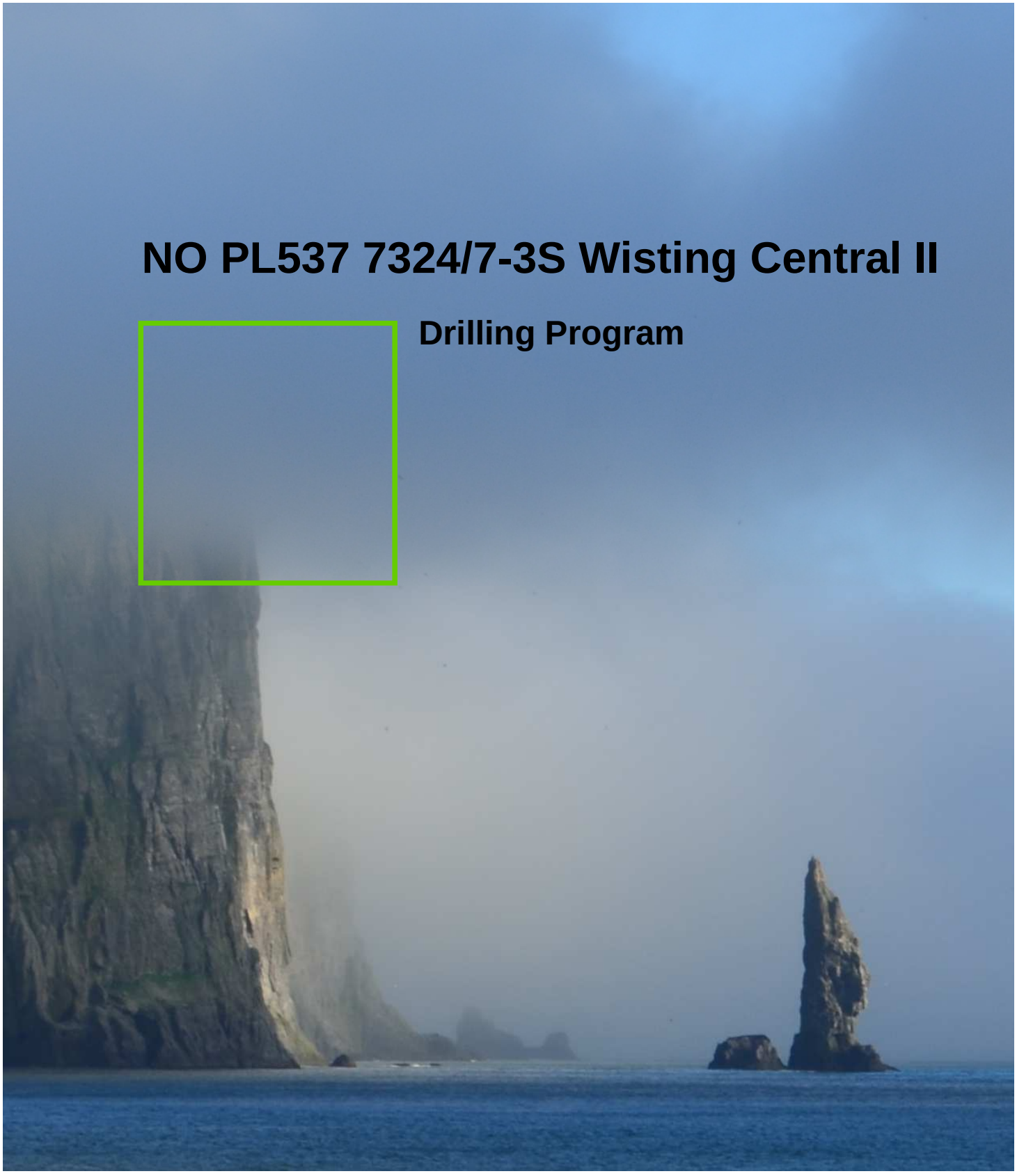
# NO PL537 7324/7-3S Wisting Central II

## Drilling Program



OMV (Norge) AS

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| Authorization | | |
|---|---|---|
| **Name / Position** | **Signature** | **Date** |
| Prepared by:<br>Stephan Trauner / Drilling Engineer | | 8/12/15 |
| Reviewed by:<br>Per Atle Flytlie / Senior Drilling Engineer | | 8/12/15 |
| Reviewed by:<br>Gerald Hollinger / Well Engineering Teamlead | | 8/12/15 |
| Reviewed by:<br>Odd Helge Myrvoll / Drilling Superintendent | | 09/12-2015 |
| Accepted by:<br>Dag H. Breivik / Drilling Manager | | 9/12-15 |

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# Table of Contents


1 Introduction ..... 1
1.1 Drilling Program Summary ..... 1
1.2 General Well Information ..... 1
1.3 Communication ..... 3
1.4 Distribution of Reports and Data ..... 3
1.4.1 OMV (Norge) AS ..... 3
1.4.2 Petoro AS ..... 3
1.4.3 Idemitsu Petroleum AS ..... 3
1.4.4 Tullow Oil Norge AS ..... 4
1.4.5 Statoil Petroleum AS ..... 4
1.4.6 NPD - Norwegian Petroleum Directorate ..... 4
1.5 Confidentiality ..... 4
2 HSSE ..... 5
2.1 HSSE Program and Goals ..... 5
2.2 Special Activities related to Barents Sea Operations ..... 5
2.2.1 Major Spills to the Environment ..... 5
2.2.2 Cold Climate ..... 6
2.3 Risk Analysis ..... 7
2.4 Safety ..... 7
2.4.1 Potential for Well Interference ..... 7
2.4.2 Shallow Gas ..... 7
2.4.3 Shallow Water Flow ..... 7
2.4.4 Hydrates ..... 7
2.4.5 H2S and CO2 ..... 7
2.4.6 External Environment ..... 7
2.4.7 Oil Spill Contingency Plan ..... 8
2.4.8 Emergency Preparedness ..... 8
2.4.9 Vessel Traffic in the Area ..... 8
2.5 Exemptions / Non-confomance ..... 9
2.5.1 Deviations from OMV WE Standards ..... 9
2.5.2 Deviations from PSA Regulations ..... 9
2.6 Waste Management ..... 9
3 Site Survey Summary ..... 10
4 Geology and Geophysics ..... 12
4.1 Prospect Description ..... 12
4.2 Offset wells ..... 12
4.3 Well Objectives and TD Criteria ..... 13
4.4 Geological Prognosis, Description and Structural Setting ..... 13
4.5 Stratigraphy ..... 14
4.6 Reservoir ..... 15
4.7 Formation Tops and Lithology ..... 15
4.8 Data Acquisition ..... 17
4.9 Pore Pressure and Fracture Gradient ..... 19
4.10 Temperature Gradient ..... 20
5 Drilling ..... 21
5.1 Drilling Unit ..... 21
5.1.1 Rig Positioning ..... 21
5.2 Well Design Summary ..... 21
5.2.1 Well Schematic ..... 21
5.2.2 Well Trajectory ..... 23
5.2.3 Time versus Depth ..... 24

5.3 Casing Design ..... 26
5.3.1 Casing Design Overview ..... 26
5.3.2 Casing Design Specifications ..... 26
5.3.3 Conductor Analysis ..... 27
5.3.4 Cementing Program ..... 27
5.4 Drilling and Well Control ..... 28
5.4.1 Kick Tolerance / Leak-Off Requirements ..... 28
5.4.2 Riser Margin ..... 28
5.4.3 Well Control Manual ..... 29
5.4.4 Well Control Equipment ..... 29
5.5 Pressure Testing ..... 29
5.6 Drillpipe ..... 30
5.7 Section Guidelines ..... 30
5.7.1 CAN Installation ..... 31
5.7.2 36″ x 42″ Hole Section ..... 32
5.7.3 26" Hole Section ..... 33
5.7.4 17 1/2″ Hole Section ..... 34
5.7.5 12 1/4″ Hole Section ..... 35
5.7.6 8 1/2″ Hole Section ..... 36
5.7.7 Plug and Abandonment ..... 37
5.8 Relief Wells ..... 38
5.9 Re-spud Location ..... 40
6 Drill Stem Test ..... 41
6.1 Drill Stem Test Summary ..... 41
7 Reference List ..... 42
8 Appendix ..... 45
8.1 Organization ..... 45
8.2 Contact Lists ..... 46
8.2.1 OMV (Norge) AS ..... 46
8.2.2 Transocean ..... 46
8.2.3 Partners ..... 46
8.2.4 Contractors ..... 47
8.3 NeoDrill's CAN Solution ..... 48
8.4 Drill Bit Summary ..... 49
8.5 Drilling Fluid Program ..... 51
8.6 Cement Program ..... 52
8.7 Drilling Unit Specifications ..... 53
8.8 Well Control Equipment Drawings ..... 54
8.8.1 BOP ..... 54
8.8.2 Choke Manifold ..... 55

List of Figures

1.1 Well Location 7324/7-3S Wisting Central II ..... 1
2.1 Average probability of daily minimum air temperatur for PL 537 ..... 6
3.1 Site Survey Map for 7324/7-3S Wisting Central II ..... 10
3.2 Bathymetry for 7324/7-3S Wisting Central II ..... 11
3.3 Top Hole Prognosis for Wisting Central II ..... 11
4.1 Seismic Cross Section of Wisting Central II ..... 12
4.2 General Stratigraphy for Wisting Central II ..... 14
4.3 Wisting Central II - Pressure Profile w/ Lithology (TVD) ..... 19
4.4 Wisting Central II - Pressure Profile w/ Lithology (MD) ..... 20
5.1 Well Schematic of Wisting Central II w/ NeoDrill's CAN ..... 22
5.2 Wisting Central II Trajectory ..... 23
5.3 Time versus Depth for 7324/7-3S Wisting Central II - Discovery Case ..... 24
5.4 Time versus Depth for 7324/7-3S Wisting Central II - Dry Hole Case ..... 25
5.5 P&A Well Schematic of 7324/7-3S Wisting Central II ..... 37
5.6 Locations of Relief Wells ..... 38
5.7 Relief Well Trajectory ..... 39
8.1 Wisting Central II - Organizational Chart ..... 45
8.2 CAN Support Structure Overview ..... 48
8.3 Wisting Central II Primary Bits ..... 49
8.4 Wisting Central II Drill Out Bits ..... 50
8.5 Drilling Fluid Program ..... 51
8.6 Cement Program Summary for Wisting Central II ..... 52
8.7 Drilling Unit Specifications - Transocean Spitsbergen ..... 53
8.8 BOP Configuration Transocean Spitsbergen ..... 54
8.9 Choke Manifold TO Spitsbergen ..... 55

List of Tables

1.1 7324/7-3S Wisting Central II General Well Information ..... 2
1.2 OMV Norge Daily Drilling Reports / Well Data ..... 3
1.3 Petoro Daily Drilling Reports / Well Data ..... 3
1.4 Idemitsu Daily Drilling Reports / Well Data ..... 3
1.5 Tullow Oil Norge Daily Drilling Reports / Well Data ..... 4
1.6 Statoil Daily Drilling Reports / Well Data ..... 4
1.7 NPD Daily Drilling Reports / Well Data ..... 4
2.1 Deviation Register for Wisting Central II ..... 9
4.1 Offset Wells ..... 12
4.2 Well Objectives for Wisting Central II ..... 13
4.3 Geological Prognosis Formation Tops for Wisting Central II ..... 13
4.4 Data Acquisition Program for Wisting Central II ..... 17
5.1 Time Estimate for 7324/7-3S Wisting Central II - Discovery Case ..... 24
5.2 Time Estimate for 7324/7-3S Wisting Central II - Dry Hole Case ..... 25
5.3 Casing Design Summary ..... 26
5.4 Casing and Connection Ratings ..... 26
5.5 Minimum Safety Factors ..... 26
5.6 Cementing Program Summary ..... 28
5.7 Kick Tolerance and Minimum Required FIT ..... 28
5.8 Riser margin ..... 29
5.9 Well Control Equipment ..... 29
5.10 Pressure Testing ..... 30
5.11 Drillpipe Design ..... 30
5.12 Heavy-Weight Drill Pipe ..... 30
5.13 36" x 42" Section Guideline ..... 32
5.14 26" Section Guideline ..... 33
5.15 17 1/2" Section Guideline ..... 34
5.16 12 1/4" Section Guideline ..... 35
5.17 8 1/2" Section Guideline ..... 36
5.18 Relief Well Location RW#1 ..... 40
5.19 Relief Well Location RW#2 ..... 40
5.20 Relief Well Location RW#3 ..... 40
8.1 OMV Contact List ..... 46
8.2 Transocean Contact List ..... 46
8.3 Petoro AS Contact List ..... 46
8.4 Idemitsu Petroleum AS Contact List ..... 46
8.5 Statoil Petroleum AS Contact List ..... 46
8.6 Tullow Oil Norge AS Contact List ..... 47
8.7 Schlumberger Contact List ..... 47
8.8 Dril-Quip Contact List ..... 47
8.9 Tenaris Contact List ..... 47
8.10 Oceaneering Contact List ..... 47
8.11 Weatherford Contact List ..... 47
8.12 Welltec Contact List ..... 47
8.13 Archer Contact List ..... 47

# 1 Introduction

The Wisting prospect lies in block 7324/7 of the OMV operated license PL 537, located north in the Barents Sea Hoop area. It is approximately 160 nautical miles (nm) north of Hammerfest.

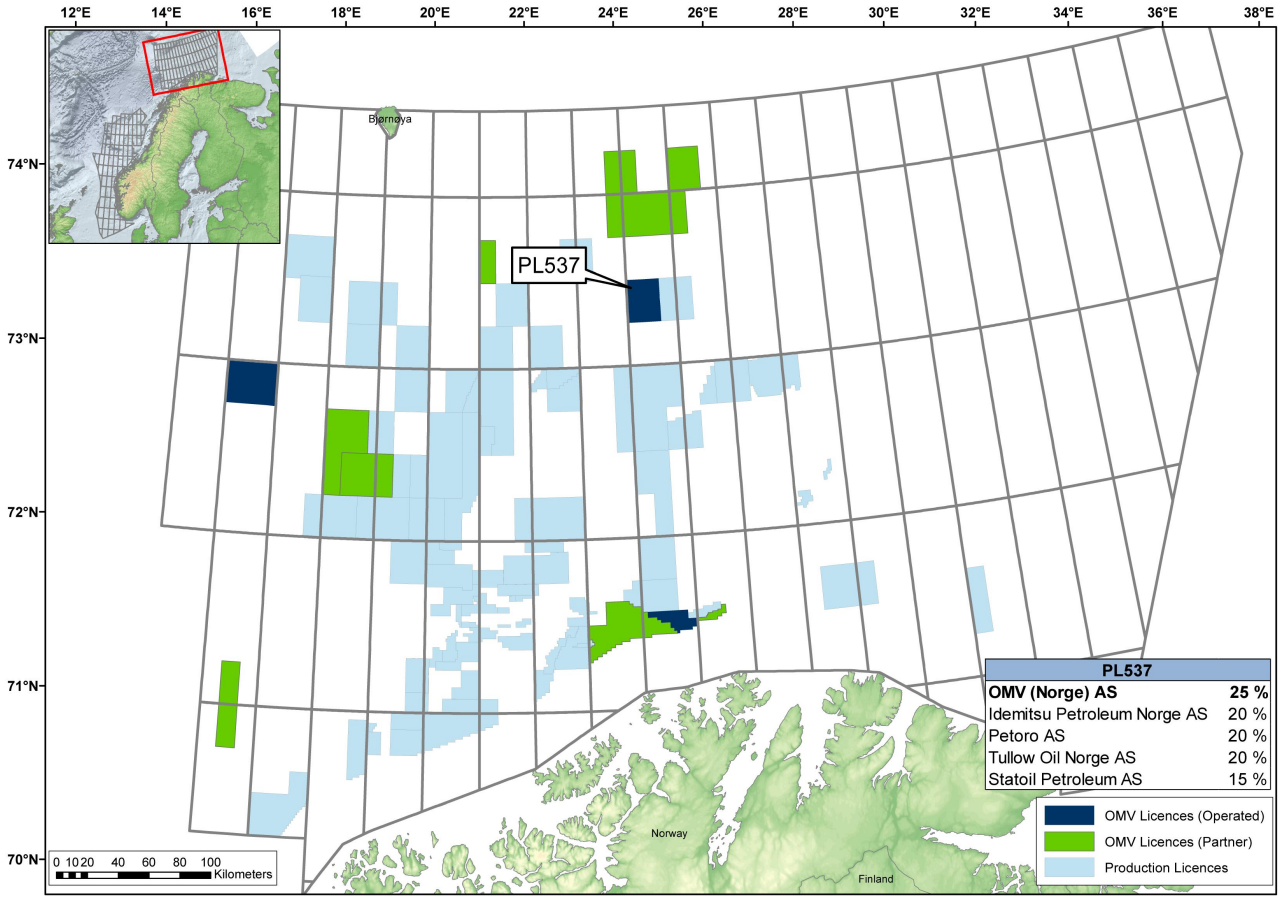


Figure 1.1 Well Location 7324/7-3S Wisting Central II

## 1.1 Drilling Program Summary

7324/7-3S Wisting Central II is an horizontal appraisal well including a well test in the PL 537 license through the Wisting Central segment to prove feasibility of horizontal wells for a possible field development. Transocean Spitsbergen is the selected rig for the operation.

The primary target is the Mid-Jurassic Stø Formation in the south segment, and the secondary target is Mid-Jurassic Stø Formation in the west segment. The TD of Wisting Central II will be 2296m MD / 711m TVD.

The well will be plugged and abandoned after a successful completion and test.

# 1.2 General Well Information

Table 1.1 7324/7-3S Wisting Central II General Well Information

| Well Name / Well Class | | 7324/7-3S Wisting Central II / Appraisal Well | |
|---|---|---|---|
| Location | | Barents Sea | |
| Block | | 7324/7 | |
| License Number | | PL537 | |
| License Partners | | OMV Norge AS (Operator) 25%<br>Idemitsu Petroleum Norge AS 20%<br>Petoro AS 20%<br>Tullow Oil Norge AS 20%<br>Statoil ASA 15% | |
| Planned Spud Date | | 01/01/2015 | |
| Spud Location | Latitude<br>Longitude<br>Northing<br>Easting | 73° 26′ 30.78577″ N<br>24° 15′ 39.88220″ E<br>8 152 829.42m N<br>603 693.35m E | |
| Spud Location Tolerance | | Circle of 50m radius | |
| Water Depth (MSL) | | 402m | |
| Seabed Gradients | | 4° - 7° | |
| Well Trajectory | | Horizontal Well | |
| Target (RKB):<br>Steering Points in the Target Reservoir (Stø) | | Control Point 1:<br>1008.07m MD / 724.31m TVD<br>73° 26' 34.43" N<br>24° 16' 20.28" E<br>8 152 961.69m N<br>604 043.62m E | Control Point 2:<br>1469.82m MD / 725.25m TVD<br>73° 26' 38.34" N<br>24° 17' 10.67" E<br>8 153 107.13m N<br>604 481.60m E |
| | | Control Point 3:<br>1720.70m MD / 722.36m TVD<br>73° 26' 40.46" N<br>24° 17' 38.05" E<br>8 153 186.18m N<br>604 719.58m E | Control Point 4:<br>1981.19m MD / 714.98m TVD<br>73° 26' 42.67" N<br>24° 18' 6.47" E<br>8 153 268.31m N<br>604 966.58m E |
| | | Control Point 5 - TD:<br>2296.21m MD / 720.78m TVD<br>73° 26' 45.34" N<br>24° 18' 40.85" E<br>8 153 367.56m N<br>605 265.35m E | Geo-steering in reservoir:<br>Steering points will be updated during operations depending on reservoir characteristics and formation tops. |
| Target Tolerance | | 50m lateral / 7–10m vertical tolerance | |
| | | Stay above predicted FWL at 734m TVD RKB | |
| Reference System | | UTM Zone 34 on ED 50 (International Spheroid 1924) | |
| Maximum Expected Reservoir Pressure (Stø) | | 69 bar / 1.06SG | |
| Expected Reservoir Temperature (Stø) | | 17°C +/- 2°C (5.6°C/100m in overburden – bottom sea temperature at 2°C) | |
| Expected Hydrocarbons in Prospect | | 100% Oil (API = 39°) | |
| $H_2S$ / $CO_2$ | | No | |
| Rig Name (Type) | | Transocean Spitsbergen (Semi-Submersible) | |
| Contractor | | Transocean | |
| Rig Datum Elevation (RKB) | | 40m RKB- MSL | |
| Rig Heading | | 180° | |
| AFE Number | | 2014 0391 | |

| | |
|---|---|
| Expected Duration | 95 days (including DST) |
| Proposed Completion Status | Permanent P&A |
| Primary Offset Wells | 7324/8-1 Wisting Central (OMV)<br>7324/7-1S Wisting Alternative (OMV)<br>7324/7-2 Hanssen (OMV)<br>7324/8-2 Bjaaland (OMV)<br>7324/2-1 Apollo (Statoil)<br>7325/1-1 Atlantis (Statoil) |

# 1.3 Communication

A final daily well report will be made available to NPD before 12:00 hours.

All well data, including logs, will be available via License2Share (L2S).

A final drilling report will be finalized no later than 3 months after completion of the well.

A final well report will be finalized no later than 6 months after completion of the well.

# 1.4 Distribution of Reports and Data

## 1.4.1 OMV (Norge) AS

Table 1.2 OMV Norge Daily Drilling Reports / Well Data

| Name | E-mail Adresses |
|---|---|
| Dag Helge Breivik | dag.breivik@omv.com |
| Odd Helge Myrvoll | oddhelge.myrvoll@external.omv.com |
| Gerald Hollinger | gerald.hollinger@omv.com |
| Per Atle Flytlie | peratle.flytlie@external.omv.com |
| Yngve Frøyland | yngve.froyland@external.omv.com |
| Stephan Trauner | stephan.trauner@omv.com |
| Øivind Eikefet | oivind.eikefet@omv.com |

## 1.4.2 Petoro AS

Table 1.3 Petoro Daily Drilling Reports / Well Data

| Name | e-mail: @petoro.no |
|---|---|
| Jan Morten Holmboe | jan.morten.holmboe |
| Marianne Goesten | marianne.goesten |
| **Logs and data to be sent to:** | L2S |
| **Realtime LWD data:** | Interact |

## 1.4.3 Idemitsu Petroleum AS

Table 1.4 Idemitsu Daily Drilling Reports / Well Data

| Name | e-mail @idemitsu.com |
|---|---|
| Ted Tadesse | ted.tadesse |
| John Martin Østby | john.martin.ostby |
| **Logs and data to be sent to:** | L2S |
| **Realtime LWD data:** | Interact |

### 1.4.4 Tullow Oil Norge AS

Table 1.5 Tullow Oil Norge Daily Drilling Reports / Well Data

| Name | e-mail: @tullowoil.com |
|---|---|
| Bente Flakstad Vold | bente.vold |
| Ivar Frøland Olsvoll | ivar.olsvoll |
| Per Bakøy | per.bakoy |
| **Logs and data to be sent to:** | L2S |
| **Realtime LWD data:** | Interact |

### 1.4.5 Statoil Petroleum AS

Table 1.6 Statoil Daily Drilling Reports / Well Data

| Name | e-mail: @statoil.com |
|---|---|
| Carlos Gil | cgi |
| Dagfinn Alm | dalm |
| Adam Juhani Sultan | adsu |
| Torbjørn Dahlgren | torbda |
| Mohammad Ibrahim Khan | moik |
| **Logs and data to be sent to:** | L2S |
| **Realtime LWD data:** | Interact |

### 1.4.6 NPD - Norwegian Petroleum Directorate

Table 1.7 NPD Daily Drilling Reports / Well Data

| Name | e-mail: @npd.no |
|---|---|
| **General Postbox** | |
| | |
| **Realtime LWD data:** | Interact |

## 1.5 Confidentiality

OMV, license partners, Transocean and contractor personnel shall be aware that information about activities and results of the drilling operation are confidential, and are not to be discussed with other parties. Release of confidential data to third parties shall only be made by decision of the operator in agreement with license partners.

# 2 HSSE

## 2.1 HSSE Program and Goals

### HSSE Incidents

OMV believes that all incidents can be avoided, and has a goal to prevent adverse HSE impact on employees, contractors, public, stakeholders and the environment.

### HSSE Program

To achieve satisfying HSE results for the Hassel operation following elements will be set as basis for defining HSE program:

- OMV HSSE Vision and Policy
- Transcocean Spitsbergen HSE program for 2015

OMV will look into some additional OMV HSE targets/program to be implemented for the drilling operations. This HSE program is not completed.

The HSE program is subject to continuous improvement and close cooperation between the involved parties. Operational HSE experience will be systematically collected and analysed in order to identify and implement corrective and preventive actions.

The project risk register will be followed up continuously.

### Audit Plan

OMV has developed an Audit and Verification Program for 2015, to verify the compliance with the HSE programs and HSE goal achievement, and to identify improvement areas.

Ref. /32/Transocean's 2015 HSE program.

Ref. /8/ OMV's 2015 Audit and Verification Plan.

## 2.2 Special Activities related to Barents Sea Operations

### 2.2.1 Major Spills to the Environment

Special focus is set on both minor and major spills for drilling in the Barents Sea area. Loss of containment has been an area of focus during the rig assurance / verification process.

OMV has installed Aptomars SECurus camera to monitor oil on water every hour.

Reference is made to the Oljevernplan (Oil Spill Contingency Plan), ref. /9/.

Ref. /10/, the Wisting Central II Blowout Contingency Plan.

### Remote Operation

Due to long distance from Hammerfest to the well location, OMV exceeds the 3 hour requirement for a red medical incident. Therefore, OMV plan to use 2 offshore medics during operation as well as telemedicine on the rig.

## 2.2.2 Cold Climate

### Temperature

The climatic conditions this far North in the Barents Sea are challenging due to long periods of low temperatures and potentially strong winds.

Figure 2.1 illustrates the average probabilities of low temperatures through the year. The figure shows that we can expect temperatures below 0° C during the drilling period.

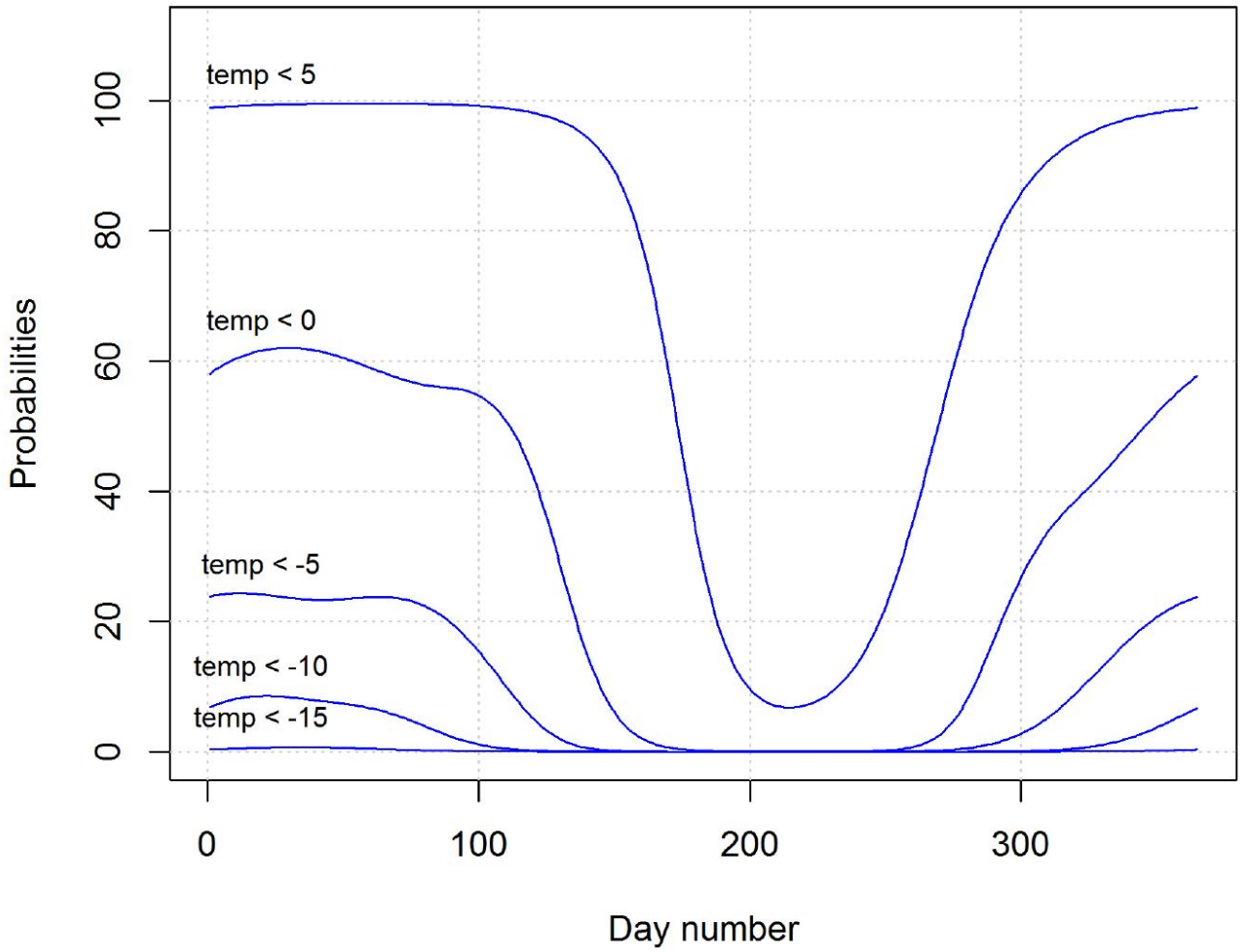


Figure 2.1 Average probability of daily minimum air temperatur for PL 537

### Wind Chill

Transocean have developed a Wind Chill Index (WCI) for exposed locations/work places on the rig. In addition Transocean have developed a recommended standard for Personal Protective Clothing & Equipment suitable for harsh winter periods in the Barents Sea.

### Winterization

Transocean have established a Winterization Manual for Transocean Spitsbergen, ref. /34/.

**Ice monitoring**
OMV will develop an ice management plan for the operation with Transocean Spitsbergen on Wisting Central II.

# 2.3 Risk Analysis

Site-, Well- and Operation- Specific Risk Analyses are performed for the Wisting Central II well with Transocean Spitsbergen. All risks identified are captured in the Wisting Central II Well Risk Register, ref /12/.

# 2.4 Safety

## 2.4.1 Potential for Well Interference

There is no potential for well interference for Wisting Central II.

The closest offset well is 7324/8-1 Wisting Central, situated 4.7km ENE of the proposed Wisting Central II location.

## 2.4.2 Shallow Gas

With reference to the Drilling Constraint Analysys performed for the Wisting Central II well location no potential shallow gas hazards were interpreted in the depth interval prior to the BOP is installed.

The rig shall still have focus on shallow gas procedures and perform shallow gas drills when drilling sections without the BOP installed.

No shallow gas was encountered on the previous exploration wells drilled in this field.

## 2.4.3 Shallow Water Flow

Although the conditions required for the formation of flow sands may be present in the area, there are no accounts of flow sands in well logs and reports for nearby offset wells.

## 2.4.4 Hydrates

The presence of gas hydrates at Wisting Central II location cannot be ruled out and will be handled in accordance with the risk register (ref. /12/ Risk Register).

## 2.4.5 H2S and CO2

There is no presence of $H_2S$ or $CO_2$ expected in the Wisting area.

## 2.4.6 External Environment

Acceptance criteria and performance standards are the basis for the environmental risk assessment and contingency analysis, which are conducted in accordance with best industry practice. A year-round environmental risk analysis for exploration drilling has been conducted showing that the highest environmental risk value is approximately 23.5% of the acceptance criteria for moderate environmental damage. This risk is related to the Pelagic sea birds.

There is no possibility that an oil spill could reach the coast of the Norwegian mainland or Bear Island. Results also show that the Ice Edge is not within the influenced area for an oil drift. Analysis are based on Wisting Crude Oil.

For both, the topside and subsea setup, the recovery rate was around 20 percentage points higher during summer compared to the winter season. There is a slightly higher recovery fraction for the subsea scenario. In total oil mass recovered, the amount is highest given a topside blowout.

Ref. /17/, Environmental Risk Assessment.

Ref. /18/, Application for Discharge well 7324/7-3S and 7324/8-3.

## 2.4.7 Oil Spill Contingency Plan

An Environmental Risk Assessment and Oil Spill Emergency Preparedness Analysis have been done as part of the well planning process. Different discharge incidents have been included in the analysis (blowout scenarios, minor acute spills and operational discharge of chemicals).

Ref. /9/ Oil Spill Contingency Plan for Wisting Central II.

## 2.4.8 Emergency Preparedness

OMV has the overall responsibility for the emergency preparedness for well 7324/7-3S Wisting Central II.

ResQ provides the 2nd line emergency organisation. The Emergency Control Center is located at Lura (ref. /21/ OMV's 2nd line response plan).

OMV's 3rd line Emergency Response Organisation mobilize at the ResQ's Emergency Control Center in case of an incident (ref. /22/ OMV's 3rd line response plan).

In an emergency situation, the 2nd line emergency response organization will perform the initial notification and communication with the relevant authorities. Communication with the Authorities will be transfered to OMV at a later stage.

A bridging document is established between 1st line, 2nd line and the 3rd line to ensure coordination between the involved parties.

A full scale exercise will be performed prior to startup at the well. The emergency preparedness training will involve Transocean and Transocean Spitsbergen.

A Site Specific Emergency Preparedness Analysis (SSEPA) will be performed for the Wisting Area and Transocean Spitsbergen (ref. /26/). This is to assess the emergency preparedness prerequisites at the well location and to examine compliance to PSA HSE Regulations and the Norwegian Oil and Gas recommended guidelines for area preparedness. The analysis covers, among other, the requirement for medical evacuation of acute ill or seriously injured personnel and the ability to recover personnel from sea. The analysis concludes that all requirements for emergency preparedness are met for the planned Wisting Central II operations.

## 2.4.9 Vessel Traffic in the Area

A Vessel Traffic Survey and Collision Risk Assessment has been performed. Acceptance criterias are met as the rig will be located in a low traffic density area.

# 2.5 Exemptions / Non-confomance

## 2.5.1 Deviations from OMV WE Standards

Following deviations have been approved:

Table 2.1 Deviation Register for Wisting Central II

| Deviation Number | Deviation Title | Deviation Description |
|---|---|---|
| NO-2015-03 (*1) | Liner pressure test | Pressure Test Casing and Liner. The 9 5/8" and 7" liner laps will not be inflow tested |
| NO-2015-04 (*2) | Linerlap | Production Casing and/or Liner. The 9 5/8" and 7" liner laps will be less than 300 feet |
| NO-2015-05 (*3) | FIT over a LOT | Formation integrity tests (FIT's) will be performed over leak-off tests (LOT's) |

*(*1) Deviation from OMV Casing Design Standard [EP-EPP-WE-06-00] reference to section 7.7.*

*(*2) Deviation from OMV Casing Design Standard [EP-EPP-WE-06-00] reference to section 6.4.*

*(*3) Deviation from OMV Technical Policy [E-C.2.3-HQ-STD-004] reference to section 7.5.*

## 2.5.2 Deviations from PSA Regulations

There are no deviations from PSA regulations.

# 2.6 Waste Management

A waste management plan has been developed for the Wisting Central II operations (ref. /20/ OMV Waste Management Plan).

# 3 Site Survey Summary

A site survey has been performed for the Wisting area in May/June 2014 by Fugro. A final Regional Report was issued on the September 16, 2014 (ref. /35/ Drilling Constraint Analysis).

According to the site survey data there are no shallow gas hazards at the propose well location or within 100m, including the proposed relief well locations. Hydrates might be present in the greater Wisting Area as also encountered in the offset wells.

Environmental survey work did not identify any areas of sensitive habitats within the survey area.

Three relief well locations will be identified for the location of Wisting Central II, all are placed ~1500m away from the planned well location.

A location specific report has been generated which maps the shallow hazards in detail, bathymetry and seabed features (i.e boulders, iceberg ploughmarks, pockmarks etc.):

The Wisting Central II location rests on a slope of between 4-7°.

A seabed soils unit comprising very soft to soft slightly sandy silty clay less than 1m thick is expected to be present at the proposed location, overlying very soft to soft becoming firm to stiff slightly sandy silty clay with occasional gravel. This is expected to continue down to 25m below seabed and overlies a stiff sandy silty clay unit which is expected to continue down to approximately 64m below seabed (ref. /36/ Seabed Survey).

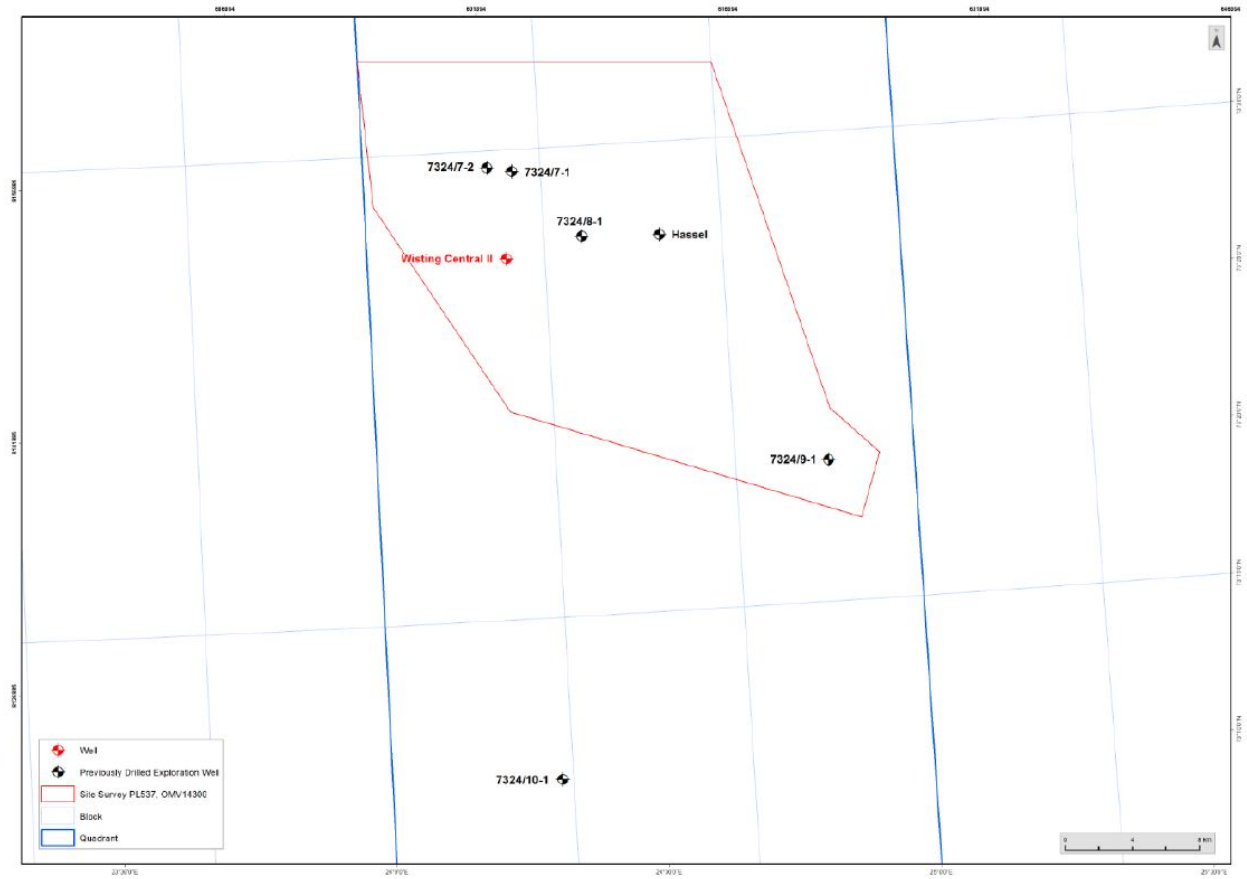


Figure 3.1 Site Survey Map for 7324/7-3S Wisting Central II

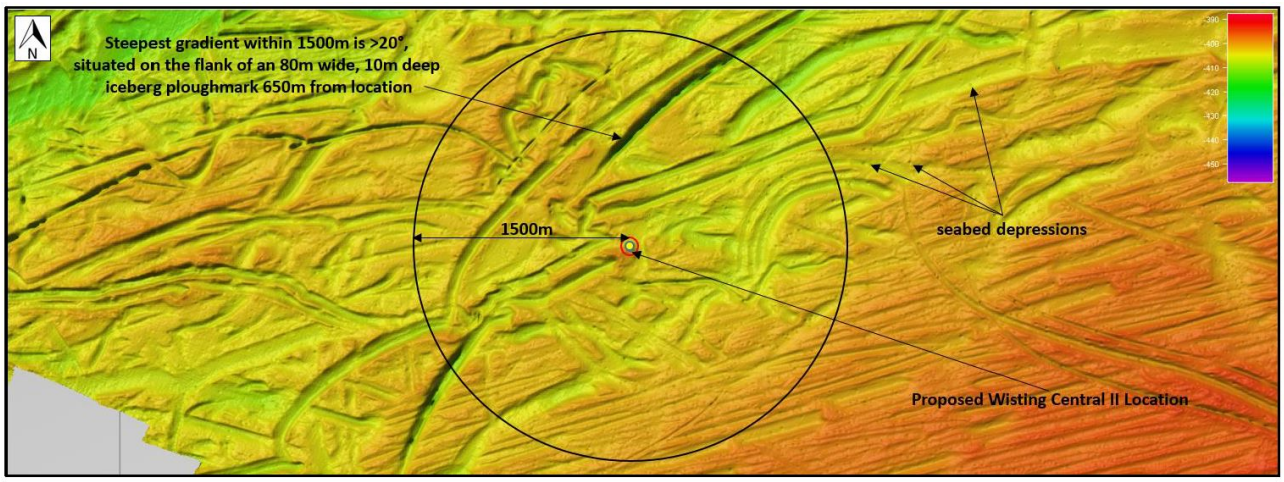


Figure 3.2 Bathymetry for 7324/7-3S Wisting Central II

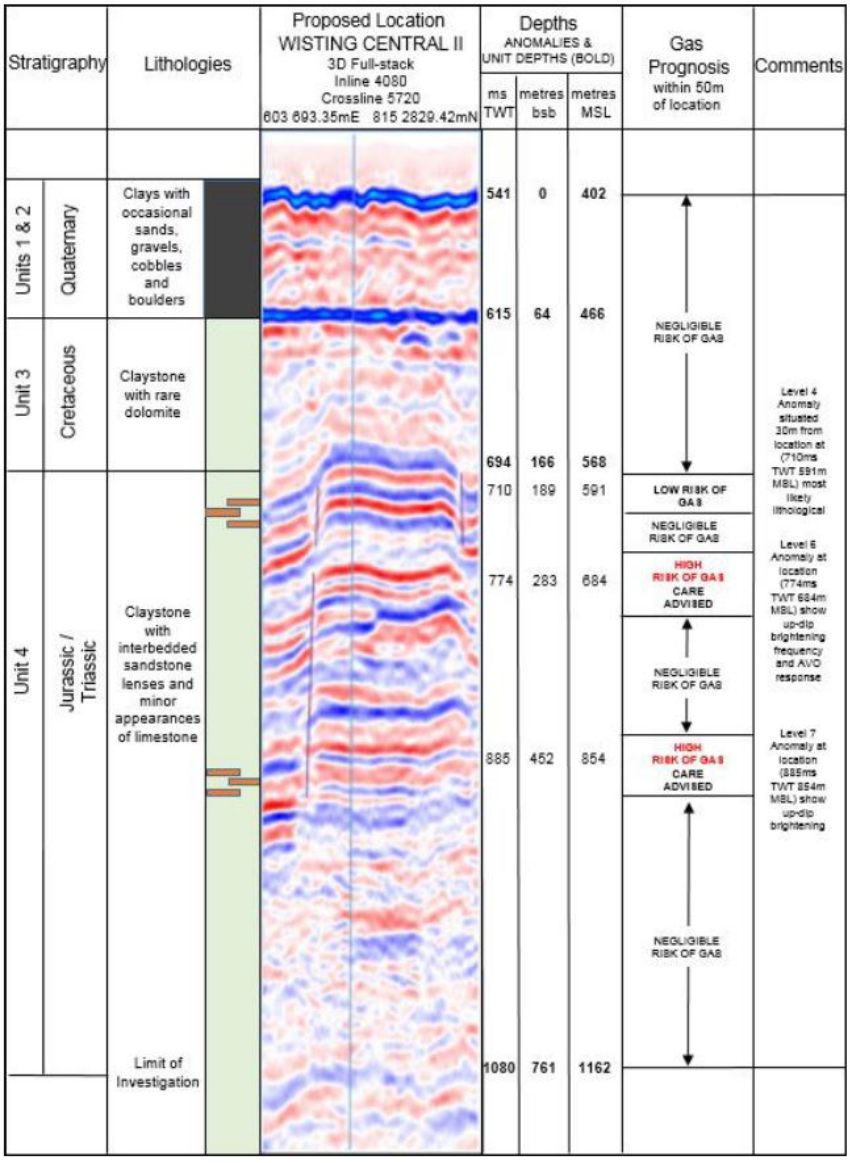


Figure 3.3 Top Hole Prognosis for Wisting Central II

# 4 Geology and Geophysics

## 4.1 Prospect Description

Block 7324/7 of the OMV operated License PL 537 is located north in the Barents Sea. The Wisting Central II well location is approximately 170nm North of Hammerfest. The Realgrunnen Sg prospect is a shallow structural 3-way dip closure. The main reservoir is the shallow marine Middle Jurassic Realgrunnen Sg.

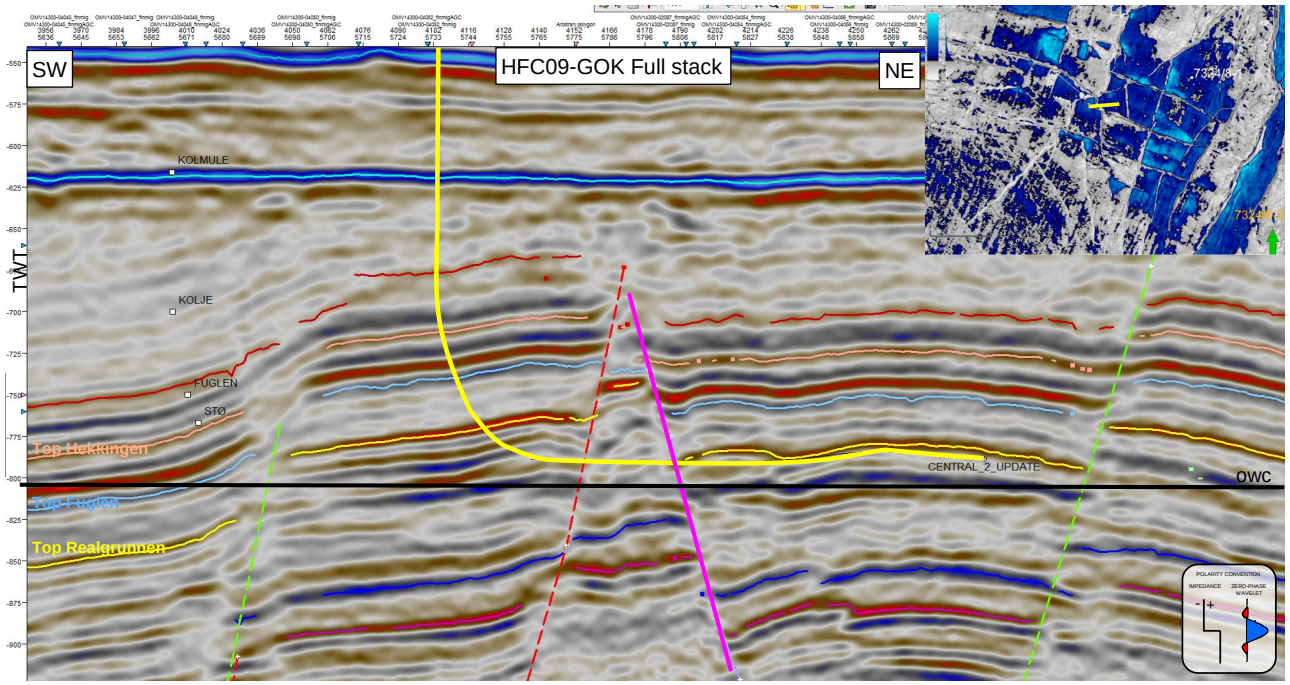


Figure 4.1 Seismic Cross Section of Wisting Central II

## 4.2 Offset wells

Table 4.1 Offset Wells

| Well Name | Operator | Distance | Direction | Comments / Problems / Relevance | Rev 0 |
|---|---|---|---|---|---|
| 7324/7-2 (Hanssen) | OMV | 5.5 km | NNW | OMV operated well drilled in 2014. Oil in Stø Fm. No gas. | |
| 7324/7-1S (Wisting Alternative) | OMV | 5.2 km | N | OMV operated well drilled in 2013. No HC. | |
| 7324/8-1 (Wisting Central) | OMV | 4.7 km | NE | OMV operated well drilled in 2013. Oil in Stø Fm and Fruholmen Fm. | |
| 7324/2-1 (Apollo) | Statoil | 55 km | NE | Drilled in 2014; no FWR. Available 2014. Dry well with shows. | |
| 7325/1-1 (Atlantis) | Statoil | 65 km | NE | Drilled in 2014; no FWR. Available 2014. Gas shows in Snadd Fm. | |
| 7324/8-2 (Bjaaland) | OMV | 7.5 km | SW | Stø and Snadd were water bearing with indications of residual | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | hydrocarbons. | |
| **Summary of key relevant lessons learnt from offset wells:** | Reactive clays in the shallow part (Hekkingen and Kolmule Fm). Hydrates possible, gas bubbles in the shallow section observed. Inclination build up in top hole sections. | | | | |

# 4.3 Well Objectives and TD Criteria

Table 4.2 Well Objectives for Wisting Central II

| Well Objectives |
|---|
| Prove HC resources (HC type / properties and reservoir quality) in the Realgrunnen Subgroup in the Central West / Central South West segments. |
| Assess technical feasibility of drilling a cost-effective high dogleg horizontal well in Wisting. |
| Test producibility of the Realgrunnen Sg (Stø) through a well test. |
| Acquisition of geo-mechanical data (XLOT or equivalent) in the Stø Formation. |
| Acquire data to evaluate and understand rock properties. |

**TD Criteria**: 2296 m MD or minimum length required for DST.

# 4.4 Geological Prognosis, Description and Structural Setting

Table 4.3 Geological Prognosis Formation Tops for Wisting Central II

| **Geological Prognosis Formation Tops** | | | | | | | **Rev0** |
|---|---|---|---|---|---|---|---|
| **Depth reference used for formation tops list below** (usually same as in 'General Information' section): | | | | | | | |
| **TWT seismic datum** (if different from depth measurement datum): | | | | | | | |
| **Age** | **Formation / Horizon / Bed** | **Lithology** | **TWT [ms]** | **Depth [m TVD MSL]** | **Uncer-tainty [m]** +deep -shallow | **Depth [m MD RKB]** | |
| | Seabed - Quarternary / Tertiary | | 543 | 402 | | 442 | |
| Cretaceous | Kolmule Fm. | Claystone | 618 | 469 | 5 | 509 | |
| Cretaceous | Kolje Fm. | Claystone | 678 | 524 | 10 | 565 | |
| Jurassic | Hekkingen Fm. (BCU) | Claystone | 714 | 580 | 10 | 625 | |
| Jurassic | Fuglen Fm. | Claystone | 742 | 615 | 10 | 669 | |
| Jurassic | Upper Realgrunnen Res. (Stø Fm.) | Sandstone | 773 | 657 | 10 | 737 | |
| Triassic | Top Fruholmen Fm. | Intercalated sand-, silt- and claystone | 784 | 673 | 10 | 775 | |
| | Fault 1(Intra Fruholmen Fm.) | Sandstone / shale | 792 | 685 | 10 | 1130 | |
| | Fault 2 / (Stø Fm.) | Sandstone / shale | 793 | 685 | 10 | 1440 | |
| **Well TD:** | | | | 681 | | 2296 | |
| **Well TD Criteria:** | 2296m MD or minimum length required for DST | | | | | | |
| **Bedding dip and azimuth direction:** | Fault Block 1: 4° SW 204°<br>Fault Block 2: 4-5° SW 204°<br>Fault Block 3: 1-2° N 3° | | | | | | |

# 4.5 Stratigraphy

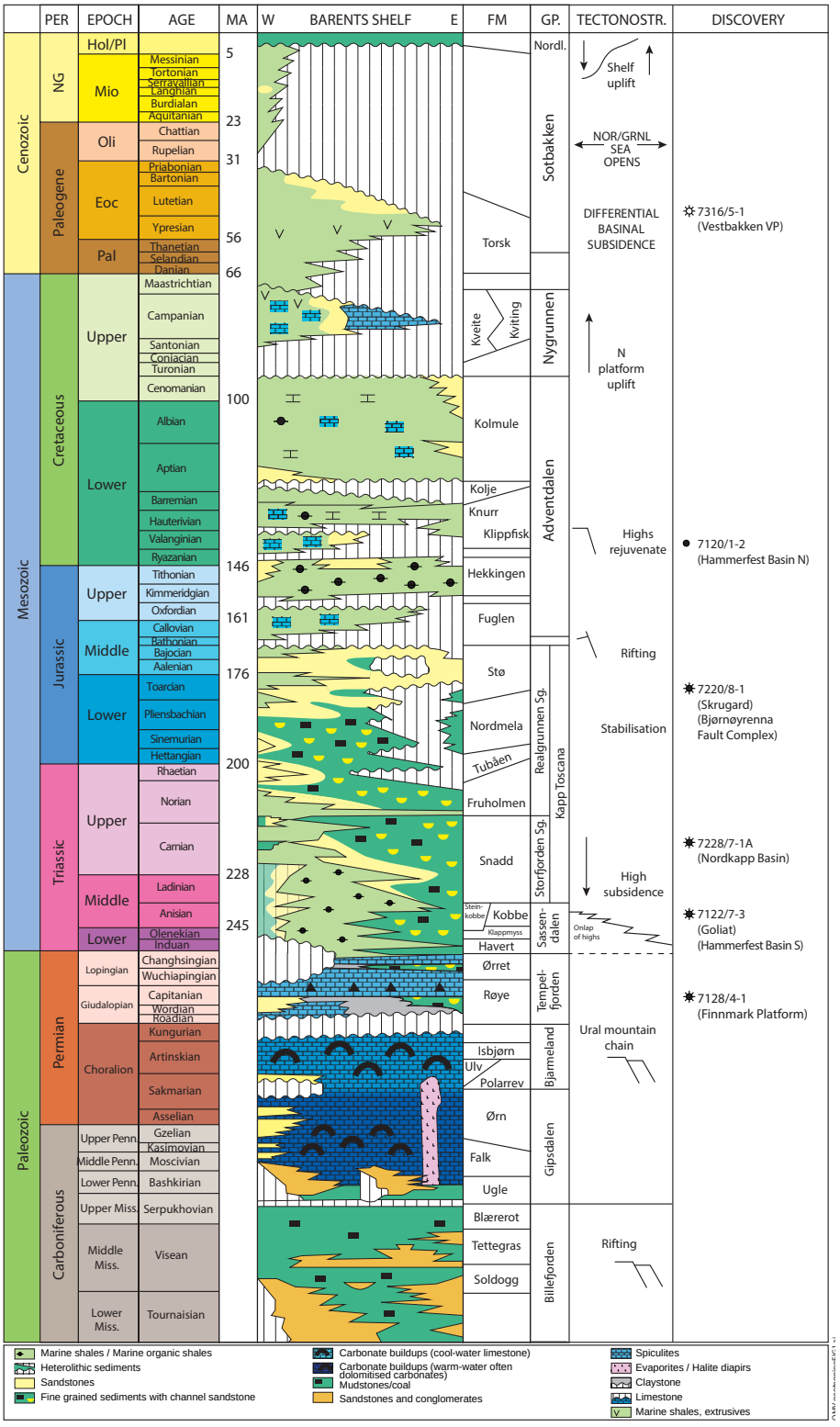


Figure 4.2 General Stratigraphy for Wisting Central II

# 4.6 Reservoir

The Stø Formation will be penetrated drilling the 12 1/4" high dogleg section and continue into the Fruholmen Formation. After setting the 9 5/8" casing in the Fruholmen Formation the well will continue in a horizontal section through 2 faults. The second fault will be the transition into the horizontal part of the Stø Formation which will be tested.

# 4.7 Formation Tops and Lithology

## Formation Descriptions:

**Nordland Group: 442 – 509m MD RKB / 402 – 469m TVD MSL**

**Undifferentiated: 442 – 509m MD RKB / 402 – 469m TVD MSL**
Age: Holocene-Paleocene

The section consists of Siltstone, Sand and soft Clay, partly transformed to Sandstone and Claystone with depth, and partly silty.

**Nordvestbanken Group: 509 – 625.1m MD RKB / 469 – 580m TVD MSL**

**Kolmule Formation: 509 – 564.5m MD RKB / 469 – 524m TVD MSL**
Age: Albian – Aptian

The formation consists of Claystone, and rare Dolomite.

Claystone; dark grey, medium grey to light grey, also more rarely dusky red to pale reddish brown, soft, firm to moderately hard, blocky to subblocky, slightly to very silty in parts, locally grading to Siltstone, rarely calcareous, and occasionally microcarbonaceous. Abundant varicolored blocky and hard Rock Fragments were seen, as well as traces of Shell fragments and Micropyrite.

**Nordvestbanken Group: 509 – 625.1m MD RKB / 469 – 580m TVD MSL**

**Kolje Formation: 564.5 – 625.1m MD RKB / 524 – 580m TVD MSL**
Age: Aptian – Barremian

The formation consists of multicoloured Claystone and minor appearance of Limestone.

Claystone: predominantly olive black to brownish black, occasionally medium dark grey to dark greenish grey, dusky red to pale reddish brown, also greyish brown to dusky brown, soft to moderate hard, sub blocky to sub platy, non calcareous, rare micromica, locally slightly glauconitic.

Limestone: medium dark grey, firm to moderately hard, blocky to subblocky, with trace of Micropyrite and rare Pyrite nodules.

**Teistengrunnen Group: 625.1 – 736.6m MD RKB / 580 – 657m TVD MSL**

**Hekkingen Fm: 625.1 – 668.9m MD RKB / 580 – 615m TVD MSL**
Age: Tithonian – Kimmeridgian

Dark grey to moderate brown Carbonaceous Claystone is the dominant content of the formation.

Claystone: can also contain reddish brown to moderate brown grading to medium dark grey greenish claystone, soft to firm, sub blocky, moderate to very calcareous, locally grading argillaceous limestone in parts, locally off white calcareous fragments. In the lower part it can be olive black to brownish black, soft to firm, sub blocky, carbonaceous, non to slightly calcareous.

**Teistengrunnen Group: 625.1 – 736.6m MD RKB / 580 – 657m TVD MSL**

**Fuglen Fm: 668.9 – 736.6m MD RKB / 615 – 657m TVD MSL**
Age: Oxfordian – Bathonian

Claystone is the main component.

Claystone: olive grey to olive black, dark grey to brownish grey, greyish black, also greyish red to dark reddish brown, soft to firm, rare moderate hard, sub blocky to blocky, amorphous in places, non to slightly calcareous, locally slightly silty, rare micromica, locally pyrite in lower parts, traces of glauconite in lower parts.

**Realgrunnen Sg: 736.6 – 2296m MD RKB / 657 – 680.8m TVD MSL**

**Stø Fm: 736.6 – 775.0m MD RKB / 657 – 673.2m TVD MSL**
Age: Bajocian –Toarchian

A homogenous Sandstone i the dominant lithology, but lenses of Claystone also occur.

Sandstone: light brownish grey to yellowish grey aggregates, clear to transparent loose quartz grains, fine to medium, predominantly fine, also very fine sand grading to siltstone, generally moderate sorted, sub angular to sub rounded, good silica cement in parts, argillaceous matrix in parts, good visible porosity in upper parts, poor/no porosity to moderate visual porosity in lower parts.

Silty Claystone: dark grey to greyish black, moderate hard to hard, blocky to sub blocky occasionally sub fissile, slightly carbonaceous, non calcareous, micromicaceous.

Claystone: medium dark grey to dark grey, greyish black, also light grey to medium light grey, firm to moderately hard, occasionally soft, sub blocky to sub fissile, shaley, slightly carbonaceous in places, very fine laminated, micromicaceous, non calcareous to very slight calcareous.

**Realgrunnen Sg: 736.6 – 2296m MD RKB / 657 – 680.8m TVD MSL**

**Fruholmen Fm: 775 – 1440m MD RKB / 673.2 – 685.2m TVD MSL**
Age: Norian

The main lithology is alternating Claystone, Siltstone, Sandstone and occasionally Limestone.

Claystone: variocolored medium dark grey to dark grey, greyish black, also light grey to medium light grey and olive grey, firm to moderately hard, occasionally soft, sub blocky to sub fissile, slightly carbonaceous in places, very fine laminated, micromicaceous, non calcareous to very calcareous, in parts very silty grad to siltstone.

Siltstone: variocolored light brownish grey, medium grey, medium dark grey, soft to firm, predominately soft, subblocky to amorphous, grad silty claystone, non to slightly calcareous, Glauconite in parts, slightly carbonaceous, no visible porosity.

Sandstone: light brownish grey to yellowish grey, clear to transparent loose quartz grains, fine to medium, predominantly fine, also very fine sand grading to siltstone, generally moderate sorted, sub angular to sub rounded, good silica cement in parts, argillaceous matrix in parts, good visible porosity in upper parts, poor/no porosity to moderate visual porosity in lower parts.

Limestone: light grey, firm to moderate hard, microcrystalline, very fine to fine sandy blocky to subblocky, soft to moderate hard, in parts grading to silty, micaceous

**Realgrunnen Sg: 736.6 – 2296m MD RKB / 657 – 680.8m TVD MSL**

**Stø Fm: 1440.0 – 2296.0m MD RKB / 685.2 – 680.8m TVD MSL**
Age: Bajocian –Toarchian

A homogenous Sandstone i the dominant lithology, but lenses of Claystone also occur.

Sandstone: light brownish grey to yellowish grey aggregates, clear to transparent loose quartz grains, fine to medium, predominantly fine, also very fine sand grading to siltstone, generally moderate sorted, sub angular to sub rounded, good silica cement in parts, argillaceous matrix in parts, good visible porosity in upper parts, poor/no porosity to moderate visual porosity in lower parts.

Silty Claystone: dark grey to greyish black, moderate hard to hard, blocky to sub blocky occasionally sub fissile, slightly carbonaceous, non calcareous, micromicaceous.

Claystone: medium dark grey to dark grey, greyish black, also light grey to medium light grey, firm to moderately hard, occasionally soft, sub blocky to sub fissile, shaley, slightly carbonaceous in places, very fine laminated, micromicaceous, non calcareous to very slight calcareous.

# 4.8 Data Acquisition

The planned data acquisition is presented in Table 4.4.

Table 4.4 Data Acquisition Program for Wisting Central II

| Section (Depths ref. [m MD RKB]) | MWD / LWD | WL | Cuttings / Sampling | Coring |
|---|---|---|---|---|
| **26" Section** (+/- 473 - 505m) | • Directional Survey<br>• Gamma Ray | | No returns Based on drilling parameters | No core |
| **17 1/2" Section (12 1/4" prior to HO)** (+/- 505 - 708m) | **12 1/4":**<br>• Directional Survey<br>• Gamma Ray<br>• Resistivity (ARC)<br>• Annular Pressure<br>• Density / Neutron<br>**17 1/2":**<br>• Directional Survey | **Firm*:** (2 WL)<br>• Gamma Ray<br>• 3D Resistivity (ZAIT)<br>• Caliper<br>• Sonic Scanner (MSIP)<br>• Spectral GR (HNGS)<br>• VSP (hDVS***)<br>**Optional:**<br>• Neutron / Density (APS) | 3m sample intervals<br>• 1 set for cuttings<br>• 1 set for geo-chem.<br>• gas samples (iso-tubes) on peaks / every 15m | No core |
| **12 1/4" Section** (+/- 708 - 845m) | • Directional Survey<br>• Gamma Ray<br>• Resistivity (ARC) | **Firm**:** (2 WL + 1 TLC)<br>• Through DP Seismic (hDVS)<br>• Gamma Ray (EDTC) | 3m sample intervals<br>• 1 set for cuttings | No core |

| | | | | |
|---|---|---|---|---|
| | • Annular Pressure | • Density / Neutron (TLD-APS)<br>• Caliper<br>• Formation Pressure, Fluid Sampling (MDT)<br>• Acoustic (MSIP)<br>• CBL - USIT<br>**Optional*:** (1 WL + 1 TLC)<br>• Magnetic Resonance (CMR+)<br>• Spectral GR (HNGS)<br>• Dielectric Scanner (ADT) | • 1 set for geo-chem.<br>• gas samples (iso-tubes) on peaks / every 15m | |
| **8 1/2" Section** (+/- 845 - 2296m) | • Directional Survey<br>• Gamma Ray<br>• Resistivity (ARC)<br>• Annular Pressure<br>• Density / Neutron<br>• Spectroscopy (EcoScope)<br>• Resistivity Mapping (GeoSphere)<br>• Sonic (SonicScope)<br>• Formation Pressure (StethoScope) | **Firm*:** (1 TLC)<br>• Spectral GR (HNGS)<br>• Sonic Scanner (MSIP, GPIT)<br>• Caliper<br>• OBMI (Quanta Geo)<br>**Optional:** (1 TLC)<br>• Magnetic Resonance (CMR+)<br>• Density / Neutron (TLD-APS)<br>• 3D Resistivity (ZAIT)<br>• Dielectric Scanner (ADT) | 3m sample intervals<br>• 1 set for cuttings<br>• 1 set for geo-chem.<br>• gas samples (iso-tubes) on peaks / every 15m | No core |
| **6" Section (Cont.)** (+/- 1440 - 2296m) | • Directional Survey<br>• Gamma Ray<br>• Annular Pressure<br>• Density / Neutron (ADN)<br>• GeoSteering (ARC, PeriScope)<br>• Sonic (SonicScope)<br>• Formation Pressure (Slim StethoScope) | **Optional:** (2 TLC)<br>• Gamma Ray (EDTC)<br>• Spectral GR (HNGS)<br>• Sonic Scanner (MSIP, GPIT)<br>• Caliper<br>• Magnetic Resonance (CMR+)<br>• Density / Neutron (TLD-APS) | 3m sample intervals<br>• 1 set for cuttings<br>• 1 set for geo-chem.<br>• gas samples (iso-tubes) on peaks / every 15m | No core |

*Realtime Advanced Gas Analysis (Controlled volume), C1-C5.*

** Depending on borehole conditions.*

*** During operational phase it will be evaluated if TLC is needed or WL is sufficient for conveyance.*

**** In case hDVS is not working, a standard VSI4 tool will be at the rig as backup*

## Fluid Sampling

### Stø Formation 1:

- PVT quality samples

- oil samples: single phase (3 sample chambers filled/station)
- gas samples: conventional sample chambers to be used (3 sample chambers)
- water: conventional sample chambers to be used (3 sample chambers)
- dead oil sample (+/- 60 liters)

**Stø Formation 2:**

- fluid sampling during DST
- SCAR sampling tool: minimum 2 x 2.4 liter samples
- PVT quality samples
- dead oil sample

Final sampling decision will be done based on LWD / Wireline results.

# 4.9 Pore Pressure and Fracture Gradient

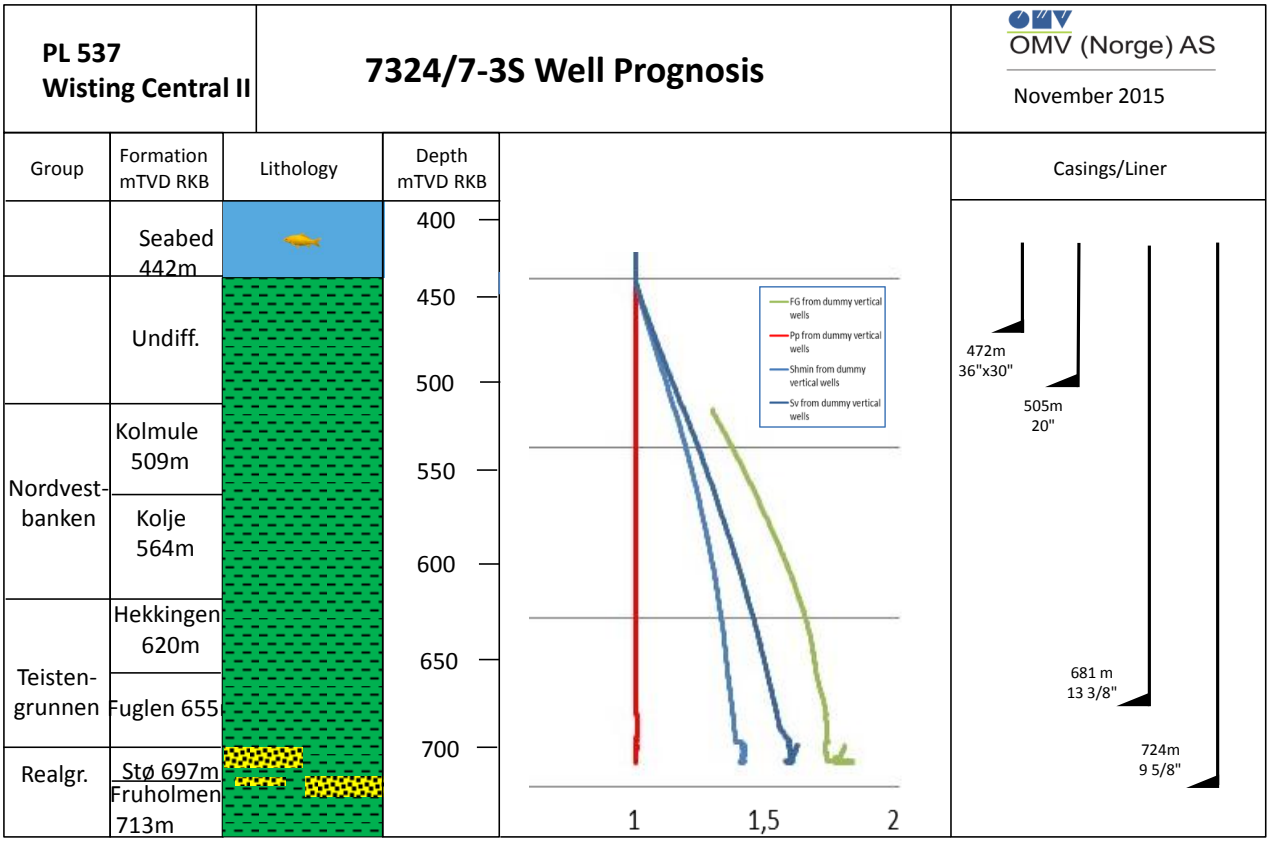


Figure 4.3 Wisting Central II - Pressure Profile w/ Lithology (TVD)

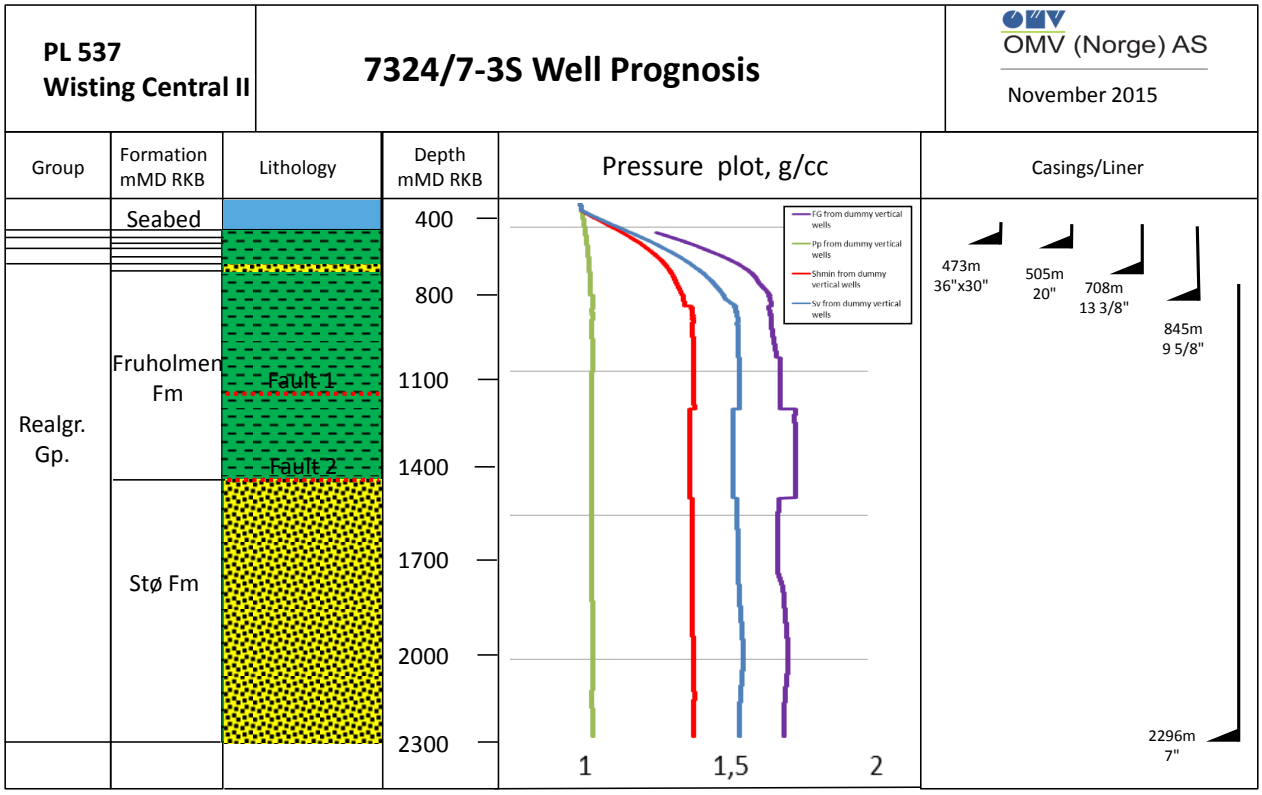


Figure 4.4 Wisting Central II - Pressure Profile w/ Lithology (MD)

# 4.10 Temperature Gradient

**5.6°C / 100m in overburden. Bottom sea temp @ 2°C**

Expected reservoir temperature: 17°C at Stø Formation (657m TVD MSL).

Expected bottom hole temperature: 18°C at Stø Formation (681m TVD MSL). Uncertainty: +/- 2°C.

# 5 Drilling

## 5.1 Drilling Unit

The well will be drilled with Transocean Spitsbergen, a 6th generation semi-submersible drilling rig. This dual ram rig is designed for operations in water depths up to 3000m.

All depths are referred to a rig floor elevation of 40m RKB-MSL.

Further information is to be found in 8.7 Drilling Unit Specifications.

### 5.1.1 Rig Positioning

The rig will be dynamically positioned. DP trials will be performed as part of the arrival procedures.

Reference is made to OMV Norge's DP Manual, ref. /5/.

Reference is made to OMV Norge's Marine Manual, ref. /2/.

## 5.2 Well Design Summary

A high dogleg well trajectory was chosen for Wisting Central II in order to proof that such a trajectory is a valid planning assumption for a field development case. However, the main well objectives can also be met with a contingent low DLS trajectory.

Building the horizontal section is planned to be done between the seabed at 402m MSL and the reservoir at 661m TVDSS generating a high dogleg severity: 8 – 10°/30m. In order to achieve this objective, the kick-off point will be set as high as technically possible.

NeoDrill's conductor anchor node (CAN - Figure 8.2) will be pre-installed at the well location optimizing the current top hole design. The CAN solution incorporates the conductor with the low pressure housing and will be installed by a vessel prior to rig arrival.

The well design fulfills the national requirement of being able to kill a blowout with one (1) relief well (ref. /37/ Blowout and Kill Simulations).

## 5.2.1 Well Schematic

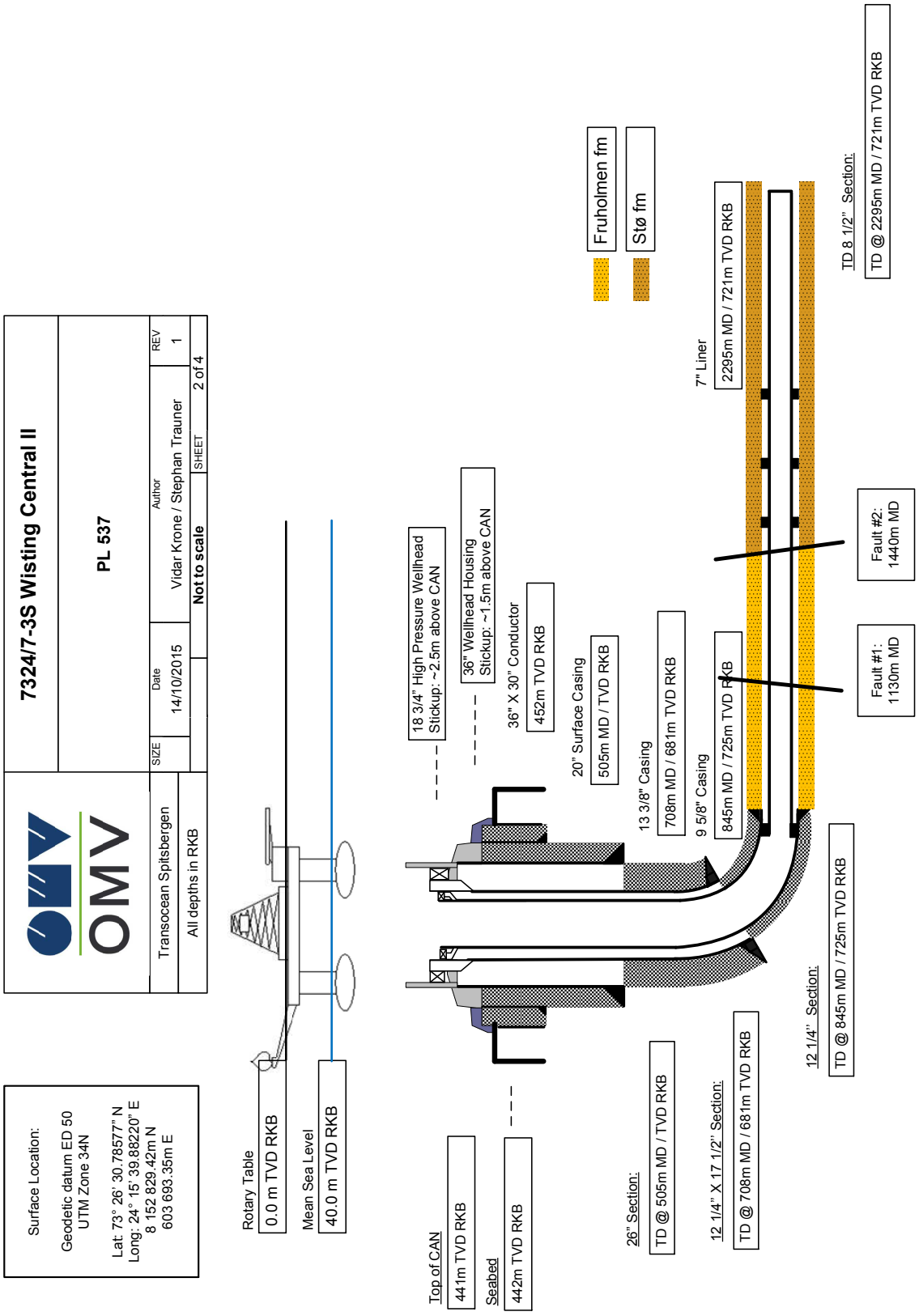


Figure 5.1 Well Schematic of Wisting Central II w/ NeoDrill's CAN

## 5.2.2 Well Trajectory

Wisting Central II is planned as a horizontal well.

A well path has been developped catering for the well objectives. 5 steering points are mentioned in 1.2 General Well Information. Wisting Central II falls in the envelope of extended reach drilling (ERD).

Reference is made to Schlumberger's Directional Drilling Program, ref. /41/.

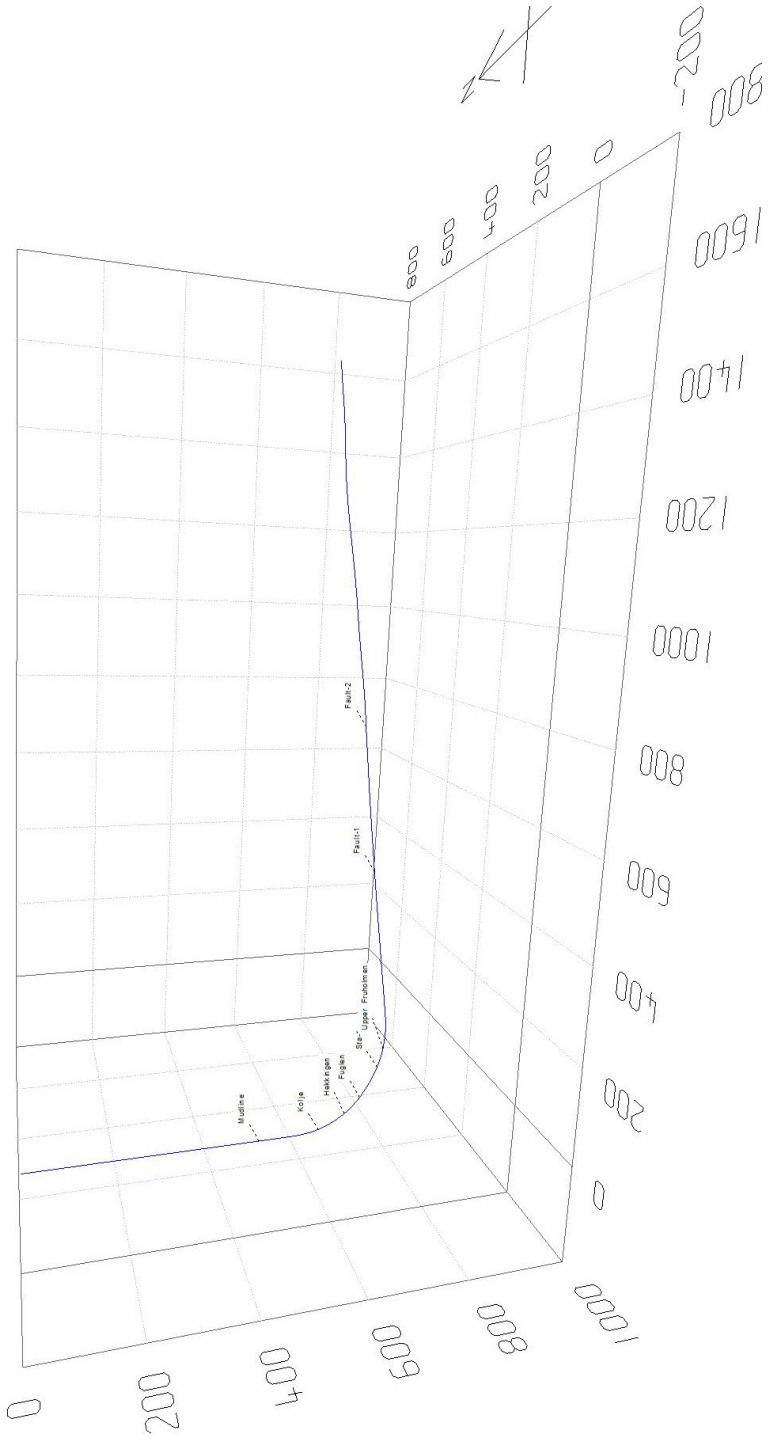


Figure 5.2 Wisting Central II Trajectory

## 5.2.3 Time versus Depth

The proposed discovery hole case well design, as described in this document, was modelled in AGR's P1™ Probabilistic Software.

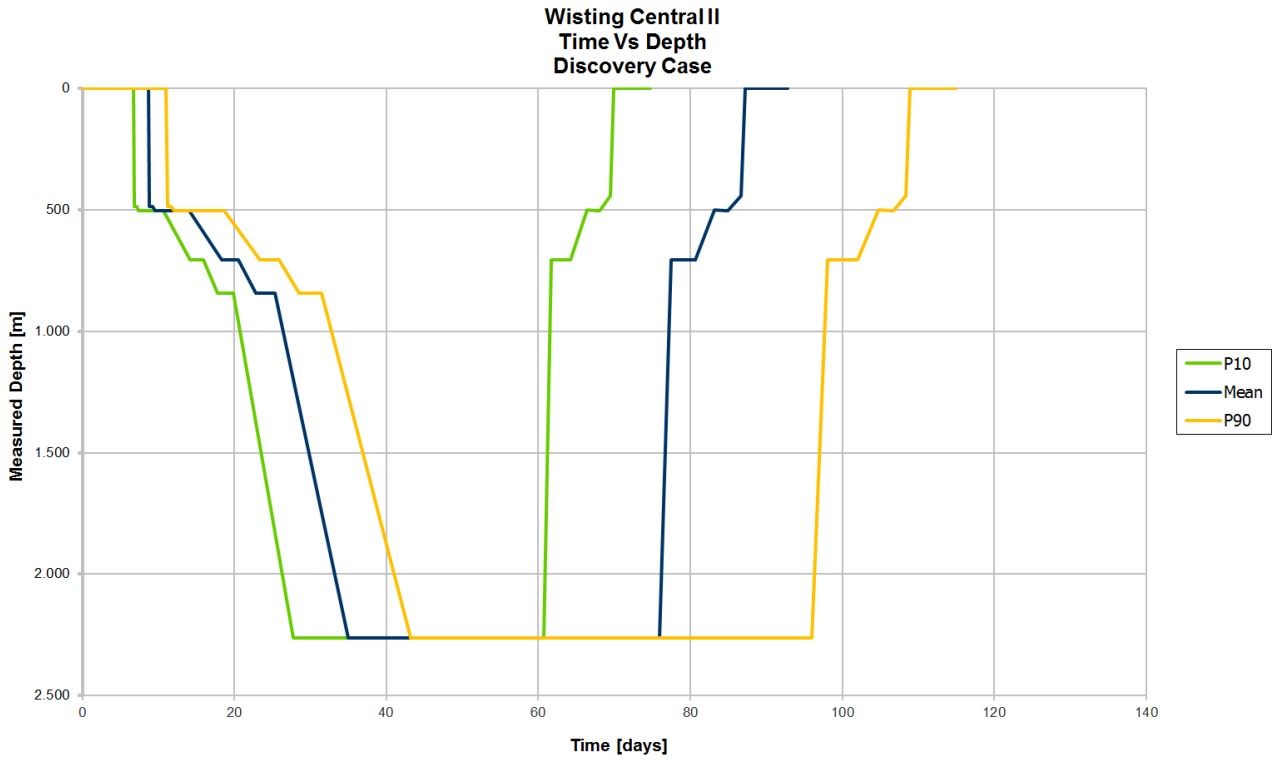


Figure 5.3 Time versus Depth for 7324/7-3S Wisting Central II - Discovery Case

Table 5.1 Time Estimate for 7324/7-3S Wisting Central II - Discovery Case

| Operations | $P_{10}$ | $P_{Mean}$ | $P_{90}$ |
|---|---|---|---|
| Rig Move and Site Preparation | 6.76 days | 8.67 days | 10.96 days |
| Drill 17 1/2"x26"x36"x42" Top Hole Section | 0.12 days | 0.17 days | 0.22 days |
| Run 30"x36" Conductor | 0.25 days | 0.37 days | 0.47 days |
| Drill 26" Section | 0.29 days | 0.33 days | 0.40 days |
| Run 20" Casing | 0.75 days | 0.89 days | 1.01 days |
| Run BOP | 2.48 days | 3.63 days | 5.55 days |
| Drill 17 1/2" Section | 3.52 days | 4.23 days | 4.76 days |
| 17 1/2" Section Logging | 0.77 days | 0.91 days | 1.03 days |
| Run 13 3/8" Casing | 1.03 days | 1.30 days | 1.50 days |
| Drill 12 1/4" section | 1.85 days | 2.28 days | 2.67 days |
| 12 1/4" Section Logging | 0.97 days | 1.17 days | 1.35 days |
| Run 9 5/8" Casing | 1.11 days | 1.39 days | 1.58 days |
| Drill 8 1/2" Hole to TD | 7.81 days | 9.69 days | 11.66 days |
| 8 1/2" Section Logging | 2.69 days | 3.08 days | 3.48 days |
| Run 7" Liner | 3.45 days | 3.88 days | 4.20 days |
| Drill Stem Test | 26.92 days | 33.99 days | 45.08 days |
| Set EZSV in 9 5/8" Casing | 0.99 days | 1.46 days | 2.18 days |
| Cut and Retrieve 9 5/8" Casing | 1.59 days | 1.85 days | 1.87 days |
| Set EZSV in 13 3/8" Casing | 0.86 days | 1.36 days | 2.02 days |
| Set P&A Plug #1 | 2.26 days | 2.53 days | 2.78 days |
| Cut and Retrieve 13 3/8" Casing | 1.56 days | 1.75 days | 1.90 days |

| | | | |
|---|---|---|---|
| Pull BOP and Riser | 1.49 days | 1.71 days | 1.70 days |
| Cut & Retrieve 20"x30" CSG | 0.43 days | 0.55 days | 0.55 days |
| Demob Rig | 4.84 days | 5.60 days | 5.99 days |
| **SUM** | **74.77 days** | **92.77 days** | **114.92 days** |

A dry hole case has also been simulated.

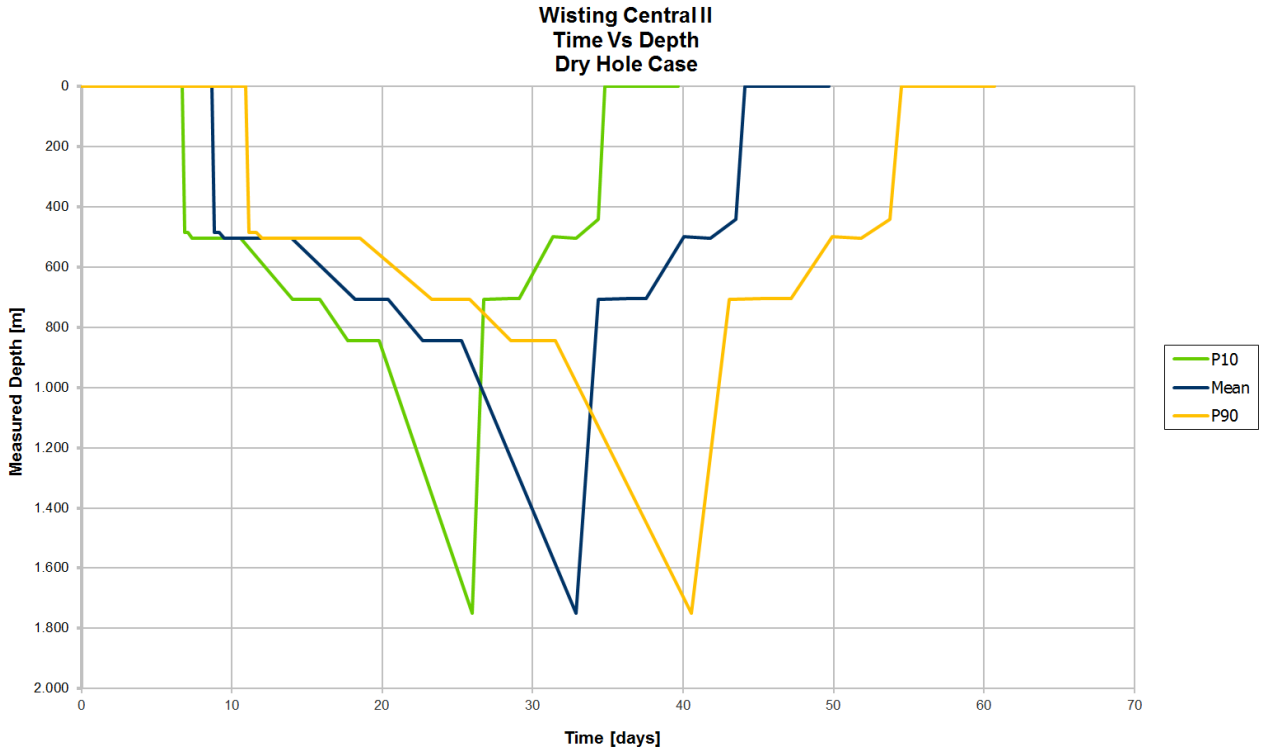


Figure 5.4 Time versus Depth for 7324/7-3S Wisting Central II - Dry Hole Case

Table 5.2 Time Estimate for 7324/7-3S Wisting Central II - Dry Hole Case

| Operations | $P_{10}$ | $P_{Mean}$ | $P_{90}$ |
|---|---|---|---|
| Rig Move and Site Preparation | 6.73 days | 8.66 days | 10.95 days |
| Drill 17 1/2"x26"x36"x42" Top Hole Section | 0.13 days | 0.17 days | 0.21 days |
| Run 30"x36" Conductor | 0.23 days | 0.35 days | 0.49 days |
| Drill 26" Section | 0.28 days | 0.34 days | 0.37 days |
| Run 20" Casing | 0.76 days | 0.89 days | 1.02 days |
| Run BOP | 2.47 days | 3.59 days | 5.51 days |
| Drill 17 1/2" Section | 3.46 days | 4.19 days | 4.74 days |
| 17 1/2" Section Logging | 0.76 days | 0.90 days | 1.05 days |
| Run 13 3/8" Casing | 1.02 days | 1.30 days | 1.50 days |
| Drill 12 1/4" section | 1.89 days | 2.28 days | 2.70 days |
| 12 1/4" Section Logging | 0.99 days | 1.18 days | 1.34 days |
| Run 9 5/8" Casing | 1.10 days | 1.38 days | 1.62 days |
| Drill 8 1/2" Hole to TD | 6.19 days | 7.62 days | 9.08 days |
| Set EZSV in 9 5/8" Casing | 0.78 days | 1.50 days | 2.50 days |
| Cut and Retrieve 9 5/8" Casing | 1.57 days | 1.85 days | 2.07 days |
| Set EZSV in 13 3/8" Casing | 0.75 days | 1.32 days | 2.02 days |
| Set P&A Plug #1 | 2.27 days | 2.52 days | 2.75 days |
| Cut and Retrieve 13 3/8" Casing | 1.53 days | 1.75 days | 1.93 days |
| Pull BOP and Riser | 1.49 days | 1.71 days | 1.90 days |

| | | | |
|---|---|---|---|
| Cut & Retrieve 20"x30" CSG | 0.40 days | 0.55 days | 0.74 days |
| Demob Rig | 4.91 days | 5.60 days | 6.20 days |
| **SUM** | **39.69 days** | **49.67 days** | **60.68 days** |

# 5.3 Casing Design

The proposed well design incorporates a casing design summary as per the table below. The detailed casing design will be performed according to "OMV EP-EPP-WE-06-00 Casing Design Standard" and "OMV E-C.2.3-HQ-STD-004-01 Technical Policy Standard". Calculations been carried out with Landmark StressCheck software (Version EDM 5000.1.10.0 (09.04.07.107)), ref. /27/.

## 5.3.1 Casing Design Overview

Table 5.3 Casing Design Summary

| Casing Size [in] | From [m MD] | To [m MD] | Weight [lbs/ft] | Grade | Connection Type |
|---|---|---|---|---|---|
| 36" x 30" | 442 | 485 | 552.5 | X-56 | N/A |
| 20" | 442 | 505 | 133 | N-80Q | TSH Blue Quick Seal Dopeless |
| 13 3/8" | 442 | 708 | 72 | P-110 | TSH Blue Dopeless |
| 9 5/8" | 442 | 845 | 53.5 | P-110 | TSH Blue Dopeless |
| 7" Liner | 795 | 2290 | 32 | P-110 | TSH Blue Dopeless |

## 5.3.2 Casing Design Specifications

The casing and connection specifications are given in Table 5.4.

Table 5.4 Casing and Connection Ratings

| | | | | Pipe Data | | | Connection Data | | |
|---|---|---|---|---|---|---|---|---|---|
| Casing Size [in] | Grade | Weight [lbs/ft] | Connection Type | Burst [bar] | Collapse [bar] | Axial [MT] | Burst [bar] | Tension [MT] | Compr. [MT] |
| 36" | X56 | 552.5 | N/A | 282 | 186 | 4130 | | | |
| 30" | X56 | 309.7 | SL-60 | 225 | 116 | 2314 | 103 | 1483 | 1483 |
| 20" | N80 | 133 | TSH Blue Quick Seal Dopeless | 302 | 108 | 1402 | 302 | 1402 | 1402 |
| 13 3/8" | P110 | 72 | TSH Blue Dopeless | 503 | 195 | 1036 | 503 | 1036 | 1036 |
| 9 5/8" | P110 | 53.5 | TSH Blue Dopeless | 741 | 540 | 775 | 741 | 775 | 775 |
| 7" Liner | P110 | 32 | TSH Blue Dopeless | 847 | 733 | 465 | 847 | 733 | 465 |

The safety factors for the casing design are calculated by use of StressCheck 5000.1.10.0. The casing design has been evaluated with respect to expected worst case load scenarios. The safety factors are within OMV's requirements and NORSOK D-010 Rev. 4 and are summarized in the table below. Reference is made to the Casing Design Report for Wisting Central II, ref. /27/.

Table 5.5 Minimum Safety Factors

| Casing Size [in] | Minimum Safety Factors | | | |
|---|---|---|---|---|
| | Burst | Collapse | Axial | Triaxial |
| 36" | 23.53 | 4.04 | 18.23 | 4.54 |
| 30" | 11.62 C | 2.20 | 3.06 C | 3.38 |
| 20" | 5.95 | 2.23 | 4.51 | 4.94 |
| 13 3/8" | 3.19 | 2.96 | 2.94 C | 3.11 |

| | | | | |
|---|---|---|---|---|
| 9 5/8" | 2.50 C | 7.15 | 3.91 C | 2.58 |
| 7" Liner | 2.49 | 9.53 | 4.30 | 2.73 |
| | **Design Factors** | | | |
| Pipe | 1.1 | 1.1 | 1.5 / 1.5 | 1.25 |
| Connection | 1.1 | 1.1 | 1.5 / 1.5 | N/A |

C = Connection critical

Note: Safety factors for the 9 5/8" casing and 7" liner are based on 345 bar surface pressure. For further information see 5.5 Pressure Testing.

## 5.3.3 Conductor Analysis

A well integrity strength analysis has been performed by Fedem Technology (ref. /39/ Well Integrity Strength Analysis). The Wisting Central II wellhead system has been investigated for ultimate strength capacity (ULS).

The analysis has been performed for both a standard wellhead system and a system supported by a CAN, Figure 8.2 under 8.3 NeoDrill's CAN Solution. In addition, the minimum conductor length for the standard design has been determined, based on soil bearing capacity and operational loads.

The 36" x 30" conductor have sufficient strength for all design variations in the standard design. The highest utilization factor, 0.86, is found for the case with 2m scour outside the conductor, and 6m cement shortfall between the conductor and the 20" casing. The 20" is found to be slightly over-utilized for the cases with 6m cement shortfall between the 36" and 20", but is well within limits for all other variations.

The system with CAN and integrated conductor is within limits for all design variations, and suggests that the system will have sufficient strength for a conductor stick-up above CAN equal to or less than 1.5m. The system shows best performance for a guide pipe cement level of 0m, i.e. cement to top of CAN.

In general the utilization factors are found to be highest with a 20" cement level of 6m below mudline, while the best performance is achieved when cement is applied up to mudline. It is recommended to aim for getting the 20" cement as far up as possible. The 30" and 20" connectors have also been checked for strength capacity and are found to be well within limits.

The minimum conductor length has been found using the vertical bearing capacity of the soil and operational vertical loads for the wellhead system. The results show that the necessary installation depth for the conductor is 42.4m below mudline.

In addition, a weak point analysis has been conducted by Fedem Technology (ref. /38/ Weak Point Analysis).

The weakest point for the riser and wellhead system at Wisting Central II (PL537) during rig drift-off has been identified. The analysis has been performed for both a standard wellhead system and a system supported by a CAN. Both configurations are checked with three different tension settings (0t, 30t and 60t overpull at LMRP/BOP). The results for CAN with integrated conductor show that the WH connector, i.e. the connector between WH and BOP, is the first component to be over-utilized for all three tension settings. This connector reaches its maximum capacity just before the 36” conductor and 20” casing

### 5.3.4 Cementing Program

The pre-installed CAN will incorporate a conductor which will be cemented in place onshore.

Table 5.6 Cementing Program Summary

| Casing Section [in] | Cementing Method | Cement Slurry | TOC [m MD] | Verification Method |
|---|---|---|---|---|
| 36" x 30" | Inner string | Conventional 1.90sg Norcem Class G | Seabed | ROV to monitor for returns |
| 20" | Inner string | Conventional 1.92sg Norcem Class G | Seabed | ROV to monitor for returns |
| 13 3/8" | Plugs | Gas tight 1.90sg Norcem Class G | +/- 500m | Volumetrics |
| 9 5/8" | Plugs | Gas tight 1.90sg Norcem Class G | +/- 658m | Volumetrics |

A centralization program will be included to the cementing program.

Zonal isolation in the 7" liner section will be achieved by using Welltec's Annular Barriers (WAB's).

For the P&A plug gas tight 1.92sg Norcem Class G cement will be used.

Reference is made to 8.6 Cement Program.

## 5.4 Drilling and Well Control

In case of well control situation, Transocean's well control procedure will be used until the well is shut-in. Thereafter, OMV (Norge) AS well control procedures will apply (ref. /3/ OMV's Well Control Manual).

Well control drills shall be performed as per Transocean's well control procedure, ref. /33/.

### 5.4.1 Kick Tolerance / Leak-Off Requirements

Table 5.7 Kick Tolerance and Minimum Required FIT

| Section [in] | Previous Casing Shoe Depth [m TVD] | Expected Pore Pressure [sg EMW] | Expected FIT [sg EMW] | Pore Pressure (*1) [sg EMW] | Required min Kick Tolerance [m³] | Kick Tolerance (*2) [m³] |
|---|---|---|---|---|---|---|
| 17 1/2" | 505 | 1.03 | 1.33 | 1.15 | 4 | 8.4 |
| 12 1/4" | 681 | 1.06 | 1.79 | 1.18 | 4 | Infinite |
| 8 1/2" | 724 | 1.06 | 1.75 | 1.18 | 4 | Infinite |

*(*1) Incl. 0.12sg safety margin on the pore pressure estimate due to drilling in a known area. MW is set according to this in the calculations.*

*(*2) Including 3 bar choke loss safety margin.*

*Note: The FIT in the 17 1/2" section is to ensure well integrity to handle expected ECD's with the OBM rather than for kick purposes. The 20" casing is a technical casing.*

### 5.4.2 Riser Margin

The riser margin calculations are based on a rig datum elevation of 40m RKB-MSL and a water depth of 402m MSL.

Table 5.8 Riser margin

| Section [in] | Required MW to obtain Riser Margin [sg] | Planned MW [sg] |
|---|---|---|
| 17 1/2" | 1.09 | 1.20 – 1.30 |
| 12 1/4" | 1.09 | 1.20 – 1.30 |
| 8 1/2" | 1.09 | 1.10 – 1.15 |

*Note: Riser margin to be adjusted based on actual pore pressure.*

## 5.4.3 Well Control Manual

A OMV well control manual, for drilling the reservoir, has been issued, ref. /3/.

## 5.4.4 Well Control Equipment

Table 5.9 Well Control Equipment

| Equipment | Manufacturer | Type | Specifications / Comments |
|---|---|---|---|
| LMRP | Cameron | 18 3/4" 10K | Upper annular DL with flange bottom X studded top, BX-164 with 3 1/16" 15M studded outlet |
| Subsea BOP Stack | Cameron | 18 3/4" 15K | HC connector, BX-164 studded top, 625 inlaid ring grooves |
| Subsea BOP Stack | Cameron | 18 3/4" 10K | Lower annular DL with 18 3/4" 15K flange bottom X 18 3/4" 10K studded top, BX-164, 625 inlaid ring grooves |
| | | 18 3/4" 15K | Upper double cavity: blind/shear ram CDVS 15K casing super shear ram, 15k with 18 3/4" BX-164, four 3 1/16" 15K BX-154 studded outlets |
| | | 18 3/4" 15K | Upper single cavity: VBR 3 1/2" – 7 5/8", 15k with 18 3/4" BX-164, two 3 1/16" 15K BX-154 studded outlets |
| | | 18 3/4" 15K | Lower double cavity: VBR 3 1/2" – 7 5/8", 15k with 18 3/4" BX-164, four 3 1/16" 15K BX-154 studded outlets |
| | | 18 3/4" 15K | Lower single cavity: VBR 3 1/2" – 7 5/8", ,15k with 18 3/4" BX-164 two 3 1/16" 15K BX-154 studded outlets |
| Diverter System | Vetco Grey | KFDS | 500 psi MWP, 60 1/2" rotary table, full bore<br>2.4 million lbf hang off capacity |
| BOP Control System | Cameron | Multiplex (MUX) | 2 ea cables, 5500ft<br>Acoustic control system Kongsberg Simrad |
| Choke Manifold | Techdrill | 3 1/16" 15K | 2 up-stream and 4 down-stream valves are remotely operated |
| Riser | Aker Kværner | 21" Clip Connector | Collapse pressure: 120 bar with fins, 130 bar with buoyancy<br>Dimensions: OD 21", ID 19.25" Wt 0.875"<br>Length: 75', 60', 35', 20', 15', 10', 5' |
| Wellhead Connector | Cameron | 18 3/4" 15K | C-PRO, BX-164 flanged top H4 hub with VX gasket |
| Wellhead | DrilQuip | SS-15 RLD WHH | 18 3/4" wellhead housing RLD 10K VX/HX |

Reference is made to 8.8.1 BOP.

# 5.5 Pressure Testing

Table 5.10 Pressure Testing

| Activity | Test Pressure [bar] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pressure Datum | Pipe Rams | Annular Preventers | Kill & Choke Valves | BOP Connector | Kill & Choke Lines | Shear Ram / Casing / Liner | Mud Weight [sg] |
| BOP stump test | Surface | 345 | 345 | 345 | | | 345 | |
| Initial installation of BOP (WH connector test) | Surface | | | | 80 | | | 1.03 |
| 20" casing & 14 day BOP test | Surface | 160 | 160 | 160 | 160 | 196 (*1) | 160 | 1.03 |
| 13 3/8" casing & 14 day BOP test | Surface | 160 | 160 | 160 | 160 | 201 (*2) | 160 | 1.15 |
| 9 5/8" casing* & 14 day BOP test | Surface | 345 | 345 | 345 | 345 | 384 (*3) | 345(*4) | 1.10 |
| 7" liner (internal)* & 14 day BOP test | Surface | 345 | 345 | 345 | 345 | 384 (*3) | 345(*4) | 1.10 |
| 7" liner lap* | Surface | 345 | 345 | 345 | 345 | 384 | 345 | 1.10 |

Note: Casing/liner test pressures shall be adjusted according to actual mud weight in use.

(*1) K/C lines fully displaced to 0.2 SG gas: 205 – 0.23 x 0.0981 x 442 = 195.03 => 196 bar

(*2) K/C lines fully displaced to 0.2 SG gas: 210 – 0.23 x 0.0981 x 442 = 200.03 => 201 bar

(*3) K/C lines fully displaced to 0.2 SG gas: 393 – 0.23 x 0.0981 x 442 = 383.03 => 384 bar

*(*4) Maximum pressure at the end of the well test is 345 bar to operate SHRV-F Reversing valve. The 9 5/8" casing and 7" liner can be exposed to this pressure if the packer fails. (Only applicable if IRDV-BA fails in closed position).*

# 5.6 Drillpipe

Table 5.11 Drillpipe Design

| Drillpipe OD [in] | Grade | Range | Weight [lbs/ft] | Tooljoint OD [in] | Tooljoint ID [in] | Connection Type |
|---|---|---|---|---|---|---|
| 4 1/2" | S-135 | 2 | 16.60 | 6 3/8" | 3 1/2" | NC 50 |
| 5" | S-135 | 3 | 19.50 | 6.625" | 2.75 | NC 50 |
| 5 7/8" | S-135 | 3 | 27.66 | 7" | 4.25 | XT-57 |

Table 5.12 Heavy-Weight Drill Pipe

| HWDP OD [in] | Grade | Range | Weight [lbs/ft] | Tooljoint OD [in] | Tooljoint ID [in] | Connection Type |
|---|---|---|---|---|---|---|
| 5" | HW-95 | 3 | 48.51 | 6.625" | 3" | NC 50 |
| 5 7/8" | HW-95 | 3 | 54.64 | 7" | 4" | XT-57 |

# 5.7 Section Guidelines

Seperate Section Recommendations will be issued for the individual operations per section, ref. /48/.

## 5.7.1 CAN Installation

A separate installation program for NeoDrill's conductor anchor node (CAN) will be distributed, ref. /40/.

## 5.7.2 36″ x 42″ Hole Section

The top hole will be drilled conventionally as a contingency solution to the CAN installation.

Table 5.13 36" x 42" Section Guideline

| | |
|---|---|
| **Drilling Risks and Hazards** | • Boulders<br>• Verticality |
| **Operational Guidelines** | • The 36" x 42" hole section will be drilled from seabed down to approx 487m TVD. The exact depth of this section will be determined by the specific casing tally for the 36" x 30" conductor. The minimum required conductor length, found in the conductor analysis from FEDEM, is 42.4 m below mudline.<br>• The ROV will be kept at seabed throughout the drilling of this section to monitor.<br>• Pump 7-10 $m^3$ bentonite hi-vis sweeps every 10m drilled.<br>• The hole will be displaced to 1.50sg bentonite displacement mud prior to POOH with BHA.<br>• The conductor will be run and cemented. |
| **BHA /Bit** | • The BHA comprises a 17 1/2" bit, a 26" x 36" two stage hole opener and a 42" hole opener. |
| **Directional Drilling and surveying** | • MWD / LWD (Directional / GR)<br>• Maintain verticality for conductor setting |
| **Drilling fluids** | • The section will be drilled with seawater and hi-vis pills (pre-hydrated Bentonite).<br>• The well will be displaced to 1.50sg bentonite mud prior to running the 36" x 30" conductor.<br>• Reference is made to 8.5 Drilling Fluid Program. |
| **Conductor** | • A 36" x 30" conductor with a 36" Low Pressure Wellhead Housing will be set at approximately 485m TVD to support the subsequent casing program.<br>• The 36" extension joint (16m) will be 1.5" WT/552.5#/X-56.<br>• The subsequent 30" joints will be 1" WT/309.7#/X-56.<br>• Low pressure Wellhead housing Stick-up above seabed should be 1.5 m (+/- 0.5 m).<br>• Conductor inclination shall be less than 1.0° at the wellhead. |
| **Cementing** | • Purpose of the cement job is to provide support for the 36" x 30" conductor. The conductor will be cemented with 1.90sg conventional Class G cement (300% excess) using innerstring.<br>• Top of cement is planned at seabed.<br>• Reference is made to 8.6 Cement Program for slurry details and volumes. |
| **Rig Action Plan** | • Refer to Rig Action Plans (RAP) for detailed procedures for the relevant operations. |

Reference is made to /48/ Section Recommendations for Wisting Central II.

## 5.7.3 26" Hole Section

Table 5.14 26" Section Guideline

| | |
|---|---|
| **Drilling Risks and Hazards** | • BOP and riser handling<br>• 20" casing setting depth sufficient for providing formation strength for drilling the 17 1/2" section |
| **Operational Guidelines** | • The 26" hole section will be drilled from the conductor shoe down to 507m TVD (including a 2m rat hole). TD criteria is to ensure sufficient formation strength prior to displacing to OBM in the next section.<br>• The well will be attempted kicked off towards TD of the section.<br>• The section will be drilled with sea water and hi-vis bentonite sweeps.<br>• The well will be displaced to 1.30 sg KCL/PAC mud prior to POOH with BHA.<br>• The 20" casing will be run to 505m TVD and cemented.<br>• Install riser and 18 3/4" 15000 psi BOP. |
| **BHA /Bit** | • The section will be drilled using a motor with a 26" bit. |
| **Directional Drilling and Surveying** | • MWD / LWD: Directional Survey, Gamma Ray.<br>• Attempt to nudge well towards TD. |
| **Drilling Fluids** | • The section will be drilled with seawater and 1.25sg hi-vis Bentonite sweeps.<br>• 1.25 sg hi-vis bentonite pills will be spotted around the BHA during connections.<br>• The well will be displaced to 1.30 sg KCL/Polymer mud prior to pulling out for running the 20".<br>• Reference is made to 8.5 Drilling Fluid Program for mud properties and volumes. |
| **20" Surface Casing** | • A 20" surface casing with an 18 3/4" High Pressure Wellhead Housing will be run to 505m.<br>• 20" casing spec: 133#, N80-Q, TSH Blue Quick Seal Dopeless. |
| **Cementing** | • The surface casing will be cemented in place with 1.92sg Norcem Class G-cement slurry including 150% open hole annular excess cement.<br>• Reference is made to 8.6 Cement Program for slurry details and volumes. |
| **Rig Action Plan** | • Refer to Rig Action Plans (RAP) for detailed procedures for the relevant operations. |

Reference is made to /48/ Section Recommendations for Wisting Central II.

## 5.7.4 17 1/2” Hole Section

Table 5.15 17 1/2" Section Guideline

| | |
|---|---|
| **Drilling Risks and Hazards** | • Spills, drilling with OBM<br>• Achieving directional objectives<br>• Hole cleaning<br>• Running 13 3/8" casing through high doglegs |
| **Operational Guidelines** | • A dedicated 17 1/2" clean out run will be performed to drill out the 20" casing shoe, clean out the rat hole, drill 3m new formation and perform the FIT.<br>• The well will be displaced to 1.20 sg OBM while drilling out the shoetrack.<br>• A 12 1/4" motor BHA will be used to drill the section to TD to achieve the directional objectives. The drilling will be performed in 100% sliding mode.<br>• Section TD is based 1.5 times the geological uncertainty on top Realgrunnen (+/- 10m).<br>• A 17 1/2" staged hole opener (SHO) will then be run to open the 12 1/4" hole to 17 1/2".<br>• The 13 3/8" casing will be run and cemented. |
| **BHA /Bit** | • The section will be drilled using a 12 1/4" bit with a motor assembly prior to opening the hole to 17 1/2". |
| **Directional Drilling and Surveying** | • MWD / LWD: Directional Survey, Gamma Ray, Resistivity (ARC), Annular Pressure, Density / Neutron.<br>• Directional drilling to be performed according to the Directional drilling program, ref. /41/. |
| **Drilling Fluids** | • The section will be drilled with 1.20sg EMS 4600 OBM.<br>• Reference is made to 8.5 Drilling Fluid Program for mud properties and volumes.<br>• Reference is made to /6/ Lost Circulation Procedure. |
| **Formation Evaluation** | • 2 WL runs (prior to HO): Gamma Ray, 3D Resistivity (ZAIT), Caliper, Sonic Scanner (MSIP), Spectral GR (HNGS), VSP.<br>• Reference is made to 4.8 Data Acquisition. |
| **13 3/8 " Intermediate Casing** | • The 13 3/8" intermediate casing will be run to +/- 708m MD/ 681m TVD.<br>• 13 3/8" casing spec: 72#, P-110 TSH Blue dopeless. |
| **Cementing** | • The intermediate casing will be cemented with a gas tight 1.90sg Norcem Class G cement slurry.<br>• The cement will be a part of the final P&A barrier.<br>• Reference is made to 8.6 Cement Program for slurry details and volumes. |
| **Rig Action Plan** | • Refer to Rig Action Plans (RAP) for detailed procedures for the relevant operations. |

Reference is made to /48/ Section Recommendations for Wisting Central II.

## 5.7.5 12 1/4” Hole Section

Table 5.16 12 1/4" Section Guideline

| | |
|---|---|
| **Drilling Risks and Hazards** | • Spills, drilling with OBM<br>• Achieving directional objectives<br>• Hole cleaning |
| **Operational Guidelines** | • The section will be drilled with 1.20sg EMS 4600 OBM<br>• A dedicated 12 1/4" clean out assembly will be run to drill out the shoetrack, clean out the rat hole, drill 3m new formation and perform the FIT.<br>• A 12 1/4" bit and motor assy will be used to drill the 12 1/4" section to achieve the directional objectives.<br>• The 9 5/8" casing will be run and cemented. |
| **BHA /Bit** | • The section will be drilled using a 12 1/4" bit with a motor assembly. |
| **Directional Drilling and Surveying** | • MWD / LWD: Directional Survey, Gamma Ray, Resistivity (ARC), Annular Pressure.<br>• Minimum one directional survey every 100m.<br>• Directional drilling to be performed according to the Directional drilling program, ref. /41/. |
| **Drilling Fluids** | • The section will be drilled with EMS 4600 OBM.<br>• The planned mud weight for drilling the section is 1.20sg<br>• Reference is made to 8.5 Drilling Fluid Program for mud properties and volumes.<br>• Reference is made to /6/ Lost Circulation Procedure. |
| **Formation Evaluation** | • 1 TLC run: Gamma Ray (EDTC), Density / Neutron (TLD-APS), Caliper, Formation Pressure, Fluid Sampling (MDT).<br>• 2 WL runs: Sonic Scanner (MSIP, GPIT), CBL - USIT, Through DP Seismic (hDVS).<br>• Optional: Magnetic Resonance (CMR+), SWC, Spectral GR (HNGS), Spectroscopy (ECS), OBMI (Quanta Geo).<br>• Reference is made to 4.8 Data Acquisition. |
| **9 5/8 " Production Casing** | • The 9 5/8" production casing will be run to +/- 845m MD/ 725m TVD.<br>• 9 5/8" casing spec: 53.5#, P-110, TSH Blue Dopeless. |
| **Cementing** | • The purpose of the cement job is to provide sufficient seal and support around the casing shoe.<br>• The slurry will be a gas tight 1.90sg Norcem Class G cement slurry.<br>• TOC is planned to be 50m inside the 13 3/8" casing.<br>• Reference is made to 8.6 Cement Program for slurry details and volumes. |
| **Rig Action Plan** | • Refer to Rig Action Plans (RAP) for detailed procedures for the relevant operations. |

Reference is made to /48/ Section Recommendations for Wisting Central II.

## 5.7.6 8 1/2” Hole Section

Table 5.17 8 1/2" Section Guideline

| | |
|---|---|
| **Drilling Risks and Hazards** | • Geosteering<br>• Hole cleaning<br>• Running 7" liner to TD |
| **Operational Guidelines** | • A dedicated 8 1/2" drill out assembly will be run to drill out the 9 5/8" shoe and sufficient rat hole to allow for the primary drilling BHA to be run into open hole prior to commence drilling. The drill out assembly will include a motor.<br>• The primary 8 1/2" drilling BHA will include a rotary steerable system to allow for geosteering through the reservoir.<br>• The 8 1/2" section will be opened to 9 1/2" if the 7" liner shall be cemented.<br>• A 7" liner will be installed. |
| **BHA /Bit** | • The section will be drilled with a rotary steerable BHA including GeoSphere for geosteering. |
| **Directional Drilling and Surveying** | • MWD / LWD: Directional Survey, Gamma Ray, Resistivity (ARC), Annular Pressure, Density / Neutron, Spectroscopy (NeoScope), Resistivity Mapping (GeoSphere), Sonic (SonicScope), Formation Pressure (StethoScope).<br>• Minimum one directional survey every 100m.<br>• Directional drilling to be performed according to the Directional drilling program, ref. /41/. |
| **Drilling Fluids** | • The section will be drilled with EMS 4600 OBM.<br>• The planned mud weight for drilling the section is 1.10 – 1.15sg<br>• Reference is made to 8.5 Drilling Fluid Program for mud properties and volumes.<br>• Reference is made to /6/ Lost Circulation Procedure. |
| **Formation Evaluation** | • 1 TLC run: Gamma Ray (EDTC), Spectral GR (HNGS), Sonic Scanner (MSIP, GPIT), Caliper, OBMI (Quanta Geo).<br>• Optional: Magnetic Resonance (CMR+), Density / Neutron (TLD-APS), 3D Resistivity (ZAIT), Dielectric (ADT).<br>• Reference is made to 4.8 Data Acquisition. |
| **7 " Production Liner** | • The 7" production liner will be run to +/- 2290 m MD/ 721 mTVD and hung off inside the 9 5/8" production casing with a planned 50m liner lap.<br>• Top liner is planned at +/- 795m MD.<br>• 7" liner spec: 32#, P-110, TSH Blue Dopeless. |
| **Cementing** | • The 7" production linerwill be run uncemented. Welltec's Annular Barriers (WAB's) will be used for zonal isolation.<br>• A contingent solution using Archer's C-flex tool will be in place. |
| **Rig Action Plan** | • Refer to Rig Action Plans (RAP) for detailed procedures for the relevant operations |

Reference is made to /48/ Section Recommendations for Wisting Central II.

## 5.7.7 Plug and Abandonment

The well will be permanently plugged and abandonned according to NORSOK D-010, rev.4 June 2013 and OMV E-C.2.3-HQ-STD-004-01 Technical Policy Standard.

A final P&A program will be issued prior to commencing P&A operations.

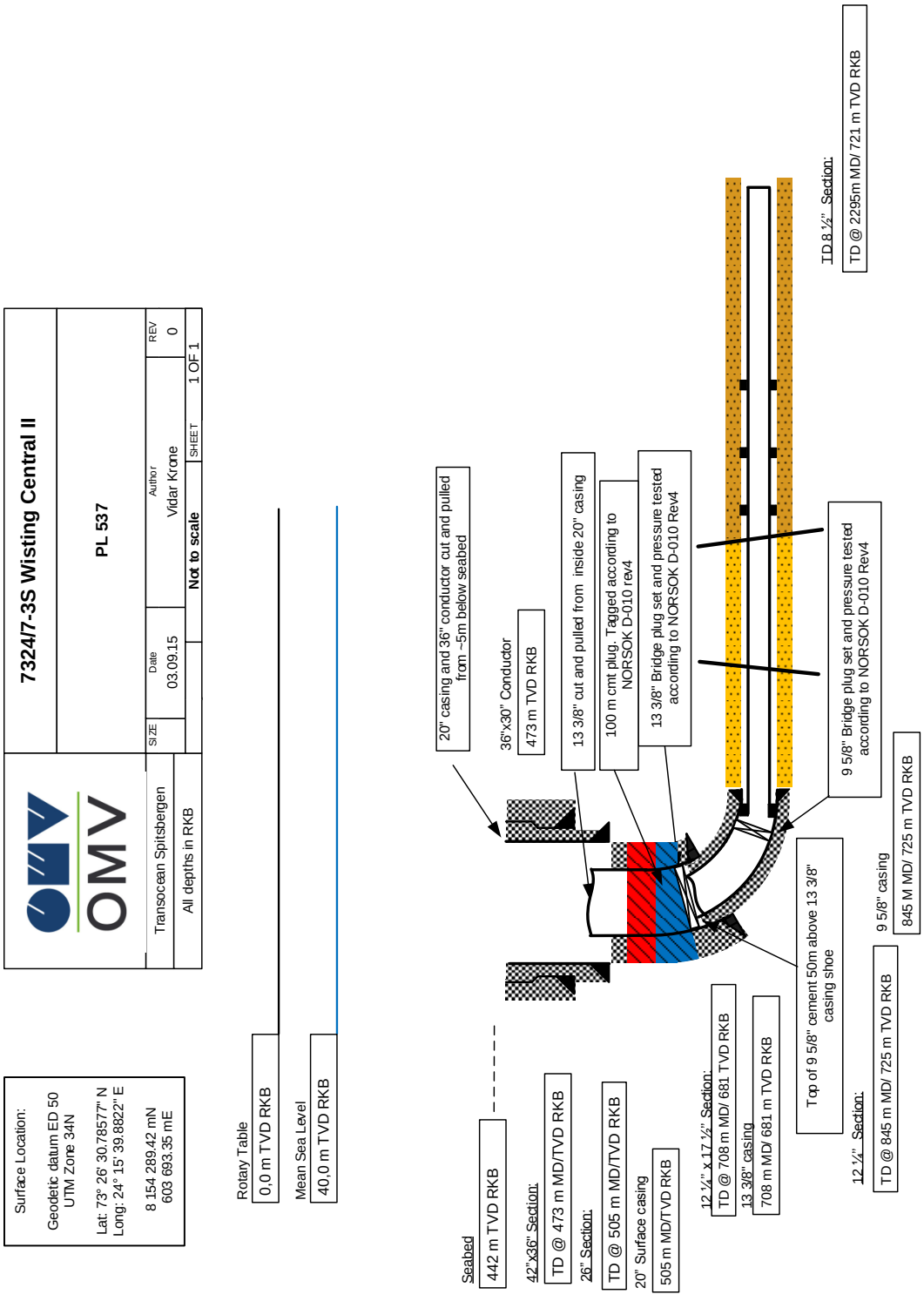


Figure 5.5 P&A Well Schematic of 7324/7-3S Wisting Central II

# 5.8 Relief Wells

Three alternative locations for relief wells have been identified and assessed for shallow gas risk. The locations have been evaluated in the Site Survey. There are no seismic anomalies that indicate shallow gas in any of the relief well locations. All three relief well locations are in the water zone.

In the event a relief well is required, OMV Norge AS would refer to the "OCES Mutual Aid Agreement and Emergency Assistance Code of Practice" through OLF, which regulates the obligation of each member to release a drilling rig to an operator in distress.

The blow out modeling for the well has shown that a blowout scenario can be killed with only one (1) relief well.

Reference is made to the Acona Blowout and Kill Simulation Study for the well Wisting 7324/7-3S, ref. /37/.

Reference is made to the blowout contingency plan for 7324/7-3S Wisting Central II, ref. /10/.

Figure 5.6

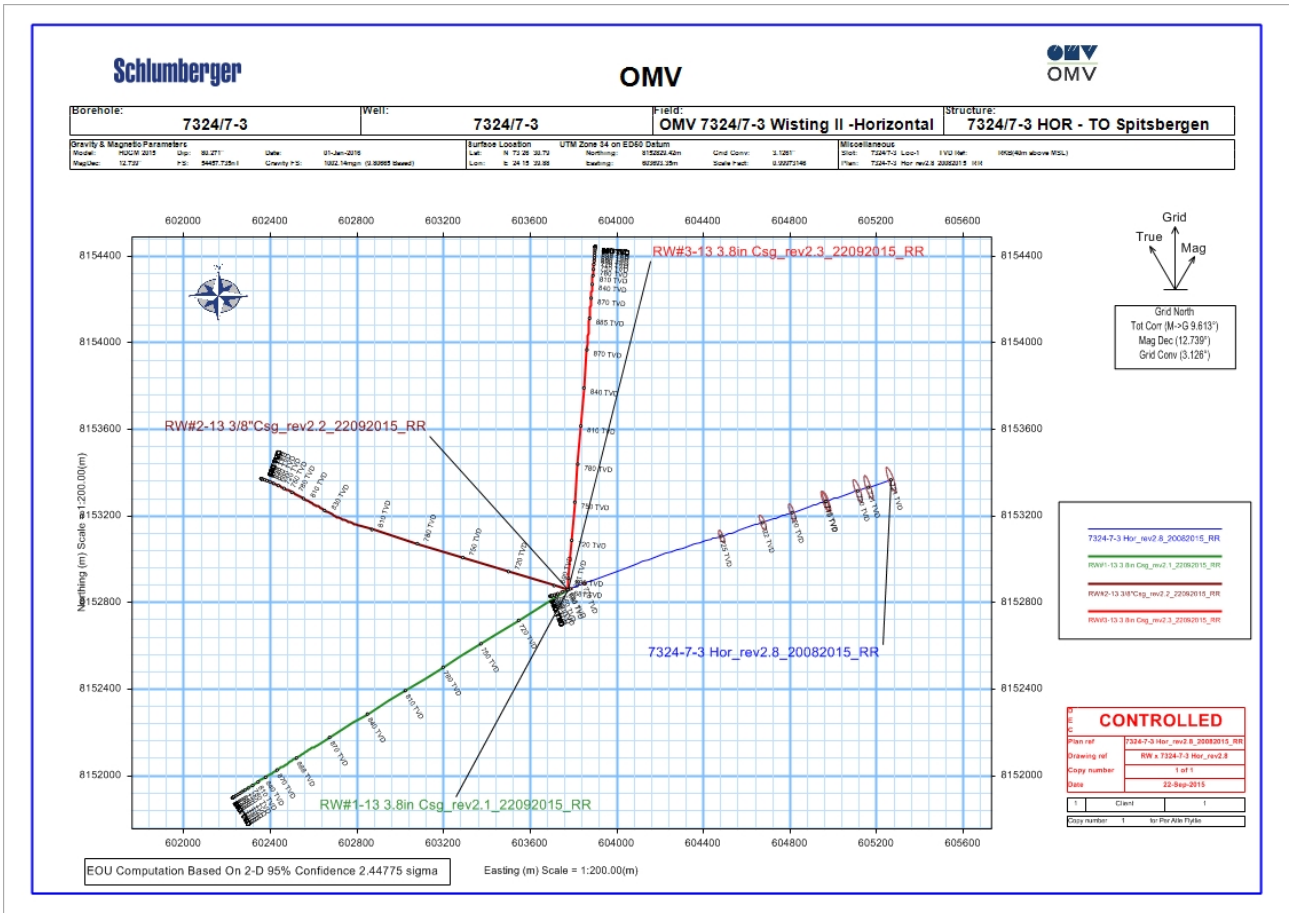


Figure 5.6 Locations of Relief Wells

Figure 5.7

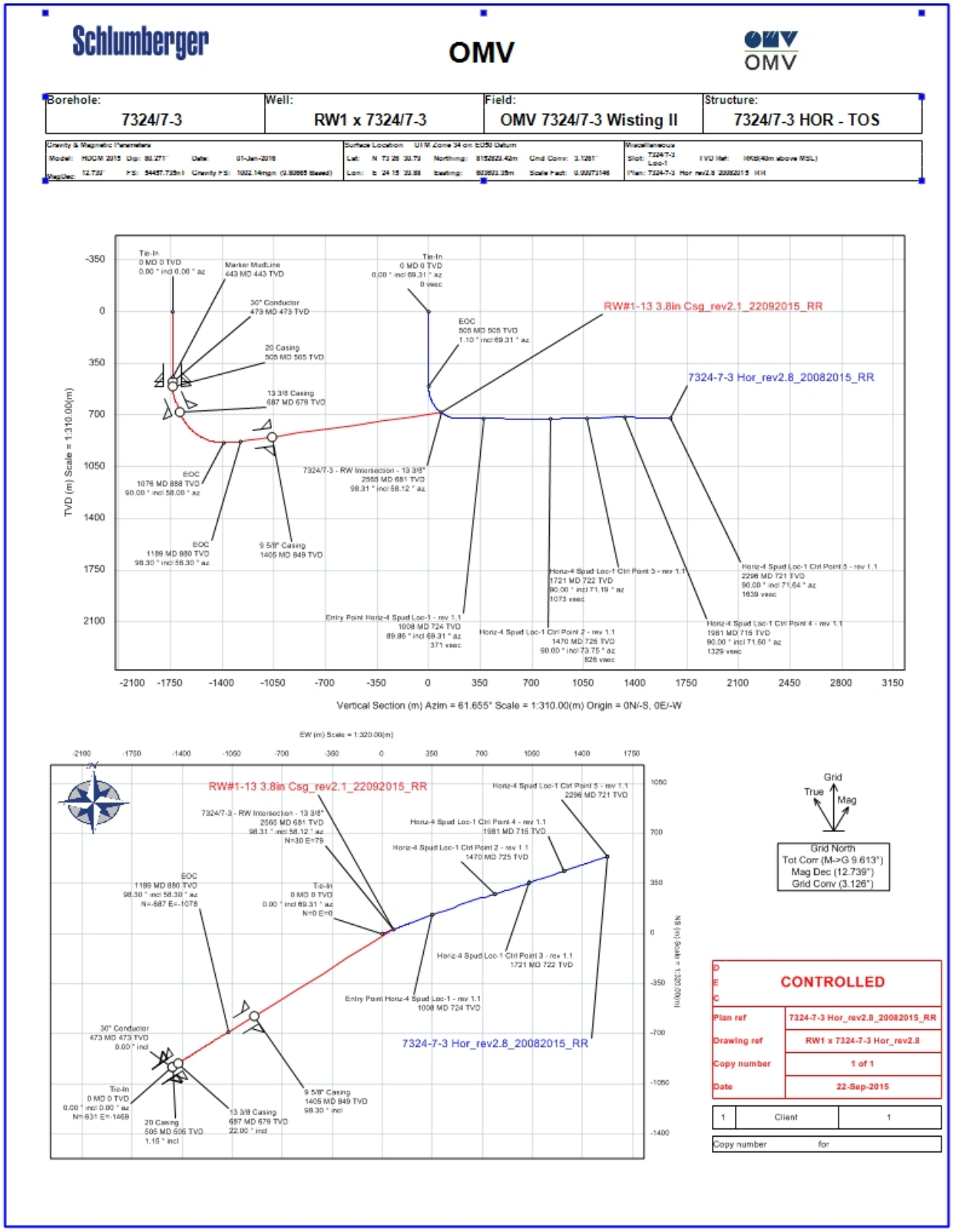


Figure 5.7 Relief Well Trajectory
Relief well intersecting 13 3/8" casing shoe of Wisting Central II

Table 5.18 Relief Well Location RW#1

| Well Name | Relief Well #1 |
|---|---|
| Latitude | 73° 26' 3.359" N |
| Longitude | 24° 12' 48.286" E |
| Northing | 8 151 898.480m N |
| Easting | 602 224.740m E |
| Reference System | UTM Zone 34 on ED 50 (International Spheroid 1924) |
| Water Depth (MSL) | +/- 403m |
| Distance from PWL | 1738m |
| Bearing from PWL | SW |
| Seabed Gradient* | |
| Drilling Constraints | A Drilling Constraints Analysis has been performed. |

Table 5.19 Relief Well Location RW#2

| Well Name | Relief Well #2 |
|---|---|
| Latitude | 73° 26' 50.643" N |
| Longitude | 24° 13' 12.189" E |
| Northing | 8 153 373.230m N |
| Easting | 602 356.860m E |
| Reference System | UTM Zone 34 on ED 50 (International Spheroid 1924) |
| Water Depth (MSL) | +/- 403m |
| Distance from PWL | 1443m |
| Bearing from PWL | WNW |
| Seabed Gradient* | |
| Drilling Constraints | A Drilling Constraints Analysis has been performed. |

Table 5.20 Relief Well Location RW#3

| Well Name | Relief Well #3 |
|---|---|
| Latitude | 73° 27' 22.478" N |
| Longitude | 24° 16' 13.200" E |
| Northing | 8 154 445.230m N |
| Easting | 603 899.740m E |
| Reference System | UTM Zone 34 on ED 50 (International Spheroid 1924) |
| Water Depth (MSL) | +/- 403m |
| Distance from PWL | 1629m |
| Bearing from PWL | N |
| Seabed Gradient* | |
| Drilling Constraints | A Drilling Constraints Analysis has been performed. |

* Seismic does not provide proper lateral resolution.

## 5.9 Re-spud Location

In the event of a necessary re-spud, the re-spud location will be within 15-20m from the original well location.The well targets will remain unchanged. Primary well targets will still be hit.

# 6 Drill Stem Test

A seperate Well Testing Program will be issued, ref. /47/.

## 6.1 Drill Stem Test Summary

The well testing operations for Wisting Central II are defined in the DST concept selection report, ref. /44/.

Based on the proposed well design, the drillstem test is planned to test the Stø Formation by perforating the 7" liner. The test is planned for 3 intervalls which can be produced individually and comingled. An electrical submersible pump (ESP) will be introduced into the test string placed above the BOP supporting the clean-up and providing valuable information about the flow potential of possible production wells. A contingency DST set up in case of a 5" liner is also in place.

The design of the well testing program will be established in accordance with the reservoir data acquisition requirements.

# 7 Reference List

/1/ OMV (Norge) AS, WEG-MA-001 Drilling manual

/2/ OMV (Norge) AS, WEG-MA-003 Marine Operations Manual

/3/ OMV (Norge) AS, DRI-NO-009 Well Control Interventions manual

/4/ OMV (Norge) AS, HSEQ-NO-00-01 Management System Manual Norway

/5/ OMV (Norge) AS, DP Manual WEB-MA-004 (NO-PGS-DSG-0002)

/6/ MI Swaco, Lost Circulation Procedure

/7/ OMV (Norge) AS, NO PL537 - 7324_7-3S Wisting Central II Design Rationale Document - signed (NO-PL537-OTD-DER-0006)

/8/ OMV (Norge) AS, Audit & Verification Plan

/9/ OMV (Norge) AS, Oil Spill Contingency Plan for Appraisal Well PL 537 - 7324/7-3S Wisting Central II (NO-PL537-OTD-ORP-0001)

/10/ OMV (Norge) AS, Blowout Contingency Plan

/11/ OMV (Norge) AS, Ice Risk Management Plan

/12/ OMV (Norge) AS, Wisting Central II Risk Register - Well Engineering Master (NO-PL537-GRP-HRM-0001)

/13/ OMV (Norge) AS, Wisting Central II Risk Register - Well Engineering Planing (NO-PL537-GRP-HRM-0004)

/14/ OMV (Norge) AS, Wisting Central II Risk Register - Well Engineering BAS (NO-PL537-GRP-HRM-0005)

/15/ OMV (Norge) AS, Wisting Central II Risk Register - WSRA (NO-PL537-GRP-HRM-0007)

/16/ OMV (Norge) AS, Wisting Central II Risk Register - SSRA (NO-PL537-GRP-HRM-0008)

/17/ OMV (Norge) AS, Environmental Risk Assessment

/18/ OMV (Norge) AS, Søknad om tillatelse til virksomhet etter forurensningsloven (NO-OMV NORGE AS-NEA-L-0005)

/19/ OMV (Norge) AS, Application for Consent - PL 537: Appraisal well 7324/7-3S Wisting Central II and 7324/8-3 Hassel (NO-PL537-APL-ACD-0002)

/20/ OMV (Norge) AS, Waste Management Plan

/21/ OMV (Norge) AS, HSEQ-NO-10-02 2nd line emergency response plan

/22/ OMV (Norge) AS, HSEQ-NO-10-01 3rd line Emergency Management Plan (NO-PGS-STA-0004)

/23/ OMV (Norge) AS, HSEQ-NO-10-03 Media response plan

/24/ OMV (Norge) AS, HSEQ-NO-10-04 Actions to NGO operations

/25/ OMV (Norge) AS, Emergency Response Bridging Document

/26/ OMV (Norge) AS, Site Specific Preparedness Analysis (SSEPA)

/27/ OMV (Norge) AS, Casing Design Report for Wisting Central II

/28/ OMV (Norge) AS, Deviation NO-2015-03: Pressure Test Casing and Liner. The 9 5/8" and 7" liner laps will not be inflow tested

/29/ OMV (Norge) AS, Deviation NO-2015-04: Production Casing and/or Liner. The 9 5/8" and 7" liner laps will be less than 300 feet

/30/ OMV (Norge) AS, Deviation NO-2015-05: Formation integrity tests (FIT's) will be performed over leak-off tests (LOT's)

/31/ OMV (Norge) AS, HSE Program for Wisting Central II

/32/ Transocean, HSE Program

/33/ Transocean, Well Control Procedure

/34/ Transocean, Winterization Manual

/35/ Senergy, Drilling Constraint Assessment (2474-OMV-DCA-01-01)

/36/ Senergy, Drilling Constraint Summary (2474-OMV-DCSUM-01-02 )

/37/ Acona, Blowout and Dynamic Wellkill Simulations

/38/ Fedem, Weak Point Analysis

/39/ Fedem, Well Integrity Strength Analysis

/40/ DOF Subsea, CAN Installation Project - Normand Reach Scope of Work

/41/ Schlumberger, Directional Drilling Program

/42/ MI-Swaco, Drilling Fluids Program for Wisting Central II

/43/ Schlumberger, Cementing Program for Wisting Central II

/44/ Neodrill, CAN Underpressure calculations

/45/ Neodrill, FEED Study report

/46/ OMV (Norge) AS, Well Testing Concept Selection report

/47/ OMV (Norge) AS, NO PL537 7324/7-3S Wisting Central II Well Testing Program

/48/ OMV (Norge) AS, Section Recommendations for Wisting Central II

/49/ OMV (Norge) AS, Central II geosteering document (NO-PL537-PRG-GWP-0002)

/50/ Schlumberger, High Angle Drilling Strategy

# 8 Appendix

## 8.1 Organization

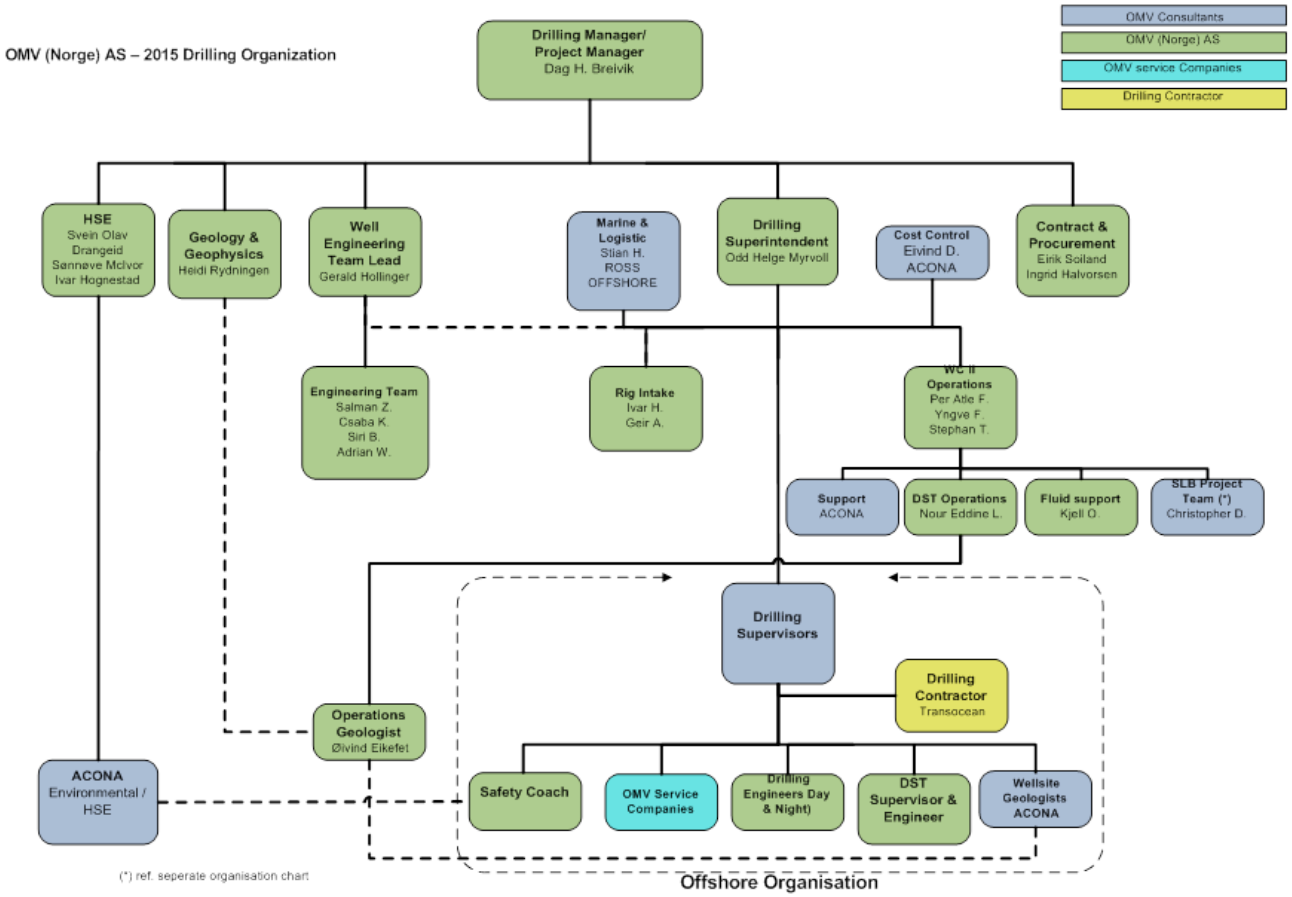


Figure 8.1 Wisting Central II - Organizational Chart

# 8.2 Contact Lists

## 8.2.1 OMV (Norge) AS

Table 8.1 OMV Contact List

| Name | Title | E-mail | Phone |
|---|---|---|---|
| Dag H. Breivik | Drilling Manager | dag.breivik@omv.com | 957 06 618 |
| Odd Helge Myrvoll | Drilling Superintendent | oddhelge.myrvoll@external.omv.com | 905 22 164 |
| Gerald Hollinger | Well Engineering Team Lead | gerald.hollinger@omv.com | 953 03 050 |
| Per Atle Flytlie | Senior Drilling Engineer | peratle.flytlie@external.omv.com | 959 93 916 |
| Yngve Frøyland | Senior Drilling Engineer | yngve.froeyland@external.omv.com | 906 09 299 |
| Stephan Trauner | Drilling Engineer | stephan.trauner@omv.com | 992 48 082 |
| Vidar Krone | Drilling Engineer | Vidar.Krone@acona.com | 473 03 080 |
| Nour-Eddine Lahlah | Senior Drilling Engineer | nour-eddine.lahlah@omv.com | 953 61 423 |
| Øivind Eikefet | Operations Geologist | oivind.eikefet@omv.com | 415 50 495 |
| Sønnøve Mclvor | Senior HSSE Professional | sonnove.mcivor@omv.com | 952 94 122 |
| Heidi Rydningen | Subsurface Team Lead | heidi.rydningen@omv.com | 976 35 696 |
| Kristoffer Birkeland | Senior Petrophysicist | kristoffer.birkeland@omv.com | 907 95 398 |
| Stian Hostad | Logistics | stian.hostad@external.omv.com | 970 37 235 |
| Eivind Dalene | Cost Controlling | eivind.dalene@external.omv.com | 934 12 604 |
| Joachim Riise | Marine | joachim.riise@rossoffshore.no | 907 86 745 |

## 8.2.2 Transocean

Table 8.2 Transocean Contact List

| Name | Title | E-mail | Phone |
|---|---|---|---|
| Jan Dale | Rig Manager | Jan.Dale@deepwater.com | |
| Sindre Eltvik | Operations Engineer | Sindre.Eltvik@deepwater.com | 916 28 023 |

## 8.2.3 Partners

Table 8.3 Petoro AS Contact List

| Name | Title | E-mail | Phone |
|---|---|---|---|
| Jan M. Holmboe | Senior Geologist | jan.morten.holmboe@petoro.no | 907 68 758 |
| Marianne Goesten | Asset Manager | marianne.goesten@petoro.no | 994 85 030 |

Table 8.4 Idemitsu Petroleum AS Contact List

| Name | Title | E-mail | Phone |
|---|---|---|---|
| Tommy M. Egebjerg | Exploration Manager | Tommy.Mogensen.Egebjerg@idemitsu.no | 950 66 808 |
| Ted Tadesse | Senior Drilling Engineer | Ted.Tadesse@idemitsu.no | 977 73 866 |
| John Martin Østby | Sr. Operation Geologist | John.Morten.Ostby@idemitsu.no | 974 63 129 |

Table 8.5 Statoil Petroleum AS Contact List

| Name | Title | E-mail | Phone |
|---|---|---|---|
| Carlos Gil | License Manager | cgi@statoil.com | 954 40 075 |
| Adam J. Sultan | Team Leader Exploration | adsu@statoil.com | 480 98 716 |
| Dagfinn Alm | Project Leader Exploration | dalm@statoil.com | 918 93 712 |

Table 8.6 Tullow Oil Norge AS Contact List

| Name | Title | E-mail | Phone |
|---|---|---|---|
| Bente Flakstad Vold | Team Leader Barents Sea | bente.vold@Tullowoil.com | 911 34 330 |
| Jan Gorgas | Drilling Advisor | jan.gorgas@Tullowoil.com | 901 39 786 |
| Per Bakøy | Operations Geologist | per.bakoy@Tullowoil.com | 414 40 049 |

## 8.2.4 Contractors

Table 8.7 Schlumberger Contact List

| Name | Title / Service | E-mail | Phone |
|---|---|---|---|
| Christophe Dupuis | Project Manager | CDupuis@slb.com | 409 24 182 |
| Rafael Rosales | Senior Drilling Engineer | rosales3@slb.com | 407 33 449 |
| Carlos Guevara | Senior Drilling Engineer | CGuevara4@slb.com | 407 33 449 |
| Bjørn Rørvik | Drilling Fluids | brorvik@miswaco.slb.com | 920 40 568 |
| Rune Sørbø | Cuttings Handling | rsorbo@miswaco.slb.com | 934 26 669 |
| Nadya Lyapunova | Cementing | NLyapunova@slb.com | 409 02 152 |
| Patrick Le Jannou | Mudlogging | plejannou@slb.com | 409 24 468 |
| Alireza Nadali | Wireline | alireza@slb.com | 409 24 466 |
| Rolf Eikeskog | Smith Bits | reikeskog@slb.com | 412 92 211 |
| Carl Hals | Account Manager | halscf@slb.com | 982 25 722 |

Table 8.8 Dril-Quip Contact List

| Name | Title / Service | E-mail | Phone |
|---|---|---|---|
| Arild Rasmussen | Wellhead and Conductor | Arild_RASMUSSEN@dril-quip.com | 917 33 018 |

Table 8.9 Tenaris Contact List

| Name | Title / Service | E-mail | Phone |
|---|---|---|---|
| Ruth Anne Lunde | Casing | rlunde@tenaris.com | 901 09 481 |

Table 8.10 Oceaneering Contact List

| Name | Title / Service | E-mail | Phone |
|---|---|---|---|
| Åge Even Graskopf | ROV | aaegrask@oceaneering.com | 473 16 415 |

Table 8.11 Weatherford Contact List

| Name | Title / Service | E-mail | Phone |
|---|---|---|---|
| Arild Jøssang | Casing Cutting & Fishing | Arild.Jossang@EU.Weatherford.com | 928 00 771 |

Table 8.12 Welltec Contact List

| Name | Title / Service | E-mail | Phone |
|---|---|---|---|
| Per Arnfinn Monge | Welltec Annular Barriers | pamonge@welltec.com | 473 14 012 |

Table 8.13 Archer Contact List

| Name | Title / Service | E-mail | Phone |
|---|---|---|---|
| Stian Laland | C-Flex | Stian.Laland@archerwell.com | 951 19 769 |

# 8.3 NeoDrill's CAN Solution

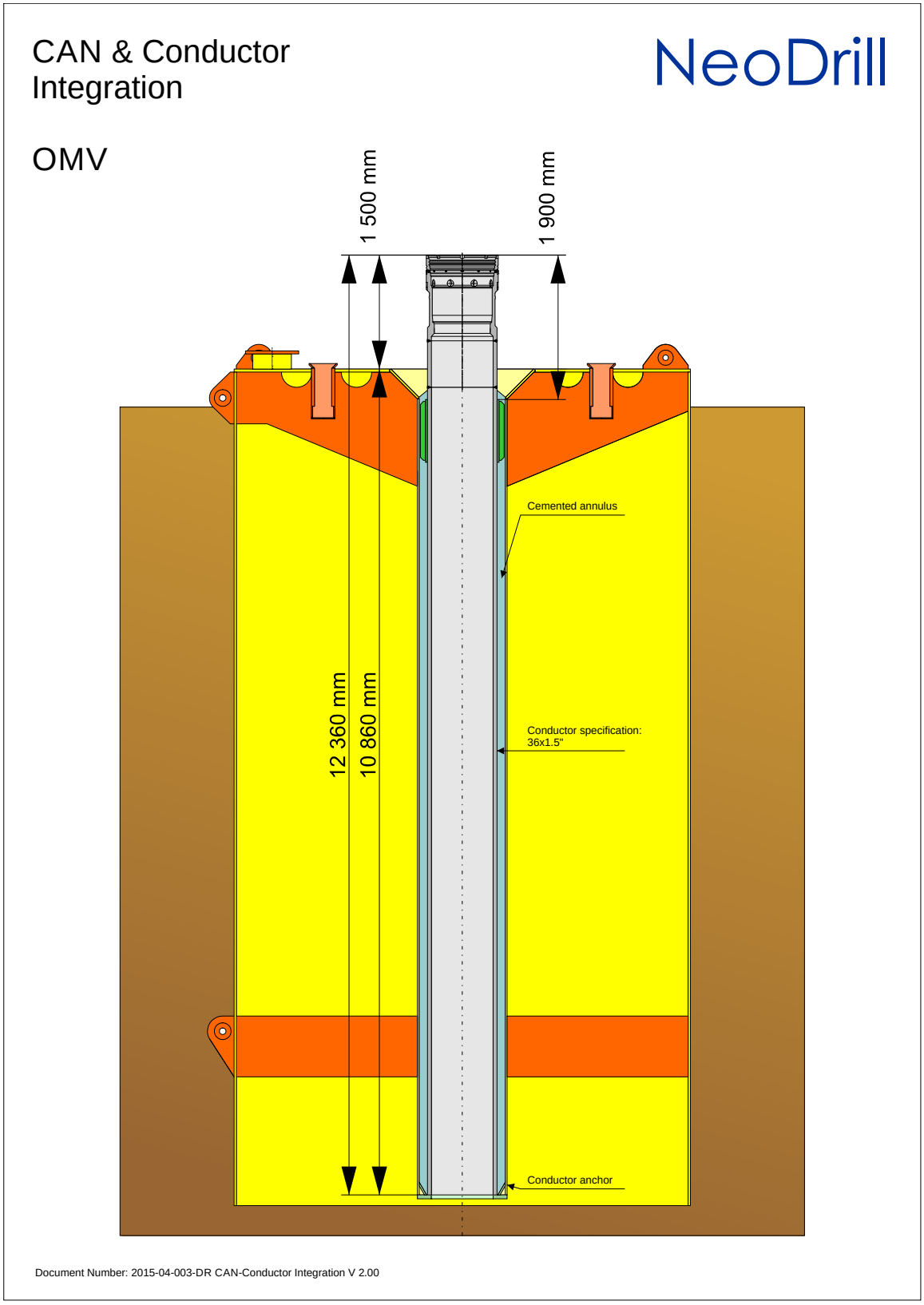


Figure 8.2 CAN Support Structure Overview

# 8.4 Drill Bit Summary

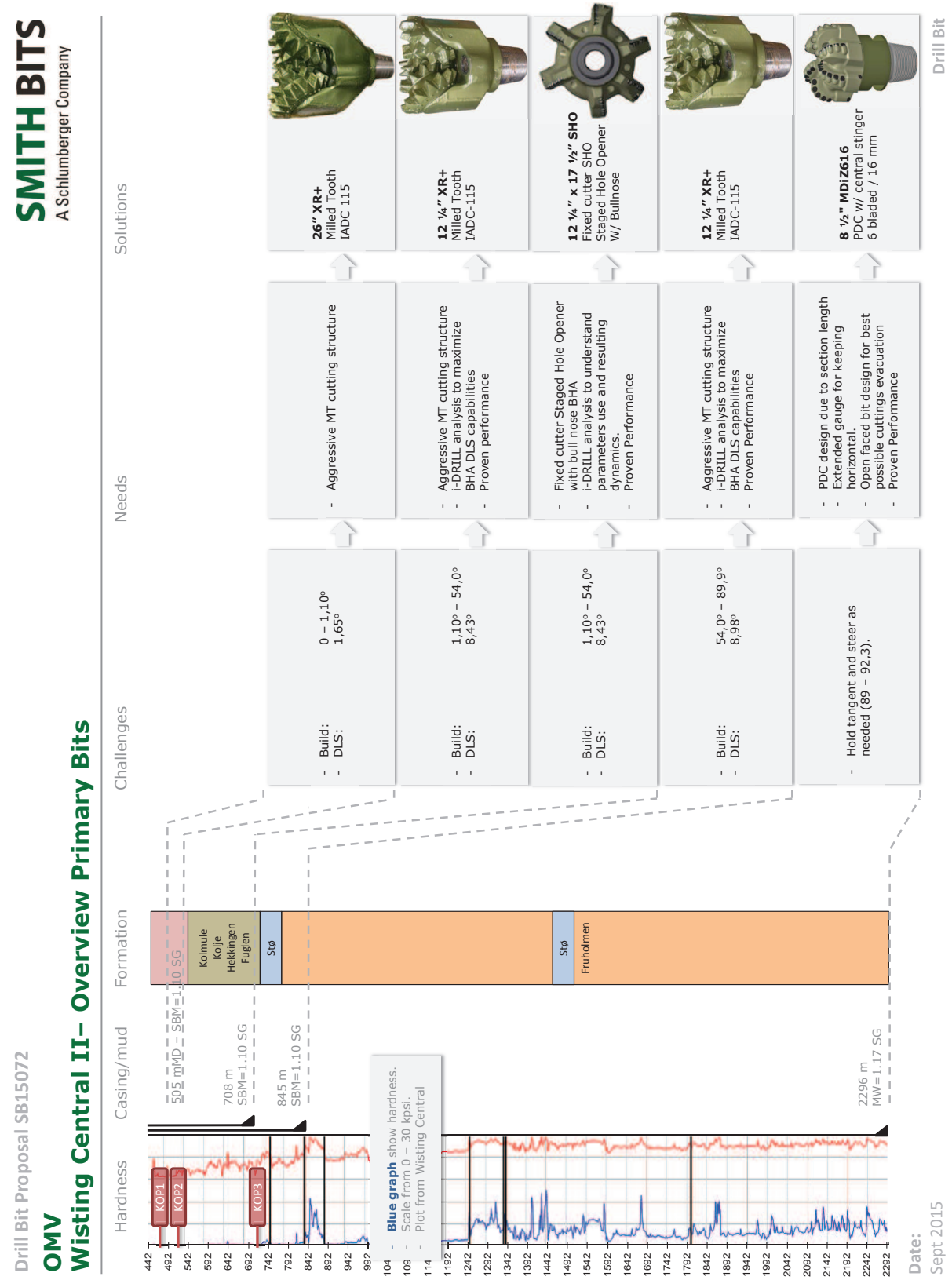


Figure 8.3 Wisting Central II Primary Bits

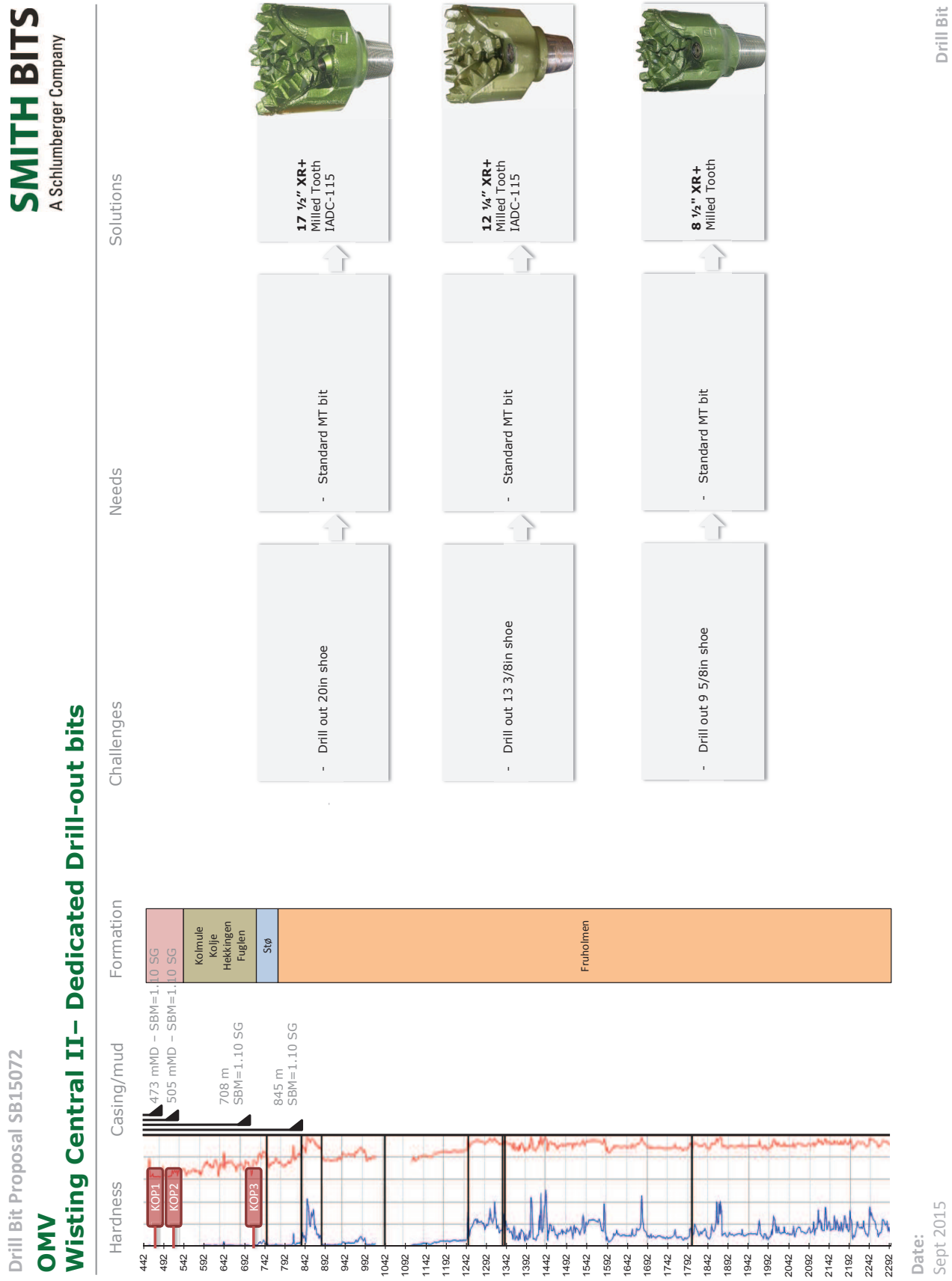


Figure 8.4 Wisting Central II Drill Out Bits

Figure 8.5 Drilling Fluid Program

| MI SWACO A Schlumberger Company | 7324/7-3 Wisting Central II | DRILLING FLUIDS PROGRAMME | Prepared by: Bjørn Rørvik | Date : 28.09.2015 | OMV |
|---|---|---|---|---|---|
| | | | Verified date/by: | Cost/m, NOK: | |
| | | REVISION NO: 11 | Approved date/by: | Total cost, NOK: | |

## 42 " Section - FLUIDS: Seawater - Bentonite / Bentonite

| Depth meters | FLUID TYPE | MW SG | FV s | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 442 | Seawater - Bentonite | 1.03 | > 100 | | | | | | | | | | |
| | Bentonite displ | 1.50 | > 100 | alap | | | | | | | | | |

473

**COMMENTS:**
Prepare 100 m³ with 1.60 sg KCL kill fluid prior to spud.
The section will be drilled using sea water - pumping hivis sweeps. Mix hivis Bentonite sweeps according to programmed specifications. Prehydrate Bentonite in fresh water for at least 6 hours. Pump 7-10 m³ Bentonite hivis pills every 10 m drilled (3 pills per stand).
At TD sweep the hole by pumping a 20 m³ hivis pill before displacing the hole to 1.50 sg Bentonite fluid by pumping 1,3 - 1.5 times the hole volume. Also sweep the hole hole by pumping 20 m³ hivis at TD if a wiper trip is required. As a contingency in case bulk Bentonite cannot be used - or time doesn't allow to mix Bentonite mud, 8 - 16 kg/m³ CMC-EHV in Sea Water is a alternative for sweeps.
**SEE DETAILED PROCEDURES IN THE M-I NORWAY OPERATIONAL PROCEDURE MANUAL**

Length: 31

**PRODUCT USAGE** — Conc. (unit/m³)

| TYPE | UNIT | SWEEPS | DISPL/KILL | TOT UNITS |
|---|---|---|---|---|
| Bentonite, OCMA | t | 0.075 | | 40 |
| Freshwater | m³ | 0.969 | | 100 |
| Soda Ash | kg | 1.5 | | 160 |
| | | | | |
| Barite | t | | | |
| Bentonite, OCMA | t | | | |
| Freshwater | m³ | | | |
| Soda Ash | kg | | | |
| | | | | |
| | | | | |
| Volume exported | m³ | (Kill fluid to next section) | | 100 |
| Volume imported | m³ | | | 150 |
| Total section cost | | | NOK | |

**VOLUMES**

| | m³ |
|---|---|
| DISPL. VOL | 55 |
| KILL FLUID VOL: | 100 |
| SWEEP VOL: | 104 |
| CASING VOL: | |
| OPEN HOLE: | 28 |
| TOTAL HOLE VOL: | 28 |
| **TOT. VOL. REQ.** | **259** |
| RECEIVED VOL: | 150 |
| **NEW MUD VOL:** | **109** |
| MUD LEFT VOL: | **100** |
| TRANSFERRED OUT VOL: | **100** |
| ANGLE, deg: | |
| | |
| Cost/meter | |

## 26 " Section - Seawater/Bentonite/KCL

| Depth meters | FLUID TYPE | MW SG | pH | PV cP | YP lb/sq.ft | Gel 10s | Gel 10m | 3 rpm | API FL ml/s | KCl g/l | Glycol % | MBT kg/m3 | Ca++ mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 473 | Seawater - Bentonite | 1.03 | > 100 | | | | | | | | | | |
| | KCL mud | 1.30 | 8-9 | alap | 15-25 | >4 | < 20 | 10-12 | N/A | 120 - 150 | 2-5 | < 60 | < 1000 |

505

**COMMENTS:**
The section will be drilled using sea water - pumping Bentonite hivis sweeps at 1.25 sg. Pump 7-10 m³ hivis pills every 10 m drilled (2-3 pills per stand). On connections - pump and spot Hi Visc bentonite pill 1,25 sg in OH.
At TD sweep the hole by pumping a 30 m³ hivis pill before displacing the hole to 1.30 sg KCL mud by pumping 1.5 times the hole volume. Also sweep the hole by pumping 30 m³ hivis at TD if a wiper trip is required.

**SEE DETAILED PROCEDURES IN THE M-I NORWAY OPERATIONAL PROCEDURE MANUAL**

Length: 32

**PRODUCT USAGE** — Conc. (unit/m³)

| TYPE | UNIT | SWEEPS | DISPL. | TOT UNITS |
|---|---|---|---|---|
| Bentonite, OCMA | t | 0.075 | | 10 |
| Freshwater | m³ | 0.969 | | 120 |
| Soda Ash | kg | 1.5 | | 180 |
| | | | | |
| KCl Brine, 1.15sg, no Glydril MC | m³ | 0.750 | | 80 |
| | ltr | | | |
| Freshwater | m³ | 0.110 | | 10 |
| Soda Ash | kg | 1.000 | | 100 |
| Duo-Tec NS | kg | 5.000 | | 500 |
| | | | | |
| Barite | t | 0.370 | | 40 |
| Volume exported | m³ | (Kill fluid to next section) | | |
| Volume imported | m³ | (Kill fluid) | | 100 |
| Total section cost | | | NOK | |

**VOLUMES**

| | m³ |
|---|---|
| DISPL. VOL | 34 |
| KILL FLUID VOL: | 100 |
| SWEEP VOL: | 120 |
| CASING VOL: | 12 |
| OPEN HOLE: | 11 |
| TOTAL HOLE VOL: | 23 |
| **TOT. VOL. REQ.** | **254** |
| TRANSFERRED IN VOL: | 100 |
| **NEW MUD VOL:** | **54** |
| MUD LEFT VOL: | |
| BACKLOAD VOL: | |
| TRANSFERRED OUT VOL: | |
| Cost/meter | |

## 17 1/2 " Section - EMS 4600

| Depth meters | MW SG | YP Pa | PV cp | Gel 10s Pa | Gel 10m Pa | 3 rpm lbs/100ft² | HPHT FL ml/s | CaCl2 kg/m³ | OW-ratio | ES mV | Ex. Lime kg/m³ | LGS kg/m³ | Sand % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 505 | | | | | | | | | | | | | |
| | 1.20 - 1.25 | 8-15 | alap | 5 - 12 | < 20 | 10-15 | < 3 | 120-180 | 80/20 | > 500 | 5-10 | < 170 | < 1 |

708

COMMENTS:300 m3 of EMS 4600 is planned shipped out from shore in preparation for this section pretreated with 15 kg/m3 Frackseal. Displace to 1.20 sg OBM while drilling out cement and shoetrack as the OBM will be used for the LOT. Run finest possible shaker screens and optimize solids removal equipment at all time in order to reduce dilutiuon volume. Maintain low end rheology in the higher end of the recommended range to ensure good hole cleaning. Monitor and evaluate cuttings quality regarding condition, texture and amount
Have a density vs temperature plot available in the pump room at all times. The reference temperature is selected to be 20°C.
**In case of total losses - follow Drilchem lost circulation procedure.**
**SEE DETAILED PROCEDURES IN THE M-I NORWAY OPERATIONAL PROCEDURE MANUAL**

Length: 203

**PRODUCT USAGE** — Conc. (unit/m³)

| TYPE | UNIT | NEW | MAINT. | TOT UNITS |
|---|---|---|---|---|
| EDC 99 | t | 0.698 | | 50 |
| Freshwater | m³ | 0.129 | | 10 |
| One-Mul | kg | 20.000 | 2.0 | 1 340 |
| VG-Plus | | 34.000 | 3.0 | 2 270 |
| Lime | kg | 20.000 | 2.0 | 1 340 |
| EMI 1824 | kg | 10.000 | 5.0 | 670 |
| CaCl2 90-95% Powder | kg | 54.200 | 5.0 | 3 620 |
| Barite | t | 0.370 | | 20 |
| CaCO3 M VK 150 | kg | | | |
| | kg | | | |
| Frac seal | kg | 15.000 | | |
| | | | | |
| Volume exported | m³ | | | |
| Volume imported | m³ | (Kill fluid) | | 250 |
| Total section cost | | | NOK | |

**VOLUMES**

| | m³ |
|---|---|
| SURFACE VOL: | 100 |
| RISER VOL: | 80 |
| CASING VOL: | 11 |
| OPEN HOLE: | 31 |
| TOTAL HOLE VOL: | 42 |
| DILUTION VOL: | 95 |
| **TOT. VOL. REQ.** | **317** |
| TRANSFERRED IN VOL: | 250 |
| **NEW MUD VOL:** | **67** |
| MUD LEFT VOL: | |
| BACKLOAD VOL: | |
| TO NEXT SECTION | **222** |
| Cost/meter | |

## 12 1/4 " Section - EMS 4600

| Depth meters | MW SG | YP Pa | PV cp | Gel 10s Pa | Gel 10m Pa | 3 rpm lbs/100ft² | HPHT FL ml/s | CaCl2 kg/m³ | OW-ratio | ES mV | Ex. Lime kg/m³ | LGS kg/m³ | Sand % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 708 | | | | | | | | | | | | | |
| | 1.15 - 1.25 | 8-13 | alap | 3 - 10 | < 20 | 9-12 | < 3 | 120-180 | 80/20 | > 500 | 5-10 | < 170 | < 1 |

845

COMMENTS: Continiue this section with drilling fluid from previous interval. Adjust MW to stable 1.15 sg while drilling out cement and shoetrack and perform LOT.
Run finest possible shaker screens and optimize solids removal equipment at all time in order to reduce dilutiuon volume. Maintain low end rheology in the higher end of the recommended range to ensure good hole cleaning. Monitor and evaluate cuttings quality regarding condition, texture and amount.
On OMV request start adding 15 kg/m3 Fiber true the predicted faults due to high risk of losses.
Have a density vs temperature plot available in the pump room at all times. The reference temperature is selected to be 20°C. **In case of total losses - follow Drilchem lost circulation procedure.**
No drilling fluid containing fibers can not be backloaded to shore for re usage unless fibers are screen out.
**SEE DETAILED PROCEDURES IN THE M-I NORWAY OPERATIONAL PROCEDURE MANUAL.**

Length: 137

**PRODUCT USAGE** — Conc. (unit/m³)

| TYPE | Unit | New | Maint | Tot Unit |
|---|---|---|---|---|
| EDC 99 | m³ | 0.698 | | 50 |
| Freshwater | m³ | 0.129 | | 10 |
| One-Mul | ltr | 20.0 | 2 | 1 410 |
| VG-Plus | kg | 34.0 | 3 | 2 390 |
| Lime | kg | 20.0 | 2 | 1 410 |
| EMI 1824 | kg | 10.0 | 5 | 700 |
| CaCl2 90-95% Powder | kg | 54.200 | 5 | 3 810 |
| Barite | t | 0.370 | | 30 |
| CaCO3 M VK 150 | kg | | | |
| | | | | |
| Frac seal | kg | | 5000 | 5 000 |
| | | | | |
| Volume exported | m³ | | | 241 |
| Volume imported | m³ | | | 222 |
| Total section cost | | | NOK | |

**VOLUMES**

| | m³ |
|---|---|
| SURFACE VOL: | 150 |
| RISER VOL: | 80 |
| CASING VOL: | 21 |
| LOST IN HOLE/BEHIND CSG: | 20 |
| OPEN HOLE: | 10 |
| TOTAL HOLE VOL: | 111 |
| DILUTION VOL: | 31 |
| **TOT. VOL. REQ.** | **292** |
| RECEIVED VOL: | 222 |
| **NEW MUD VOL:** | **70** |
| MUD LEFT VOL: | **241** |
| TO NEXT SECTION | **241** |
| | |
| | |
| Cost/meter | |

## 8 1/2 " Section - EMS 4600

| Depth meters | MW SG | YP Pa | PV cp | Gel 10s Pa | Gel 10m Pa | 3 rpm lbs/100ft² | HPHT FL ml/s | CaCl2 kg/m³ | OW-ratio | ES mV | Ex. Lime kg/m³ | LGS kg/m³ | Sand % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 845 | | | | | | | | | | | | | |
| | 1.10 - 1.15 | 8-13 | alap | 3 - 10 | < 20 | 7-11 | < 3 | 120-180 | 80/20-85/15 | > 500 | 5-10 | < 170 | < 1 |

2296

COMMENTS:Make up a pill of 10 m3 with 100 kg/m3 Optiseal IV LCM pill for preparetion for the ETLOT. Displace to 1.10 sg OBM while drilling out cement and shoetrack and perform ELOT.
Run finest possible shaker screens and optimize solids removal equipment at all time in order to reduce dilutiuon volume. Maintain low end rheology in the higher end of the recommended range to ensure good hole cleaning. Monitor and evaluate cuttings quality regarding condition, texture and amount.On OMV request start adding 15 kg/m3 fiber and maintain concentration true the predicted faults due to high risk of losses. Have a density vs temperature plot available in the pump room at all times. The reference temperature is selected to be 20°C.
**In case of total lossed - follow Drilchem lost circulation procedure or consider to use M-I SWACO lost circ procedure.**
Drilling fluid containing fibers can not be backloaded to shore for re usage unless fibers are screened out.
**SEE DETAILED PROCEDURES IN THE M-I NORWAY OPERATIONAL PROCEDURE MANUAL.**

Length: 1451

**PRODUCT USAGE** — Conc. (unit/m³)

| TYPE | Unit | New | Maint | Tot Unit |
|---|---|---|---|---|
| EDC 99 | m³ | 0.720 | | 80 |
| Freshwater | m³ | 0.1 | | 10 |
| One-Mul | ltr | 20.0 | 2 | 2 330 |
| VG-Plus | kg | 34.0 | 3 | 3 960 |
| Lime | kg | 20.0 | 2 | 2 330 |
| EMI 1824 | kg | 10.0 | 5 | 1 170 |
| CaCl2 90-95% Powder | kg | 54.200 | 5 | 6 320 |
| Barite | t | 0.2 | | 20 |
| CaCO3 M VK 150 | kg | 80.000 | | 9 320 |
| | | | | |
| Frac seal | | | 5000 | 5 000 |
| | | | | |
| Volume exported | m³ | | | 268 |
| Volume imported | m³ | | | 341 |
| Total section cost | | | NOK | |

**VOLUMES**

| | m³ |
|---|---|
| SURFACE VOL: | 150 |
| RISER VOL: | 80 |
| CASING VOL: | 15 |
| LOST IN HOLE/BEHIND CSG: | 30 |
| OPEN HOLE: | 53 |
| TOTAL HOLE VOL: | 148 |
| DILUTION VOL: | 159 |
| **TOT. VOL. REQ.** | **458** |
| RECEIVED VOL: | 341 |
| **NEW MUD VOL:** | **117** |
| MUD LEFT VOL: | |
| TRANSFERED OUT: | **268** |
| ANGLE, deg: | **90** |
| | |
| Cost/meter | |

## Completion Section FLUIDS: LSOBM

| Depth | MW | YP | PV | Gel 10s | Gel 10m | 3 rpm | HPHT FL | CaCl2 | OW- | ES | Ex. Lime | LGS | Sand |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**PRODUCT USAGE** — Conc. (unit/m³)

| TYPE | Unit | New | Maint | Tot Unit |
|---|---|---|---|---|

**VOLUMES**

| | m³ |
|---|---|





8.5 Drilling Fluid Program

OMV

# 8.6 Cement Program

**Customer:** OMV
**Well:** Wisting Central II
**Data:** 10-Dec-15 V6

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Cement Job:** | **36 x 30" Conductor** | **20" Casing** | **13 3/8" Casing** | **9 5/8" Casing** | **7 inch Liner** | **PnA Plug** |
| | | | **(contingency)** | | | | **(Contingency)** | |
| | | **Slurry Design:** | **Conventional Class G** | **Conventional Class G** | **Gas tight Class G** | **Gas tight Class G** | **Gas tight Class G** | **Gas tight Class G** |
| Well Data | Depth | MD, m | 485 | 505 | 708 | 845 | 1.345 | 700 |
| | Depth | TVD, m | 495 | 505 | 681 | 725 | 721 | 676 |
| | TOC | MD, m | 442 | 442 | 508 | 658 | 795 | 500 |
| | Hole Size | inch | 42 x 36 | 26 | 17,5 | 12 1/4 | 8 1/2 | N/A |
| | BHST / BHCT | deg C | 4 / 18 | 5 / 16 | 15 / 20 | 15 / 20 | 18 / 20 | 15 / 20 |
| | Mud Weight / Type | SG | Sea water | Sea water/ Hi-vis pills | OBM / 1.20 | OBM/ 1.20 | OBM / 1.17 | OBM/ 1.20 |
| | Shoe Track | m | 5 | 10 | 25 | 25 | 25 | N/A |
| Spacer | Type: | | Sea water | Fresh water | MUDPUSH II | MUDPUSH II | MUDPUSH II | MUDPUSH II |
| | Density: | SG | 1,03 | 1,00 | 1,50 | 1,40 | 1,50 | 1,50 |
| | Volume: | m³ | 15,00 | 15,00 | 10,00 | 10,00 | 8,00 | 10,00 |
| | B174 | kg/m³ | | | 3,50 | 3,50 | 3,50 | 3,50 |
| | B213 | ltr/m³ | | | 8,00 | 8,00 | 8,00 | 8,00 |
| | B411 | ltr/m³ | | | 2,00 | 2,00 | 2,00 | 2,00 |
| | U066 | ltr/m³ | | | 40,00 | 40,00 | 40,00 | 40,00 |
| | B323 | ltr/m³ | | | 35,00 | 35,00 | 35,00 | 35,00 |
| | D031 | kg/m³ | | | 660,50 | 660,50 | 660,50 | 660,50 |
| **Cement design** | **Cement type** | | **Norcem Class G** | **Norcem Class G** | **Norcem Class G** | **Norcem Class G** | **Norcem Class G** | **Norcem Class G** |
| | Total Cement | MT | 49,00 | 24,40 | 26,00 | 9,30 | 9,20 | 20,90 |
| | Freshwater | ltr/tonne | | | 345,00 | 336,00 | 336,00 | 345,00 |
| | Seawater | ltr/tonne | 437,00 | 437,00 | | | | |
| | B018 | ltr/tonne | | | 100,00 | 100,00 | 100,00 | 100,00 |
| | B165 | ltr/tonne | | | | | | |
| | B213 | ltr/tonne | | | 20,00 | 20,00 | 20,00 | 20,00 |
| | B411 | ltr/tonne | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 |
| | D075 | ltr/tonne | | | | | | |
| | D077 | ltr/tonne | 20,00 | 20,00 | 10,00 | 10,00 | 10,00 | 10,00 |
| | D081 | ltr/tonne | | | | 5,00 | 5,00 | |
| | D095 | kg/m3 | | | | | | |
| | D153 | %BWOB | | | | | | |
| | D193 | ltr/tonne | | | 25,00 | 30,00 | 30,00 | 25,00 |
| | Yield | ltr/tonne | 770,00 | 770,00 | 814,00 | 815,00 | 815,00 | 814,00 |
| | **Density:** | **SG** | **1,92** | **1,92** | **1,90** | **1,90** | **1,90** | **1,90** |
| Data | Thickening Time (70 BC) | hrs | 4-5 | 4-5 | 4-5 | 4-4.5 | 5-6 | 5-6 |
| | API Free Water | % | 0 | 0 | 0 | 0 | 0 | 0 |
| | API Fluid Loss | cc/30 min | N/A | <50 | <50 | <50 | <50 | <50 |
| | Compressive strength for WOC | psi | >500 | >500 | >500 | >500 | >500 | >500 |
| Cement Slurry | Volume including excess | m³ | 37,7 | 18,8 | 21,2 | 7,6 | 7,5 | 17,0 |
| | OH Annular Excess Cement used in Volume Calculation | % | 300 | 150 | 50 (to be evaluated) | 30 (to be evaluated) | 10 | 20% excess for cement volume |
| Cementing equipment to be used | | | Sponge balls | Float equipment, Centralizers, Sponge balls | Float equipment, Centralizers, DSEH package, Sponge balls | Float equipment, Centralizers, DSEH package, Sponge balls | Rigid Centralizers (Spirolizers), Sponge balls | Sponge balls |
| Comments | | | Inner string cementing. For volume calculation: 42" OH at 442-450 m; 36" OH at 450-495 m | Inner string cementing. If the gas zone penetrated, then gas-tight slurry will be used. | TOC must be below 20" shoe. Losses are expected at the previous casing shoe. Cement (volume of the cement line as a minimum) to be pumped on top of the top plug. | Low rheology of fluids is a key. Losses are expected. Cement (volume of the cement line as a minimum) to be pumped on top of the top plug. | Additional volume of cement may be required and circulated out after disconnection of the running tool. | Plug to be set on top of the Bridge Plug. Cement excess to be evaluated based on the PlugAdvisor simulations. |

General comments:
Depends on the batch of Norcem G cement sea or fresh water will be used for the cement systems.
Concentration of viscosifier B174 for the spacer systems will be optimized based on the final mud rheology
If losses anticipated, D095 (LCM) can be added to cement @ 3-5 kg/m3.
D075 may be required as a gel breaker for the cement slurries
Both Accelerator and Retarder are included to the cement recipes for 9 5/8" casing and 7" Liner.
Displacement to start with the spacer (mud line volume) if severe mud/cement incompatibility is observed

Figure 8.6 Cement Program Summary for Wisting Central II

# 8.7 Drilling Unit Specifications

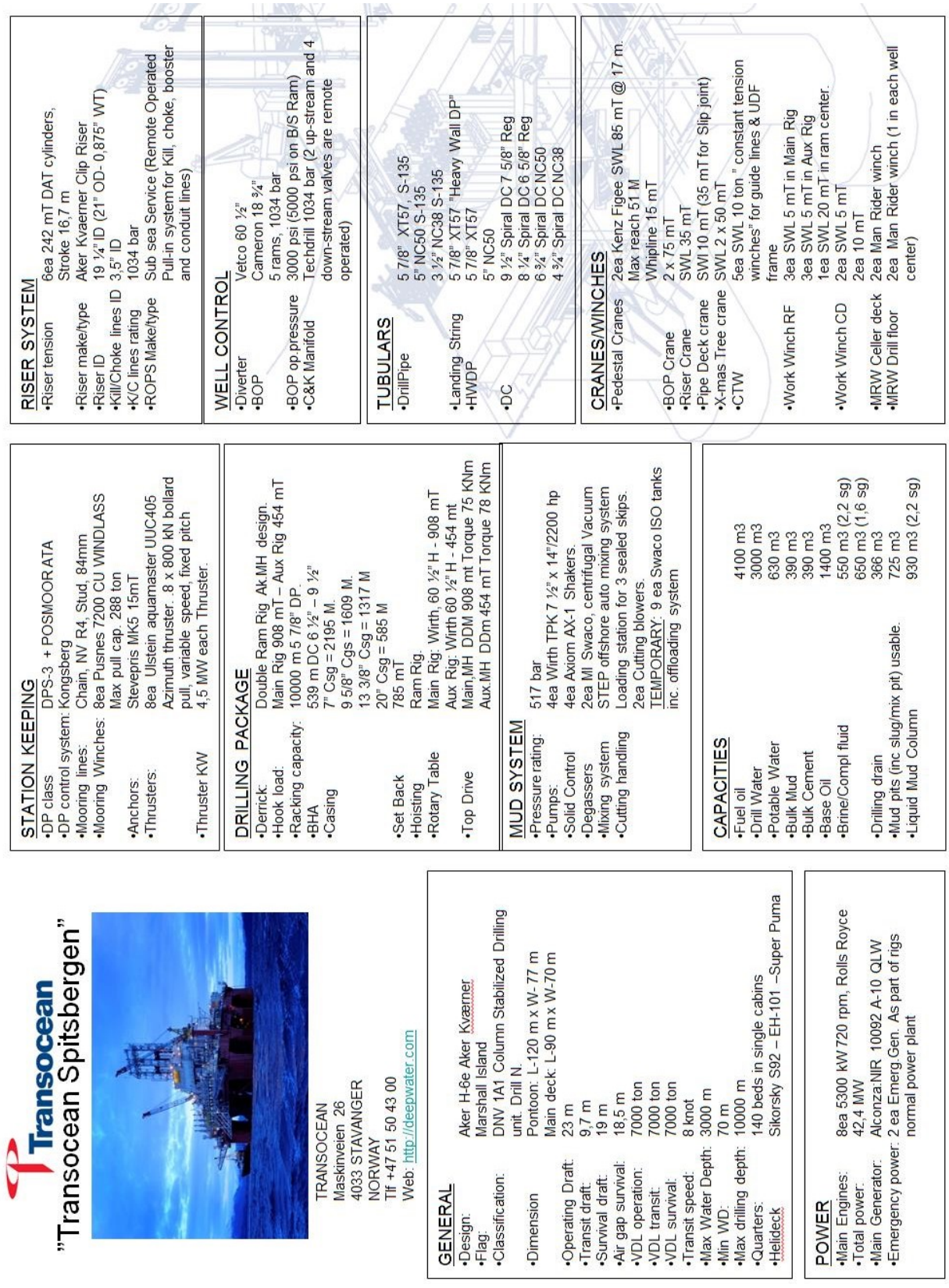


Figure 8.7 Drilling Unit Specifications - Transocean Spitsbergen

# 8.8 Well Control Equipment Drawings

## 8.8.1 BOP

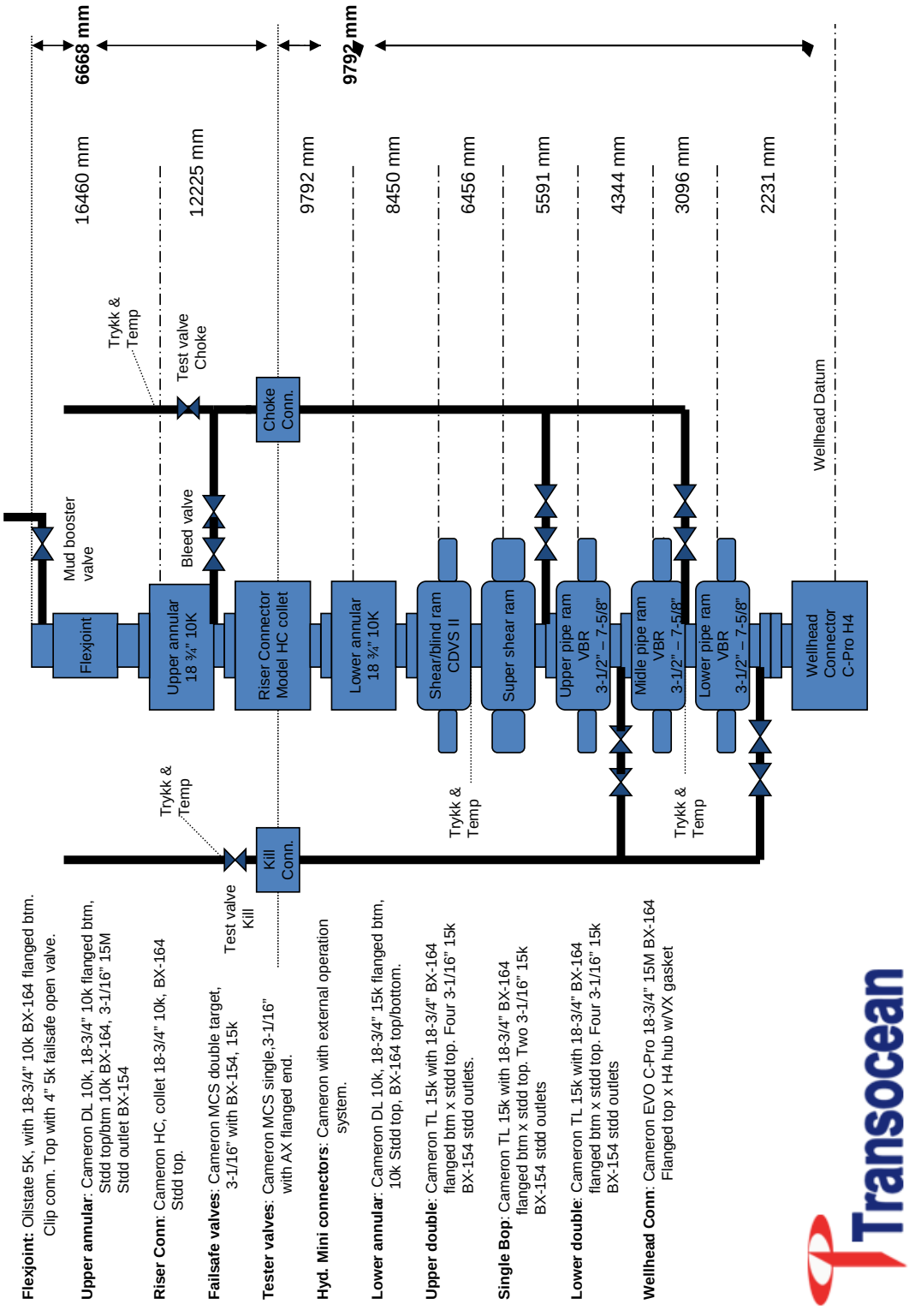


Figure 8.8 BOP Configuration Transocean Spitsbergen

## 8.8.2 Choke Manifold

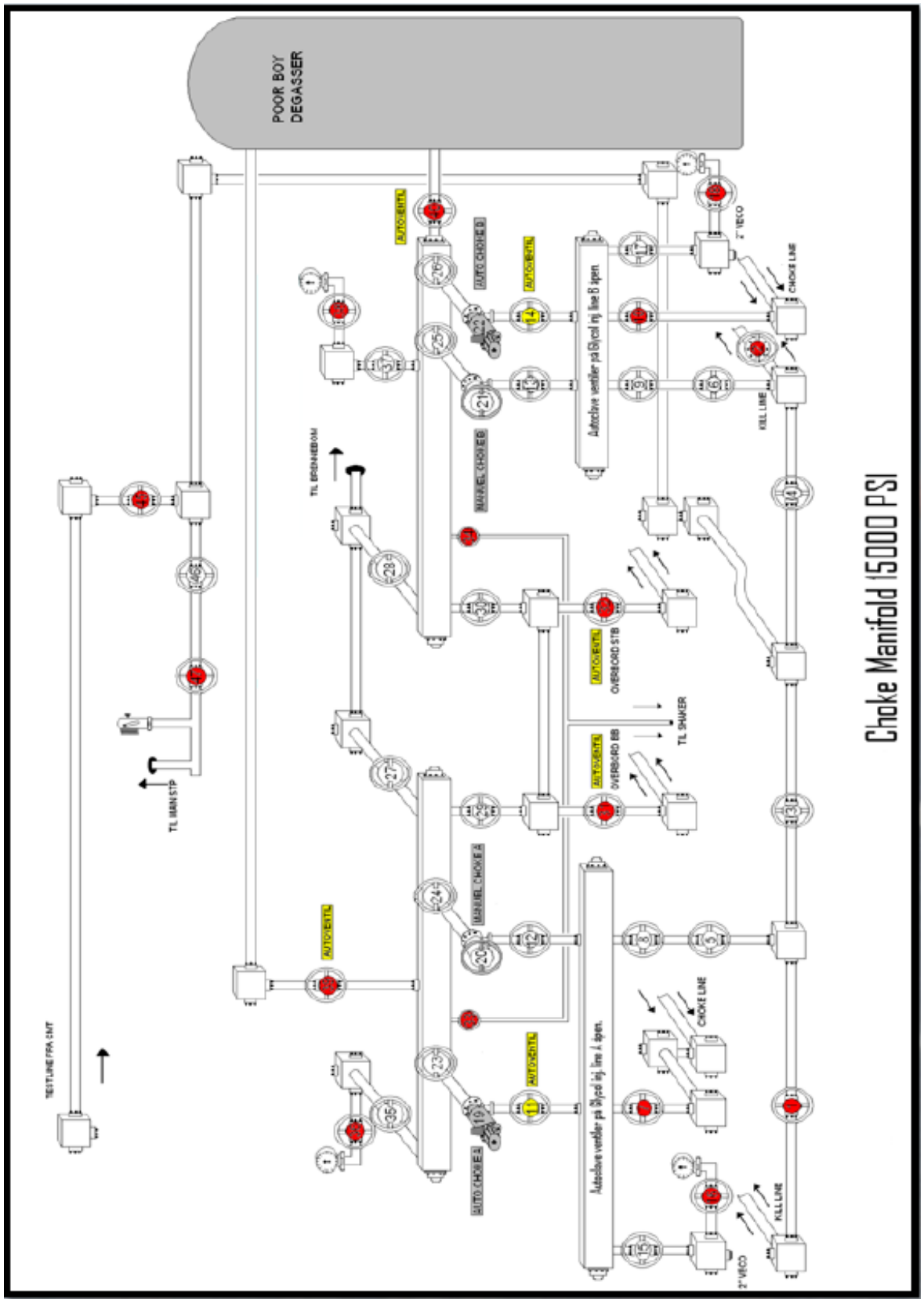


Figure 8.9 Choke Manifold TO Spitsbergen

**OMV (Norge) AS**
**Fjordpiren, Laberget 22**
**P.O Box 130**
**NO-4065 Stavanger**
**Norge**