulations - Directive 36, Workplace Health and Safety Regulations, NWT Oil and Gas Operations Act, NWT Drilling and Production Regulations, OROGO Well Suspension and Abandonment Guidelines.
- The Wellsite Supervisor and Rig Manager will conduct daily walk-around inspections and complete a daily rig inspection report in an effort to identify deficiencies regarding well control and safety related items.
- The Wellsite Supervisor must ensure that all pertinent data (tubulars, logs, tests etc.) are properly recorded on the tour sheets and that samples, where required are collected as required by well licence. Also, the Wellsite Supervisor must ensure that trip sheets are properly completed and maintained.
- During cold weather operations, the Wellsite Supervisor must ensure that the blowdown line from the BOP stack to the choke manifold to the degasser is filled with a water/antifreeze solution.
- The Wellsite Supervisor must ensure that all personnel are advised and instructed not to trespass off the demised property.
- Safety meetings are to be held every day with wellsite personnel and recorded on both the morning reports and tour reports. Pre-job safety/orientation meetings are to be held prior to commencing new or non-routine work at which time the Wellsite Supervisor shall advise all personnel of known hazards, special pre-cautions and procedures. Hazard assessments must be conducted in accordance to Workplace Health and Safety Regulations and documented accordingly.
- BOP equipment will be tested at least once daily, and any equipment found defective should be made serviceable before operations are resumed. Blowout prevention drills are to be performed weekly and are to be recorded on both the morning reports and tour reports. **All appropriate Certifications for equipment used will be on-site and available for review.** Communicate this information with the contracted services.

- The Wellsite Supervisor will ensure that service companies supplying products and/or materials that require Material Safety Data Sheets review and advise wellsite personnel with the potential hazards associated and the appropriate emergency response to be undertaken when handling the same. As well, in compliance with WHMIS regulations, all MSDS are to be posted in a conspicuous and accessible place known to all personnel for their information and emergency reference. Site Specific Orientation to all personnel on-site must be given for all chemicals and materials used.
- The Wellsite Supervisor will ensure that dangerous goods shipped or received are classified, packaged, marked, labeled and documented in compliance with the Transportation of Dangerous Goods Regulations. If required, placards must be attached to vehicles transporting dangerous goods. All shipping documents must be forwarded to the Calgary office for filing.
- The Operator expects full compliance with all conditions detailed on the Land Use Permit and Water Permit, OA and ACW.
- During the absence of the Wellsite Supervisor, a qualified and competent alternate shall be designated, in writing, to carry out the principal Contractor's responsibilities. Written instructions must be posted in a conspicuous and accessible location known to all personnel prior to the Wellsite Supervisor leaving the location.
- All verbal notifications and approvals received on location from any regulatory agency must be documented and recorded on both morning reports and tour reports and should include a contact name from the agency, phone number and details of the subject matter.
- Daily reports shall be e-mailed (faxed) to the Operator's office by 07:00 AM every morning. Copy will be forwarded to Calgary. A daily operations report will be provided to the Wellsite Supervisor.
- All field tickets and other supporting documentation submitted for materials purchased and/or services rendered require a correct AFE# and accurate identification of the well location along with the Wellsite Supervisor's signature indicating acceptance to the same.
- All rental equipment must be accounted for and returned promptly upon conclusion of operations. Rental Sheets must be utilized.
- All surplus material and/or equipment must be accounted for and either returned for credit or material transferred to the appropriate warehouse point accordingly.
- All Accidents or Incidents shall be reported **immediately** to the District Field Office and to the Calgary Office - Attention: Richard Bean and/or Don Jones. Complete the Paramount Safe Incident Report and conduct the necessary Investigations immediately. Fax copy to Calgary within 6 hours of incident.
- Upon conclusion of operations:
  - Fill out the following forms (*OROGO does not have these forms, fill out on the AER form*):  
**AER "Surface Casing Vent Flow/Gas Migration Data Sheet"**  
**Paramount's Suspended /Abandonment Action form**

Email/ Fax a copy of the above completed form/s to the Calgary office.

  - Ensure that all garbage and debris has been removed from the location in accordance with AER Guide G-58 and that any environmental concern has been addressed. Contact the Construction foreman with any concerns.
  - Ensure that all flange bolts are properly torqued in accordance with the manufacturer's specifications and that all valves are properly lubricated.
  - Prepare a final wellbore diagram with all pertinent information recorded.
  - Forward all paperwork including field logs and computer data files to the Calgary office including copies of all field logs. A paper and digital copy of all Paramount operation reports should be provided. All field tickets, Material Transfers, Incident Reports, well test reports, rig inspection reports and service reports shall be included with the operation report package.
  - Notify the District Production Foreman of the well status.

## APPENDIX 1

### SURFACE CASING VENT FLOWS:

- If a SCVF issue exists, bleed off well and allow well to stand for a minimum of twenty-four (24) hours with the SCV left in the “open” position to allow well to stabilize prior to Noise-Temperature logging.
- Perform “bubble” test as per AEUB Directive 20 and complete the “Surface Casing Vent Flow / Gas Migration Data Sheet”.

### NOISE-TEMPERATURE LOGGING:

- When Noise-Temperature Logging, RIH with Noise-Temperature Logging Tools and, correlated to a cased-hole log provided, run the Temperature Log while running in hole to PBTD. Note and record results.
- Pull the Noise Log to surface and obtain readings every five (5) meters. Over “high” noise level intervals and possible origin(s) of the vent flow, reduce increments to one (1) meter readings. Note and record results of same.
- Upon conclusion of logging operations, forward copy of log to Calgary office for inspection prior to proceeding with the balance of the program.

### CEMENT DUMPBAILING:

- On way in hole with loaded bailer, stop just above plug and make careful detailed note of line weight
- Dump cement on plug by breaking glass bottom by either method above
- DO not stroke bailer repeatedly to insure glass is broken. Use only a single hard jar
- Pick up 1-2m off plug and wait ~5 minutes to let cement displace from bailer
- Pick up above estimated cement top and check line weight for indication of loss of cement
- If obvious weight/cement loss, pull out of the hole slowly for 1<sup>st</sup> ~20m so not to swab cement up hole
- If no weight loss, jar on bottom again and repeat steps above
- Ensure to not inhibit wellbore fluid until after cement is dumped.

### CEMENT-RETAINER CIRCULATIONS/SQUEEZES:

- Ensure a representative sample of make-up water has been forwarded to cementers for compatibility testing.
- Set retainer two (2.0) meters above perfs avoiding a casing collar and pressure test to 7.0 MPa.
- RIH with stinger, sting into and perform pressure and function tests.
- Perform feedrate test to perfs with produced water.
- Tie in single-pumping unit cementer with squeeze manifold and chart recorder.
- Pressure test surface lines to 1,400kPa (low) and 14,000kPa (high).
- Pull stinger from retainer, mix, pump and circulate prescribed cement design to tubing bottom.
- Sting back into retainer and perform cement circulation/squeeze.

### NOTE:

- Where circulation was not established and, after displacing the lead cement, monitor tubing to determine if plug is gravity feeding. If so and if cement setting times permit, allow well to gravity feed at a controlled rate of not more than 0.50 m<sup>3</sup>/min. as best possible with manifold valve or by pulling the stinger into the “neutral” position. When the well no longer gravity feeds, commence hesitation squeezes in 0.50 m<sup>3</sup> increments/stage unless breakdown is observed while pumping a stage at which time pumping should be stopped immediately ending that particular stage. Wait thirty (30) minutes or as appropriate, depending on actual conditions between stages. Attempt to achieve a stabilized lock-up pressure to 7.0 MPa and hold for ten (10) minutes with chart recorder. Record and report same.
- Do not over displace cement squeeze.
- Be prepared to batch mix and pump an additional 1.50 m<sup>3</sup> – 3.00 m<sup>3</sup> cement, if necessary.
- Do not exceed a pump rate of 1.0 m<sup>3</sup>/min. or frac gradient (18.0 kPa/m) when feed rate testing or cementing.

Eg. Maximum allowable surface pump pressure when using 1030 kg/m<sup>3</sup> fluid @ a depth of 300 m:

$$\begin{aligned} &= \text{Frac pressure} - \text{Hydrostatic pressure} \\ &= (300 \text{ m} \times 18.0 \text{ kPa/m}) - (300 \text{ m} \times 1030 \text{ kg/m}^3 \times 0.00981) \\ &= 5,400 \text{ kPa} - 3,031 \text{ kPa} \\ &= 2,369 \text{ kPa} \end{aligned}$$

- Pull stinger from retainer, displace an eight (8.0) meter balanced cement plug over the retainer, raise string out of balanced cement plug, backwash string clean with inhibited water and POOH with stinger.



- Shut in casing valves and WOC as prescribed.

#### **SUSPENSION & ABANDONMENT PLUGS:**

- Bridge plugs and cement retainers used for zonal suspension or abandonment and set in compliance with OROGO Well Suspension and Abandonment Guidelines, must be pressure tested to 7000 Kpa prior to capping with fifteen (15) meters of circulated cement for Level II wells and thirty (30) meters of circulated cement for Level I wells.

#### **CUTTING & CAPPING PROCEDURES:**

- Move in 'B'-ticket welder, backhoe, hydrovac unit and steamer, if required.
- Read and record SIP(s). Check and monitor LEL and H2S levels at wellhead and investigate for evidence of gas migration at surface. Examine surface casing vent for blow or suction. Record and report findings. If present, stop work and hold a safety meeting to review working procedures. If required, contact the Calgary office for further direction. Proceed with work only when conditions are able to be managed safely.

#### **NOTE:**

- When ambient temperatures are below freezing, tarp in wellhead and steam wellhead to ensure that wellhead and piping are not frozen.
- Remove all plugs and function test all wellhead valves to confirm there is no pressure built up in the wellhead or casing. Disassemble the SCV piping assembly and visually inspect that the vent is not plugged with cement or ice.
- Review corporate ground disturbance package and policies with all on-site personnel prior to commencing excavation around the wellhead. Hydrovac expose all underground facilities (casing, flowlines etc.) within five (5.0) meters of area to be excavated and excavate a 6.0m x 2.5m bell hole around the wellhead ensuring that walls of the bell hole are properly sloped for safe entry and egress and to prevent sloughing in. Check and monitor LEL and H2S levels and investigate for evidence of gas migration.
- While exercising caution, weld cut a small hole 30 cm below the surface casing bowl and investigate for trapped gas and fluids. Check and monitor LEL and H2S levels. With closed hooks and shackles, connect backhoe bucket to wellhead and pull into tension slightly more than the weight of the wellhead. Weld cut three (3) windows in the surface casing to access the innermost casing string ensuring that 50% of the circumferential metal remains to prevent possible collapse of the surface casing from the weight of the wellhead. While exercising caution, weld cut the innermost string.

#### **NOTE:**

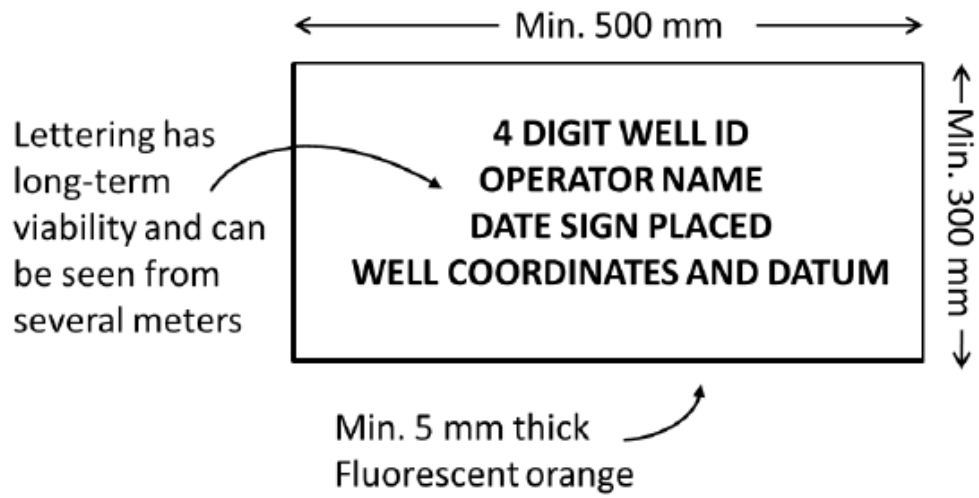
- Innermost string can be expected to suddenly drop once completely cut. Do not place pry bars, hands or fingers in the windows.
- Complete weld cut of the surface casing, lift, and remove wellhead from bellhole with backhoe.
- Review the Capping Schematic in this Appendix. Cut off the casing strings so that the top of the Protective Cap will be a minimum of 1.5 meters below the surveyed ground elevation. The surface casing and production casing are to be cut off at the same depth.
- Fabricate the Protective Cap and slip-on collar using the surplus surface casing material.
- Dress the casing stubs. Using compatible metallurgical material, install and seal weld a 12.7 mm steel plate "donut" and vent assembly over the surface casing and production casing annulus, and a 12.7 mm steel plate and vent assembly over the inner most casing string. Required vent assemblies are as shown on the Capping Schematic.

#### **NOTE:**

- All seal welds are to be pre & post-heated to 3000°C.

- Install and weld the Protective Cap to the surface casing as shown on the Capping Schematic. Weld inscribe the LSD on top of the Protective Cap and document with a digital photograph.
- Backfill and compact the excavation, clean up lease and rig out and release all services.
- Complete material transfer(s) and forward equipment for servicing and/or storage.
- Note: OROGO guidelines state that field verified coordinates for the well center must be provided as part of the Well Operations report as follows:
  - The geodetic datum must be specified (NAD83 is recommended): and
  - Coordinates must be provided:
    - In decimal degrees to 4 decimal places or more, or
    - In degrees, minutes and seconds to 2 decimal places, if decimal coordinates are not possible.
- A field sketch of the area must also be submitted as part of the Well Operations Report.
- After surface abandonment is completed, all abandoned wells must be marked with a durable post and a sign as per below:

**Sign Requirements**



**Post Requirements**

