End of well report HAG GT 01

Operator	**:**	**Aardwarmte Den Haag**
Prepared by	**:**	**R. te Gussinklo Ohmann**
Approved by	**:**	**R. Woudstra**
Date	**:**	**11th of Februari 2011**
Status	**:**	**Draft**

NDDC
Northern Dutch Drilling Company

WPMI
Well Project Management International

Content

Summary

Well Details
The rigging up started in the first week of July, 2010
Drilling operations started on July 16th 2010 and the operations, including the production test were finalized on September 23rd 2010.

Well	:	Geothermal Well HAG GT01
Exploration Licence	:	The Hague Geothermal
Acronym	:	HAG GT 01
Well Type	:	Deviated water production well
Operator	:	Aardwarmte Den Haag VOF
Surface coordinates	:	x= 78210.955 m; y = 452500.55 m z = 0,23 m above NAP
Target	:	Delft Sand
Total depth :		2298 m tv

Time Details

Planned (10-7-2010)	:	38 days
Actual days	:	70 days

HSE performance
Good safety performance. The project was completed without any LTI´s and RWC´s.

Main contractors:

Activity	Contractor
Top hole drilling	Grondboorbedrijf Haitjema b.v. Dedemsvaart, NL
Drilling contractor	NDDC, Drachten, NL
Directional drilling company	Halliburton B.V., Rijswijk, NL
Mud company	SCOMI, Aberdeen, Scotland
Mud logging	Petrolog, Amsterdam NL
Cementing	Schlumberger Offshore Services Ltd., Coevorden, NL
Casing running & drill pipe	Odfjell Well Services Europe, Coevorden, NL
Waste & cutting disposal	REYM, Beverwijk, NL
ESP supplier	BAKER HUGHES Centrilift, Velsen-Noord, NL
Mobilisation	Mammoet, Schiedam, NL

HAG GT 01

1.1 Introduction

Geothermal well HAG GT-1 was drilled from an onshore surface location at the Leyweg in the city of The Hague using the NDDC Huisman LOC 400 rig. It is intended to develop the water bearing Delft sand formation, located in the "The Hague Geothermal" exploration license area. The well has reached TD at an along hole depth of 2694 m (2298 m TVD) with a step-out of ca 1 km approx. to an azimuth of N84E degrees. The well is completed with 4,5" WWS and will be equipped with an ESP. The ESP will be installed in a later stage due to late delivery of the ESP.

Well Details

Well	:	Geothermal Well HAG GT01
Exploration Licence	:	The Hague Geothermal
Acronym	:	HAG GT 01
Municipality	:	The Hague
Well Type	:	Deviated water production well
Operator	:	Aardwarmte Den Haag VOF
Surface coordinates	:	x= 78210.955 m; y = 452500.55 m z = 0,23 m above NAP
Target	:	Delft Sand
Total depth :		2298 m tv (see the well diagrams for more details.)
Drilling contractor	:	NDDC (Northern Dutch Drilling Company).
Drilling rig	:	Huisman LOC 400

Time Details

Planned (10-7-2010)	:	38 days
Actual days	:	70 days

Content appendices

Appendix 1	:	Detailed drilling program
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Appendix 7	:	Pipe tallies
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1.2 12 ¼" hole and 10 ¾" casing

Time details

Planned (10-7-2010)	:	151 hours
Actual hours	:	288 hours
Of which hours NPT	:	10,75 hours

Highlights

- No shallow gas found
- Directionally the target was achieved.
- No problems running the casing.
- Good FIT to 1.4sg EMW
- No mud losses experienced while drilling through chalk
- Good results from Floc Unit and centrifuge at controlling fines and MBT.

Lowlights

- Reaming took longer than was planned
- Some CO2 contamination experienced which lowered pH
- Cement to surface, then cement dropped and multiple top fills were performed to get cement to surface again.

Lessoned learned

- Weld the HGT-01 bottom flange (now cut off) on the flow riser for connection to the next well
- Prior to running the 10 ¾" casing remove the riser and cut off the 13 3/8" stove pipe.
- Cement job with returns to cellar, have 2 cellar pumps on line.
- Make 1" top fill hard line; current system with fire hose works but could be made user friendly
- Pre-make up all equipment as much as possible.
- Reamer BHA was done, but not the 7" shoe track.
- Leave sufficient stick up when running first 15 joints of casing to enable use of belt tongs when making up casing with casing drive. After this there should be sufficient weight of string to prevent rotation. Be aware of stick up and potential collision with "incoming" casing joint.

1.3 8 ½" hole and 7" liner

Time details

Planned (10-7-2010)	:	322 hours
Actual hours	:	888 hours
Of which hours NPT	:	63,5 hours

Highlights

- Mud kept the hole in good condition for much extend period
- No MWD failures
- Directionally the target was achieved, no time lost going for the "Bulls eye".
- Cement job performed as programmed , full returns.

Lowlights

- Low ROP
- Experienced bit balling, resulting in several trips
- Large wash outs due to slow drilling, long open hole time.
- Fishing for to retrieve loss of cone downhole
- Unable to get liner past 2300 m MD in first attempt, had to pull liner and perform wiper trip
- Unable to pass 2470 on second liner run, had to set liner higher than planned.
- Trip required due to scheduled BOP test

Lessons learned

- Drill 8 1/2" BU and tangent section in one PDC
- Shaker counterweights suited for 50 Hz to be fitted.
- Start the section with mud KCl contents at 150 g/l
- Run more aggressive PDC bit. For GT-02 it is recommended to run an aggressive 4 or 5 bladed PDC bit with min. 16 mm cutters. The cutters must stand out.

1.4 6" Hole and 4 ½"liner WWS

Time details

Planned (10-7-2010)	:	175,5 hours
Actual hours	:	336 hours
Of which hours NPT	:	62,5 hours

Highlights

- Drilled to section TD at controlled ROP.
- Acidizing and cleaning of the screens and formation went well.
- Liner was drilled in due to instable formation

Lowlights

- Coal layer reacted with the acid which resulted in H2S gas
- Brussels sands was not capable to handle initial mud weight
- Long time taken to drill out plugs and shoe track some doubt over accuracy of displayed top drive torque.
- Problems experienced transferring mud to silos during displacement to drill in fluid.
- Difficulty cleaning out pocket below 7" liner.
- Difficulty pulling out and running back through 6" hole section after reaching TD
- Time taken to ream liner to TD.
- Problems displacing well to completion brine, time taken equalising string and annulus pressure

Lessons learned

- Have check list for required rig equipment when using 3 1/2" drill pipe. No jaws for Roger tong on site; had to make up pipe with rig tongs.
- Have lifting plan and equipment well planned in advance with good handovers. Large Odfjell BXS elevators not suited to running 4 1/2" tubing.
- While drilling plugs run centrifuge to reduce circulating mud density prior to displacing to lighter drill in fluid
- The Roodenrijs formation should be drilled with a lower mud weight to over come hole stability problems while drilling the Brussels sand formation

1.5 Production test

Time details

Planned (10-7-2010) : 74 hours
Actual hours : 168 hours

Highlights

- Formation water temperature and flow rate was high enough
- Logistics worked out fine
- Test was executed with ESP and plug, securing continuers well control

Lowlights

- H2S and natural gas encountered while producing
- Not all certificates of used equipment was on site

Lessons learned

- Proactive gas detection and precautions available on site
- Flow meters should be able to deal with gas
- Long lead time in decision making about the test procedure

Appendix 1, Detailed drilling program

Geothermal Wells The Hague South West

Detailed Drilling Guidelines Well GT-01

Operator

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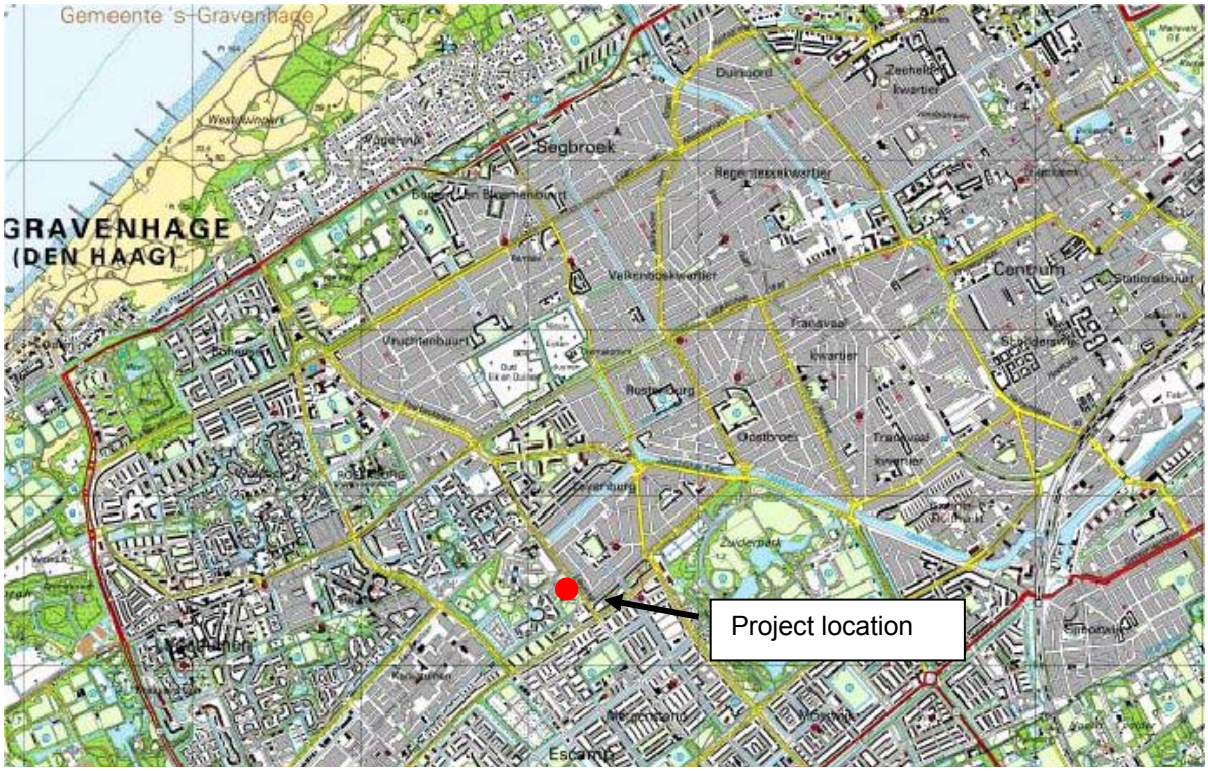
Detailed Drilling Guidelines for the drilling of Geothermal Production Well HAG GT-01

Version 4, 5th of August 2010

Prepared by: WPMI / NDDC
Approved:
Publication date: 05-08-2010

0. Introduction

Geothermal well HAG GT-1 will be drilled from an onshore surface location at the Leyweg in the city of The Hague using the NDDC LOC 400 rig. It is intended to develop the water bearing Delft sand formation, located in the “The Hague Geothermal” exploration license area. The well is supposed to reach TD at an along hole depth of 2675 m (2305 m TVD) with a step-out of ca 1 km approx. to an azimuth of N84E degrees. The well is planned to be completed with 5” WWS and will be equipped with an ESP. The ESP will be installed in a later stage due to late delivery of the ESP.



The design of the well is based on geological studies by TNO and Geowulf Consultants and on a study of nearby hydrocarbon exploration and production wells. The turn-key drilling contract is awarded to WPMI by ADH (Aardwarmte Den Haag).

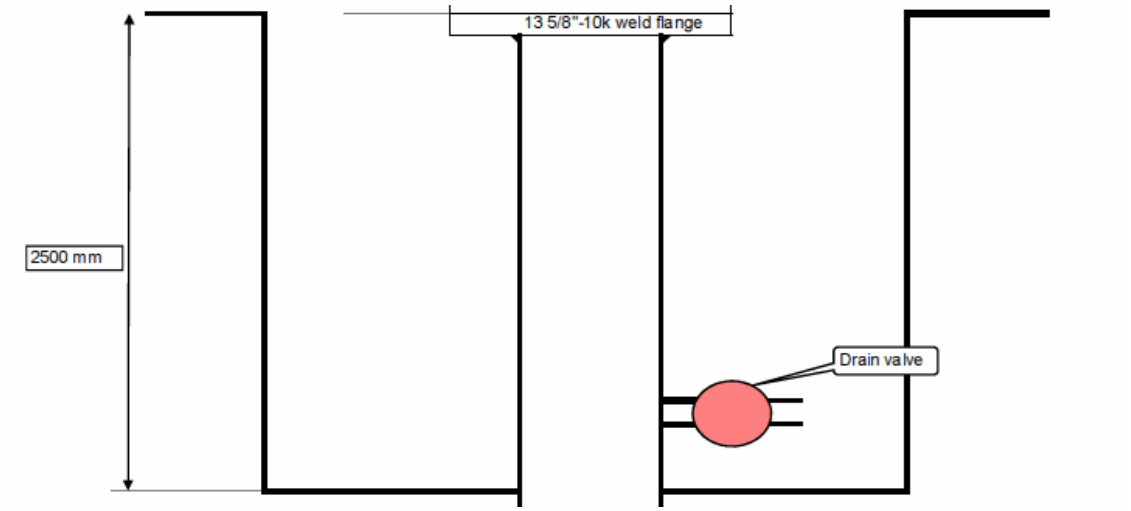
Detailed Drilling Guidelines

1. Cellar and Conductor

The well has a pre-installed and cemented 13 ⅜" – 54.5# conductor with the shoe set at 250 m.

Prior to arrival of the rig:

- A 13 5/8"- 10k welded flange will be installed on the 13 3/8" casing at top cellar level.
- The welded flange on both conductors will be covered with a solid plate to prevent foreign objects falling into the conductor.
- Both cellars will be covered or fenced off properly in order to prevent people falling into it.
- A 3" drain valve with a pressure rating of at least 25 bar will be welded to the conductor at approximately 25 cm above the cellar bottom.



2. BOP installation

2.1 Summary

The BOP stack will be installed onto the 13 5/8"-10k welded flange and will function as a diverter only. For further details see well control section: 3.2.

2.2. Sequence of operations

1. Install 13 5/8" BOP-stack on 13 5/8"- 10k flange
2. Function test all BOP functions
3. Pressure test the BOP with the shear rams to 20 bar / 10 min against the cement in the conductor shoe.

3. Drilling 14" Hole 250 – 1250 m

3.1 Summary

5. This section will be drilled vertically to the KOP at 700 m and then directionally drilled to an inclination of 39º at 1200m. Casing depth is planned at 1250 m.
6. The section is expected to be water bearing, based on evidence of nearby HAG-01. The 10 ¾" casing is positioned above the point of reported shows. However if gas readings and/or fluorescence on cuttings indicate the presence of hydrocarbons, the matter must be discussed without delay with the Operator Representative.
7. In view of the narrow clearance between 12 ¼" hole and the 10 ¾" VAMTOP casing. (Collar OD =11 ½") the hole will be opened up to 14". This will be done in a separate hole opening run after casing depth has been reached.

3.2. Well Control

Because the presence of hydrocarbons, although very unlikely, could not be completely excluded, the following shallow gas measures are being taken to safely control the well:

1. The 14" section will be drilled with 1.20 sg mud weight which represents an overbalance of 0.20 sg on the expected formation pressure.
2. Extra awareness, training and diverter drills are being conducted.
3. Alarm settings will be set low.
4. The drill string will be pumped out of the hole with sufficient flowrate vs pulling speed.
5. BOP-stack (13 5/8") will be installed for the 14" hole section.

The BOP-stack will only serve as a diverter and cannot be used to hold pressure due to the shallow setting and the weak shoe strength of the conductor.
The set-up of the choke manifold will be different from the normal set-up. Both chokes will be open and the choke manifold valves to the poor-boy degasser will be open to provide an unrestricted flow path in the event that shallow gas will be encountered. Only the hydraulic choke valve on the BOP-stack will be closed during drilling.

In case of an influx from the well the following procedure will be followed:

Diverter Drill

1. Reduce the pump rate to 1000 ltr/min
2. Open the hydraulic choke valve
3. Close the annular preventer
4. Continue circulating until all gas has been removed from the well.
5. Mudweight must be increased if gasreadings stay at an unacceptable high level.

3.3. BHA

The following directional drilling BHA will be used to drill the 12 ¼" section

12 ¼" Bit

8" Mudmotor type: Lobe 6/7

Float sub

11 3/4" String Stab

8" MWD-GR

12" String Stab

2 x 8" DC

X-over

2 x 6 1/2" DC

7 x 5" HWDP

Jar

22 x 5" HWDP

After reaching TD the hole will be enlarged to 14 " with the following hole opening BHA:

8" Bull nose

12" Stab

8" Pony DC

14" Hole opener / near bit reamer

Floatsub

1 x 8" DC

12 1/4 " Stab

1 x 8" DC

X-over

2 x 6 1/2" DC

7 x 5" HWDP

Jar

22 x 5" HWDP

Fishing equipment for all BHA components shall be available on the rig or shall be able to be called out at short notice.

3.4. Bits

The primary choice is an insert bit IADC type 4-1-7. An IADC type 1-1-5 or 1-1-7 rockbit needs to be on the location as back-up.

Nozzle sizes will be 4 x 20/32" or a TFA of 1.25 square inches.

3.5. Drilling Parameters

The first 20 m below the conductor shoe will be drilled with a maximum flowrate of 2000 ltr/min to avoid creating a large wash-out below the 13 3/8" shoe.

The ROP is not to exceed 25 m/hr to ensure good hole cleaning and to reduce the chances of clay balls and losses due to an overloaded annulus.

Target Drilling Parameters
Flow: 2800 ltr/min
RPM: 70
WOB: 5 - 15 MT

Target Hole Opening Parameters
Flow: 2800 ltr/min
RPM: 100
WOB: 5 MT

All three rig pumps will be fitted with 6" liners.

3.6. Mud

A water based mud will be used in this section.

Type: KCl – polymer – PHPA MW: ~ 1.20 g/cm^3

The section will be drilled vertically from 250 m to the kick off point at 700 m, then deviated to 39° by 1200 m measured depth and finished off tangential to 10 ¾" casing TD at 1250 m.

Shales in this section are expected to be water sensitive and prone to dispersion. The selected drilling fluid takes account of these aspects as well as ensuring adequate fluid loss control to firm up the filter cake to allow hydrostatic pressure on the newly drilled hole wall. Thin firm filter cake helps to avoid differential sticking which is a significant risk in this interval, particularly when sliding while building angle.

The use of starch, cellulosic and acrylamide polymers will provide sufficient lubricity in the build up and tangential sections.
Shale deterioration is a time sensitive process, and therefore the time spent drilling and casing this section should be kept as short as possible, keeping in mind effective hole cleaning and cuttings removal at the shakers.

Mud losses may occur in the chalk section from 450 to 800 m. Mud weight should be kept as low as possible and LCM material will be available at the rig-site. In this regard it is to be noted that the prognosed pore pressures is 1.0 kg/l equivalent. There will be a significant overbalance and losses

are likely. If pit space allows, it is advisable to have an 8 m3 LCM pill ready mixed such that losses can be responded to immediately.

14” Hole Drilling fluid properties

Parameter	Value
Fluid Type:	HYDRO-FOIL, i.e. KCl / Polymer / PHPA
Density	1.2 to 1.30 kg/L at 20 °C
Plastic Viscosity:	As low as possible
Yield Point:	20 to 25 lb/100 ft^2 at 48.9 °C
Shear Stress at 6 and 3 rpm	circa 8 and 7 at 48.9 °C
API Fluid Loss	<5 mL
KCL Concentration	2.9% by weight (28.57 g/L)
Chloride Concentration	54,000 mg/L
pH	9.5 – 10.0

14” Hole Drilling fluid formulation

Density (kg/L) =	**1.250**	**Concentration per Unit Volume**			
Component	**Function**	**1 bbl**	**Unit**	**1 m3**	**Unit**
KCl Brine 80 ppb, 9.420 ppg (1.1308 sg)	Cation exchange and hydration suppression	0.1283	bbl	0.1283	m^3
		50.76	lb	145.0	kg
NaCl Brine 110.8 ppb, 10.00 ppg (1.2004 sg)	Density and hydration suppression	0.2438	bbl	0.2438	m^3
		102.4	lb	292.6	kg
Flowzan	Viscosifier	1.2	lb	3.429	kg
Beta DS FR	Filtration controller	2	lb	5.714	kg
Beta Pac PLE	Filtration controller / encapsulator	2	lb	5.714	kg
HYDRO-CAP XP	Shale encapsulator	0.75	lb	2.143	kg
Caustic Soda	pH control	0.25	lb	0.714	kg
Cumulus CPG	Shale hydration inhibitor	10.71	lb	30.60	kg
		4.77	L	30.00	L
Ground Dolomite	Densifier	96.14	lb	274.70	kg
Fresh Water	Base fluid	0.490	bbl	490.2	L

3.7. Formation Evaluation

GR logs will be provided by the MWD-GR.

No wireline logging is foreseen in this section. However if gas shows or cuttings fluorescence is observed in this hole section, the Operator may elect to run logs. The contractor is to be prepared to call off logging for neutron density/resistivity/GR and sonic/GR without delay upon reaching casing point.

Mudlogging services including gas detection will be carried out by Petrolog. 2 sets of cutting samples will be taken and described every 10 m in the 14" section.

3.8. Sequence of operations

1. Make up directional BHA as per Dir Co's directional driller's instruction
2. Perform surface test on mudmotor and MWD
3. RIH with BHA to 200 m
4. Perform a diverter drill.
5. Drill out the shoe track. Take care not to unscrew the shoe track. WOB: max 5 MT. Set topdrive torque setting below 10.000 Nm.
6. Start drilling the vertical section. Use a low flowrate of 2000 l/min until 20 m below the conductor shoe. Then bring up the pumps to the target flowrate of 2800 ltr/min. Nudge away lightly in 84.1º direction with a maximum inclination of 2º. This to avoid collision between HGT-1 and HGT-2.
7. At 700 m commence the kick-off as per directional plan and directional driller's instruction. A build-up with a dogleg severity of 0.8º/10 m is planned. Avoid doglegs above 1.2º/10 m.
8. Continue building angle until 39º inclination has been reached at 1200 m in 84.1º direction.
9. The last 50 meters to section TD at 1250 m will be drilled tangentially.
10. Circulate the hole clean with a 5 m3 high-vis pill. Circulate at 2800 ltr/min and minimal 2 times bottoms up and continue circulating if the shale shakers are not clean. Note the number of total number of strokes for the Hi-vis pill to reach the shale shakers.
11. Pump out of hole to the conductor shoe. Flow: 2000 l/min. Do not rotate unless hole conditions dictate.
12. Lay down drilling BHA and make up hole opening BHA.
13. RIH with the hole opener just below the conductor shoe.
14. Open up the hole to 14" using the target parameters for hole opening. Use 2000 ltr/min flow rate until 20 m below the conductor shoe.
15. At 1250 m circulate the hole clean with a 10 m3 high-vis pill. Circulate at 2800 ltr/min and minimal 2 times bottoms up and continue circulating if the shale shakers are not clean. Note the number of total number of strokes for the Hi-vis pill to reach the shale shakers. This will be a great help in calculating the amount of excess cement required for the 10 ¾" casing.
16. Pump out of hole to the conductor shoe. Flow: 1500 l/min. Do not rotate unless hole conditions dictate.
17. Lay down reaming BHA.

8. Run and cement 10 ¾" casing

4.1. Summary

1. The section will be cased off with 10 ¾" casing. The casing will be cemented with lightweight lead cement and high strength tail cement.
2. Prepare in the shop one 10 3/4" joint with cementing shoe, one joint with float collar and one plain joint. All connections to be made up with Bakerlock.
3. A slip-on casing head housing will be installed on the 10 ¾" casing and the BOP's will be rigged up for safe drilling of the 8 ½" section.

4.2. Casing type

The 10 ¾" casing will consist mainly of 45.5# - VM110 – VAMTOP casing. The shoetrack will be made up of 10 ¾" -51# - K55 - VAMTOP casing.

The 10 ¾" casing will cover the build-up section up to 1200m TVD and the shoe will be set in the tangent section at 1245 m.

M/U Torque: 10 ¾" – 45.5# - VM110 – VAMTOP:	Min: 11.700 ftlbs = 16.100 Nm Opt: 13.000 ftlbs = 18.000 Nm Max:14:300 ftlbs = 19.700 Nm

M/U Torque: 10 ¾" – 51# - K55 – VAMTOP:	Min: 11.100 ftlbs = 15.300 Nm Opt: 12.300 ftlbs = 17.000 Nm Max:13:500 ftlbs = 18.600 Nm

4.3. Casing configuration.

A 2-joint shoe track is planned:

- Shoe joint Float shoe pre-made up on a baker locked joint
- Baker locked joint
- Float collar joint Float collar pre-made up on a baker locked joint
- +/- 1200 m 10 ¾" – 45.5# - VM110 – VAMTOP casing

Shoe track connections must be baker locked up to and including the box of the float collar joint

It is extremely important that there is no casing collar at the wellhead area when the casing is landed. The slip-on casing head housing will be placed +/- 0,3 m above the cellar bottom and the housing can only slip over plain 10 ¾" pipe. So space out such that there is no collar situated inside the cellar.

4.4. Centraliser placement

The 10 ¾" casing will be centralised with:

- 1x Bow spring Centraliser / joint over the lower 10 joints
- 1x Bow spring Centraliser / 2 joints in the remainder of the open hole section
- 1x Positive centraliser / 2 joints in the 13 3/8" casing.
- 1x Positive centralizer will be placed 1 mtr below the wellhead.

The centralizers will be placed between the casing collars.

4.5 Cement specifications

For the 10 ¾" casing cementation a Pozzo Cemoil 1.58 SG lead and 1.65 SG tail slurry are selected. These slurries will provide sufficient strength to support the casing.

An excess amount of 25% will be used to ensure that cement returns will be obtained at surface. The narrow clearance between the 10 ¾" casing inside the 13 3/8" casing will make a top fill job difficult.

The WPMI supervisor and the cementing supervisor will witness the correct loading of the plugs into the cement head.

All calculations must be checked on the well site, when actual depths and sizes are available.

4.6 Sequence of operations

1. Pick up and install 10 ¾" - 45.5# casing drive assembly
   Ensure the casing drive assy is suitable for running 10 ¾" – 51# shoetrack
2. Hold a pre-job safety meeting.
3. Make up and bakerlock shoe track. Check float equipment.
4. RIH 10 ¾" - 45,5 # - VM110 - VAMTOP casing to 1245 m.
   Fill up each joint with the casing drive assembly
5. Circulate 120% casing contents.
   Hold a pre-cementing safety meeting during circulation.
6. Rig up cement head with the plugs installed.
7. Pressure test cement lines to 200 bar
8. Pump 10 m³ fresh water spacer
9. Drop bottom plug
10. Pump +/- 50 m³ Lead slurry and 5 m³ Tail slurry
11. Drop Top plug
12. Pump 2 m³ water spacer behind with cement unit
13. Change over to rig pumps
14. Displace cement with +/- 60 m³ mud.
    Do not over displace more than half the shoe track.
15. Bump the plugs and pressure test casing to 100 bar/20 min.
16. Check for back flow
17. Remove cement head
18. Take over the casing weight with the casing drive assembly
19. Remove power slips from rotary table.
20. Drain and flush BOP and riser. Ensure BOP-cavities are flushed with a HP water jet.
21. Wait on cement

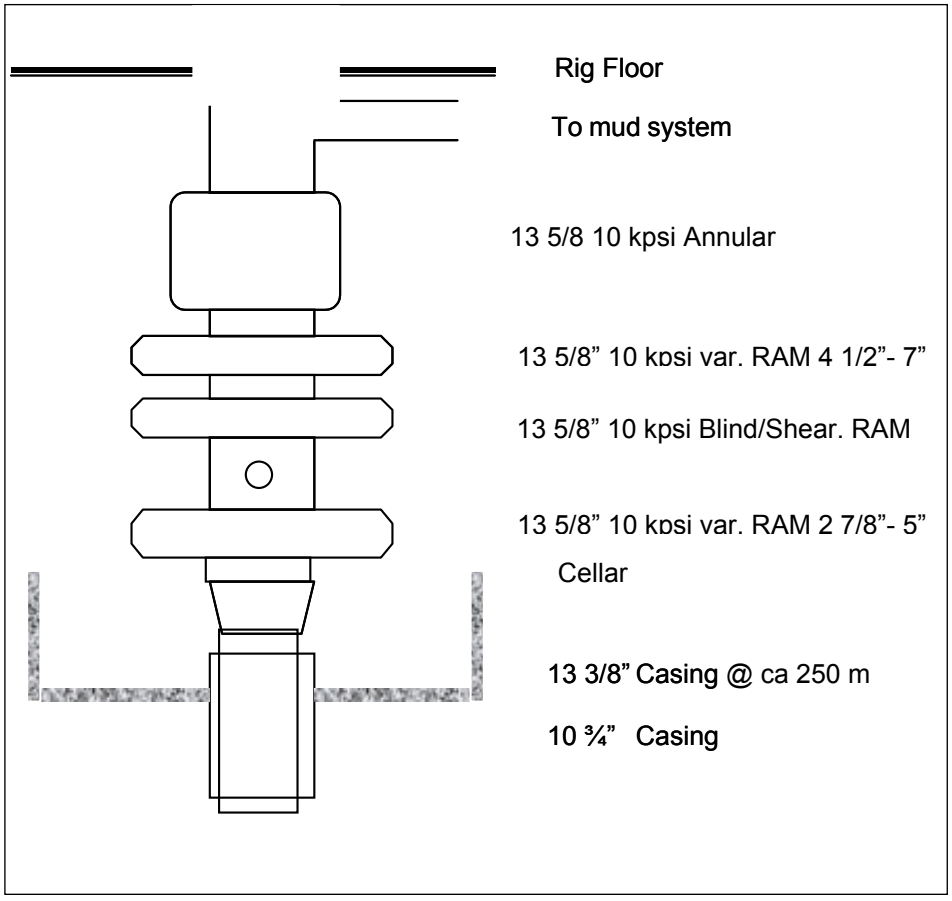
9. Wellhead and BOP stack installation

5.1. Well head

The 10 ¾" casing head housing is provided with a 10 ¾" slip lock bottom and a 13 5/8"-3K top flange and 2x 4 1/16"-3k side outlets. The well head is supplied by Cameron.
One side outlet will be fitted with a blind flange and the other with 2x 4 1/16"-3k valves.

5.2. BOP stack

A 13 3/8" 10k BOP stack will be installed. including shear rams, two variable bore rams and an annular preventer. On top of the casing head housing a 13 5/8"-3K x 13 5/8"-10K cross over spool and a HP riser spool will be installed.



5.3. Sequence of operations

When the surface cement samples are hard:

1. Slack off 10 ¾" casing weight in stages
2. Lift BOP-stack
3. Rough cut 10 ¾" casing and lay out joint.
4. Set BOP-stack aside
5. Cut-off 13 3/8" casing 10 cm above cellar bottom
   Take care not to cut into the 10 ¾" casing when using a cutting torch.
6. Lay out 13 3/8" casing stump
7. Final cut 10 ¾" casing 58 cm above cellar bottom
8. Install casing head housing in accordance with Cameron procedure
9. Pressure test the seals with 125 bar/10 min
10. Install 13 5/8" - 3k X 13 5/8" – 5k DSAF spool
11. Install 13 5/8" – 5k x 10 k X-over spool (length 47 cm)
12. Install 13 5/8" – 10k extension spool (length = 99 cm)
13. Install BOP stack and LP flow riser
14. Lay down casing drive assembly
15. Make up 10 ¾" - 45,5# cup type tester on 5" DP
16. Pressure test BOP stack 25/200 bar 5/10 min.
17. Pressure test topdrive and choke manifold 25/200bar 5/10 min.
18. Pressure test standpipe manifold 25/200 bar
19. Lay out test assembly
20. Run plug tester assy and P/T shear rams to 25/200 bar 5/10 min.
21. Lay out plug tester assembly
22. Install wear bushing

10. Drilling 8 ½" Hole 1250 – 2425 m

6.1. Summary

1. This section will be drilled tangentially to casing point at ca. 2425 m (40 m in Rodenrijs claystone).
2. The section is expected to be predominantly water bearing, based on evidence of nearby HAG-1. However gas readings and/or fluorescence are expected in sandy and silty intervals, almost certainly in the Rijswijk Sand. If gas show or cuttings fluorescence indicate the presence of hydrocarbons, the matter must be discussed without delay with the Operator Representative.
3. The section will be cased off with a 7" liner which will be cemented with a suitable lead cement and high strength tail cement.

6.2. Well control

The section is expected to be predominantly water bearing however gas readings of fluorescence might be seen in the sandy and silty intervals.

1. The 8 ½" section will be drilled with 1.35 sg mud which is 0.35 sg over the predicted pore pressure of 1.00 sg.
2. Kick-drills will be held regularly with different crews and different operating panels.
3. BOP-stack will be installed with 2x Pipe Rams, shear rams and annular preventer.
4. BOP-stack will be pressure tested to 25/200 bar 5/10 min.
5. Intervals between BOP-tests may not exceed 21 days.
6. X-overs to all drill string components to be on the drill floor for quick installation of the TIW valves.
7. Triptank to be used for POH.
8. Flowchecks will be conducted:
    1. Prior to POH.
    2. At the casing shoe.
    3. At the top of the BHA.

6.3. BHA

The following directional drilling BHA will be used to drill the 8 ½" section

8 ½" Bit

6 ¾"" Mudmotor type: ??

8" String Stab

6 1/2" MWD-GR

Float sub

8" String Stab

5x 5" HWDP

6 1/2" Jar

12x 5" HWDP

Fishing equipment for all BHA components shall be available on the rig or shall be able to be called out at short notice.

6.4. Bits

The primary choice is 8 ½" FMX645E PDC bit.

A rockbit needs to be on the location as back-up.

Nozzle sizes still to be determined.

6.5. Drilling Parameters

Target Drilling Parameters
Flow: 2000 ltr/min
RPM: 60 rpm
WOB: 3-6 MT

All three rig pumps will be fitted with 5" liners.

6.6 Mud

A water based mud will be used in this section.

Type: KCl - glycol MW: ~ 1.35 g/cm^3

This section will continue to be directionally drilled at the 39° angle to 40 meters in to the Rodenrijs Claystone (ca. 2425 m MD) above the Delft Sand where the 7" liner will be set.
The drilling fluid carried over from the 14" section will need to deal with possible contamination by green cement while the float collar, casing shoe and rat-hole will be drilled out.
The drilling fluid will then encounter water sensitive Vlieland shales. A glycol will be added to the formulation to compliment the hydrolysed poly-acrylamide in providing stabilization of the shale.

8 ½" Hole Drilling fluid properties

Parameter	Value
Fluid Type:	HYDRO-FOIL GEN 1, i.e. KCl / Glycol system
Density	1.25 – 1.45 kg/L at 20 °C
Plastic Viscosity:	As low as possible
Yield Point:	15 to 18 lb/100 ft^2 at 48.9 °C
Shear Stress at 6 and 3 rpm	circa 6 and 5 at 48.9 °C
API Fluid Loss	<5 mL
KCL Concentration	2.9% by weight (28.57 g/L)
Chloride Concentration	54,000 mg/L
Glycol Concentration	3% by volume
pH	9.5 – 10.0

8 ½" Hole Drilling fluid formulation

Density (kg/L) = 1.350		Concentration per Unit Volume			
Component	**Function**	**1 bbl**	**Unit**	**1 m3**	**Unit**
KCl Brine 80 ppb, 9.420 ppg (1.1308 sg)	Cation exchange and hydration suppression	0.1283	bbl	0.1283	m3
		50.76	lb	145.0	kg
NaCl Brine 110.8 ppb, 10.00 ppg (1.2004 sg)	Density and hydration suppression	0.2438	bbl	0.2438	m^3
		102.4	lb	292.6	kg
Flowzan	Viscosifier	0.80	lb	2.286	kg
Beta DS FR	Filtration controller	2.00	lb	5.714	kg
Beta Pac PLE	Filtration controller / encapsulator	2.00	lb	5.714	kg
HYDRO-CAP XP	Shale encapsulator	0.75	lb	2.143	kg
Caustic Soda	pH control	0.25	lb	0.714	kg
Cumulus CPG	Shale hydration inhibitor	10.71	lb	30.60	kg
		4.77	L	30.00	L
Ground Dolomite	Densifier	150.25	lb	429.3	kg
Fresh Water	Base fluid	0.436	bbl	435.9	L

6.7 Formation Evaluation

GR logs will be provided by the MWD-GR.

No logging is foreseen in this section, except GR-MWD. However if gas shows or cuttings fluorescence is observed in this hole section, the Operator may elect to run logs. The Contractor is to be prepared to call off logging for neutron density/resistivity/GR and sonic/GR without delay upon reaching casing point.

Mudlogging services including gas detection will be carried out by Petrolog. 2 sets of cutting samples will be taken and described every 10 m in the 8 ½" section. The sample interval will be shortened to 2 m to determine the casing setting depth in the Rodenrijs Claystone.

6.8 Sequence of operations

1. Make up directional BHA as per Dir Co's directional driller's instruction
2. Perform surface test on mudmotor and MWD
3. Drill out the shoetrack. Take care not to unscrew the shoetrack. WOB: max 5 MT. Set topdrive torque setting below 6.000 Nm.
4. Circulate hole clean and mud in balance
5. Rig-up lines to drill pipe and annulus. Pressure test lines 100 bar.
6. Perform FIT
7. Drill 8 ½" hole to ca. 2425 m as per directional driller's instruction (40 m into Rodenrijs Claystone).
8. Circulate the hole clean with a 5 m3 high-vis pill. Circulate at 2000 ltr/min and minimal 2 times bottoms up and continue circulating if the shale shakers are not clean. Note the total number of strokes for the Hi-vis pill to reach the shale shakers. This will help in calculating the amount of excess cement required for the 7" liner.
9. A wiper trip may be considered if hole conditions dictate.
10. Pull out of hole. Do not pump / rotate unless hole conditions dictate.
11. Lay down drilling BHA.

11. Run and cement 7” liner

7.1 Summary

1. The need for a scraper run will be evaluated before running the liner.
2. Prepare in the shop one 7” joint with float shoe, one joint with float collar, one joint with landing collar, and one plain joint. All connections to be made up with Bakerlock.
3. The 7” liner is to be cemented with a liner plug type cementation, using drill pipe and liner wiper tandem plugs.
4. Fluid loss controlled lead cement slurry with a slurry density of 1.5 bar/10 m followed by tail cement of min 1.7 bar/10 m is to be used.
5. The 7” liner is to be tested to 100 bar upon bumping the plug.
6. After the cementation, the liner top packer is to be set and the excess cement circulated out. Integrity of the liner top is to be tested with a pressure test of 100 bar.

7.2. Liner type

7” - 23# - K55 – VAGT casing is selected for this section (VAGT is compatible with NVAM)

M/U Torque: 7” – 23# - K55 – VAGT:	Min: 5600 ftlbs = 7700 Nm Opt: 6220 ftlbs = 8500 Nm Max: 6840 ftlbs = 9400 Nm

7.3. Liner configuration

A 2-joint shoe track is planned:

- Shoe joint (26# - L80) Float shoe pre-made up on a baker locked joint
- Float collar joint (26# - L80)
- Landing collar joint (26# - L80) Landing collar pre-made up on a baker locked joint
- Baker locked joint (26# - L80)
- +/- 100 m 7” – 26# - L80 – VAGT casing (total 10 joints)
- +/- 1200 m 7” – 23# - K55 – VAGT casing
- GOT liner hanger

Shoe track connections must be baker locked up to and including the box of the landing collar joint

The 7” liner will be hung-off 100 m inside the 10 ¾” casing.

7.4. Centraliser placement

The 7” liner is to be centralised with:

- 1x bow centraliser per joint over the bottom 10 joints,
- 1x bow centraliser per 2 joints up to the 10 3/4” shoe
- 1x positive centraliser per 2 joints inside the 10 3/4” casing.
- Centralisers are to be installed over a stopcollar if possible.

7.5. Cement specifications

1. The liner will be cemented 100 meters into 10 ¾" casing.
2. 25% excess over the annular volume will be used. Top of cement is planned 50 meters above the hanger to ensure an homogeneous cement coverage across the liner lap.
3. Fluid loss controlled lead cement slurry with a slurry density of 1.5 bar/10 m followed by tail cement of min 1.7 bar/10 m is to be used.

7.6. Sequence of operations

1. Pick up and install 7" casing drive assembly
2. Make up and bakerlock shoetrack.
3. Check float equipment.
4. RIH +/- 100 meter 7" - 26# - L80 – VAGT liner
5. RIH +/- 1200 meter 7" - 23# - K55 – VAGT liner
6. Change out Casing Drive Assembly for 5" DP running gear.
7. Make up hanger assembly as per GOT procedure.
8. Circulate 120% liner contents. Max flow and pressures as per GOT instructions.
    - GOT representative on the floor when running in open hole.
9. RIH liner. Fill up each joint. RIH speed 1 min/single (slips to slips)
10. Wash down last 2 joints to bottom.
11. Circulate hole clean.
12. Make space-out with pupjoints and install plug dropping head.
13. Set hanger, release running tool, shear ball seat as per GOT instructions.
14. Rig up and pressure test cement equipment
15. Pre-mix cement slurry
16. Pump 5 m^3 spacer
17. Drop DP wiper bottom plug
18. Pump +/- 20 m^3 cement slurry and 1m^3 spacer
19. Drop DP wiper top plug
20. Displace cement with +/- 30 m^3 mud. Do not over displace more than half the shoe track.
21. Bump the plug and pressure test liner to 100 bar above differential.
22. Check for back flow.
23. Set liner packer as per GOT instructions. Observe shears.
24. Pick up drill string to sting out.
25. Reverse circulate out and dump excess cement and spacers.
    - Mud engineer to check mud / cement returns.

    Note: Only reverse circulate when plugs have been bumped **and** the liner packer is set.
26. Drop wiper ball and straight circulate clean.
27. Remove plug dropping head
28. POH with liner running tool.

8. Drilling 6” Hole 2425 – 2675 m

8.1. Summary

The operation covers the following steps:

1. Drill the 7” shoe track and the pocket and circulate clean
2. Displace the well to clean drill-in fluid.
3. Drill the Delft Sand with a clean drill-in fluid and protect the sand section with a solids free highly viscous pill

8.2. Well control

The Delft sand is expected to be water bearing and poorly consolidated and highly permeable. The pore pressure is expected to be hydrostatic 1.00 sg. So losses, rather than influxes are expected in this section.

1. The BOP-stack will be pressure tested to 25/200 bar 5/10 min.
2. Flow checks and drills will be held as per NDDC procedures.
3. Sufficient acid soluble LCM material will be on location.

8.3. BHA

The following drilling BHA will be used to drill out the 7” shoe and drill the 6” hole:

6” Bit

6” NBstab

4 ¾” MWD-GR

5 7/8” String Stab

4 ¾ ” DC

6” String Stab

5x 3 ½” HWDP

4 ¾” Jar

12x 3 ½” HWDP

Fishing equipment for all BHA components shall be available on the rig or shall be able to be called out at short notice.

8.4. Bits

The primary choice is a FXD73 PDC bit. Back-up bit to be on location.

Nozzle sizes to be minimum 16/32” in view of the expected losses.

8.5. Drilling Parameters

Target Drilling Parameters
Flow: 1200 ltr/min
RPM: 100
WOB: 2-5 MT

All three rig pumps will be fitted with 5” liners.

8.6. Mud

A water based mud will be used in this section.

Type: Drill-in fluid MW: ≈ 1,08 sg

150 - 250 m of 6” reservoir section will be drilled from the 7” liner shoe at ca. 2425 m to 2675 m (not further than bottom Delft Sand).
While in the prior section the fluid is carried over from one section to the next, this interval must be drilled with a completely new drill-on fluid so as to minimise formation damaging effects. However the drill-in fluid used in the reservoir section of the production well should be carried over to the reservoir section of the injector well, if possible.

It is absolutely essential that all components used in the drill-in fluid are acid soluble or hydro soluble such that formation damage is avoided and if it occurs can be remediated.
Ph should be controlled primarily with magnesium oxide which buffers the system at a value of approximately 9.5.
Porosity and permeability data have not been provided, consequently the bridging material calcium carbonate should have a broad particle size distribution to ensure effective bridging across the whole range of pore throat radii.
Losses are anticipated at the top of the Delft Sand and given the paramount requirement for protection of the formation sacrificial sized calcium carbonate should be added throughout the interval while using as fine shaker screens as the flow rate will allow.

6” Hole Drilling fluid properties

Parameter	Value
Fluid Type:	HYDRO-FOIL GEN 1, i.e. KCl / Glycol system
Density	1.08 kg/L at 20 °C
Plastic Viscosity:	As low as possible
Yield Point:	15 to 18 lb/100 ft^2 at 48.9 °C
Shear Stress at 6 and 3 rpm	circa 6 and 5 at 48.9 °C
API Fluid Loss	<5 mL
KCL Concentration	2.9% by weight (28.57 g/L)
Chloride Concentration	54,000 mg/L
Glycol Concentration	3% by volume
Bridging Material (100 % acid soluble)	>40 ppb, i.e. >110 g/L
pH	9.5 – 10.0

6” Hole Drilling fluid formulation

Density (kg/L) =	**1.080**	**Concentration per Unit Volume**			
Component	**Function**	**1 bbl**	**Unit**	**1 m3**	**Unit**
KCl Brine 80 ppb, 9.420 ppg (1.1308 sg)	Cation exchange and hydration suppression	0.1283	bbl	0.1283	m3
		50.8	lb	145.0	kg
NaCl Brine 110.8 ppb, 10.00 ppg (1.2004 sg)	Density and hydration suppression	0.0000	bbl	0.0000	m^3
		0.0	lb	0.0	kg
Flowzan	Viscosifier	0.75	lb	2.143	kg
Drispac SL	Filtration controller	0.50	lb	1.429	kg
FL7+	Filtration controller	5	lb	14.286	kg
Magnesium Oxide	pH buffer	1	lb	2.857	kg
Sized Calcium Carbonate	Densifier / Bridging Agent	31.87	lb	91.06	kg
Fresh Water	Base fluid	0.823	bbl	823.2	L

8.7 Formation Evaluation

No logging is foreseen in this section, except GR-MWD. However if gas shows or cuttings fluorescence is observed in this hole section, the Operator may elect to run logs. The Contractor is to be prepared to call off logging for neutron density/resistivity/GR and sonic/GR without delay upon reaching casing point.

8.8 Sequence of operations

1. Make up 6” bit on rotary BHA.
2. RIH on 3 ½” and 5” drill pipe.
3. Drill shoe track and pocket.
4. Circulate hole clean with 5 m3 hi-vis pill.
5. Clean mudpits, lines and shakers.
6. Fill up mudpits with drill-in fluid.
7. Pump cleaning pills and displace well to solids free drill-in fluid
8. Drill to 2675m.
    - Be prepared to add acid soluble LCM.
9. Circulate the hole clean.
10. Spot a hi-vis drill-in fluid pill in the open hole, if required.
11. POOH. Do not PUMP & rotate unless hole conditions dictate.
12. Lay down drilling BHA.

9. Running 5” WWS

9.1 Summary

A 5” Wire Wrapped Screen will be installed over the Delft sand.
The production liner WWS will be hung-off 50 m inside the 7” liner.
A swellable packer will be incorporated in the 4.5” liner string.

9.2 WWS type

A 5” OD wire wrapped screen on 4.5" 13.5# L80 VAGT base pipe is selected for this section.

9.3 WWS configuration

Float shoe
4.5” Blank pupjoint
2 3/8” seal bushing
+/- 7 joints WWS
2 pce 4.5" 13.5# L80 VAGT R3 joints with swellable packer
+/- 4 joints plain 4.5"
Liner hanger
3 ½” DP

9.4 Sequence of operations

1. Rig up liner running equipment
2. Make up and Bakerlock shoe track
3. RIH approximately 300 m 5” WWS and blank liner
4. Pick-up the WWS joints with extreme care.
5. Use a crane for picking up the joints and hanger assembly.
6. Run 2 3/8” inner string
7. Make up liner hanger assembly
8. Pick up liner on hanger assembly
9. Circulate liner contents.
10. Flow rate and pressures as per GOT instructions
11. RIH liner on 3 ½” and 5” DP to 7” casing shoe
12. Fill up each joint.
13. Break circulation
14. RIH to open hole
15. GOT representative on drill floor when running in open hole.
16. Space out string and make up plug dropping head
17. Rig up and pressure test lines to 220 bar
18. Set liner hanger
19. Release running tool
20. Shear out ball seat
21. Set ZXP packer
22. Displace drilling fluid with brine (NaCl)
23. POH liner running tool

10. Production test

10.1 Summary

The ESP will not be available at this time.
A production test using the pump principle will be carried out.
Permission has been obtained to dispose of 3000 m3 of formation water.

10.2. Equipment requirement

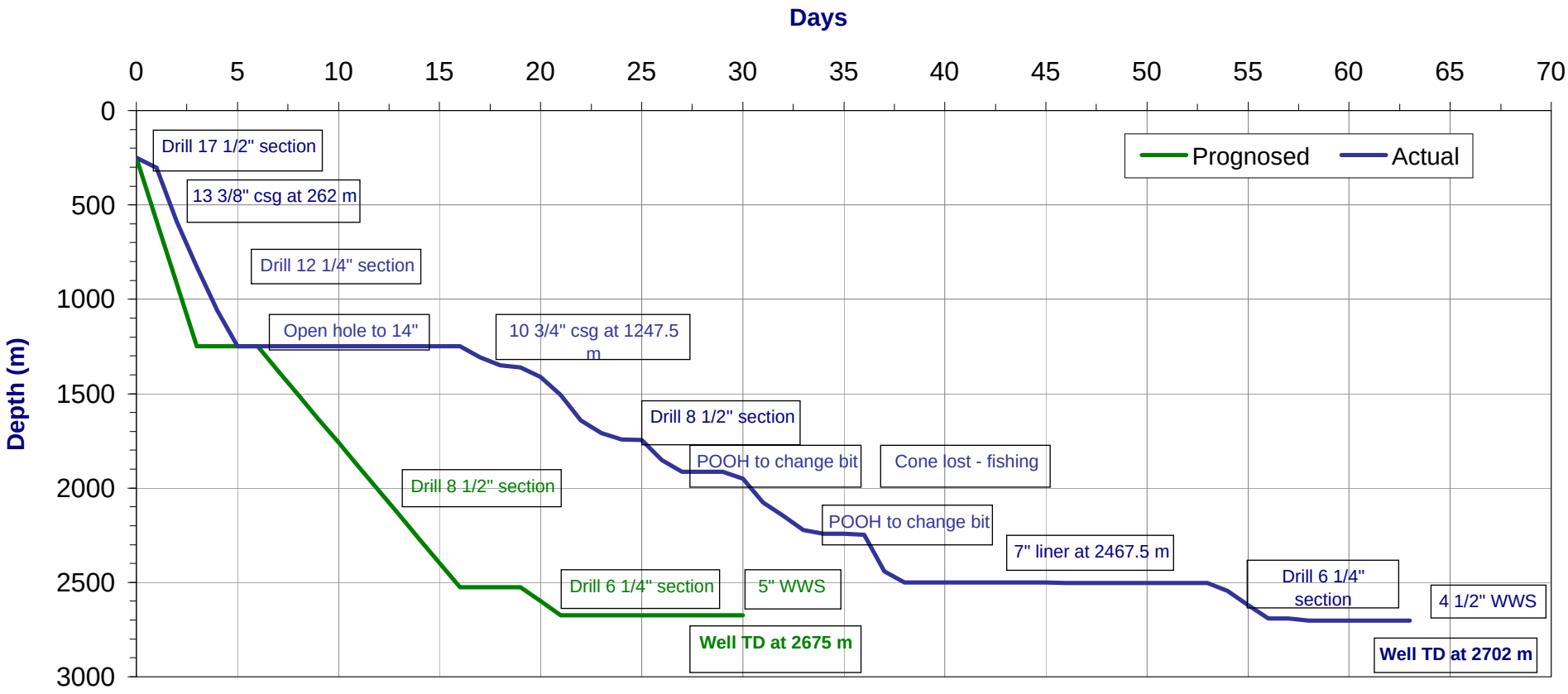
1. Suitable pumping equipment
2. Measuring devices for flow / temperature / Ph.
3. Storage and transport capacity.

10.3. Sequence of operations

To be provided in Well Test Program HAG GT 01.

Appendix 2, Time Depth Curve

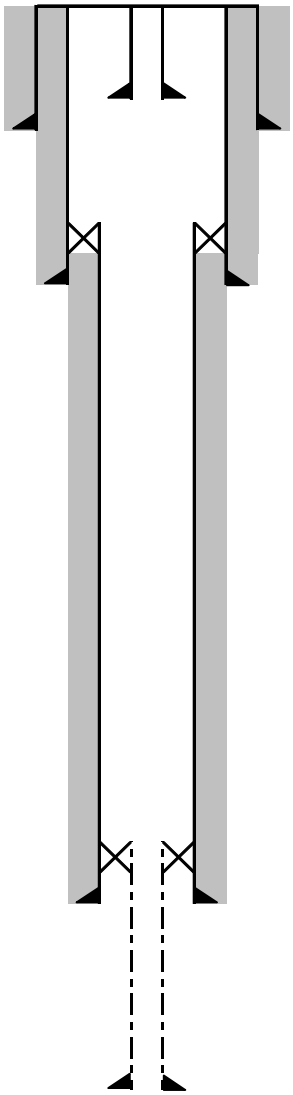
HAG GT-01 , Time vs Depth



Appendix 3, Well Sketch

HAG GT01

Date: 24-sept-2010

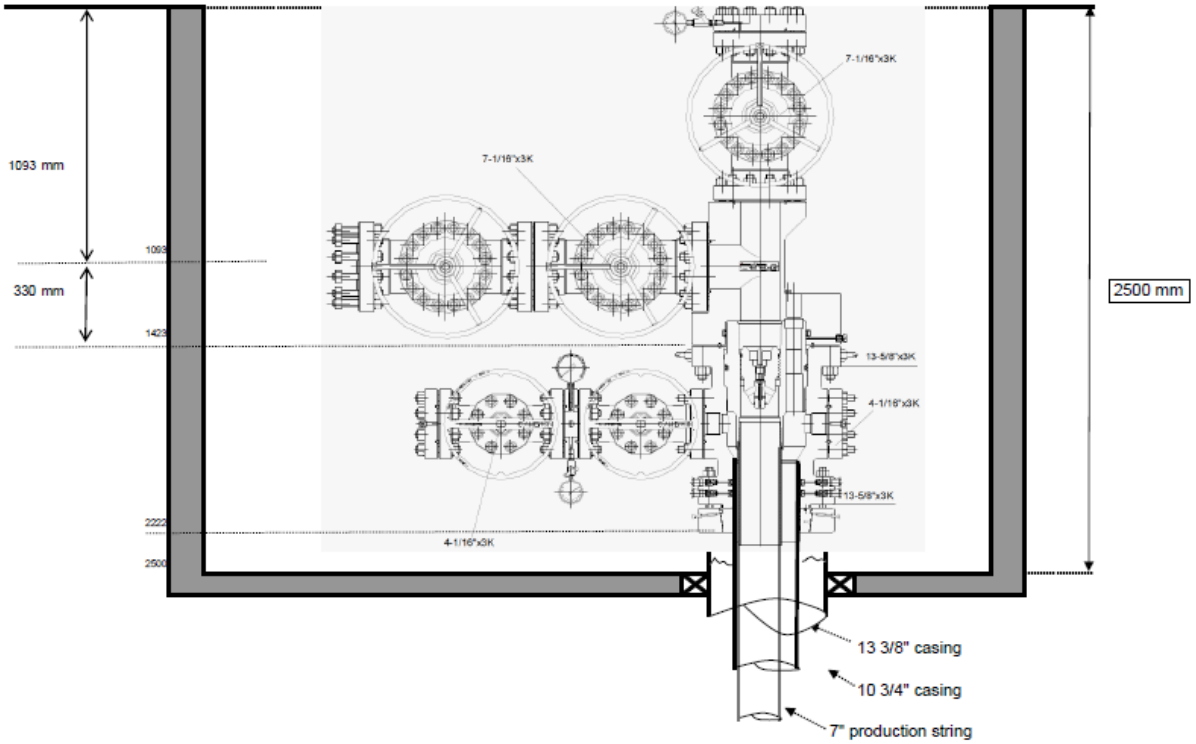


		MD (m)	TVD (m)
7" tubing		240 m	240 m
Casing/Liners			
13 3/8"; 54,5;K-55		250 m	250 m
	Hanger @	1120 m	1096 m
10 3/4"; 45,5#; P-110		1248 m	1200 m
	Hanger @	2430 m	2112 m
7"; 23#; K-55		2522 m	2190 m
4 1/2" WSS		2690 m	2298 m

All depth are from ground level

Appendix 4, Well head sketch

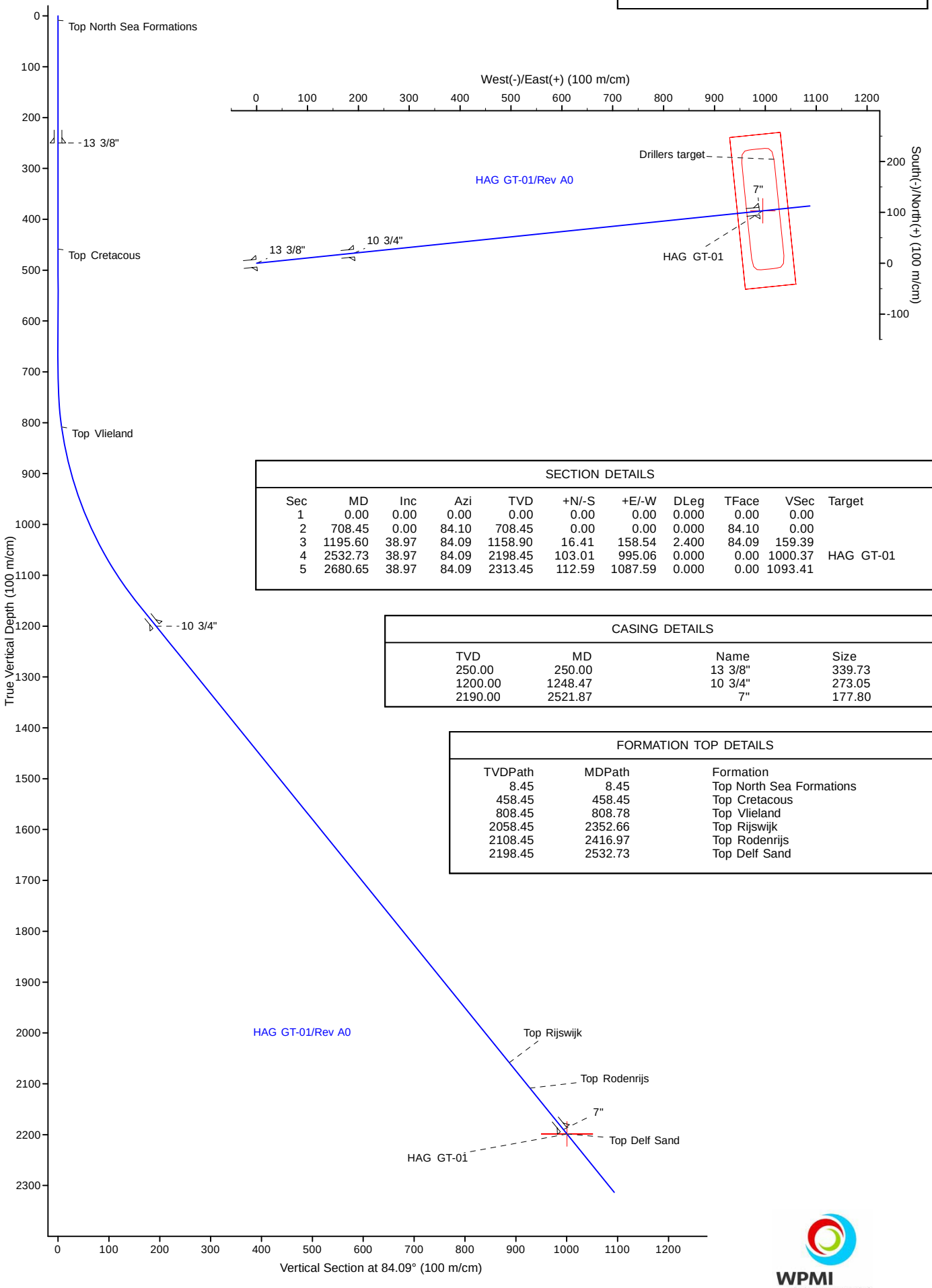
Well: HAG GT 01
Phase: Production
Position: From tram rails



Appendix 5, Directional data and plot

HALLIBURTON | Sperry Drilling

Project: The Hague Geotermal
Site: The Hague
Well: HAG GT-01
Wellbore: HAG GT-01
Design: Rev A0



SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	DLeg	TFace	VSec	Target
1	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	
2	708.45	0.00	84.10	708.45	0.00	0.00	0.000	84.10	0.00	
3	1195.60	38.97	84.09	1158.90	16.41	158.54	2.400	84.09	159.39	
4	2532.73	38.97	84.09	2198.45	103.01	995.06	0.000	0.00	1000.37	HAG GT-01
5	2680.65	38.97	84.09	2313.45	112.59	1087.59	0.000	0.00	1093.41	

CASING DETAILS

TVD	MD	Name	Size
250.00	250.00	13 3/8"	339.73
1200.00	1248.47	10 3/4"	273.05
2190.00	2521.87	7"	177.80

FORMATION TOP DETAILS

TVDPath	MDPath	Formation
8.45	8.45	Top North Sea Formations
458.45	458.45	Top Cretacous
808.45	808.78	Top Vlieland
2058.45	2352.66	Top Rijswijk
2108.45	2416.97	Top Rodenrijs
2198.45	2532.73	Top Delf Sand

WPMI
Well Project Management International

Powered by INSITE

Sperry Drilling

DIRECTIONAL SURVEY REPORT

WPMI
HAG GT-01
Den Haag Geothermal
Den Haag
The Netherlands
HO-MW-000744111
Survey at 263m MD has been interpolated.
Surveys are SAG corrected above 5 degrees where applicable.
Definitive surveys

Measured Depth (metres)	Inclination (degrees)	Direction (degrees)	Vertical Depth (metres)	Latitude (metres)	Departure (metres)	Vertical Section (metres)	Dogleg (deg/30m)
0.000	0.00	0.00	0.000	0.000 N	0.000 E	0.000	TIE-IN
263.000	0.87	249.95	262.990	0.685 S	1.876 W	-1.933	0.10
284.000	0.94	249.95	283.987	0.798 S	2.187 W	-2.254	0.09
293.900	0.99	255.10	293.886	0.848 S	2.345 W	-2.417	0.32
301.400	0.87	255.04	301.385	0.879 S	2.463 W	-2.537	0.50
310.500	0.36	232.31	310.484	0.914 S	2.553 W	-2.630	1.83
335.100	0.28	203.15	335.084	1.016 S	2.637 W	-2.723	0.22
348.800	0.43	136.41	348.784	1.084 S	2.615 W	-2.708	0.89
362.400	0.44	146.99	362.383	1.164 S	2.551 W	-2.652	0.18
376.700	0.52	104.77	376.683	1.227 S	2.458 W	-2.565	0.75
390.300	0.59	86.16	390.282	1.238 S	2.328 W	-2.437	0.42
403.900	0.80	80.80	403.881	1.219 S	2.164 W	-2.273	0.49
417.500	1.06	86.09	417.479	1.195 S	1.945 W	-2.052	0.61
431.100	1.45	81.21	431.076	1.160 S	1.649 W	-1.754	0.88
444.700	1.42	86.70	444.672	1.124 S	1.311 W	-1.414	0.31
458.300	1.58	94.12	458.267	1.128 S	0.955 W	-1.061	0.56
471.900	1.37	88.31	471.863	1.136 S	0.605 W	-0.713	0.57
485.600	1.50	86.34	485.558	1.120 S	0.261 W	-0.369	0.31
499.100	1.52	83.12	499.054	1.087 S	0.094 E	-0.013	0.19
512.800	2.09	83.03	512.747	1.035 S	0.522 E	0.419	1.23
526.400	2.20	87.54	526.337	0.994 S	1.029 E	0.927	0.45
539.900	2.18	86.98	539.828	0.969 S	1.544 E	1.442	0.07
553.600	2.13	81.11	553.518	0.916 S	2.055 E	1.956	0.49
567.200	2.16	90.31	567.108	0.878 S	2.562 E	2.464	0.76
580.800	2.16	85.77	580.699	0.861 S	3.074 E	2.976	0.38
594.400	2.16	86.61	594.289	0.827 S	3.586 E	3.488	0.07
608.000	2.27	87.23	607.879	0.799 S	4.111 E	4.014	0.25
621.600	2.17	91.46	621.469	0.792 S	4.637 E	4.538	0.43
635.200	2.13	90.44	635.059	0.801 S	5.147 E	5.044	0.11
648.800	1.98	91.06	648.650	0.807 S	5.634 E	5.529	0.34
662.500	1.93	89.05	662.342	0.807 S	6.101 E	5.994	0.18
676.100	2.02	94.62	675.934	0.823 S	6.569 E	6.458	0.46
689.700	2.80	92.10	689.522	0.854 S	7.140 E	7.023	1.73
703.300	3.90	90.30	703.099	0.869 S	7.934 E	7.812	2.45
716.900	5.01	91.92	716.657	0.891 S	8.990 E	8.861	2.46
730.500	6.43	93.26	730.190	0.954 S	10.343 E	10.201	3.14
744.100	7.88	90.64	743.683	1.008 S	12.035 E	11.880	3.28
757.700	8.91	89.67	757.137	1.012 S	14.020 E	13.854	2.30
771.300	9.45	91.41	770.563	1.034 S	16.189 E	16.011	1.35
785.000	9.46	90.86	784.077	1.078 S	18.439 E	18.246	0.20
798.600	10.47	88.74	797.472	1.068 S	20.791 E	20.588	2.36
812.200	10.90	86.99	810.836	0.973 S	23.310 E	23.104	1.19
825.800	11.36	88.49	824.181	0.871 S	25.932 E	25.724	1.21
839.400	11.50	88.84	837.511	0.808 S	28.627 E	28.412	0.35
853.000	11.88	83.88	850.829	0.631 S	31.375 E	31.164	2.37
866.600	12.98	81.88	864.110	0.266 S	34.279 E	34.090	2.60
880.200	13.70	81.92	877.343	0.176 N	37.385 E	37.225	1.58
893.800	14.44	82.44	890.535	0.625 N	40.661 E	40.528	1.66
907.400	15.46	84.27	903.675	1.029 N	44.146 E	44.036	2.48
921.000	16.54	84.66	916.748	1.390 N	47.877 E	47.785	2.40
934.600	17.89	85.53	929.738	1.733 N	51.888 E	51.810	3.02
948.200	18.64	87.79	942.652	1.980 N	56.143 E	56.069	2.28
961.800	19.71	87.92	955.498	2.147 N	60.607 E	60.528	2.35
975.400	21.08	87.70	968.245	2.328 N	65.343 E	65.259	3.04
989.000	22.34	87.07	980.880	2.559 N	70.368 E	70.283	2.81
1002.600	23.71	86.35	993.396	2.865 N	75.679 E	75.598	3.10
1016.200	24.95	85.19	1005.788	3.280 N	81.267 E	81.200	2.92
1029.800	25.83	84.58	1018.074	3.801 N	87.074 E	87.030	2.02
1043.400	26.88	85.46	1030.260	4.324 N	93.089 E	93.067	2.48
1057.100	28.14	86.21	1042.411	4.783 N	99.400 E	99.393	2.86
1070.700	29.27	85.06	1054.339	5.281 N	105.914 E	105.924	2.78
1084.300	30.05	85.26	1066.157	5.849 N	112.620 E	112.654	1.72
1097.900	30.89	85.94	1077.879	6.378 N	119.495 E	119.548	2.01
1111.500	31.79	86.07	1089.495	6.871 N	126.551 E	126.619	2.00
1125.100	33.22	85.65	1100.964	7.399 N	133.840 E	133.924	3.19
1138.700	34.27	85.33	1112.272	7.993 N	141.372 E	141.478	2.35
1152.300	35.56	84.80	1123.424	8.663 N	149.127 E	149.261	2.91
1165.900	36.70	84.05	1134.408	9.444 N	157.107 E	157.280	2.72
1179.500	37.66	83.90	1145.243	10.307 N	165.281 E	165.499	2.13
1193.100	38.29	83.04	1155.964	11.259 N	173.595 E	173.867	1.81
1206.700	38.58	83.61	1166.617	12.241 N	181.992 E	182.319	1.01
1220.300	38.72	83.91	1177.238	13.164 N	190.436 E	190.812	0.52
1234.000	38.74	84.62	1187.925	14.021 N	198.964 E	199.384	0.97
1255.000	38.69	84.55	1204.311	15.261 N	212.041 E	212.519	0.10
1268.600	38.46	84.44	1214.943	16.074 N	220.481 E	220.999	0.54
1282.200	38.69	83.36	1225.576	16.976 N	228.913 E	229.478	1.57
1295.800	38.66	83.38	1236.193	17.957 N	237.355 E	237.976	0.08
1323.100	38.66	82.66	1257.510	20.030 N	254.283 E	255.025	0.50
1340.800	38.72	81.41	1271.326	21.563 N	265.240 E	266.079	1.32
1367.600	39.40	79.64	1292.138	24.345 N	281.894 E	282.925	1.46
1395.200	40.70	78.93	1313.266	27.647 N	299.342 E	300.612	1.50
1409.300	40.79	79.37	1323.948	29.379 N	308.380 E	309.776	0.63
1422.900	41.47	79.42	1334.192	31.026 N	317.173 E	318.687	1.49
1436.600	41.83	77.18	1344.430	32.872 N	326.087 E	327.738	3.35
1448.200	41.64	76.64	1353.086	34.621 N	333.608 E	335.394	1.05
1463.300	40.42	76.14	1364.476	36.953 N	343.243 E	345.210	2.52
1476.400	40.20	76.68	1374.466	38.944 N	351.480 E	353.602	0.95
1490.300	39.68	77.98	1385.124	40.902 N	360.186 E	362.457	2.12
1504.500	39.43	78.23	1396.072	42.766 N	369.034 E	371.445	0.64
1517.400	38.91	80.15	1406.074	44.295 N	377.036 E	379.558	3.06
1531.300	38.73	80.37	1416.904	45.769 N	385.624 E	388.248	0.49
1559.300	38.46	79.55	1438.788	48.814 N	402.822 E	405.661	0.62
1572.300	38.52	79.02	1448.964	50.318 N	410.771 E	413.719	0.78
1585.800	39.33	78.37	1459.466	51.981 N	419.089 E	422.160	2.01
1599.900	39.42	77.95	1470.366	53.817 N	427.844 E	431.052	0.61
1613.500	39.56	77.42	1480.861	55.662 N	436.294 E	439.641	0.80
1626.900	39.44	78.28	1491.201	57.456 N	444.627 E	448.109	1.26
1640.800	39.67	77.86	1501.917	59.286 N	453.288 E	456.907	0.76
1654.000	39.53	78.55	1512.088	61.006 N	461.524 E	465.272	1.06
1667.600	38.73	79.48	1522.637	62.642 N	469.949 E	473.816	2.20
1681.600	38.28	80.65	1533.594	64.147 N	478.534 E	482.506	1.84
1694.900	38.68	79.37	1544.005	65.582 N	486.683 E	490.757	2.02
1708.700	38.67	79.60	1554.779	67.156 N	495.162 E	499.349	0.32
1721.900	38.52	80.68	1565.096	68.566 N	503.275 E	507.561	1.55
1728.300	37.99	80.82	1570.121	69.203 N	507.186 E	511.515	2.54
1735.500	37.72	80.59	1575.806	69.917 N	511.546 E	515.924	1.26
1749.100	37.87	81.17	1586.553	71.238 N	519.776 E	524.243	0.86
1762.400	37.65	81.41	1597.068	72.472 N	527.826 E	532.376	0.59
1775.800	37.54	81.61	1607.685	73.679 N	535.912 E	540.541	0.37
1802.800	37.20	82.15	1629.142	75.995 N	552.136 E	556.913	0.52
1818.200	37.69	81.92	1641.369	77.293 N	561.408 E	566.267	0.99
1843.900	37.68	81.99	1661.708	79.493 N	576.964 E	581.964	0.05
1871.100	37.71	82.18	1683.230	81.783 N	593.438 E	598.582	0.13
1898.800	37.31	82.80	1705.203	83.988 N	610.159 E	615.439	0.59
1911.500	37.22	82.02	1715.311	85.004 N	617.782 E	623.124	1.13
1925.200	37.56	81.67	1726.195	86.184 N	626.018 E	631.436	0.88
1938.900	37.68	81.62	1737.046	87.399 N	634.292 E	639.789	0.26
1952.400	37.70	81.66	1747.729	88.599 N	642.458 E	648.033	0.08
1966.400	37.75	81.83	1758.802	89.829 N	650.935 E	656.590	0.24
1980.200	38.12	81.83	1769.686	91.035 N	659.333 E	665.066	0.80
1993.900	38.22	81.49	1780.457	92.264 N	667.710 E	673.522	0.51
2007.500	38.25	81.77	1791.140	93.489 N	676.037 E	681.929	0.40
2021.400	38.63	81.16	1802.027	94.772 N	684.583 E	690.559	1.16
2034.700	38.74	81.68	1812.409	96.012 N	692.803 E	698.861	0.78
2048.700	39.14	81.30	1823.297	97.315 N	701.506 E	707.650	1.00
2075.900	40.04	80.73	1844.257	100.023 N	718.628 E	724.954	1.06
2103.300	41.48	79.91	1865.010	103.031 N	736.262 E	742.797	1.69
2130.100	42.27	79.86	1884.965	106.173 N	753.875 E	760.632	0.88
2157.200	42.92	79.90	1904.915	109.396 N	771.931 E	778.916	0.71
2185.300	43.47	79.77	1925.401	112.791 N	790.862 E	798.088	0.60
2212.200	44.40	79.34	1944.772	116.176 N	809.217 E	816.685	1.09
2226.200	44.09	79.44	1954.801	117.974 N	818.818 E	826.416	0.68
2238.700	43.62	78.91	1963.815	119.600 N	827.324 E	835.040	1.44
2252.800	43.32	78.77	1974.048	121.478 N	836.841 E	844.694	0.66
2279.800	42.93	78.23	1993.754	125.158 N	854.927 E	863.053	0.60
2293.500	42.66	78.34	2003.807	127.048 N	864.040 E	872.307	0.62
2306.300	42.32	78.41	2013.246	128.790 N	872.509 E	880.905	0.79
2320.300	41.87	78.95	2023.635	130.631 N	881.711 E	890.243	1.25
2333.500	41.80	78.87	2033.470	132.324 N	890.351 E	899.006	0.19
2347.700	41.77	78.64	2044.058	134.169 N	899.631 E	908.422	0.33
2361.100	41.30	78.82	2054.089	135.905 N	908.345 E	917.264	1.09
2374.500	41.04	78.51	2064.176	137.638 N	916.993 E	926.040	0.74
2415.800	40.07	78.94	2095.556	142.889 N	943.325 E	952.758	0.73
2443.100	39.60	79.85	2116.520	146.108 N	960.514 E	970.178	0.82
2470.300	39.02	80.12	2137.566	149.104 N	977.483 E	987.358	0.67
2482.200	38.71	80.60	2146.831	150.354 N	984.845 E	994.807	1.08
2528.700	39.31	80.59	2182.963	155.135 N	1013.721 E	1024.012	0.38
2543.000	40.03	80.68	2193.971	156.620 N	1022.727 E	1033.120	1.52
2556.000	40.79	79.87	2203.870	158.044 N	1031.033 E	1041.525	2.14
2569.600	41.52	80.08	2214.109	159.602 N	1039.846 E	1050.448	1.65
2583.300	42.21	80.44	2224.311	161.148 N	1048.858 E	1059.567	1.59
2596.200	43.06	80.96	2233.802	162.559 N	1057.481 E	1068.287	2.14
2609.400	43.88	80.42	2243.381	164.028 N	1066.442 E	1077.349	2.05
2622.900	44.70	80.10	2253.044	165.623 N	1075.734 E	1086.751	1.89
2636.800	45.77	80.47	2262.833	167.289 N	1085.461 E	1096.595	2.37
2650.300	46.57	80.96	2272.181	168.859 N	1095.072 E	1106.313	1.96
2663.200	48.21	81.07	2280.914	170.342 N	1104.450 E	1115.791	3.82
2694.600	49.34	80.24	2301.605	174.178 N	1127.754 E	1139.357	1.24

CALCULATION BASED ON MINIMUM CURVATURE METHOD

SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT
TVD VALUES GIVEN RELATIVE TO DRILLING MEASUREMENT POINT

VERTICAL SECTION RELATIVE TO WELL HEAD
VERTICAL SECTION IS COMPUTED ALONG A DIRECTION OF 84.41 DEGREES (GRID)
A TOTAL CORRECTION OF 0.73 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 2694.600 METRES
IS 1141.125 METRES ALONG 81.22 DEGREES (GRID)

Date Printed:13 September 2010

Appendix 6, Geological report

Geological Well Report

Hag GT-01

Den Haag, The Netherlands

Contents

Tables

Tables

Attachments

Attachment # 1 Masterlog 1:500

Pertinent Well Data

WELL NAME:	HAG GT-1
COUNTRY:	Netherlands
MUNICIPALITY:	The Hague
WELL TYPE:	Geothermal
OPERATOR:	Aardwarmte Den Haag VOF
SUFRACE COORDINATES:	x= 78210.955 m y= 452500.55 m
PRIMARY TARGET:	Delft Sandstone
TARGET COORDINATES:	x= 79207.00 m y= 452598.00 m Latitude: 54.55.46.541 Longitude: 09.50.17.664 Top TVD RT: 2196.27 m (Delft Sandstone)
TARGET TOLERANCE:	300 m x 100 m (Rectagle, centred on target)
ROTARY TABLE ELEVATION:	8.24 m
GROUND LEVEL ELEVATION:	0.23 m above NAP
DEPTH REFERENCE:	Rig floor @ 8.24 m above ground level
SPUD DATE:	16.05.2010
TD DATE:	11.09.2010
TOTAL DEPTH:	2702 m MD / 2306.44 m TVD
CASING DEPTHS:	13 3/8" at 262 m 10 3/4" at 1248 m 7" top at 1120.0 m at 2467.5 m WWS 4 ½" top at 2431.2 m at 2690.6 m
RIG:	LOC-400
OFFSET WELLS:	HAG-01, HAG-02,

Contractor Services

DRILLING:	NDDC
MWD	HALLIBURTON
DIRECTIONAL DRILLING	HALLIBURTON
MUD-LOGGING	PETROLOG International B.V.
MUD CHEMICALS	SCOMI-OIL TOOLS (EUROPE) LTD
CEMENT	Schlumberger
CASING	NDDC, Odfjel

1. CONCISE DRILLING SUMMARY

1.1. General

The Hag GT-1 geothermal well was spudded on 16 July 2010, using the Heismann LOC-400 “No limit -1” rig. TD was reached at 1702 m on 11 September 2010.

The primary target of the Hag GT-01 has been reached on 8th of September 2010. Top of the Delft Sandstone was reached at 24549m MD BRT / 2187.87m TVD SS. Assumed 40m thickness of clear (not interbedded by Claystone layers) Sandstone formation, had been satisfied – 70m. The drilling stopped in the Delft Sandstone Mb. One type of WBM systems were applied in the Hag GT-01 well: KCL – Glycol/Polymer (266 – 2702 m). For well test, mud was displaced with brine.

2. MUD-LOGGING AND GEOLOGICAL PROCEDURES

2.1. Geological Monitoring

Geological duties were carried out according to the project requirements elaborated by WPMi

Mud-logging services were performed by PETROLOG under the agreement with WPMi. PETROLOG mudlogging crew at the HAG GT-01 location consisted of: Krzysztof Gudz, Przemyslaw Hamankiewicz, Marek Jamka, Bartlomiej de Lorme, Miroslaw Ochwat, Tomasz Pachciarek, Tomasz Przybycien, Jacek Sawicz, Andrzej Spinczyk, Wojciech Tomsia,

2.2. Mudlogging Equipment

- OnLine air-conditioned logging unit with suitable workspaces, benches, electricity/water supply connections fully compatible with international safety standards
- Microscope, hot plates, cuttings trays, spot plates, probes, chemicals and all other necessary tools and ware for proper cuttings examination and analysis
- FID gas detection and fast THC sensor
- H2S sensor
- GeoWellPower software package integrating online parameters for following displays and calculations:

  ⇒ Selected parameters on continuous display in graphical and/or numerical format on three monitor screens.
  ⇒ Online updating of geological Masterlog and continuous screen display of the same
  ⇒ Continuous Data storage time and depth dependant (every 2 sec / 20cm)
  ⇒ Time or depth based technical / engineering log with user defined lay out
  ⇒ Visualization of actual rig operation with smart alarms (drilling, tripping, survey)

- Mudlogging Crew responsible for the following duties:

  ⇒ Cuttings sampling, washing, packaging and dispatching of samples. Intervals and packaging as per the sampling program
  ⇒ Lithological analysis and descriptions
  ⇒ Stratigraphical interpretation
  ⇒ Daily reporting as required by the Client and/or the circumstances
  ⇒ Continuous computer update of Masterlog, displaying lithology, formation tops, total gas, and selected drilling parameters against depth.
  ⇒ Continuous monitoring and interpretation of online drilling parameters, assistance to the drilling personnel as per normal drilling practice and as the circumstances may require

The configuration of monitoring equipment appeared to be fully sufficient for relevant mudlogging services and onsite data processing with respect to the required scope of work.

The use of the FID gas detector and rate of penetration allowed recognition and pinpointing of the zones of high content of hydrocarbon gases. Moreover, fast THC sensor supplied hydrocarbon gas level readings to Petrolog and rig monitoring system in real time (no gas line lag).

The observation of the ROP and LWD curve during drilling allowed for accurate interpretation of lithological changes.

Pump stroke counters were essential at calculating the lag time, which in turn enabled correlation of cuttings lithology to depth.

2.3. Hardware and Software

The following software was used for the preparation and elaboration of the geological data:

2.3.1. Windows XP - operating system on-line computer
2.3.2. MS Office 2000 – daily geological reports, other documents,
2.3.3. GeoWellPower - preparing logs, graphics, tables of drilling parameters,
2.3.4. Drilling and Petroleum Engineering Package
2.3.5. WITS protocol software

The following hardware was used for the drilling and geological data presentation:

2.3.6. Main PC computer in mudlogging unit (Controller PC)
2.3.7. Three PC computers connected to the Main PC (Geoserv PC, Backup PC and Geology PC)
2.3.8. One remote computer (company representative) with Well View visualisation

2.4. Cuttings Sampling

2.4.1. Cutting samples were taken from shale shakers at intervals varying from 5 m to 2 m for archival records.

Hag GT – 1 main hole sampling frequencies:

From depth (m MD)	To depth (m MD)	Sampling frequency (m)
270	2505	5
2505	2702	2

Two sets of ditch unwashed cutting samples (packed first in cloth bags then in plastic bags) and two sets of washed and dried ones (packed in plastic bags) were collected.

A small fraction of each cutting sample was washed on the sieve, dried and examined under the microscope. Basic features were described for each lithological type.

When the bit approached the depth of the next expected formation top, spot-samples were taken more often. This enabled proper identification of formation lithology and accurate definition of the lithological transitions.

These additional samples were not stored; they were used only for microscopic examination.

All samples were marked and packed into plastic boxes (see table # 2).

2.5. Data Reporting

Geological data acquired while drilling were classified as reports and documents according to the instructions of operator representatative, in order to secure constant information indispensable for their current work.

2.5.1. Daily Basis Data Reporting

Following reports were daily delivered in electronic version

2.5.1.1. Daily geological report,
2.5.1.2. Geological profile (GeoWellPower software),
2.5.1.3. 24 hours Well View visualisation of 8 main parameters (1 min resolution)

3. STRATIGRAPHY AND LITHOLOGY

3.1. Stratigraphy

The stratigraphy of the drilled well was established on the basis of the profile lithology analysis, field identification of the main correlation markers and the correlation with the lithosections of the previously drilled well HAG-1, HAG-2.
The table below presents tops, names and chronostratigraphy of formations recognized while drilling.
See table #4

6. Lithology Hag GT-1

Tertiary (not picked) – 266 m MD / not picked – 266 m TVD

North Sea Group

266 – 270 m	**Sand** (40 %), clear, fine – medium grains, rarely coarse, transparent, minor translucent, subspherical, subangular – rounded, moderately sorted, single foraminifera **Clay** (40 %), grey, very soft, plastic, slightly sticky, calcareous, sandy **Cement** (20 %)
270 – 275 m	**Sand** (60 %), clear, fine grains, occasionally medium grains, transparent, minor translucent, subspherical - spherical, subangular – rounded, well sorted, shell fragments **Clay** (40 %), grey, minor beige, very soft, plastic, slightly sticky, calcareous, sandy
275 – 280 m	**Sand** (50 %), clear, fine – medium grains, rarely coarse, transparent, minor translucent, subspherical, subangular – rounded, moderately sorted, single foraminifera, traces glauconite **Clay** (50 %), as above
280 –285 m	**Sand** (40 %), clear, fine – medium grains, rarely coarse, transparent, minor translucent, subspherical, subangular – rounded, moderately sorted, single foraminifera, glauconite, traces foraminifera, shell fragments **Clay** (60 %), as above
285 – 290 m	**Sand** (70 %), as above **Clay** (30 %), as above
290 – 295 m	**Sand** (20 %), as above **Clay** (80 %), grey, minor beige, very soft, plastic, slightly sticky, calcareous, sandy, shell fragments

295 – 305 m **Sand** (40 %), as above
Clay (60 %), as above

305 – 310 m **Sandstone** (80%), light grey – olive, moderately hard to hard, fine to medium grained, moderately sorted, mainly subrounded, calcareous cement, slightly argillaceous, big fragments of shells, Glauconite
Clay (20 %), as above
Traces of **Amber**

310 – 315 m **Sandstone** (60 %), as above
Clay (40 %), as above

315 – 320 m **Sandstone** (50 %), light grey, fine grained, well sorted, subrounded, rarely subangular, Glauconite and Pyrite, occasionally black pieces – Lignite?
Claystone (50%), grey, light grey, soft, firm, calcareous, molusca, foraminifera

320 – 325 m **Sandstone** (70 %), light grey, fine grained, well sorted, subrounded, rarely subangular, Glauconite, Mica and Pyrite, occasionally black pieces – Lignite?
Claystone (30%), grey, light grey, soft, firm, calcareous, sandy and silty, molusca, foraminifera

325 – 330 m **Claystone** (80%), grey to dark grey, soft, strongly calcareous to marly, sandy and silty.
Sandstone (70 %), light grey, fine to very fine grained, well sorted, subrounded, Glauconite, Mica.

330 – 360 m **Claystone** (80%), grey to dark grey, soft, strongly calcareous to marly, sandy and silty.
Sandstone (20 %), light grey, fine to very fine grained, well sorted, subrounded, Glauconite, Mica.

360 – 365 m **Claystone** (80 %), grey, soft, sandy and silty, calcareous, marly
Marl (10 %), light brown, beige, soft, firm, sticky, silty
Sandstone (10%), light grey, fine to very fine grained, well sorted, subrounded, fossils, Mica, mainly milled to loose Quartz grains.

365 – 375 m **Claystone** (40 %), as above
Marl (50 %), as above
Sandstone (10%), as above

375 – 380 m **Claystone** (20 %), as above
Marl (80%), as above
Sandstone in traces

380 – 385 m **Claystone** (50 %), as above
Marl (30%), as above
Sandstone (20%), as above

385 – 390 m **Claystone** (70 %), dark grey, soft, plastic and sticky, subblocky, calcareous, sandy and silty.
Sandstone (30%), as above
Marl in traces

390 – 395 m **Claystone** (100 %), as above

395 – 400 m	**Claystone** (90 %), as above **Sandstone** (10%), as above
400 – 405 m	**Claystone** (100 %), grey to dark grey, soft, plastic and sticky, silty and sandy, strong calcareous, grading to Marl
405 – 410 m	**Marl** (95 %), beige, light brown, soft, plastic, subblocky, slightly sandy. **Sandstone** (5%), as above
410 – 415 m	**Claystone** (100 %), grey-greenish, soft, plastic and sticky, slightly sandy and silty, weak dolomitic, subblocky. Traces of **Sandstone** and **Marl**
415 – 420 m	**Claystone** (100 %), dark brown, soft, firm, subblocky, non-calcareous, slightly sandy.
420 – 435 m	**Claystone** (100 %), predominantly brownish-grey and dark brownish, soft, firm, dolomitic, silty, rarely **Claystone**, grey, soft, marly, silty
435 – 440 m	**Marl** (70 %), light grey – greenish, soft – firm, amorphous **Sandstone** (30 %), grey, very fine – fine grained, soft, argillaceous, glauconitic, very well sorted, subspherical, subangular – subrounded
440 – 445 m	**Marl** (15 %), as above **Sandstone** (25 %), as above, but mostly as loose grains **Claystone** (60 %), beige, very soft, slightly calcareous Traces of **Pyrite** and **Cherts** (brown, transparent, very hard, angular)
445 – 450 m	**Marl** (80 %), beige – light brownish, occasionally light grey – greenish, soft – firm, amorphous **Sandstone** (20 %), as above, but mostly as loose grains Traces of **Pyrite** and **Cherts** (brown, transparent, very hard, angular)
450 – 455 m	**Marl** (80 %), beige – light brownish, light grey – greenish, soft – firm, amorphous **Sandstone** (20 %), as above, but mostly as loose grains Traces of **Pyrite** and **Chalk** (off white, slightly argillaceous, soft)
455 – 460 m	**Marl** (40 %), as above **Sandstone** (55 %), grey, very fine – fine grained, rarely medium grained, soft, argillaceous, moderately sorted, subspherical, subangular - subrounded, Glauconite, commonly Pyrite, foraminifera **Limestone** (5 %), off white, very soft, mudstone – wackstone, slightly argillaceous
460 – 465 m	**Sandstone** (30 %), grey, very soft, fine grained, very argillaceous, very well sorted, subspherical, subangular - subrounded, Glauconite, commonly Pyrite, commonly grading to sandy Claystone **Claystone** (70 %), grey, very soft, sandy, commonly Pyrite and micro Pyrite
465 – 470 m	**Sandstone** (80 %), as above, but mainly as loose grains **Claystone** (20 %), grey, soft - firm, calcareous, commonly Pyrite and micro Pyrite
470 – 475 m	**Sandstone** (40 %), as above

Claystone (60 %), as above
Traces of **Pyrite** and **Chalk** (off white, slightly argillaceous, soft)

475 – 485 m **Sandstone** (50 %), as above
Claystone (50 %), grey, soft – firm, Pyrite dispersed, calcareous

485 – 490 m **Sandstone** (30 %), as above
Claystone (70 %), as above + Glauconite dispersed
Traces of **Chalk**

490 – 495 m **Marl** (75 %), medium grey, firm – moderately hard
Sandstone (20 %), as above
Claystone (5 %), as above + Glauconite dispersed

495 – 505 m **Marl** (85 %), light grey, firm – moderately hard
Sandstone (15 %), as above

Cretaceous

Upper Cretaceous

Chalk group

Omellanden Formation : 505.2 – 724.7 m MD / 496.73 – 715.93 m TVD SS

505 – 510 m **Chalk** (50 %), white, soft - firm
Marl (40 %), as above
Sandstone (10 %), as above

510 – 520 m **Chalk** (90 %), as above
Marl (traces), as above
Sandstone (10 %), as above

520 – 550 m **Chalk** (95 %), as above, commonly fossils
Sandstone (5 %), as above

550 – 580 m **Chalk** (95 %), white, soft – firm, commonly fossils and Cherts
Sandstone (5 %), as above

580 – 605 m **Chalk** (100 %), white, soft – firm, amorphous, commonly fossils and Cherts
Sandstone in traces

605 – 615 m **Chalk** (100 %), as above
Limestone (traces), white-bluish, soft, wackstone texture, slightly sandy, with Pyrite

615 – 670 m **Chalk** (100 %), white, soft – firm, occasionally moderately hard to hard, amorphous, commonly Cherts (brown, clear, very hard, angular)
Sandstone in traces

670 – 690 m **Chalk** (100 %), white, soft – firm, occasionally moderately hard to hard, amorphous, rare Cherts (brown, clear, very hard, angular) and fossils

690 – 705 m **Chalk** (95 %), as above

Limestone (5%) white, hard, massive, calcarenite, with fossils
Sandstone (traces) grey, fine grained, well rounded, poorly sorted, hard

705 – 710 m **Chalk** (100 %), white, soft – firm, occasionally moderately hard to hard, amorphous, rare fossils
Limestone (traces) white, hard, massive, calcarenite, with fossils
Sandstone (traces) grey, fine grained, well rounded, poorly sorted, hard

710 – 715 m **Chalk** (100 %), as above

715 – 720 m **Chalk** (100 %), white, pale greenish in places, soft – firm, occasionally moderately hard, amorphous, rare fossils

Texel Formation

Plenus Marl Mb : 724.7 – 727.1 m MD / 715.93 – 718.33 m TVD SS

720 – 725 m **Chalk** (40 %), as above
Marl (60 %), green, greenish, beige, soft – firm, occasionally moderately hard, glauconitie, sandy, grading to glauconitic Sandstone in places

725 – 730 m **Chalk** (20 %), as above
Marl (80 %), as above
Traces of **Pyrite**

Texel Marlstone Mb : 727.1 – 815.1 m MD / 718.33 – 805.23 m TVD SS

730 – 735 m **Chalk** (5 %), as above
Marl (35 %), grey, soft – firm, common Glauconite, Pyrite
Limestone (20 %), greenish – beige, moderately hard, packstone – grainstone, sandy
Sandstone (40 %), light grey, very hard, very fine grained, well sorted, dolomitic cement, common Glauconite and Feldspar

735 – 740 m **Marl** (90 %), as above
Sandstone (10 %), as above
Traces of **Chalk** and **Pyrite**

740 - 745 m **Marl** (60 %), grey, soft - firm, very silty, sandy, glauconite
Sandstone (40 %), light grey, very fine grained, firm – hard, crumbly in places, calcareous cement, Glauconite, commonly grading to sandy Siltstone, often bit mashed

745 – 750 m **Marl** (30 %), as above
Sandstone (70 %), as above

750 – 755 m **Marl** (80 %), as above
Sandstone (20 %), as above

755 – 760 m **Marl** (90 %), as above
Sandstone (10 %), as above

760 – 765 m **Marl** (40 %), as above
Sandstone (60 %), as above

765 – 770 m **Marl** (80 %), as above
Sandstone (20 %), as above

770 – 780 m **Sandstone** (80 %), light grey, very fine grained, moderately hard to hard, calcareous cement, Glauconite, commonly grading to Siltstone
Siltstone (20%) light grey to grey, moderately hard, locally grading to very fine sandstone, calcareous

780 – 790 m **Siltstone** (60%) light grey to grey, moderately hard, locally grading to very fine sandstone, calcareous
Sandstone (40 %), light grey, very fine grained, moderately hard to hard, calcareous cement, Glauconite, commonly grading to Siltstone

790 – 795 m **Sandstone** (60 %), light grey, very fine grained, moderately hard to hard, calcareous cement, Glauconite, commonly grading to Siltstone
Siltstone (40%) light grey to grey, moderately hard, calcareous, sandy

795 – 800 m **Siltstone** (80%) light grey to grey, moderately hard, calcareous
Sandstone (20 %), light grey, very fine grained, moderately hard to hard, calcareous cement, Glauconite, commonly grading to Siltstone

800 – 820 m **Siltstone** (100%) light grey to grey, moderately hard, calcareous and marly, Pyrite

Texel Greensand Mb : 815.1 – 830.5 m MD / 805.23 – 820.33 m TVD SS

820 – 825 m **Sandstone** (80 %), light grey to greenish-grey, fine to very fine grained, moderately hard to hard, calcareous cement, with Glauconite
Siltstone (20%) light grey to grey, moderately hard, calcareous and marly,
Glauconite

825 – 830 m **Sandstone** (100 %), light grey to greenish-grey, fine to very fine grained, moderately hard to hard, calcareous cement, with Glauconite

Lower Cretaceous

Rijnland group

Holland Formation :

Upper Holland Marl Mb : 830.5 – 1112.9 m MD / 820.33 – 1082.23 m TVD SS

830 – 835 m **Sandstone** (100 %), light grey to whitish-grey, fine to very fine grained, moderately hard to hard, calcareous cement, Glauconite

835 – 840 m **Sandstone** (30 %), light grey, fine to very fine grained, moderately hard to hard, calcareous cement, Glauconite

Siltstone (70%) light grey to grey, moderately hard, calcareous and marly, Glauconite

840 – 855 m **Sandstone** (10 %), as above
Siltstone (90%) as above

855 – 885 m **Siltstone** (100 %), grey to light grey, fine to very fine grained, soft to moderately hard, friable, calcareous cement, marly, slightly sandy, mainly subblocky, Glauconite

885 – 890 m **Siltstone** (100 %), grey to light grey, soft to moderately hard, friable, calcareous, marly, mainly subblocky, occasionally Glauconite and Pyrite

890 – 920 m **Siltstone** (100 %), grey, soft to moderately hard, friable, calcareous, mainly subblocky, occasionally Pyrite, grading to **Claystone**

920 – 1040 m **Claystone** (100%)**,** grey, soft to moderately hard, calcareous and marly, silty, water-soluble, occasionally foraminifera. Single light brown Claystone grains form 970 m

1040 – 1055 m **Claystone** (100%)**,** as above
Traces of **Siltstone,** and **Pyrite**

1055 – 1070 m **Claystone** (100%), grey, soft to moderately hard, calcareous and marly, silty, water-soluble, foraminifera (among another things Epistomina and Lagena), very occasionally Pyrite

1070 – 1080 m **Claystone** (100 %), grey, soft to moderately hard, calcareous and marly, silty, water-soluble, occasionally foraminifera

1080 – 1085 m **Claystone** (100 %), grey, occasionally brownish-grey, soft to moderately hard, calcareous and marly, silty, water-soluble, also **Claystone**, grey, hard, platy and shaly, calcareous, with Mica

1085 – 1090 m **Claystone** (100 %) as above
Traces of **Marl**, reddish-brown and brownish grey, soft.

1090 – 1095 m **Marl** (60 %), variegated and brownish grey, soft, calcareous
Claystone (40 %) as above

1095 – 1105 m **Claystone** (80 %) as above
Marl (20 %), as above
Traces of non-calcareous fossils fragments

1105 – 1110 m **Claystone** (100 %) as above
Traces of **Pyrite**, variegated **Marl** and **Siltstone**, greenish, brown, moderately hard, calcareous and argillaceous

Middle Holland Claystone Mb:1112.9–1273 m MD / 1082.23 – 1209.93 m TVD SS

1110 – 1115 m **Claystone** (100 %) as above

1115 – 1125 m **Claystone** (90 %) as above

Claystone (10 %) dark grey, moderately hard, calcareous, strong glauconitic.
Traces of variegated **Marl**

1125 – 1130 m **Claystone** (100 %), grey, soft to moderately hard, with Glauconite and Pyrite.
Traces of reddish **Marl**

1130 – 1145 m **Claystone** (100 %), dark grey, moderately hard, calcareous, very glauconitic.
Traces of **Claystone**, green and greenish grey, soft to moderately hard, non-calcareous

1145 – 1150 m **Claystone** (90 %), grey to dark grey, soft, calcareous.
Siltstone (10 %), light grey to grey, moderately hard to hard, splintery, elongated, platy-shaly, calcareous, with Mica and Pyrite.
Traces of fine grained **Sandstone** and greenish-grey **Claystone**

1150 – 1155 m **Claystone** (80 %), as above
Siltstone (20 %), as above
Traces of **Pyrite**, greenish-grey **Claystone** and glauconitic **Sandstone**

1155 – 1160 m **Claystone** (95 %), light grey – grey – dark grey, minor light brown – brown, soft – firm, fine black carbonaceous matter dispersed in dark grey variety, calcareous, silty, Glauconite
Sandstone (5 %), light grey, hard – very hard, very fine grained, occasionally fine grained, moderately sorted, subspherical – spherical, subangular – subrounded, transparent, Glauconite, mainly as loose grains
Traces of **Pyrite** and **Foraminifera**

1160 – 1165 m **Claystone** (100 %), grey, occasionally light grey and dark grey, soft – firm, moderately calcareous - calcareous, fine organic matter dispersed in places, silty, grading to Siltstone in places
Traces of **Pyrite**

1165 – 1170 m **Claystone** (90 %), grey, dark grey, occasionally light grey, firm – moderately hard, slightly calcareous, black fine organic matter dispersed in places, silty to very silty, grading to Siltstone in places, common Mica
Sandstone (10 %), brownish, light grey, very fine – fine grained, crumble, moderately sorted, Glauconite, mainly as loose grains
Dolomite (traces), brown, microcrystalline, hard – very hard, translucent
Common Pyrite**.** Traces of **Glauconite**, **Foraminifera**, **Fossils**

1170 – 1175 m **Claystone** (100 %), as above
Traces of **Sandstone**, **Pyrite**

1175 – 1180 m **Claystone** (100 %), as above + single light brown grains
Traces of **Sandstone**, **Pyrite, Foraminifera**

1180 – 1185 m **Claystone** (95 %), grey, occasionally light grey, firm, minor moderately hard, slightly calcareous, black fine organic matter dispersed in places, silty to very silty, grading to Siltstone in places, common Mica
Sandstone (5 %), loose quartz grains, very fine, minor fine, transparent, moderately sorted, subspherical – spherical, subangular – subrounded
Traces of **Pyrite, Foraminifera**

1185 – 1190 m **Claystone** (95 %), as above

Sandstone (5 %), as above
Traces of **Pyrite**

1190 – 1195 m **Claystone** (90 %), as above, but soft, minor firm
Siltstone (10 %), grey, dark grey, soft – firm, slightly – non-calcareous, fine black carbonaceous matter dispersed
Common Pyrite

1195 – 1200 m **Claystone** (100 %), as above
Traces of **Siltstone**, **Dolomite**, **Pyrite**, **Fossils**, **Glauconite**

1200 – 1205 m **Claystone** (95 %), as above, but grey – dark grey
Sandstone (5 %), as above
Traces of **Pyrite**

1205 – 1210 m **Claystone** (100 %), grey, occasionally light grey, soft, minor firm, slightly calcareous, black fine organic matter dispersed in places, silty, grading to Siltstone in places, Mica
Traces of **Pyrite** and **Dolomite**

1210 – 1220 m **Claystone** (100 %), as above
Traces of **Pyrite, Dolomite, Glauconite** and **Foraminifera**

1220 – 1230 m **Claystone** (100 %), as above
Siltstone (traces), as above
Traces of **Pyrite, Dolomite, Glauconite**

1230 – 1235 m **Claystone** (95 %), as above
Sandstone (5 %), mainly as loose grains, fine grained, occasionally medium grains, subspherical – pherical, subrounded – rounded, moderately sorted, with Glauconite
Traces of **Pyrite, Dolomite, Glauconite**

1235 – 1240 m **Claystone** (100 %), as above
Sandstone (traces), as above
Traces of **Pyrite**, **Glauconite**, **Fossils**

1240 – 1245 m **Claystone** (95 %), as above
Sandstone (5%), as above
Traces of **Pyrite**, **Glauconite, Dolomite**

1245 – 1250 m **Claystone** (95 %), as above
Siltstone (10 %), light grey to grey, moderately hard to hard, splintery, platy-shaly, calcareous, with **Mica and Pyrite.**

1250 – 1255 m **Claystone** (100 %), medium grey, moderately hard, subblocky, non calcareous, common **Pyrite**, in places silty

1255 – 1260 m **Claystone** (100 %), medium grey, soft to firm, slightly silty, common **Glauconite and Pyrite**, weak calcareous, very poor Hydrocarbon shows

1260 – 1270 m **Claystone** (100 %), as above, silty, grading to **Siltstone**, also very fine sandy

Holland Greensand Mb : 1273 – 1332 m MD / 1209.93 – 1256.03 m TVD SS

1270 – 1275 m **Claystone** (60 %), dark grey to grey, plastic to soft, sub blocky to sub platy, locally amorphous, calcareous in part, washable in part, often silty and sandy.
Siltstone (30 %), grey, locally dark grey, soft to moderate hard, sub blocky, amorphous in part, moderate to weak calcareous, rare glauconitic, in part graded to **Sandstone**.
Sandstone (10 %), predominant loose Quartz, yellowish, translucent to transparent, very fine to fine, occasionally medium, sub rounded to rounded, well rounded in part.
Traces of **Limestone**, beige, creamy, moderate hard to hard, micro to crystalline.

1275 – 1285 m **Claystone** (50-55 %), as above.
Siltstone (35-40 %), as above.
Sandstone (10 %), as above. Also **Sandstone**, grey, brown-grey, soft to friable, very fine to fine, sub rounded to rounded, poor sorted, argillaceous, moderate calcareous, occasionally glauconitic. Poor oil shows.
Traces of **Limestone**, as above.
Traces of **Calcite and Pyrite**.

1285 – 1290 m **Claystone** (40 %), as above.
Siltstone (40 %), as above.
Sandstone (20 %), as above. Occasionally **Sandstone**, off white, white, friable to moderate hard, very fine, sub angular to sub rounded, poor sorted, glauconitic.
Weak oil shows:
5% of cuttings
Natural: weak odour
Fluorescence: direct: white to pale yellow cut: white, fast, stream
Traces of **Limestone**, as above.

1290 – 1300 m **Claystone** (45 %), as above.
Siltstone (40 %), as above.
Sandstone (15 %), as above.
Poor oil shows.
Traces of **Limestone,** as above.

1300 – 1305 m **Claystone** (20 %), as above.
Siltstone (40 %), as above.
Sandstone (40 %), predominant loose Quartz as above. In part Sandstone, grey, light brown – grey, soft to friable, very fine to fine, sub angular to sub rounded, poor to weak sorted, weak calcareous, rare glauconitic, occasionally nodules of Pyrite. Poor oil shows.

1305 – 1310 m **Claystone** (30 %), dark grey to grey, plastic to soft, sub blocky to sub platy, locally amorphous, calcareous in part, washable in part, often silty and sandy.
Siltstone (40 %), grey, locally dark grey, soft to moderate hard, sub blocky, amorphous in part, moderate to weak calcareous, rare glauconitic, in part grading to **Sandstone**

Sandstone (30 %), predominant loose Quartz as above. In part Sandstone, grey, light brown – grey, soft to friable, very fine to fine, sub angular to sub rounded, poor to weak sorted, weak calcareous, rare glauconitic, occasionally nodules of **Pyrite**.
Weak oil shows: 15% of cuttings, natural: weak odour, fluorescence: direct: white to pale yellow, cut: white, fast, cloudy

1310 – 1315 m **Siltstone** (45 %), grey, grey-brown, soft to moderately hard, sub-blocky, slightly calcareous, sandy,
Claystone (30 %), as above
Sandstone (25 %), as above
Traces of **Calcite**
Poor oil shows

1315 – 1320 m **Claystone** (40 %), as above,
Siltstone (45 %), as above,
Sandstone (15 %), as above
Traces of **Calcite**

1320 – 1330 m **Claystone** (25-30 %), as above,
Siltstone (55 %), as above,
Sandstone (15-20 %), as above
Traces of **Pyrite** and **Glauconite**
Rare traces of **Calcite**

Lower Holland Marl Mb : 1332 – 1619 m MD / 1256.03 – 1476.71 m TVD SS

1330 – 1335 m **Claystone** (40 %), medium grey, soft to plastic, subblocky, slightly calcareous, silty grading to
Siltstone (50 %), as above,
Sandstone (10 %), loose, very fine quartz grains, transparent and translucent, subangular to subrounded
Traces of **Glauconite**

1335 – 1340 m **Claystone** (50 %), medium grey, soft and plastic to firm, marly, silty and very fine sandy, grading to
Siltstone (50 %), as above.
Traces of **Glauconite**

1340 – 1345 m **Claystone** (60 %), grey to light grey, moderately hard to firm, subblocky to rare subplaty, marly, silty and very fine sandy
Siltstone (40 %), as above.
Traces of **Pyrite**

1345 – 1350 m **Claystone** (60 %), medium grey, soft and plastic, subblocky, marly, silty grading to **Siltstone** (40 %), as above
Traces of **Pyrite** and **Glauconite**

1350 – 1360 m **Claystone** (70-85 %), dark grey to grey, plastic to soft, locally moderate hard, amorphous to sub blocky, locally sub platy, slightly calcareous, marly, silty in places.
Siltstone (15-30 %), grey, rare dark grey, soft to moderate hard, sub blocky, none to weak calcareous, locally sandy.

Traces of Sandstone, loose, very fine Quartz grains, yellowish, transparent and translucent, subangular to subrounded.

1360 – 1365 m **Claystone** (85 %), dark grey to grey, plastic to soft, locally moderate hard, amorphous to sub blocky, locally sub platy, slightly calcareous, marly, silty in places.
Siltstone (15 %), grey, rare dark grey, soft to moderate hard, sub blocky, none to weak calcareous, locally sandy.

1365 – 1375 m **Claystone** (50 %), dark grey to grey, plastic to soft, also moderately hard, amorphous to sub blocky, locally sub platy, marly, silty in places
Argillaceous Marl (50 %), grey, locally light grey, plastic, sticky, washable, amorphous, moderate calcareous, rare spots of black organic material, graded to marly **Claystone**, as described above.

1375 – 1380 m **Claystone** (70%), medium grey, soft, amorphous and subblocky, silty, washable in part,
Claystone (20 %), medium to dark grey, moderately hard, predominantly subplaty, shaly in part, silty, micromicaceous, calcareous, with dispersed **Pyrite**
Argillaceous Marl, (10 %) as above

1380 – 1385 m **Claystone** (75 %), medium to dark grey, moderately hard, predominantly subplaty, shaly in part, silty, micromicaceous, calcareous, with dispersed **Pyrite**
Claystone (25%), medium grey, soft, amorphous and subblocky, silty, washable in part, calcareous

1385 – 1390 m **Claystone** (100 %), light to medium grey, soft to firm, amorphous to subblocky, silty, calcareous, also medium to dark grey, moderately hard as above

1390 – 1395 m **Claystone** (95 %), grey to dark grey, soft to firm, moderate hard in part, sub blocky tp sub platy, silty in places, occasionally marly, slightly to moderate calcareous.
Siltstone (5 %), dark grey, moderate hard, sub blocky, none to weak calcareous, rare black spots of carbonated material.

1395 – 1400 m **Claystone** (90 %), grey, light grey in part, soft to moderate hard, sub blocky to sub platy, sub fissile in part, weak to moderate calcareous, locally marly and silty.
Shale (10 %), dark grey, firm, fissile, slightly clacareous.

1400 – 1405 m **Claystone** (80 %), as described above.
Shale (15 %), as described above.
Siltstone (5 %), as described above.

1405 – 1410 m **Claystone** (85 %), as described above.
Shale (5 %), as described above.
Marl argillaceous (10 %), light grey to grey, plastic, sticky, amorphous, washable in part.
Traces of **Siltstone**, as described above.

1410 – 1415 m **Claystone** (85 %), grey, light grey in part, soft to moderate hard, sub blocky to sub platy, sub fissile in part, weak to moderate calcareous, locally marly and silty.
Marl argillaceous (15 %), light grey to grey, plastic, sticky, amorphous, washable in part.
Traces of **Siltstone**, as described above.

1415 – 1420 m **Claystone** (60 %), dark grey to grey, plastic to soft, locally moderate hard, amorphous to sub blocky, locally sub platy, slightly calcareous, marly, silty in places.
Shale (15 %), dark grey, firm, fissile, slightly clacareous.
Marl argillaceous 25 %), grey, locally light grey, plastic, sticky, washable, amorphous, moderate calcareous, rare spots of black organic material, graded to marly **Claystone**, as described above.

1420 – 1425 m **Claystone** (75 %), as above.
Shale (10 %), as above.
Marl argillaceous 15 %), as above.
Traces of **Siltstone**, dark grey, firm to moderate hard, sub blocky, with spots of carbonated material and glauconite.

1425 – 1430 m **Claystone** (85 %), grey, soft, sub blocky to platy, occasionally amorphous, calcareous, silty, glauconitic, common piryte, rare single fine quartz grains, locally grading to **Marl**.
Claystone (15 %), dark grey, moderately hard, platy, splintery, rare blocky, slightly calcareous, slightly silty.

1430 – 1450 m **Claystone** (70-100 %), grey, soft, sub blocky to platy, occasionally amorphous, calcareous, silty, rare glauconite grains, often grading to **Marl**.
Claystone (Traces-30%), dark grey, moderately hard, platy, splintery, rare blocky, slightly calcareous, slightly silty.

1450 – 1460 m **Claystone** (40-45 %), grey, soft, sub blocky to platy, occasionally amorphous, calcareous, silty, rare glauconite grains, often grading to **Marl**, occasionally grey to dark grey, sub fissille to sub platy garding to **Shale**.
Marl argillaceous (40-50 %), light grey, plastic, soft, washable, calcareous.
Siltstone (10-15 %) dark grey, blackish in part, firm to moderate hard, friable when sandy, sub blocky, sandy in part, slightly calcareous, occasionally black – carbonated spots.

1460 – 1465 m **Claystone** (45 %), grey, soft, sub blocky to platy, occasionally amorphous, calcareous, silty, rare glauconite grains, often grading to **Marl**.
Marl argillaceous (40 %), light grey, plastic to soft, washable, calcareous.
Siltstone (10 %) dark grey, blackish in part, firm to moderate hard, sub blocky, sandy, slightly calcareous, occasionally black – carbonated spots.
Sandstone (10 %), predominant loose Quartz, yellowish, translucent to transparent, very fine, sub rounded to rounded, in part, light grey, occasionally beige, firm to friable, very fine, sub angular to subrounded, poor sorted, occasionally glauconitic, slightly calcareous, in transition to **Siltstone**.
Traces of Pyrite nodules.

1465 – 1470 m **Claystone** (35 %), grey, soft, sub blocky to platy, occasionally amorphous, calcareous, silty, rare glauconite grains, often grading to **Marl**.
Marl argillaceous (60 %), light grey, plastic, soft, washable, calcareous.
Traces of **Siltstone**.

1470 – 1480 m **Claystone** (40-50%), grey, soft, sub blocky to platy, occasionally amorphous, calcareous, silty, rare glauconite grains, often grading to **Marl**.
Marl argillaceous (45-55 %), light grey, plastic to soft, washable, calcareous.
Siltstone (5 %) dark grey, blackish in part, firm to moderate hard, sub blocky, sandy, slightly calcareous, occasionally black – carbonated spots.

1480 – 1500 m **Claystone** (40-65 %), grey, soft, amorphous to sub blocky, rare sub platy and sub fissille, calcareous, silty, occasionally sandy, rare glauconite grains, often grading to **Marl**.
Marl argillaceous (35-60 %), as described before. Traces of **Siltstone**.

1500 – 1515 m **Claystone** (30-65 %), grey, soft, amorphous to sub blocky, rare sub platy and sub fissille, calcareous, silty, occasionally sandy, rare glauconite grains, often grading to **Marl**.
Marl argillaceous (35-70 %), light grey, amorphous, plastic to soft, washable, calcareous, occasionally slightly sandy.
Traces of **Siltstone**.
Traces of loose **Quartz**, yellowish, transparent to translucent, very fine, sub rounded to rounded.

1515 – 1525 m **Claystone** (35 %), grey, soft, amorphous to sub blocky, rare sub platy and sub fissille, calcareous, silty, occasionally sandy, rare glauconite grains, often grading to **Marl**.
Marl argillaceous (60 %), light grey, amorphous, plastic to soft, washable, calcareous, occasionally slightly sandy.
Siltstone (5 %), dark grey, firm to moderate hard, sub blocky, occasionally glauconitic, rare pyritized.
Traces of loose **Quartz**, as described before.

1525 – 1535 m **Claystone** (20-25 %), as described before.
Marl argillaceous (75-80 %), as described before. Locally brownish shade.
Traces of **Siltstone**.
Traces of loose **Quartz**, as described before.

1535 – 1545 m **Claystone** (20-25 %), as described before.
Marl argillaceous (70-75 %), as described before.
Siltstone (5 %), as described before.
Traces of loose **Quartz**, as described before.

1545 – 1565 m **Claystone** (45 - 60 %), grey, soft to moderately hard, subblocky, often amorphous, rare sub platy and sub fissile, calcareous to moderately calcareous, slightly silty, very rare glauconite grains, visible pyrite nodules, often grading to **argillaceous Marl**.
Marl argillaceous (40-55 %), light grey to grey, amorphous, plastic to soft, washable, occasionally slightly silty.
Siltstone (Traces %), dark grey, firm to moderate hard, sub blocky, occasionally glauconitic, rare pyritized.

1565 – 1600 m **Claystone** (20 - 75 %), grey, soft, subblocky, often amorphous, rare sub platy, calcareous to moderately calcareous, slightly silty, in part grading to **argillaceous Marl**.
Claystone (5 – 80 %), dark grey, moderately hard, platy, tabular, often splintery, fissile, moderately to sightly calcareous.
Marl argillaceous (traces - 20 %), light grey to grey, amorphous, plastic to soft, washable, occasionally slightly silty.

Siltstone (traces), dark grey, firm to moderate hard, sub blocky, occasionally glauconitic, rare pyritized.

1600 – 1620 m **Claystone** (90-95 %), as described above.
Siltstone (5-10 %), dark grey, loccally blackish, firm to moderate hard, sub blocky, rare glauconitic, occasionally bituminous, sandy in places..
Traces of **Marl argillaceous,** as described above.

Vlieland Sandstone Formation

De Lier Member : 1619 – 1726.5 m MD / 1476.71 – 1560.32 m TVD SS

1620 – 1625 m **Claystone** (95 %), as described above, also dark grey, firm to moderate hard, sub blocky, weak calcareous, graded to **Siltstone**.
Siltstone (5 %), as described above.
Traces of **Sandstone**, light grey, friable, very fine, sub angular, poor sorted, slightlu glauconitic, slightly calcareous, in trasition to **Siltstone**.

1625 – 1630 m **Claystone** (95 %), as described above.
Siltstone (5 %), as described above.
Traces of **Sandstone**, as descibed above, also loose Quartz, yellowish, transparent to translucent, very fine, sub rounded to rounded.
Traces of **Dolomite**, beige, light brown, very hard, cryptocrystalline.

1630 – 1640 m **Claystone** (100 %), grey, firm, sub blocky, weak to slightly calcareous, locally black spots of carbonated material, silty, also light grey to grey, soft to firm, slightly sandy, weak to moderate calcareous, marly, also grey to dark grey, sub platy, sub fissile to fissile, slightly calcareous, grading to **Shale**.
Traces of **Siltstone**, as described above.
Traces of **Sandstone**, as described above.
Traces of **Dolomite**, as described above.

1640 – 1650 m **Claystone** (100 %), grey, firm, sub blocky, weak to slightly calcareous, locally bituminous, silty also light grey to grey, soft to firm, slightly sandy, weak to moderate calcareous, marly, also grey to dark grey, sub platy, sub fissile to fissile, slightly calcareous, grading to **Shale**.
Traces of **Siltstone**, as described above.
Traces of **Sandstone**, predominant loose Quartz, yellowish, transparent to translucent, very fine, sub rounded to rounded.
Traces of **Dolomite**, as descibed above.

1650 – 1660 m **Claystone** (100 %), grey to dark grey, moderately hard, firm, subblocky to subplaty, in part fissile, none calcareous, silty, in part grading to **silty Claystone.**

1660 – 1675 m **Claystone** (70 %), grey to dark grey, moderately hard, firm, subblocky to subplaty, in part fissile, none to slightly calcareous, silty, in part grading to **silty Claystone**.
Sandstone (30 %), grey, greenish grey, moderately hard, also friable, fine to very fine grained, poorly sorted, moderately cemented, silty, argillaceous, glauconitic, none to slightly calcareous, Qtz gr translucent, subrounded to subangular, subspherical, frosted luster, common pyrite coating, single

muscovite, visible intragranular porosity, traces of very weak oil shows. Often grading to **sandy Siltstone**.

1675 – 1685 m **Claystone** (100 %), grey to dark grey, also brownish grey, soft to moderately hard, firm, subblocky to subplaty, in part fissile, none to slightly calcareous, silty, in part grading to **silty Claystone**.
Sandstone (Traces), grey, greenish grey, moderately hard, also friable, fine to very fine grained, poorly sorted, moderately cemented, silty, argillaceous, glauconitic, none to slightly calcareous, Qtz gr translucent, subrounded to subangular, subspherical, frosted luster. Often grading to **sandy Siltstone**.

1685 – 1690 m **Claystone** (100 %), as described before.

1690 – 1705 m **Claystone** (100 %), as described before.
Traces of **Dolomite**, light brown to brown, very hard, cryptocrystalline.

1705 – 1710 m **Claystone** (95 %), as described before.
Siltstone (5 %), dark grey, blackish, moderate hard, sub blocky, locally bituminous, sandy in part.
Traces of **Sandstone**, predominant loose **Quartz,** yellowish, clear in part, translucent, very fine, moderate rounded, also **Sandstone**, light grey, frim, friable, very fine, sub angular to sub rounded, poor sorted, rare glauconitic, argillaceous.

1710– 1715 m **Claystone** (95 %), as described before.
Siltstone (5 %), dark grey, blackish, moderate hard, sub blocky, locally bituminous, sandy in part.

1715– 1720 m **Claystone** (100 %), grey to dark grey, also brownish grey, moderately hard, firm, sub blocky to sub platy, in part sub fissille to fissile, none to slightly calcareous, silty in part, locally grading to **Shale**. Also **Claystone**, grey to light grey, soft to firm, amorphous to sub blocky, weak to moderate calcareous, marly.
Siltstone (traces), dark grey, blackish, moderate hard, subblocky, locally bituminous, sandy in part.

Vlieland Claystone Fm: 1726.5 – 2148.5 m MD / 1560.32 – 1890.1 m TVD SS

1720– 1745 m **Claystone** (60 - 75 %), grey to dark grey, also brownish grey, moderately hard, firm, sub blocky to sub platy, in part sub fissille to fissile, none to slightly calcareous, silty in part, micaceous, locally grading to **Shale**. Subordinate **Claystone**, grey to light grey, soft to firm, amorphous to sub blocky, weak to moderate calcareous, marly.
Siltstone (25 -40%), grey, dark grey, occasionally blackish, moderate hard, friable, subblocky to subplaty, locally bituminous, argillaceous, glauconitic, sandy in part, locally grading to **silty Sandstone**, grey, light grey, very fine grained.

1745– 1760 m **Claystone** (40-50 %), grey to dark grey, also brownish grey, moderately hard, firm, sub blocky to sub platy, in part sub fissille to fissile, none to slightly calcareous, silty in part, locally grading to **Shale**. Subordinate **Claystone**, grey, soft to firm, amorphous to sub blocky, weak to moderate calcareous, rare marly.

Siltstone (50-60 %), grey, dark grey, occasionally blackish, locally browni shade, moderate hard, friable, sub blocky to sub platy, locally bituminous, argillaceous, glauconitic, sandy in part, locally grading to **silty Sandstone**, grey, light grey, very fine grained.
Traces of **Pyrite** nodules.

1760– 1775 m **Claystone** (70 %), as described above but mainly grey, soft, amorphous to subblocky, rare sub platy, slightly calcareous.
Siltstone (30 %), as described above.

1775– 1780 m **Claystone** (50%), light grey to grey, soft, subblocky, non calcareous, very silty and sandy
Claystone (30%), dark grey, moderately hard, subplaty, with mica, locally calcareous
Siltstone (20%), grey to dark grey, moderately hard, friable, subblocky, sandy, non calcareous, sparse glauconite

1780– 1790 m **Claystone** (85-90%), light grey to grey, soft, subblocky, non calcareous, silty to sandy
Siltstone (10-15%), grey to dark grey, moderately hard, friable, subblocky, sandy, non calcareous

1790– 1810 m **Claystone** (85-90%), light grey to grey, brown, soft, subblocky, non calcareous, alternating silty and sandy
Siltstone (10-15%), grey to dark grey, moderately hard, friable, subblocky, sandy, non calcareous
Traces of **Claystone**, brown-reddish, very hard, splintery, non-calcareous, with pyrite and glauconite

1810– 1815 m **Claystone** (90%), light grey to grey, brown, soft, subblocky to subplaty, non calcareous, sandy
Claystone (10%), dark grey, moderately hard, subblocky, non calcareous, often grading to **Siltstone**, moderate amount of quartz grains, piryte
Claystone (Traces), beige to light brown, hard, splintery to platy, non calcareous, moderately sandy.

1815– 1825 m **Claystone** (100%), light grey to grey, locally brown shade, soft, subblocky to subplaty, none calcareous, sandy also **Clayston**, dark grey, moderately hard, subblocky, non calcareous, often grading to **Siltstone**, moderate amount of quartz grains, piryte.

1825– 1835 m **Claystone** (95 %), light grey to grey, plastic to soft, amorphous to subblocky, none to very slightly calcareous, rare sandy, also traces of **Claystone**, dark grey, moderately hard, subblocky, none calcareous, in part grading to **Siltstone**.
Siltstone (5 %), dark grey, blackish in part, moderate hard, sub blocky, rare pyritized, black bituminous spots, in part graded to **Sandstone**, light grey, friable, very fine, sub rounded, poor sorted.

1835– 1850 m **Claystone** (100 %), light grey to grey, plastic to soft, amorphous to subblocky, none to very slightly calcareous, rare sandy, also traces of **Claystone**, dark grey, moderately hard, subblocky, none calcareous, in part grading to **Siltstone**.

1850– 1860 m **Claystone** (90-95 %), light grey to grey, brownish shade, occasionally greenish shade, plastic to soft, amorphous to subblocky, also **Claystone**, dark grey, firm, subblocky to subplaty, occasionally splintery, subfissile, none calcareous, in part grading to **Siltstone**.
Siltstone (5-10 %), dark grey, blackish in part, firm to moderate hard, sub blocky, locally subfissile, rare pyritized, black bituminous spots.
Traces of Sandstone, off white to light grey, occasionally greenish shade, firm to friable, very fine to fine, sub angular to sub rounded, moderate sorted, slightly calcareous, slightly glauconitic.

1860– 1870 m **Claystone** (90%), as described above also sandy in part, somewhat argillaceous **Sandstone**.
Siltstone (5%), as described above.
Sandstone (5%), predominant loose Quartz, translucent to transparent, occasionally yellowish to off white, very fine to fine, sub angular to sub rounded, rare rounded, in traces as described above. Often argillaceous, in transition to sandy **Claystone**, as above.

1870– 1900 m **Claystone** (100%), light grey to grey, brownish shade, occasionally greenish shade, plastic to soft, amorphous to subblocky, non calcareous, sparse quartz grains also **Claystone**, dark grey, firm to moderately hard, subblocky to subplaty, occasionally splintery, subfissile, none calcareous, rarely mica, in part grading to **Siltstone**.

1900– 1914 m **Claystone** (85-90%), light grey, beige, soft to firm, subblocky, non-calcareous, sandy.
Siltstone (10-15%), dark grey, brownish, firm to moderately hard, subblocky to splintery, locally grading to **Sandstone,** very fine grained, friable, moderately sorted, subangular, quartz transparent.

1914– 1930 m **Claystone** (70-95 %), light grey to grey, light brown in part, soft to plastic, firm in places, amorphous to subblocky, non to weak calcareous, sandy in part, also **Claystone**, grey to dark grey, firm to moderately hard, subblocky, non calcareous, in places graded to Siltstone, also **Claystone**, light grey, creamy to off white, plastic, amorphous, washable in part, weak calcareous, marly, also **Claystone**, light brown to brown, hard, sub platy, dolomitic.
Siltstone (5-30 %), grey to dark grey, rare blackish, friable to moderate hard, subblocky, none to slightly calcareous, occasionally sandy.
Traces of **Pyrite**.

1930– 1945 m **Claystone** (75-85 %), as described above.
Siltstone (10-15 %), as described above.
Sandstone (5-10 %), off white to light grey, beige in part, friable to moderately hard, very fine, subangular to subrounded, poorly to moderately sorted, moderately to strongly calcareous, slightly glauconitic, predominantly argillaceous, occasionally sillicaceous. No shows. In part as loose Quartz.

1945– 1965 m **Claystone** (65-85 %), light grey to grey, light brown in part, soft to plastic, firm in places, amorphous to subblocky, non to weak calcareous, sandy in part, also **Claystone**, grey to dark grey, firm to moderate hard, subblocky, non calcareous, in places graded to Siltstone, also **Claystone**, light grey, creamy to off white, plastic, amorphous, washable in part, weak calcareous, marly, also **Claystone**, light brown to brown, hard, subplaty, dolomitic.
Siltstone (5-20 %), grey to dark grey, rare blackish, friable to moderately hard, subblocky, non to slightly calcareous, occasionally sandy.

Sandstone (5-15 %), light brown to brown, beige, soft, friable, argillaceous, very fine, sub angular to subrounded, poorly sorted, mainly washed out to loose Quartz, occasionally off white to light grey, grey to dark grey, friable to moderately hard, subangular to subrounded, poorly to moderate sorted, sillicaceous, locally glauconitic, quartzic in places.

1965– 1970 m **Claystone** (90 %), predominantly creamy, light grey, soft to plastic, amorphous, non to very slightly calcareous, contains loose Quartz grains, also as described above.
Siltstone (5 %), as described above.
Sandstone (5 %), as described above.

1970– 1975 m **Claystone** (95 %), as described above.
Siltstone (5 %), as described above.
Traces of **Sandstone**, as described above.

1975– 1985 m **Claystone** (85 – 95%), light grey, soft, sub-blocky, non-calcareous, slightly sandy; **Claystone**, dark grey, friable to firm, calcareous, sub-blocky to subplaty.
Siltstone (5 – 10%), dark grey, moderately hard, subblocky, non-calcareous, with small amount of sand grains, with pyrite, grading to sandstone.
Sandstone (traces – 5%) off-white, light grey to dark grey, very fine to fine, friable to firm to moderately hard, poorly sorted, subangular to subrounded, no visible porosity, argillaceous in part, with sparse glauconite grains.

1985– 2010 m **Claystone**, (60 – 90%), light grey, soft, sub-blocky, non-calcareous, slightly sandy; **Claystone**, dark grey, friable to firm, calcareous, sub-blocky to subplaty.
Siltstone (traces – 20%), light to dark grey, moderately hard, subblocky to subplaty, sandy, with pyritic burrowings.
Sandstone (10 – 20%), off-white, light to dark grey, very fine to fine, mainly in the form of loose quartz grains, friable to firm, moderately sorted, subangular to subrounded, quartz grains transparent to translucent, argillaceous in places, with sparse glauconite.

2010– 2030 m **Claystone** (60 – 75%), light grey to grey, soft, sub-blocky, non-calcareous, sandy to very sandy.
Siltstone (20%), grey to dark grey, moderately hard, sub-blocky to sub-platy, containing pyrite and glauconite, non-calcareous, grading to sandstone.
Sandstone (5 – 20%), off-white, grey to dark grey, very fine to fine, friable to moderately hard, moderately sorted, quartz sub-angular to subrounded, calcareous in places, no visible porosity, grain supported

2030– 2055 m **Claystone**, (40 – 60%), light grey, soft, sub-blocky, non-calcareous, slightly sandy; **Claystone**, dark grey, friable to firm, calcareous, sub-blocky to subplaty.
Siltstone (10 – 15%), light to dark grey, moderately hard, subblocky to subplaty, sandy, with pyritic burrowings.
Sandstone (30 – 50%), off-white, light to dark grey, occasionally creamy, very fine to fine grained, commonly as loose quartz grains, friable to firm, non to very slightly calcareous, moderately cemented, grain supported, moderately sorted, argillaceous in places, sparse glauconite and mica, occasionally visible intragranular porosity, quartz grains transparent to translucent, angular to subangular, subspherical to spherical, common frosted luster

2055– 2060 m **Claystone**, (60%), as above
Siltstone (10%), as above
Sandstone (30%), as above, also light grey, creamy, medium grained, occasionally coarse – very coarse grained, hard, poorly sorted, well rounded, subspherical – spherical, siliceous matrix, slightly dolomitic, transparent - translucent

2060– 2065 m **Claystone**, (60%), as above
Siltstone (15%), as above
Sandstone (25%), as above, but traces of the second variety

2065– 2078 m **Claystone**, (60 - 70%), as above
Siltstone (20%), as above
Sandstone (10 – 20%), as above, but lack of the second variety

2078- 2100 **Claystone**, (70 – 80%), light grey, soft, sub-blocky, non-calcareous, slightly sandy; **Claystone**, dark grey, friable to firm, calcareous, sub-blocky to subplaty.
Siltstone (10 – 20%), light to dark grey, moderately hard, subblocky to subplaty, sandy.
Sandstone (5 – 10%), off-white, light to dark grey, occasionally creamy, very fine to fine grained, commonly as loose quartz grains, friable to firm, non- to very slightly calcareous, moderately cemented, grain supported, moderately sorted, argillaceous in places, sparse glauconite and mica, occasionally visible intragranular porosity, quartz grains transparent to translucent, angular to subangular, subspherical to spherical, common frosted luster.

2100- 2145 **Claystone**, (80 – 95%), light grey to grey, soft, sub-blocky, non to slightly calcareous, slightly sandy; **Claystone**, dark grey, greenish, moderately hard, firm, non-calcareous, subblocky to subplaty.
Siltstone (10 – 20%), grey to dark grey, moderately hard, friable, subblocky to subplaty, non-calcareous, sandy, sparse glauconite grains, often grading to **silty Claystone.**
Traces of **Pyrite.**

Vlieland Sandstone Formation

Berkel Sandstone Mb : 2148.5 – 2170.0 m MD / 1890.1 – 1905.79 m TVD SS

2145- 2175 **Claystone**, (50 – 70 %), light grey to grey, soft, subblocky, non- to slightly calcareous, slightly sandy; **Claystone**, dark grey, greenish, moderately hard, firm, non-calcareous, subblocky to subplaty.
Siltstone (15 - 20%), grey to dark grey, moderately hard, friable, subblocky to subplaty, non-calcareous, sandy, sparse glauconite grains, often grading to **silty Claystone.**
Sandstone (10 - 30%), light grey with brownish shade in places, occasionally brown, very fine – fine grained, moderately hard, very well sorted, spherical, subangular – subrounded, predominantly transparent, non- to moderately calcareous, calcareous to argillaceous cement, rarely glauconite, mainly as loose quartz grains.
Traces of **Siderite** and **Pyrite**

Berkel Sand-Claystone Mb: 2170.0 – 2381.5 m MD / 1905.79 – 2061.0 m TVD SS

2175 - 2195	**Claystone** (70 – 90%), light to dark grey to brown, soft to firm to moderately hard, subblocky to subplaty, non-calcareous, occasionaly calcareous, silty in places. **Siltstone** (10– 20%), dark grey, dark brown, firm, subblocky to subplaty, slightly sandy, occasionaly microlamination, sparse grains of organic material, sparse mica, sparse glauconite, non-calcareous, sandy in places. **Sandstone** (5 – 10%), off-white to beige, very fine, friable, subangular, subspherical, non-calcareous, no visible porosity; sandstone, dark grey, brown, very fine, firm to moderately hard, argillaceous, siliceous, grains angular, subspherical to elongated, grading to Siltstone; rock flour and loose quartz grains. Traces of **Siderite**: brown, hard, subplaty, splintery, traces of pyrite either as lumps of crystals or growths.
2200 - 2215	**Claystone** (100 %), light to dark grey, dark beige, soft to moderately hard, subblocky to platy, splintery, mainly non-calcareous, occasionally weakly to calcareous, sparse, tiny fragments of organic material Traces of **Siderite** and **Pyrite**. Shell fragments at 2210 m.
2215 - 2220	**Claystone** (90%), as above **Siltstone** (5%), dark grey, moderately hard, non-calcareous, with mica and glauconite **Sandstone** (5%), light grey, very fine – fine grained, moderately hard, well sorted, spherical, subangular – subrounded, transparent, with pyrite in places, non-calcareous, no visible porosity
2220 - 2235	**Claystone** (90%), light to dark grey, dark beige, soft to moderately hard, subblocky to platy, splintery, mainly non-calcareous, occasionally weakly to calcareous, sparse, tiny fragments of organic material. **Siltstone** (5%), dark grey, moderately hard, non-calcareous, with mica and glauconite. **Sandstone** (5%), light grey, very fine – fine grained, moderately hard, well sorted, spherical, subangular – subrounded, transparent, with pyrite in places, non-calcareous, no visible porosity.
2235 - 2240	**Claystone** (95%), light to dark grey, soft to moderately hard, subblocky, subplaty and splitery, non-calcareous, with sparse organic material, pyrite, sandy in places. **Siltstone** (5%), dark grey, firm to friable, subblocky, slightly calcareous, contains glauconite, sandy in places
2240 - 2245	**Claystone** (95%), light to dark grey, soft to moderately hard, subblocky, subplaty and splitery, non-calcareous, fine organic material in places, pyrite, silty in places **Siltstone** (5%), dark grey, firm to friable, subblocky, slightly calcareous, with glauconite, sandy in places, fine organic material dispersed **Sandstone** (traces), light grey, very fine – fine grained, moderately hard, well sorted, spherical, subangular – subrounded, transparent, with pyrite in places, calcareous cenent, argillaceous in places, no visible porosity. Traces of **Pyrite** and **Siderite**

2245 - 2255	**Claystone** (95%), light to dark grey, soft to moderately hard, subblocky, subplaty and splitery, non-calcareous, fine organic material in places, pyrite, silty in places **Siltstone** (5%), dark grey, firm to friable, subblocky, slightly calcareous, with glauconite, sandy in places, fine organic material dispersed **Sandstone** (traces), light grey, very fine – fine grained, moderately hard, well sorted, spherical, subangular – subrounded, transparent, with pyrite in places, calcareous cenent, argillaceous in places, no visible porosity. Traces of **Pyrite** and **Siderite**
2255 - 2275	**Claystone** (60 - 75%), as above **Siltstone** (20 - 25%), as above **Sandstone** (5 – 15%), as above Traces of **Pyrite**
2275 - 2280	**Claystone** (30), light to medium grey, soft to moderately hard, subblocky, subplaty, non-calcareous, fine organic material in places, pyrite, silty in places **Siltstone** (30%), medium grey, brownish - grey, firm to moderately hard, subblocky, slightly calcareous, sandy in places, with Pyrite **Sandstone** (40%), light grey to light beige grey, very fine – fine grained, moderately hard, well sorted, locally pyritic, calcareous cement, argillaceous in places Traces of **Pyrite**
2280 - 2285	**Claystone** (40%), as above **Siltstone** (40%), as above **Sandstone** (20%), as above Traces of **Pyrite**
2285 - 2295	**Claystone** (40 – 60%), light to medium grey, soft to firm, subblocky, subplaty, non-calcareous, fine organic material in places, pyrite, silty and sandy in places, micaceous **Siltston**e (30 – 50%), medium grey, light beige grey, brownish - grey, firm to moderately hard, rare hard, subblocky, argillaceous, also calcareous, sandy in places, locally pyritic **Sandstone** (10%), as above Traces of **Pyrite**, minor traces of **Sideritic** concretions and cement
2295 - 2305	**Claystone** (70%), as above, also splintery **Siltstone** (20%), as above **Sandstone** (10%), as above Traces of **Pyrite**, minor traces of **Sideritic** concretions and cement
2305 - 2325	**Sandstone** (30 – 60%), light grey to medium grey, brownish grey, firm to moderately hard, very fine grained grading to siltstone, well sorted, subblocky, often pyritic, slightly calcareous **Claystone** (30 – 60%), light to medium grey, firm, predominantly sub-platy and splintery, non-calcareous, **Siltstone** (10 %), as above Traces of **Pyrite**, minor traces of **Sideritic** concretions and cement
2325 - 2350	**Claystone** (70 – 80%), light grey, soft and sticky, amorphous, slightly silty, none to weak calcareous, also medium grey, firm, sub-platy and splintery, non-calcareous

Siltstone (5 – 10 %), as above
Sandstone (15 - 30%), light grey to medium grey, brownish grey, firm to moderately hard, very fine grained grading to siltstone, well sorted, subblocky, often pyritic, slightly calcareous
Traces of **Pyrite**, traces of **Sideritic** concretions and cement

2350 - 2370 **Sandstone** (50 – 75%), light grey to medium grey, brownish grey, friable to moderately hard, very fine to fine grained, well rounded, transparent and translucent grains, grading to siltstone, well sorted, subblocky, often pyritic, none to very weak calcareous, traces of glauconite
Claystone (25 – 45%), light grey, soft and sticky, amorphous, slightly silty, none to weak calcareous, also medium grey, firm, sub-platy and splintery, non- calcareous
Siltstone (traces – 5%), as above
Traces of **Pyrite**, minor traces of **Sideritic** concretions and cement

2370 - 2375 **Sandstone** (60%), light grey to medium grey, brownish grey, friable to moderately hard, very fine to fine grained, rare medium grains, well rounded, transparent and translucent grains, grading to siltstone, well sorted, subblocky, often pyritic, none to very weak calcareous, traces of glauconite
Claystone (40%), light grey, soft and sticky, amorphous, slightly silty, none to weak calcareous, also medium grey, firm, sub-platy and splintery, non-calcareous
Traces of **Pyrite**, minor traces of **Sideritic** concretions and cement
Traces of **Calcite**

Rijswijk Mb: 2381.5 – 2444.2 m MD / 2061.0 – 2108.94 m TVD SS

2375 - 2390 **Sandstone** (70 – 80%), predominantly brownish grey, also light to medium grey, friable to moderately hard, very fine to fine, rare medium grains, predominantly well rounded, moderately to well sorted, weak calcareous, in places pyritic, traces of glauconite
Claystone (20 – 30%), as above
Traces of **Pyrite**, minor traces of **Sideritic** concretions and cement
Traces of **Calcite**

2390 - 2395 **Sandstone** (95%),
Claystone (5%), as above
Traces of **Pyrite**

2395 - 2410 **Sandstone** (95%), brownish grey, light to medium grey, friable to moderately hard, fine, medium – coarse loose grains, subspherical – spherical, subrounded - well rounded, moderately to poorly sorted, weak calcareous, pyrite in places, traces of glauconite, no visible porosity
Claystone (5%), as above
Traces of **Pyrite**

2410 - 2425 **Sandstone** (90 - 95%), light to medium grey, minor brownish grey, friable to moderately hard, fine, medium – coarse loose grains, subspherical – spherical, subrounded - well rounded, moderately to poorly sorted, weak calcareous, pyrite in places, traces of glauconite, no visible porosity
Claystone (5 - 10%), grey, moderately hard, silty in places, subplaty, non-calcareous
Traces of **Pyrite**

2425 - 2440 **Sandstone** (80%), light to medium grey, minor brownish grey, friable to moderately hard, fine - medium - coarse, subspherical – spherical, subrounded - well rounded, moderately to poorly sorted, weak calcareous, pyrite in places, traces of glauconite, no visible porosity
Claystone (20%), grey, moderately hard, silty in places, subplaty, non-calcareous
Traces of **Pyrite** and **Siderite**

2440 - 2445 **Sandstone** (60%), light to medium grey, minor brownish grey, friable to moderately hard, fine - medium - coarse, subspherical – spherical, subrounded - well rounded, moderately to poorly sorted, weak calcareous, pyrite in places, traces of glauconite, no visible porosity
Claystone (40 %), grey, moderately hard, silty in places, subplaty, pyrite, non-calcareous
Traces of **Pyrite** and **Siderite**

Schieland Group

Nieuwerkerk Formation

Rodenrijs Mb: 2444.2 m – 2545.9 m MD / 2108.94 – 2187.87 m TVD SS

2445 - 2455 **Claystone** (60 - 80%), grey, firm to moderately hard, silty in places, subplaty, splintery in part, pyrite, non-calcareous, also beige, soft to firm, sub-blocky to blocky, silty in part, with sparse organic material and glauconite
Sandstone (20 – 40%), as above
Traces of **Pyrite** and **Siderite**

2455 - 2460 **Claystone** (60 %), light grey to grey, light brown, firm to moderately hard, sub-platy to splintery, also beige, soft to firm, sub-blocky to blocky, silty in part, with sparse organic material and glauconite
Sandstone (40 %), as above
Siltstone (traces), light brown – beige, firm to moderately hard, argillaceous, dispersed pyrite, sparse organic matter, non- calcareous
Traces of **Coal**

2460 - 2465 **Claystone** (80 %), light brownish - grey, medium grey, dark brown grey, moderately hard, predominantly sub-platy, also sub – blocky, in part elongated, silty in part, micromicaceous, dispersed pyrite, non- calcareous
Siltstone (15 %), light brown – beige, firm to moderately hard, argillaceous, dispersed pyrite, sparse organic matter, non- calcareous
Sandstone (5%), as above
Traces of **Coal**

2465 - 2475 **Claystone** (90 %), as above
Siltstone (10 %), as above
Many traces of **Pyrite**
Traces of **Coal**

2475 - 2490 **Claystone** (40 – 50 %), as above
Siltstone (50 – 60 %), as above
Traces of **Coal/Lignite**

2490 - 2495	**Claystone** (55 %), grey, dark grey, light brown, firm to moderately hard, sub-blocky to platy, occasionally waxy, occasionally with mica and organic material particles, non-calcareous **Siltstone** (5 %), as above **Sandstone** (40 %), loose quartz, medium graines, moderately sorted, angular lu subrounded, subspherical to elongated, transrant and translucent Traces of **Pyrite**
2495 - 2500	**Claystone** (50 %), light brownish - grey, medium grey, dark brown grey, moderately hard, predominantly sub-platy, also sub – blocky, in part elongated, silty in part, micromicaceous, dispersed pyrite, non- calcareous **Siltstone** (50 %), light brown – beige, firm to moderately hard, argillaceous, dispersed pyrite, sparse organic matter, non- calcareous
2500 - 2502	**Claystone** (70 %), brownish - grey, medium grey, dark brown grey, moderately hard, predominantly sub-platy, also sub – blocky, in part elongated, silty in part, micromicaceous, dispersed pyrite, non- calcareous **Siltstone** (30 %), brown – beige, firm to moderately hard, argillaceous, dispersed pyrite, sparse organic matter, non- calcareous **Sample contaminated with previously drilled formations**
2502 - 2503	**Claystone** (70 %), brownish - grey, medium grey, dark brown grey, moderately hard, predominantly sub-platy, also sub – blocky, in part elongated, silty in part, micromicaceous, dispersed pyrite, non- calcareous **Siltstone** (30 %), brown – beige, firm to moderately hard, argillaceous, dispersed pyrite, sparse organic matter, non- calcareous Traces of **Pyrite** **Sample contaminated with previously drilled formations** No junk found in sample.
2503 - 2504	**Claystone** (75 %), brownish - grey, medium grey, dark brown grey, moderately hard, predominantly sub-platy, also sub – blocky, in part elongated, silty in part, micromicaceous, dispersed pyrite, non- calcareous **Siltstone** (25 %), brown – beige, firm to moderately hard, argillaceous, dispersed pyrite, sparse organic matter, non- calcareous **Sample contaminated by technical cement.**
2504 - 2505	**Claystone** (85 %), light brown – grey, occasionally grey, friable to moderate hard, sub palty platy, sub fissile to fissile, splintery, grading to **Shale**, silty, in transition to **Siltstone** (15 %), light grey to grey, rare dark grey, moderate hard to hard, sub blocky to blocky, traces of organic material, slightly micaceous, locally pyritized, sandy in places. **Sample contaminated by technical cement.**
2505 - 2507	**Claystone** (80 %), as described above **Siltstone** (20 %), as described above Traces of **Sandstone**, white to off white, clear when quartzic, friable, very fine, rare fine, poor sorted, mainly sillicaceous, quartzic in places **Sample contaminated by technical cement.**
2507 - 2519	**Claystone** (75-85 %), as described above, also, in part brown to dark brown, locally grey **Siltstone** (15-25 %), as described above Traces of **Sandstone**, as described before

Sample contaminated by technical cement.

2519 - 2523 **Claystone** (85 %), grey, beige-grey, brownish-grey, locally dark grey, friable, subplaty-shaly, silty, sporadicaly slightly sandy, microPyrite in places, occasionally with carboniferous matter inclusions (Lignite?), non calcareous, grading to Siltstone.
Siltstone (15 %), as described above

2523 - 2525 **Claystone** (95 %), as above.
Siltstone (5%), as above.
Traces of **Coal** and sporadically **Lignite**
Note: adding $CaCO_3$ into mud system.

2525 - 2527 **Claystone** (90 %), as above.
Sandstone (5%), unconsolidated (probably milled by bit), Quartz grains are transparent, translucent, subrounded to subangular, moderately sorted.
Coal (5%), black, friable, locally **Lignite**.
Note: adding $CaCO_3$ into mud system.

2527 - 2529 **Claystone** (85 %), as above.
Sandstone (5%), as above.
Coal (10%), as above
Note: adding $CaCO_3$ into mud system.

2529 - 2531 **Claystone** (60 %), as above.
Sandstone (10%), as above.
Coal (30%), black, dark brown, friable, locally pyritized, offen argillaceous.

2531 - 2535 **Claystone** (80 %), as above.
Sandstone (10%), off white, friable, fine grained, subrounded, rarely subangular, well sorted, argillaceous (kaolinitic?) – siliceous cement, occasioanlly with Muscovite, non calcareous, non- to weak visible porosity.
Coal (10%), as above
Note: adding $CaCO_3$ into mud system.

2535 - 2545 **Claystone** (70-80 %), beige-grey, grey, light grey, grey-brownish, friable, subblocky to subplaty, occasionally Coal (Lignite?) inclusions, silty and locally sandy, non- calcareous, rare micro Pyrite.
Sandstone (20-30%), as above.
Traces of **Coal**
Note: adding $CaCO_3$ into mud system.

Schieland Group

Nieuwerkerk Formation

Delft Sandstone Mb: 2545.9 m MD – 2702 m / 2187.87 m – 2297.98 TVD SS

2545 - 2551 **Claystone** (60-70 %), beige-grey, grey, light grey, grey-brownish, friable, subblocky to subplaty, occasionally Coal (Lignite?) inclusions, silty and locally sandy, non- calcareous, rare micro Pyrite.
Sandstone (30-40%), off white, friable, fine grained, subrounded, rarely subangular, well sorted, argillaceous (kaolinitic?) – siliceous cement, occasioanlly with Muscovite, non calcareous, non- to weak visible porosity.

Traces of **Coal**
Note: adding $CaCO_3$ into mud system.

2551 - 2553 **Claystone** (60 %), beige-grey, grey, light grey, grey-brownish, friable, subblocky to subplaty, occasionally Coal (Lignite?) inclusions, silty and locally sandy, non- calcareous, rare micro Pyrite.
Sandstone (35%), off white, friable, fine grained, subrounded, rarely subangular, well sorted, argillaceous (kaolinitic?) – siliceous cement, occasioanlly with Muscovite, non calcareous, non- to weak visible porosity.
Traces of **Coal** (5 %), black, friable, locally **Lignite**.
Note: adding $CaCO_3$ into mud system.

2553 - 2557 **Claystone** (30-40 %), as described above.
Sandstone (60-70%), predominant loose Quartz, clear, off white in places, transparent to translucent, fine to medium, rare coarse, sub angular to sub rounded; when cemented, off white, creamy, friable to moderate hard, poor to moderate sorted, weak visible porosity, sillicaceous, occasionally argillaceous.
Traces of **Coal.**

2557 - 2559 **Claystone** (30 %), as described above.
Sandstone (70%), predominant loose Quartz, clear, off white in places, transparent to translucent, medium to coarse, locally fine, sub rounded to rounded; when cemented, off white, creamy, friable to moderate hard, poor to moderate sorted, none to weak visible porosity, sillicaceous, occasionally argillaceous.
Traces of **Coal.**

2559 - 2561 **Claystone** (25 %), as described above.
Sandstone (75%), predominant loose Quartz, clear, off white in places, transparent to translucent, medium to coarse, locally fine, sub rounded to rounded; when cemented, off white, creamy, friable to moderate hard, poor to moderate sorted, none to weak visible porosity, sillicaceous, occasionally argillaceous.
Traces of **Coal** and **Siltstone,** brownish-grey, friable to moderate hard, sub blocky, sandy, pyritized in places, occasionally carbonated material.

2561 - 2563 **Claystone** (35 %), as described above.
Sandstone (65%), predominant loose Quartz, clear, off white in places, transparent to translucent, very fine to coarse, sub rounded to rounded; when cemented, off white, creamy, locally light brown, friable to moderate hard, predominant poor sorted, occasionally moderate sorted, none to weak visible porosity, sillicaceous, occasionally argillaceous.
Traces of **Coal** and **Siltstone.**

2563 - 2567 **Claystone** (60-70 %), light brow, grey-brown, occasionally light grey to grey, firm to moderate hard, sub platy to platy, sub fissile to fissile, splintery in places, somewhat **Shale**, silty, locally pyritized, micaceous in places, occasionally carbonated material, in part graded to **Siltstone**.
Sandstone (30-40%), predominant loose Quartz, clear, off white in places, transparent to translucent, very fine to medium, sub rounded; when cemented, off white, creamy, locally light brown, friable to moderate hard, predominant poor sorted, rare moderate sorted, poor porosity, sillicaceous, occasionally argillaceous. In places, off white, milled by bit quartz – rock flour.
Traces of **Coal** and **Siltstone.**

2567 - 2573	**Claystone** (30-35 %), as described above. **Sandstone** (65-70%), predominant milled by bit to rock flour, in part clear, off white, friable, fine to medium, sub rounded, rare sub angular, moderate sorted, poor to fair visible porosity. Traces of **Siltstone.**
2573 - 2575	**Claystone** (30 %), as described above. **Sandstone** (70 %), as descrbed above, but very fine to medium, poor visible porosity, increase of rock flour.
2575 - 2577	**Claystone** (15 %), light grey to grey, rare light brown, soft to firm, sub blocky to sub platy, silty in part. **Sandstone** (85%), predominant loose Quartz, clear, fine to coarse, sub rounded, when cemented, poor to moderate sorted, poor visible porosity, quartzic. Traces of **Coal**
2577 - 2583	**Claystone** (20-25 %), as described above, carbonated in places **Sandstone** (65-75%), as described above, also light brownish, firm to friable, very fine to fine, poor sorted, sub angular to sub rounded, argillaceous. **Coal** (5-10 %), black, bright, brittle.
2583 - 2585	**Claystone** (20 %), as described above. **Sandstone** (70%), as described above, also, sub rounded to rounded - loose Quartz grains, moderate to well sorted, predominant fair visible porosity – cemented grains. **Coal** (10 %), as described above.
2585 - 2587	**Claystone** (55 %), brownish-brown, grey in part, firm to moderately hard, sub platy to platy, locally subblocky, silty. **Sandstone** (45%), as described above. Traces of **Coal**
2587 - 2589	**Claystone** (65 %), as described above. **Sandstone** (35%), as described above.
2589 - 2593	**Claystone** (65 %), as described above. **Sandstone** (25%), as described above. **Coal** (10 %), as described above.
2593 - 2597	**Claystone** (15 %), grey, grey-brownish, beige, friable to moderately hard, occasionally with micro Pyrite, subplaty to subblocky, non- calcareous. **Sandstone** (80%), off white, friable to moderately hard, very fine to fine grained, rarely medium grains, subrounded, moderately sorted, argillaceous-siliceous cement, non- calcareous, fair visible porosity, mainly milled to loose Quartz grains, transparent and translucent, sporadically milky. **Coal** (5 %), black, brittle, shiny lustre, Lignite in parts.
2597 - 2599	**Claystone** (15 %), as described above. **Sandstone** (75%), off white, friable to moderately hard, fine to medium grained, rarely coarse grains, subrounded, poorly sorted, argillaceous-siliceous cement, non- calcareous, fair visible porosity, mainly milled to loose Quartz grains, transparent and translucent, sporadically milky. **Coal** (10 %), as described above.

2599 - 2603	**Claystone** (15 %), as described above. **Sandstone** (80%), as described above. **Coal** (5 %), as described above.
2603 - 2605	**Claystone** (15 %), as described above. **Sandstone** (80%), off white, friable to moderately hard, very fine to medium grained, subrounded, moderately sorted, argillaceous-siliceous cement, non-calcareous, fair visible porosity, mainly milled to loose Quartz grains, transparent and translucent, sporadically milky. **Coal** (5 %), as described above.
2605 - 2607	**Claystone** (10%), as described above. **Sandstone** (90%), as described above. Traces of **Coal**
2607 - 2609	**Claystone** (10%), as described above. **Sandstone** (85%), as described above. **Coal** (5 %), as described above.
2609 - 2617	**Claystone** (10%), grey-brownish, beige, grey, friable to moderately hard, occasionally with micro Pyrite, subplaty to subblocky, locally carbonaceous matter inclusion, non- calcareous. **Sandstone** (90%), off white, friable to moderately hard, fine to medium grained, occasionally coarse grains, subrounded, poorly to moderately sorted, argillaceous-siliceous cement, non- calcareous, fair visible porosity, mainly milled to loose Quartz grains, transparent and translucent, sporadically milky. Traces of **Coal**
2617 - 2621	**Claystone** (5%), as described above. **Sandstone** (85%), loose Quartz grains, transparent and translucent, sporadically milky, medium to fine grained, subrounded, subspherical, moderately to well sorted. **Coal** (10 %), as described above.
2621- 2623	**Claystone** (5%), grey-brownish, beige, grey, friable to moderately hard, occasionally with micro Pyrite, subplaty to subblocky, locally carbonaceous matter inclusion, non- calcareous. **Sandstone** (90%), loose Quartz grains, transparent and translucent, sporadically milky, medium to fine grained, subrounded, subspherical, moderately to well sorted. **Coal** (5 %), black, brittle, shiny lustre.
2623 - 2631	**Claystone** (10%), as described above. **Sandstone** (90%), as described above. Traces of **Coal**
2631 - 2637	**Claystone** (10-15%), as described above. **Sandstone** (85-90%), predominant loose Quartz, clear, off white in places, transparent to translucent, fine to medium, rare coarse, sub angular to sub rounded; when cemented, off white, creamy, friable, moderate sorted, rare well sorted, fair to poor visible visible porosity, quartzic, locally sillicaceous.
2637 - 2641	**Claystone** (15 %), as described above.

Sandstone (85%), loose Quartz, clear, milky, transparent to translucent, fine to coarse, sub angular to subrounded, rounded in places; when cemented, moderate to well sorted, fair to poor visible porosity, quartzic.

2641 - 2645 **Claystone** (30-35 %), as described above.
Sandstone (65-70%), loose Quartz, clear, milky, transparent to translucent, very fine to medium, sub angular to subrounded; when cemented, moderate to poor sorted, poor visible porosity, occasionally fair visible porosity, quartzic, partly milled by bit – rock flour.
Traces of **Coal** black, bright.

2645 - 2647 **Claystone** (25 %), as described above.
Sandstone (75%), loose Quartz, clear, milky, transparent to translucent, fine to medium, sub angular to subrounded; when cemented, moderate to poor sorted, poor to fair visible porosity, quartzic.
Traces of **Coal**.

2647 - 2649 **Claystone** (20 %), as described above.
Sandstone (80%), loose Quartz, clear, milky, transparent to translucent, fine to coarse, subrounded; when cemented, moderate sorted, poor to fair visible porosity, quartzic.
Traces of **Coal**, pyritized in places.

2649 - 2653 **Claystone** (10-20 %), as described above.
Sandstone (80-85 %), loose Quartz, clear, milky, transparent to translucent, fine to coarse, subrounded; when cemented, moderate to poor sorted, poor to fair visible porosity, quartzic.
Coal (traces-5 %), as described above.

2653 - 2655 **Claystone** (10 %), as described above.
Sandstone (90 %), loose Quartz, clear, milky, transparent to translucent, very fine to medium, subrounded, occasionally elongated; when cemented, poor to moderate sorted, poor to fair visible porosity, quartzic.
Coal traces, as described above.

2655 - 2659 **Claystone** (10-15 %), as described above.
Sandstone (85-90%), predominant loose Quartz, clear, very fine to medium, sub angular to sub rounded, when cemented, poor to moderate sorted, poor to fair visible porosity, quartzic.
Traces of **Coal**.

2659 - 2661 **Claystone** (10 %), as described above.
Sandstone (90%), predominant loose Quartz, clear, fine to coarse, sub angular to sub rounded, when cemented, poor to moderate sorted, fair visible porosity, quartzic.
Coal (traces), black, bright, lustre.

2661 - 2667 **Claystone** (10-30 %), as described above.
Sandstone (65-90%), predominant loose Quartz, clear, very fine to coarse, predominant medium, sub angular to sub rounded, when cemented, mainly moderate sorted, locally poor sorted, fair to good visible porosity, quartzic.
Coal (traces-5 %), black, bright, lustre.

2667 - 2671 **Claystone** (35-45 %), brownish-grey, grey, firm, sub platy to platy, locally sub blocky, rare fissile, silty in places, occasionally carbonated.

Sandstone (45-55%), predominant loose Quartz, clear, very fine to medium, sub angular to sub rounded, when cemented, moderate to poor sorted, poor to fair visible porosity, quartzic.
Coal (traces), as described above.

2671 - 2675 **Claystone** (60 %), beige, grey, brownish, friable to moderately hard, subplaty, shally, rarely subblocky, locally micro Pyrite, with Coal (Lignite?) inclusions, non- calcareous.
Sandstone (40 %), as described above.
Traces of **Coal**.

2675 - 2685 **Claystone** (80 %), as described above.
Sandstone (20 %), as described above.
Traces of **Coal**.

2685 - 2687 **Claystone** (70 %), as described above.
Sandstone (30 %), as described above.

2687 - 2689 **Claystone** (40 %), as described above.
Sandstone (60 %), loose Quartz grains, fine to medium grained, subangular to subrounded, subspherical, moderately to well sorted, Quartz grains are transparent and translucent.

2689 - 2690 **Claystone** (30 %), as described above.
Sandstone (70 %), as described above.

2690 - 2691 **Claystone** (45 %), grey, brownish grey, beige, friable to moderately hard, micaeous, silty.
Sandstone (55 %), lose Quartz grains, fine to medium grained, rare coarse, subangular to subrounded, sub spherical, moderately to well sorted, Quartz grains are transparent and translucent.
Sample contaminated by mud chemicals -$CaCO_3$ (up to 80%).

2691 - 2702 **Claystone** (70-90 %), grey, brownish grey, beige, friable to moderately hard, micaeous, silty.
Sandstone (10-30 %), lose Quartz grains, fine to medium grained, subangular to subrounded, sub spherical, moderately to well sorted, Quartz grains are transparent and translucent.
Coal (traces-5 %), black, brtight, lustre.
Sample contaminated by mud chemicals -$CaCO_3$ (up to 80%).

Well Total Depth at 2702m MD / 2297.98m TVD SS

4. SUMMARY OF HYDROCARBON SHOWS

4.1. Mud gas samples were continuously analyzed by FID gas chromotograph. The FID gas chromotograph gave reflections of continous qualitative and quantitative drilling fluid gas analyses (C1 – C5). Its main advantage is precise and continous

measurement, it can be considered as a main instrument in kick detection and determining intervals containing hydrocarbons.

Gas shows				
From [m] / To [m]:		Max. readings C1 [ppm]	BG gas [ppm]	Remarks
262	465	900	100	Formation gas
465	505.2	720	100	Formation gas
505.2	724.7	2380	110	Formation gas
724.7	815.1	2790	170	Formation gas
815.1	830.5	2260	1000	Formation gas
830.5	1112.9	2010	190	Formation gas
1112.9	1273	3300	200	Formation gas
1273	1332	2560	200	Formation gas
1332	1619	2050	210	Formation gas
1619	1726.5	2780	650	Formation gas
1726.5	2148.5	2790	340	Formation gas
2148.5	2170	1900	500	Formation gas
2170	2381.5	3800	360	Formation gas
2381.5	2442.2	4020	60	Formation gas
2442.2	2545.9	5500	1000	Formation gas
2545.9	2702	970	300	Formation gas

5. WIRELINE LOGGING

No logging run was conducted at the HAG GT-01 well

6. Drilling Highlights

8 1/2" section.

- Date: 21/08/2010. Mud losses at 2415 m. Losses rate – 26 m3/ h at flow rate of 2000 l/min
- Date: 25/08/2010. Unable to pass 2300 m while running 7" liner. Casing was POOH and the hole reamed. 11 centralizers left remained downhole.
- Date: 27/08/2010. RIH with ream BHA. 20 t weight loss at 1665m. Ream to bottom.
- Date: 02/09/2010. RIH with 7'' liner. Tight spot at 2390m. Continue to RIH with slow rate circulation. Impossible to go deeper than 2467.5m. Set casing point at this depth.

6'' section.

- Date: 06/09/2010. Ream from 2467m to 2503m. POOH. RIH, resistance ar 2467m. Wash down to 2485m.
- Date: 09/09/2010. Wash down and ream from 2466m to 2504m. POOH. From 2689m to 2507m over pull – 10 T at 2680m – 25 T. Increas of stand pipe pressure to177 bar.
- Date: 10/09/2010. RIH. Wash down from 2490m to 2520m. Ream from 2573m to 2588m; from 2632m to 2642m; from 2659m to 2668m. Next RIH. Ream down from 2467m to 2504m.
- Date: 11/09/2010. POOH. Wash and back ream from 2690m to 2467m. From 2662m to 2651m. Over pull 25 T. RIH. Wash down from 2470m to 2562m. From 2597m to 2630m. From 2649m to 2690m. POOH. Over pulls. At 2690m – 15T. At 1665m, 2644m, 2616m – 10 T. At 2580m, 2577m – 20 T.
- Date: 12/09/2010. RIH. Ream from 2466m.

HAG GT-01
Holland

Lithology Log, 1:500

Mudlogging:

Space for notes

Client:
Client: Aardwarmte Den Haag VOF
Operator: Aardwarmte Den Haag VOF

Project:
Borehole Section: HAG GT-01
Well Name: HAG GT-02

Location:
Country: Holland
Region or oilfield: HAG GT
Location: The Hague
Concession: The Hague Geothermal

Well Type:
New field wildcat

Coordinates:
Easting / Northing: 78215.39 / 452494.28
Ordnance Survey Map:

Duration:
First day drilled: 16.07.2010
Start depth (Tie-in) 0.00 m
End depth: 2702.00 m

Rig:
LOC 400 -No limit 01-
Huisman

Team:
Company Man: K. Eleveld, C. Madley, Lars Anderson
Toolpusher: J. Vliek, T. Harris
Supervisor:
Wellsite geologist:

Mudlogging:
Petrolog International BV
Mudloggers: Pachciarek, Gudz, Sawicz, Tomsia, de Lorme, Jamka, Spinczyk

Service:
Fluid Services: SCOMI-OILTOOLS (EUROPE) LTD
Mud Engineers: Paul Van Lamsweerde, Mark Cooper

Remarks:
Depth reference - RT (8.47 m NAP)

Volcanic rocks
Basalt, Basement, Granite, Intrusive rock, Tuff, Volcanic rock

Evaporites
Anhydrite, Gypsum, Potassium Salt, Rock Salt

Clastic sediments
Breccia, Claystone, Conglomerate, Flint, Gravel, Ironstone, Mud/Clay, Sand, Sandstone, Sandstone, Arkose, Sandstone, Graywacke, Shale

Silt, Siltstone

Carbonates and Biogenic sediments
calc. Sandstone, Calcarenite, Chalk, Coal, Coal seams, Dolomite, Dolomite, calcareous, Limestone, Limestone, dolomitic, Limestone, marly, Marl (-stone), Marl, argillaceous, Marlstone, calcareous, Marlstone, dolomitic, Oolite

Metamorphic rocks
Anatexite, Aplite, Diatexite, Gneiss, Hornfels, Marble, Metamorphic Rock, Phyllite

Schist, Slate

Artificial
Bentonite, Cavings, Cement, Mud Additives, No sample

Accessories
Anhydritic, Argillaceous, Biotite, Bituminous, Calcareous, Calcite, Carbonaceous, Chert, Conglomeratic, Cordierite, Dolomitic, Epidote, Ferruginous, Flint, Garnet, Glauconite, Gypsiferous, Hornblende, Iron Ooids, Ironstone

Kaolinite, Laminated, Lignite, Marly, Mica (unspec.), Ooids, Particles, Pyrite, Quartz, Quartzitic, Sandy, Silty, Tuffaceous

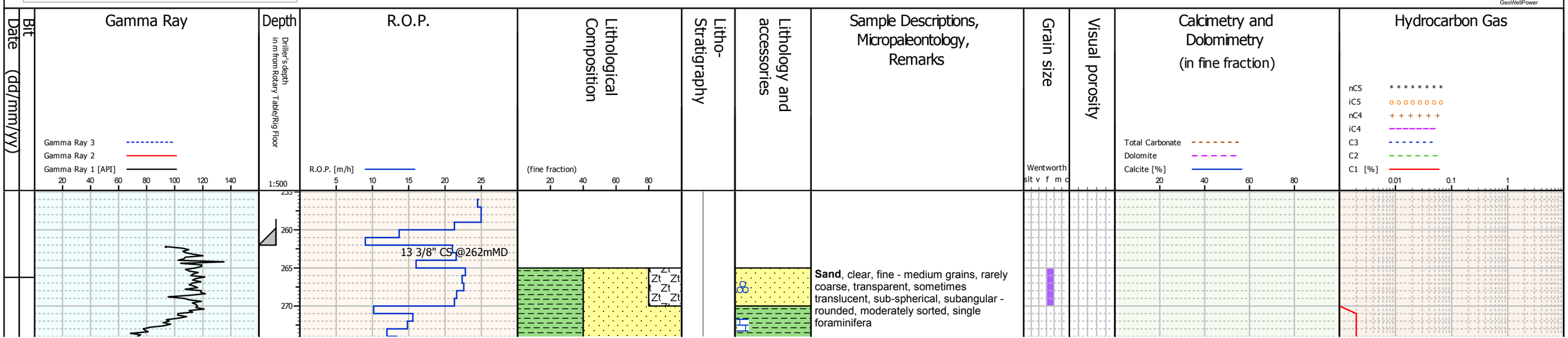
Fossils
Algae, Brachiopods, Bryozoans, Cephalopods, Charophyte, Conodonts, Corals, Crinoids, Echinoids, Fish, Foraminifera, Fossiliferous, Fusulinoids, Gastropods, Graptolytes, Inoceramus, Molluscs, Ostracods, Pelecypods, Pellets, Plants, Rudists, Shell fragments, Sponges, Vertebrates

Framework
Lime-Mudstone, Lime-Wackestone, Lime-Packstone, Lime-Grainstone, Lime-Boundstone, Aphanitic, Chalky, Caliche, Sucrosic, Cryptocrystalline, Microcrystalline, Fine crystalline, Crystalline, Recrystallized, Matrix-supported, Grain-supported

Technical symbols
Casing shoe, Liner head, Sidewall core, (unrecovered), Hydrocarbon show, Gains, Losses, FIT or leakoff test

Vertical axis is measured depth.

GEO data
GeoWellPower



17/07/2010

17/07/2010

275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420

Incl at 284.00 m
0.94 °
AZ : 249.95 °
TOT DEV: 2.33 m
TVD : 283.99 m

WOB: 0-2.6 t
SPP: 43 bar
Flow: 2339 l/min
RPM bit: 119-162
RPM string: 0-43

Incl at 390.30 m
0.59 °
AZ : 86.16 °
TOT DEV: 2.64 m
TVD : 390.28 m

Tertiary

North Sea Group

Clay, grey, very soft, plastic, slightly sticky, calcareous, sandy

Sandstone, light grey - olive, moderately hard to hard, fine to medium grained, moderately sorted, mainly subrounded, calcareous cement, slightly argillaceous, shell fragments, Glauconite
Traces of **Amber**

Claystone, grey to dark grey, soft, strongly calcareous, grading to Marl, sandy and silty

Claystone, grey to dark grey, soft, strongly calcareous to marly, sandy and silty.

Marl, light brown, beige, soft, firm, sticky, silty.

Claystone, dark grey, soft, plastic and sticky, sub-blocky, calcareous, sandy and silty.

Sandstone, light grey, fine to very fine grained, well sorted, subrounded, fossils, Mica, mainly milled to loose Quartz grains.

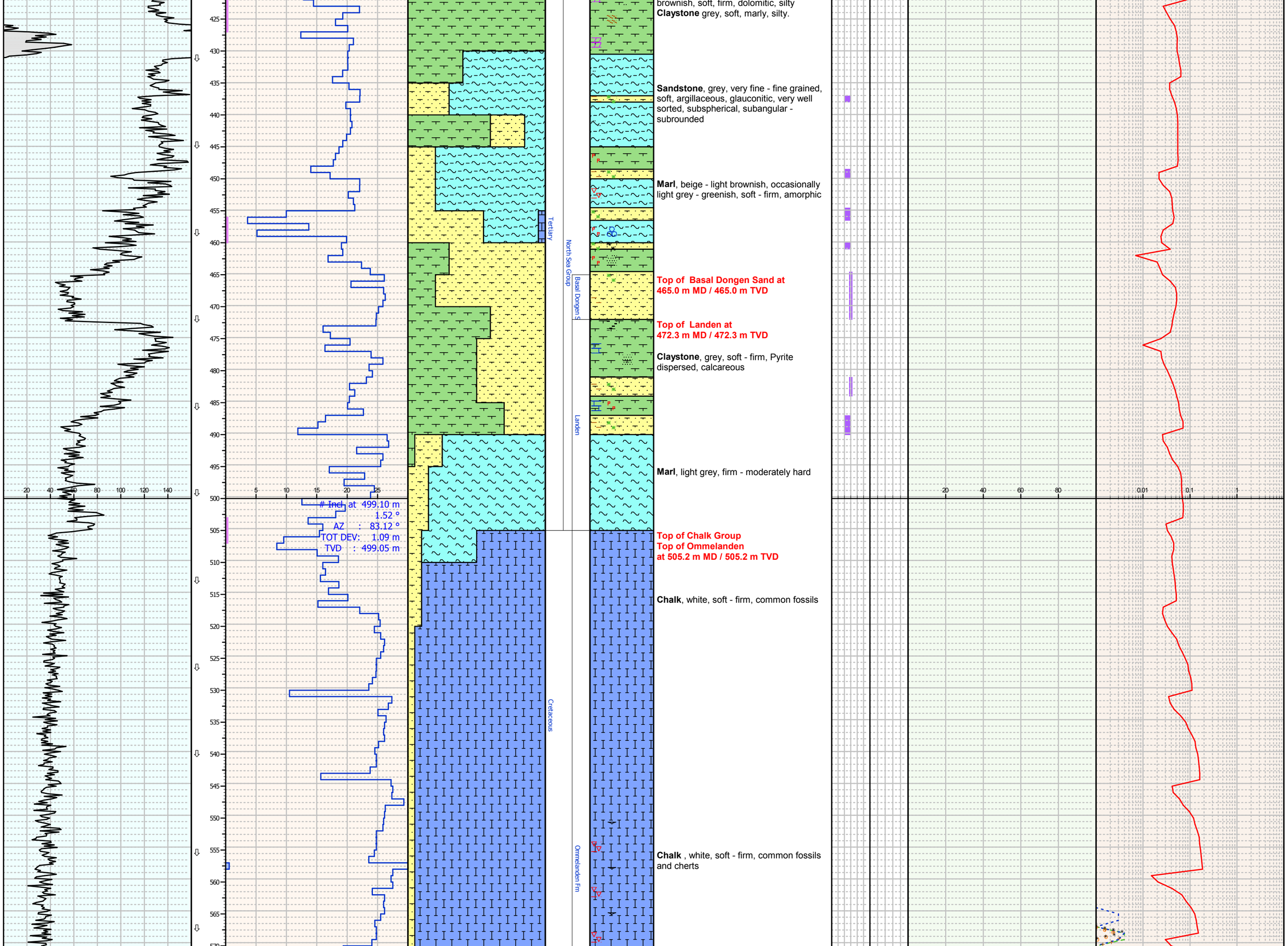
Marl, beige, light brown, soft, plastic, sub blocky, slightly sandy.

Claystone, grey-greenish, soft, plastic and sticky, slightly sandy and silty, weakly dolomitic, sub blocky.

Claystone, mainly brownish-grey and dark

MW: 1.2 kg/l

max. C1: 0,048% @367m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100
120
140
5
10
15
20
25
Incl at 499.10 m
1.52 °
AZ : 83.12 °
TOT DEV: 1.09 m
TVD : 499.05 m
Tertiary
Cretaceous
North Sea Group
Basal Dongen S
Landen
Ommelanden Fm
brownish, soft, firm, dolomitic, silty
Claystone grey, soft, marly, silty.
Sandstone, grey, very fine - fine grained, soft, argillaceous, glauconitic, very well sorted, subspherical, subangular - subrounded
Marl, beige - light brownish, occasionally light grey - greenish, soft - firm, amorphic
Top of Basal Dongen Sand at
465.0 m MD / 465.0 m TVD
Top of Landen at
472.3 m MD / 472.3 m TVD
Claystone, grey, soft - firm, Pyrite dispersed, calcareous
Marl, light grey, firm - moderately hard
Top of Chalk Group
Top of Ommelanden
at 505.2 m MD / 505.2 m TVD
Chalk, white, soft - firm, common fossils
Chalk , white, soft - firm, common fossils and cherts
20
40
60
80
0.01
0.1
1

18/07/2010

570
575
580
585
590
595
600
605
610
615
620
625
630
635
640
645
650
655
660
665
670
675
680
685
690
695
700
705
710
715

WOB: 0-6.4 t
SPP: 70 bar
Flow: 3002 l/min
RPM bit: 119-193
RPM string: 0-73

Incl at 608.00 m
2.27 °
AZ : 87.23 °
TOT DEV: 4.18 m
TVD : 607.88 m

Incl at 703.30 m
3.90 °
AZ : 90.30 °
TOT DEV: 7.98 m
TVD : 703.10 m

Cretaceous

Cretaceous

Cretaceous

Cretaceous

Ommelanden Fm

Omnmelanden Fm

Traces of Limestone, white-bluish, soft, wackestone, slightly sandy, with Pyrite

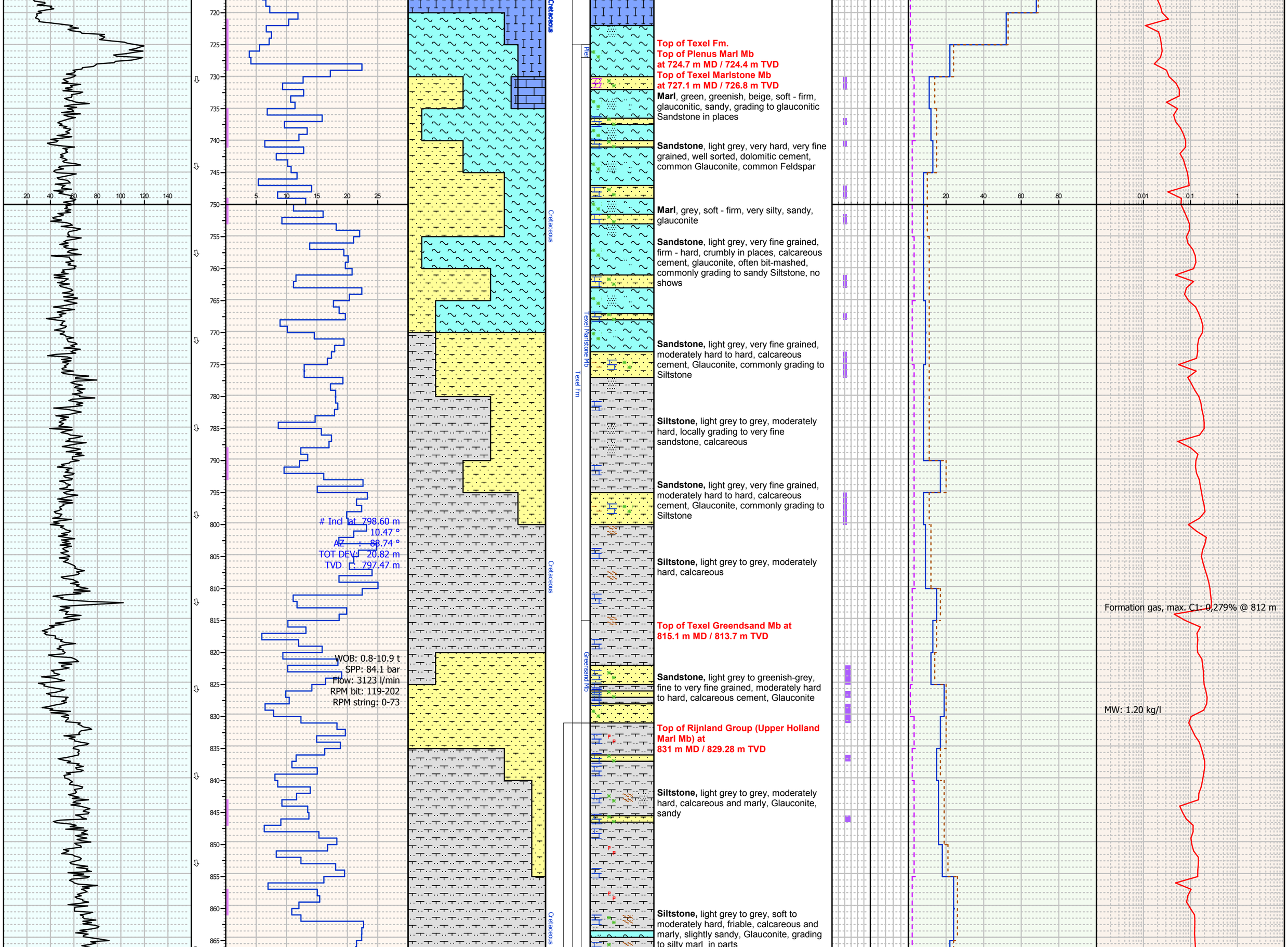
Chalk, white, soft - firm, occasionally moderately hard to hard, amorphous, common Cherts (brown, clear, very hard, angular)

Chalk, white, soft - firm, occasionally moderately hard to hard, amorphous, infrequent Cherts (brown, transparent, very hard, angular) and fossils.

Chalk, white, soft - firm, occasionally moderately hard to hard, amorphous, infrequent foraminifera and bryozoa
In traces: **Limestone,** white, hard, massive, calcarenite, with fossils

MW: 1.21 kg/l

max. C1: 0,213% @583m


20
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120
140
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720
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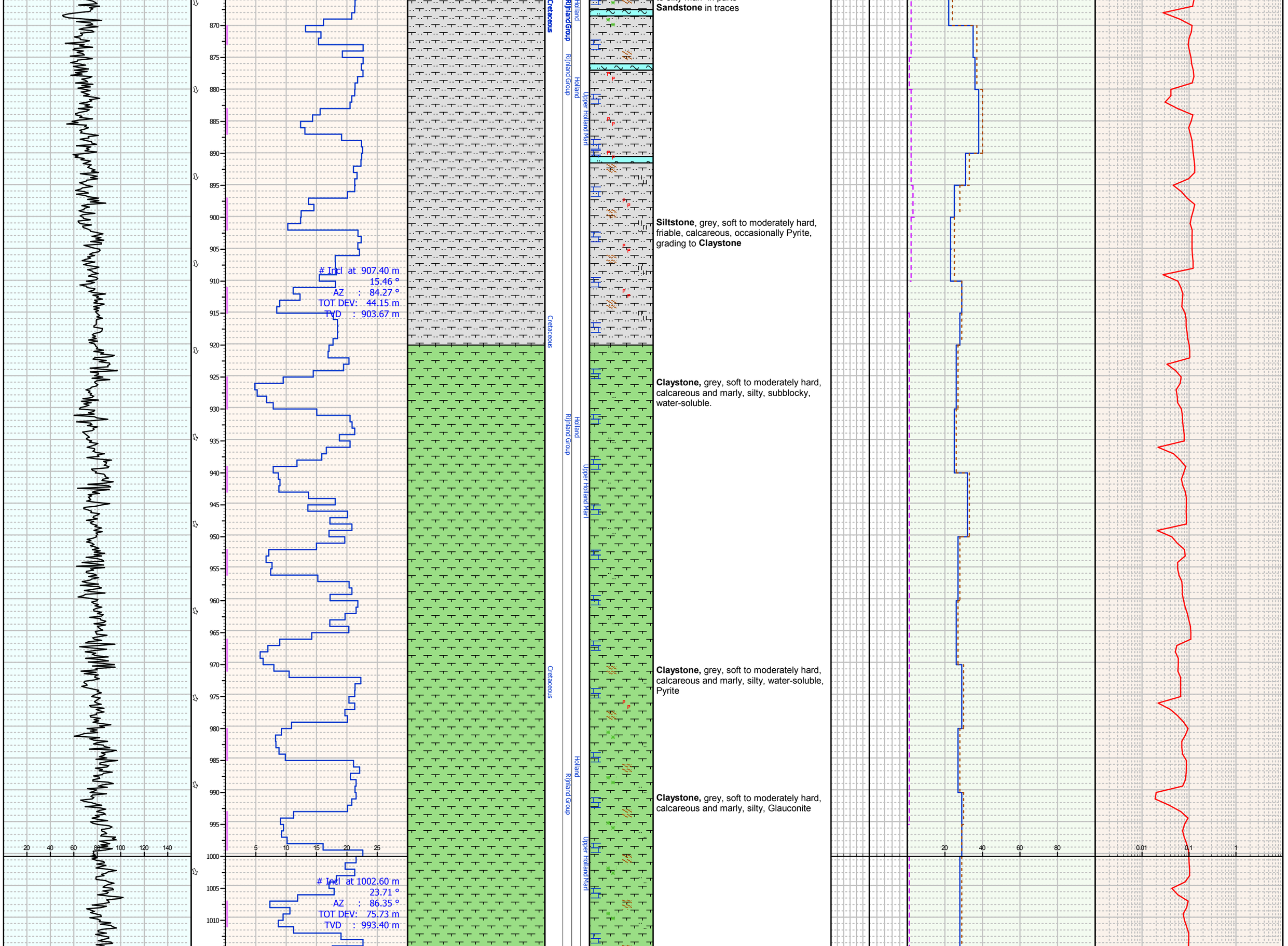
750
755
760
765
770
775
780
785
790
795
800
805
810
815
820
825
830
835
840
845
850
855
860
865
Cretaceous
Cretaceous
Cretaceous
Incl at 798.60 m
10.47 °
AZ : 88.74 °
TOT DEV 20.82 m
TVD : 797.47 m
WOB: 0.8-10.9 t
SPP: 84.1 bar
Flow: 3123 l/min
RPM bit: 119-202
RPM string: 0-73
Plen
Texel Marlstone Mb
Texel Fm
Greensand Mb
Top of Texel Fm.
Top of Plenus Marl Mb
at 724.7 m MD / 724.4 m TVD
Top of Texel Marlstone Mb
at 727.1 m MD / 726.8 m TVD
Marl, green, greenish, beige, soft - firm, glauconitic, sandy, grading to glauconitic Sandstone in places
Sandstone, light grey, very hard, very fine grained, well sorted, dolomitic cement, common Glauconite, common Feldspar
Marl, grey, soft - firm, very silty, sandy, glauconite
Sandstone, light grey, very fine grained, firm - hard, crumbly in places, calcareous cement, glauconite, often bit-mashed, commonly grading to sandy Siltstone, no shows
Sandstone, light grey, very fine grained, moderately hard to hard, calcareous cement, Glauconite, commonly grading to Siltstone
Siltstone, light grey to grey, moderately hard, locally grading to very fine sandstone, calcareous
Sandstone, light grey, very fine grained, moderately hard to hard, calcareous cement, Glauconite, commonly grading to Siltstone
Siltstone, light grey to grey, moderately hard, calcareous
Top of Texel Greendsand Mb at
815.1 m MD / 813.7 m TVD
Sandstone, light grey to greenish-grey, fine to very fine grained, moderately hard to hard, calcareous cement, Glauconite
Top of Rijnland Group (Upper Holland Marl Mb) at
831 m MD / 829.28 m TVD
Siltstone, light grey to grey, moderately hard, calcareous and marly, Glauconite, sandy
Siltstone, light grey to grey, soft to moderately hard, friable, calcareous and marly, slightly sandy, Glauconite, grading to silty marl, in parts
20
40
60
80
0.01
0.1
1
Formation gas, max. C1: 0,279% @ 812 m
MW: 1.20 kg/l
19/07/2010


Cretaceous
Holland
Rijnland Group
Upper Holland Marl
Incl at 907.40 m
15.46 °
AZ : 84.27 °
TOT DEV: 44.15 m
TVD : 903.67 m
Incl at 1002.60 m
23.71 °
AZ : 86.35 °
TOT DEV: 75.73 m
TVD : 993.40 m
Sandstone in traces
Siltstone, grey, soft to moderately hard, friable, calcareous, occasionally Pyrite, grading to **Claystone**
Claystone, grey, soft to moderately hard, calcareous and marly, silty, subblocky, water-soluble.
Claystone, grey, soft to moderately hard, calcareous and marly, silty, water-soluble, Pyrite
Claystone, grey, soft to moderately hard, calcareous and marly, silty, Glauconite

20/07/2010

20/07/2010

1015
1020
1025
1030
1035
1040
1045
1050
1055
1060
1065
1070
1075
1080
1085
1090
1095
1100
1105
1110
1115
1120
1125
1130
1135
1140
1145
1150
1155
1160

WOB: 4-12 t
SPP: 103 bar
Flow: 2780 l/min
RPM bit: 111-205
RPM string: 0-74

Incl at 1084.30 m
30.05 °
AZ : 85.26 °
TOT DEV: 112.77 m
TVD : 1066.16 m

Cretaceous
Rijnland Group
Cretaceous
Holland
Rijnland Group
Upper Holland Marl
Holland
Rijnland Group
Cretaceous
Holland
Rijnland Group
Middle Holl

Claystone, grey to brownish-grey, soft, calcareous and marly, silty, Glauconite, Pyrite, Foraminifera

Claystone, grey, occasionally brownish-grey, soft to moderately hard, calcareous and marly, silty, water-soluble, also **Claystone**, grey, hard, platy and shaly, calcareous, with Mica

Marl, variegated and brownish grey, soft.

Claystone, light grey and grey, soft to moderately hard, calcareous and marly, silty

Top of Middle Holland
Clst Mb at
1112.9 m MD / 1090.70 m TVD

Claystone, dark grey, moderately hard, calcareous, very glauconitic.

Claystone, grey to dark grey, soft, slightly calcareous.

Siltstone, light grey to grey, moderately hard to hard, splintery, elongated, platy-shaly, calcareous, with Mica and Pyrite.

Claystone, light grey - grey - dark grey, sometimes light brown - brown, soft - firm, fine black carbonaceous matter dispersed in dark grey variety, slightly calcareous,

MW: 1.20 kg/l

Carbide test

01/08/2010

8 1/2" Halliburton DBS FMX645E + MOTO

20 40 60 80 100 120 140

1165 1170 1175 1180 1185 1190 1195 1200 1205 1210 1215 1220 1225 1230 1235 1240 1245 1250 1255 1260 1265 1270 1275 1280 1285 1290 1295 1300 1305

5 10 15 20 25

Incl at 1193.10 m
38.29 °
AZ : 83.04 °
TOT DEV: 173.94 m
TVD : 1155.97 m

WOB: 3.2 - 13.4 t
SPP: 130 bar
Flow: 2760 l/min
RPM bit: 112-187
RPM string: 0-74

Incl at 1268.60 m
38.46 °
AZ : 84.44 °
TOT DEV: 221.05 m
TVD : 1214.95 m

Oil shows at 1285m:
Natural: weak odour
Fluorescence: direct: white to pale yellow
cut: white, fast, stream
5% of cuttings

WOB: 1.7 - 17.2 t
SPP: 144.6 bar
Flow: 2033 l/min
RPM bit: 301
RPM string: 41

Oil shows at 1305m:

Cretaceous

Rijnland Group

Holland

Middle Holland Claystone

Holland Greensand

Claystone, grey, dark grey, occasionally light grey, firm - moderately hard, slightly calcareous, black fine organic matter dispersed in places, silty to very silty, grading to Siltstone in places, common Mica

Sandstone, loose quartz grains, very fine, occasionaly fine, transparent, moderately sorted, subspherical - spherical, subangular - subrounded
Traces of **Pyrite, Foraminifera**

Claystone, grey, occasionally light grey, soft, sometimes firm, slightly calcareous, black fine organic matter dispersed in places, silty, from time to time grading to Siltstone, Mica

Claystone, grey and light grey, soft, at times firm, slightly calcareous,

Siltstone, light grey to grey, moderately hard to hard, splintery, platy-shaly, calcareous, with Mica and Pyrite

Claystone, medium grey, soft to firm, rare moderately hard, slightly calcareous, common Glauconite, traces of Pyrite, silty grading to **Siltstone**, very poor **Hydrocarbon shows**

Claystone, as above, silty grading to **Siltstone**, also fine sandy

Top of Holland Greensand at 1273 m MD / 1218.40 m TVD
Siltstone, grey, brownish - grey, soft to moderate hard, sub blocky, slightly to none calcareous, graded to **Sandstone**.

Sandstone, predominant loose Quartz, yellowish, transparent to translucent, very fine to fine, occasionally medium, subrounded to rounded, moderate to well sorted. Rare **Sandstone**, dark grey to grey, brownish, soft to friable, very fine to fine, poor to moderate sorted, argillaceous, moderate to weak calcareous, occasionally glauconitic, often in transition to argillaceous **Siltstone.**

20 40 60 80

0.01 0.1 1

Formation gas, max. C1: 0,330% @ 1237 m

MW: 1.20 kg/l

Formation gas, max. C1: 0,056% @ 1277 m

Formation gas, max. C1: 0,256% @ 1293 m

MW: 1.28 kg/l

8 1/2 Smith GFAS21BYODVPD + MOTOR + MWD

03/08/2010

04/08/2010

8 1/2" Halliburton DBS FMX645E + MOTOR + MWD

05/0

Natural: weak odour
Fluorescence: direct: white to pale yellow
cut: white, fast, cloudy
15% of cuttings

WOB: 6.6 - 17.7 t
SPP: 150 bar
Flow: 1994 l/min
RPM bit: 310
RPM string: 50

Incl at 1348.90 m
38.72 °
AZ : 81.41 °
TOT DEV: 271.16 m
TVD : 1277.65 m

WOB: 3.2 - 9.5 t
SPP: 164 bar
Flow: 2165 l/min
RPM bit: 326
RPM string: 45

Incl at 1395.20 m
40.70 °
AZ : 78.93 °
TOT DEV: 300.57 m
TVD : 1313.31 m

WOB: 2.6 - 15.1 t
SPP: 162 bar
Flow: 2175 l/min
RPM bit: 327
RPM string: 44

Cretaceous

Rijnland Group

Holland

Lower Holland Marl

Claystone, dark grey to grey, plastic to soft, sub blocky to sub platy, locally amorphous, calcareous in part, silty and sandy

Top of Lower Holland Marl at 1332 m MD / 1264.5 m TVD

Claystone, medium grey, soft and plastic, subblocky, marly, silty grading to **Siltstone**

Claystone, dark grey to grey, plastic to soft, locally moderate hard, amorphous to sub blocky, locally sub platy, slightly calcareous, marly, silty in places.

Marl argillaceous, grey, locally light grey, sticky, washable, amorphous

Claystone, medium to dark grey, moderately hard, pred. subplaty, shaly in part, calcareous, silty, micromicaceous

Claystone, medium grey, soft to firm, amorphous to subblocky, silty, calcareous

Shale, dark grey, firm, fissile, slightly calcareous.

Marl argillaceous, light grey to grey, plastic, sticky, amorphous, washable in part.

Claystone grey, soft, sub blocky to platy, occasionally amorphous, calcareous, silty, glauconitic, common piryte, rare single fine quartz grains, locally grading to **Marl**. Interlayered with **Claystone** dark grey, moderately hard, platy, splintery, slightly calcareous.

High dolomite content due to mud additives

Sample contaminated by Calcium carbonate added to mud system.

Formation gas, max. C1: 0,232% @ 1310 m

Formation gas, max. C1: 0,232% @ 1310 m

MW: 1.32 kg/l

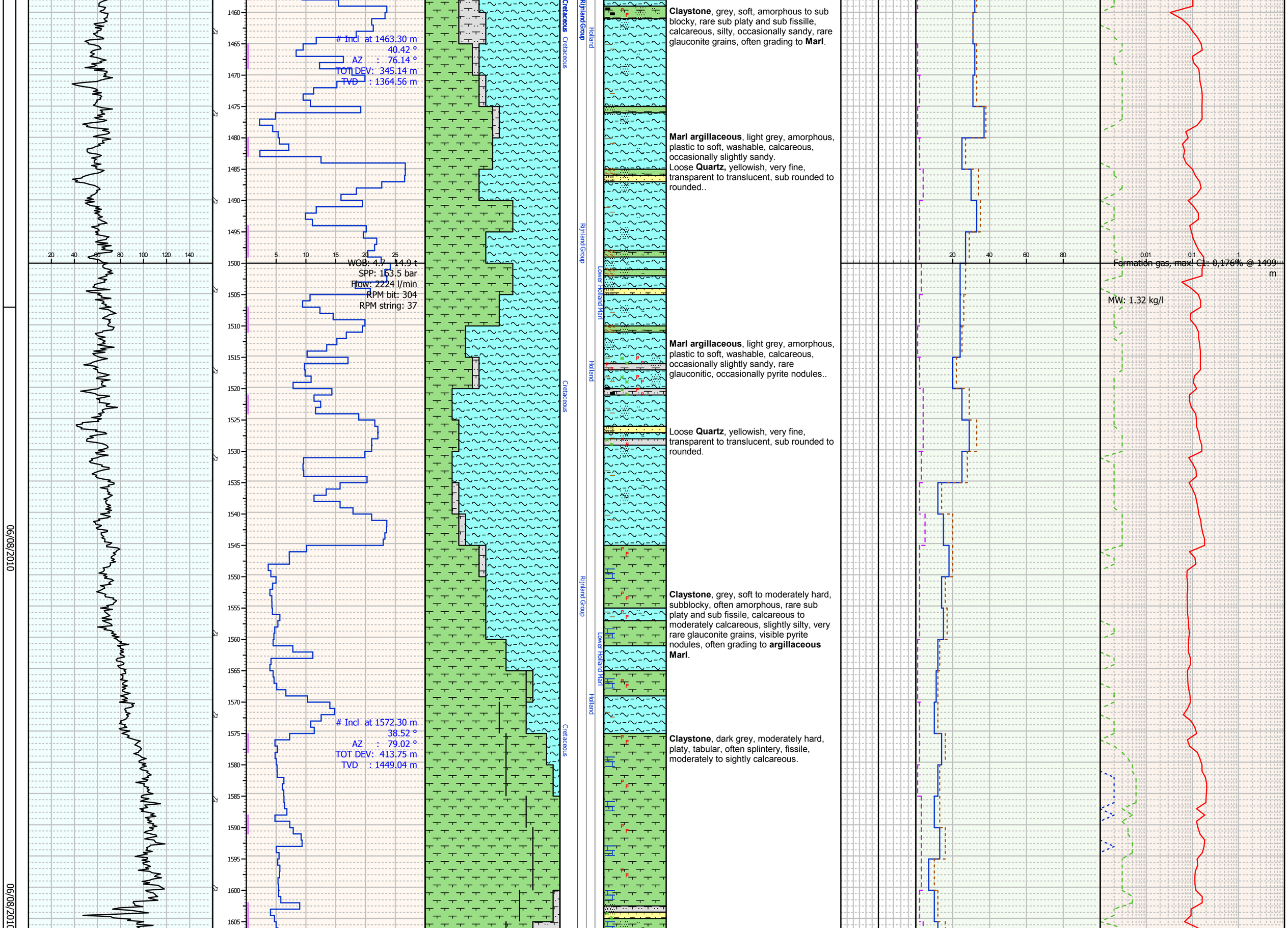
Trip gas

MW: 1.32 kg/l

Connection gas

MW: 1.31 kg/l

Formation gas, max. C1: 0,096% @ 1423 m


06/08/2010
06/08/2010
20
40
60
80
100
120
140
5
10
15
20
25
WOB: 4.7 - 14.9 t
SPP: 153.5 bar
Flow: 2224 l/min
RPM bit: 304
RPM string: 37
Incl at 1463.30 m
40.42 °
AZ : 76.14 °
TOT DEV: 345.14 m
TVD : 1364.56 m
Incl at 1572.30 m
38.52 °
AZ : 79.02 °
TOT DEV: 413.75 m
TVD : 1449.04 m
1460
1465
1470
1475
1480
1485
1490
1495
1500
1505
1510
1515
1520
1525
1530
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1595
1600
1605
Cretaceous
Rijnland Group
Holland
Lower Holland Marl
Claystone, grey, soft, amorphous to sub blocky, rare sub platy and sub fissille, calcareous, silty, occasionally sandy, rare glauconite grains, often grading to Marl.
Marl argillaceous, light grey, amorphous, plastic to soft, washable, calcareous, occasionally slightly sandy.
Loose Quartz, yellowish, very fine, transparent to translucent, sub rounded to rounded..
Marl argillaceous, light grey, amorphous, plastic to soft, washable, calcareous, occasionally slightly sandy, rare glauconitic, occasionally pyrite nodules..
Loose Quartz, yellowish, very fine, transparent to translucent, sub rounded to rounded.
Claystone, grey, soft to moderately hard, subblocky, often amorphous, rare sub platy and sub fissile, calcareous to moderately calcareous, slightly silty, very rare glauconite grains, visible pyrite nodules, often grading to argillaceous Marl.
Claystone, dark grey, moderately hard, platy, tabular, often splintery, fissile, moderately to sightly calcareous.
20
40
60
80
0.01
0.1
1
Formation gas, max: C1: 0,176% @ 1499 m
MW: 1.32 kg/l

07/08/2010

08/08/2010

09

Gamma tool malfunction.

20 40 60 80 100 120 140

1610 1615 1620 1625 1630 1635 1640 1645 1650 1655 1660 1665 1670 1675 1680 1685 1690 1695 1700 1705 1710 1715 1720 1725 1730 1735 1740 1745 1750

Incl at 1626.90 m
39.44 °
AZ : 78.28 °
TOT DEV: 448.23 m
TVD : 1491.28 m

WOB: 3.1 - 13.0 t
SPP: 173.5 bar
Flow: 2219 l/min
RPM bit: 344
RPM string: 55

Incl at 1694.90 m
38.68 °
AZ : 79.37 °
TOT DEV: 490.99 m
TVD : 1544.09 m

WOB: 2.0 - 10.3 t
SPP: 165.3 bar
Flow: 2211 l/min
RPM bit: 332
RPM string: 45

Incl at 1728.30 m
37.99 °
AZ : 80.82 °
TOT DEV: 511.79 m
TVD : 1570.20 m

WOB: 1.0 - 12.5 t
SPP: 161 bar
Flow: 2182 l/min
RPM bit: 327
RPM string: 43

5 10 15 20 25

ROP value changes whilst different drilling parameters and sliding.

Cretaceous

Cretaceous

Cretaceous

Holland

Rijnland Group

Vlieland Subgroup

Rijnland Group

De Lier Mb

Claystone, as described above, also dark grey, firm to moderate hard, sub blocky, weak calcareous, graded to **Siltstone**.

Top of De Lier at 1619 m MD / 1485.18 m TVD

Traces of **Sandstone**, light grey, friable, very fine, sub angular, poor sorted, slightly glauconitic, slightly calcareous, in transition to **Siltstone**. Traces of **Dolomite**, light brown, beige, very hard, cryptocrystalline.

Claystone, grey, firm, sub blocky, weak to slightly calcareous, bituminous in part, silty, also **Claystone**, light grey to grey, soft to firm, slightly sandy, weak to moderate calcareous, marly, also **Claystone**, grey to dark grey, sub platy, sub fissile to fissile, slightly calcareous, grading to **Shale**.

Claystone, grey to dark grey, moderately hard, firm, subblocky to subplaty, in part fissile, none to slightly calcareous, silty, in part grading to **silty Claystone**. **Sandstone**, grey, greenish grey, moderately hard, also friable, fine to very fine grained, poorly sorted, moderately cemented, silty, argillaceous, glauconitic, none to slightly calcareous, Quartz grains, translucent, subrounded to subangular, subspherical, frosted luster, common pyrite coating, single muscovite, visible intragranular porosity, traces of very weak oil shows. Often grading to **sandy Siltstone.**

Top of Vlieland Claystone at 1726.5 m MD / 1568.79 m TVD

Siltstone, grey, dark grey, occasionally blackish, moderate hard, friable, subblocky to subplaty, locally bituminous, argillaceous, glauconitic, sandy in part, locally grading to **silty Sandstone**, grey, light grey, very fine grained.

Traces of **Pyrite**.

20 40 60 80

0.01 0.1 1

Formation gas, max. C1: 0,278% @ 1625 m

MW: 1.32 kg/l

Formation gas, max. C1: 0,213% @ 1670 m

MW: 1.32 kg/l

Formation gas, max. C1: 0,205% @ 1723 m

MW: 1.32 kg/l

Trip (ream) gas, max. C1: 0,278% @ 1745 m

11/08/2010

1755
1760
1765
1770
1775
1780
1785
1790
1795
1800
1805
1810
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1850
1855
1860
1865
1870
1875
1880
1885
1890
1895
1900

Incl at 1818.20 m
37.69 °
AZ : 81.92 °
TOT DEV: 566.61 m
TVD : 1641.45 m

WOB: 3.0 - 17.8 t
SPP: 173.4 bar
Flow: 2077 l/min
RPM bit: 222
RPM string: 56

Cretaceous

Rijnland Group

Vlieland Claystone Frm

Vlieland Subgroup

Claystone, light grey to grey, soft, subblocky, non calcareous, very silty and sandy
Claystone, dark grey, brownish, moderately hard, subplaty, with mica, locally calcareous
Siltstone, grey to dark grey,brownish, moderately hard, friable, subblocky, sandy, non calcareous, sparse glauconite

Traces of **Claystone**, reddish-brown, very hard, splintery, non-calcareous, with pyrite and glauconite

Claystone, light grey to grey, plastic to soft, amorphous to subblocky, none to very slightly calcareous, rare sandy, also traces of **Claystone**, dark grey, moderately hard, subblocky, none calcareous, in part grading to **Siltstone**.

Siltstone, dark grey, blackish in part, moderate hard, sub blocky, occasionally pyritized, black bituminous spots, in part graded to **Sandstone**, light grey, friable, very fine, sub rounded, poor sorted.

Sandstone, predominant loose Quartz, translucent to transparent, occasionally yellowish to off white, very fine to fine, sub angular to sub rounded, rare rounded, in traces as described above. Often argillaceous, in transition to sandy **Claystone**.

Claystone, light grey, beige, soft to firm,

Formation gas, max. C1: 0,179% @ 1775 m

Formation gas, max. C1: 0,157% @ 1840 m

MW: 1.32 kg/l

14/08/2010

8 1/2" Halliburton DBS FMX645E + MOTOR + MWD

15/08/2010

15/08/2010

20 40 60 80 100 120 140

1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050

5 10 15 20 25

WOB: 12.8-22.6 t
SPP: 165 bar
Flow: 2015 l/min
RPM bit: 217
RPM string: 56

Incl at 1925.20 m
37.56 °
AZ : 81.67 °
TOT DEV: 631.88 m
TVD : 1726.24 m

WOB: 1.7 - 14.8 t
SPP: 147 bar
Flow: 2012 l/min
RPM bit: 234
RPM string: 56

Incl at 2021.40 m
38.63 °
AZ : 81.16 °
TOT DEV: 691.07 m
TVD : 1802.07 m

Cretaceous

Rijnland Group

Vlieland Claystone Fm

Vlieland Subgroup

Rijnland Group

Cretaceous

Claystone, light grey to grey, light brown in part, soft to plastic, firm in places, amorphous to subblocky, non to weak calcareous, sandy in part, also **Claystone**, grey to dark grey, firm to moderately hard, subblocky, non calcareous, in places grading to Siltstone, also **Claystone**, light grey, creamy to off white, plastic, amorphous, washable in part, weak calcareous, marly, also **Claystone**, light brown to brown, hard, subplaty, dolomitic. **Sandstone**, light brown to brown, beige, soft, friable, argillaceous, very fine, subangular to subrounded, poorly sorted, mainly washed out to loose Quartz, occasionally off white to light grey, grey to dark grey, friable to moderately hard, subangular to subrounded, poorly to moderately sorted, sillicaceous, locally glauconitic, quartzitic in places.

Sandstone, off-white, grey, dark grey, very fine to fine, friable to firm to moderately hard, moderately sorted, subangular to subrounded, sub-spherical, weakly calcareous, no visible porosity

Siltstone, grey, dark grey, moderately hard, sub-blocky to sub-platy, non-calcareous, grading to sandstone, with pyrite and minor amounts of glauconite

Sandstone, off-white, light to dark grey, occasionally creamy, very fine - fine grained, commonly as loose quartz grains, friable - firm, non - very slightly calcareous, moderately cemented, moderately sorted, argillaceous in places, sparse glauconite and mica, occasionally visible intragranular porosity, quartz grains transparent - translucent, angular - subangular, subspherical - spherical, common frosted luster

Formation gas, max. C1: 0,192% @ 1908 m

MW: 1.32 kg/l

Gas test

Formation gas, max. C1: 0,194% @ 1951 m

MW: 1.31 kg/l

Calcimetry tests suspended due to a high amount of calcium carbonate in the mud

Ethane increase due to carbide test

20 40 60 80

0.01 0.1 1

16/08/2010

17/08/2010

2050
2055
2060
2065
2070
2075
2080
2085
2090
2095
2100
2105
2110
2115
2120
2125
2130
2135
2140
2145
2150
2155
2160
2165
2170
2175
2180
2185
2190
2195

WOB: 2 - 14 t
SPP: 155 bar
Flow: 2025 l/min
RPM bit: 290
RPM string: 65

WOB: 3 - 17 t
SPP: 160 bar
Flow: 2025 l/min
RPM bit: 285
RPM string: 56

Incl at 2130.10 m
42.27 °
AZ : 79.86 °
TOT DEV: 761.26 m
TVD : 1885.01 m

WOB: 5 - 17 t
SPP: 170 bar
Flow: 2025 l/min
RPM bit: 288
RPM string: 59

Cretaceous
Rijnland Group
Vlieland Claystone Frm
Vlieland Subgroup
Berkel Sandstone Mb

Sandstone, as above, also light grey, creamy, medium grained, occasionally coarse - very coarse grained, hard, poorly sorted, well rounded, subspherical - spherical, siliceous matrix, slightly dolomitic, transparent - translucent

Claystone, light grey to grey, soft, sub-blocky, non to slightly calcareous, slightly sandy; **Claystone**, dark grey, greenish, moderately hard, firm, non-calcareous, sub-blocky to subplaty, alternating with: **Siltstone**, grey to dark grey, moderately hard, friable, subblocky to subplaty, non-calcareous, sandy, sparse glauconite grains, often grading to **silty Claystone.**

Top of Berkel Sandstone at 2148.5 m MD / 1898.57 m TVD

Sandstone, light grey with brownish shade in places, very fine - fine grained, moderately hard, very well sorted, spherical, subangular - subrounded, predominantly transparent, non to moderately calcareous, moderately cemented, rarely glauconite, mainly as loose quartz grains

Top of Berkel Sand-Claystone at 2170 m MD / 1914.26 m TVD

Claystone, light to dark grey, dark beige, soft to moderately hard, subblocky to platy, splintery, mainly non-calcareous, occasionally weakly to calcareous, sparse fine organic material

MW: 1.31 kg/l

Ethane increase due to carbide test

MW: 1.32 kg/l

MW: 1.32 kg/l

18/08/2010

20/08/2010

8 1/2" Smith MI516 JD2960 + MOTOR + MWD

21/08/2010

21/08/2

20 40 60 80 100 120 140

5 10 15 20 25

2200 2205 2210 2215 2220 2225 2230 2235 2240 2245 2250 2255 2260 2265 2270 2275 2280 2285 2290 2295 2300 2305 2310 2315 2320 2325 2330 2335 2340 2345

Incl at 2226.20 m
44.09 °
AZ : 79.44 °
TOT DEV: 827.22 m
TVD : 1954.85 m

WOB: 4 - 10 t
SPP: 180 bar
Flow: 2020 l/min
RPM bit: 293
RPM string: 66

Incl at 2333.50 m
41.80 °
AZ : 78.87 °
TOT DEV: 900.08 m
TVD : 2033.52 m

Cretaceous

Rijnland Group

Berkel Sand-Claystone Mb

Vlieland Subgroup

Sandstone, light grey, very fine - fine grained, moderately hard, well sorted, spherical, subangular - subrounded, transparent, with pyrite in places, non-calcareous, no visible porosity

Claystone, light to medium grey, soft to moderately hard, subblocky, sub-platy, non-calcareous, fine organic material in places, pyrite, silty in places

Siltstone, medium grey, light beige grey, brownish - grey, firm to moderately hard, subblocky, argillaceous, also calcareous, sandy in places, with Pyrite

Sandstone, light grey to light beige grey, very fine to fine grained, moderately hard, well sorted, with pyrite in places, calcareous cement, argillaceous in places

Sandstone, light grey to light beige grey, very fine - fine grained, firm - moderately hard, well sorted, locally pyritic, calcareous cement, minor traces of **Sideritic** cement

Claystone, light grey, soft and sticky, amorphous, slightly silty, none to weak calcareous, also medium grey, firm, sub-platy and splintery, non-calcareous

Sandstone, light grey to medium grey,

Ethane increase due to carbide test

MW: 1.33 kg/l

Trip gas, max. C1: 1.58 % at 2241 m

20 40 60 80

0.01 0.1 1

22/08/2010

2350 2355 2360 2365 2370 2375 2380 2385 2390 2395 2400 2405 2410 2415 2420 2425 2430 2435 2440 2445 2450 2455 2460 2465 2470 2475 2480 2485 2490

WOB: 2 - 7 t
SPP: 170 bar
Flow: 1980 l/min
RPM bit: 301
RPM string: 73

Incl at 2415.80 m
40.07 °
AZ : 78.94 °
TOT DEV: 954.04 m
TVD : 2095.60 m

Incl at 2470.30 m
39.02 °
AZ : 80.12 °
TOT DEV: 988.74 m
TVD : 2137.61 m

WOB: 2 - 10 t
SPP: 164 bar
Flow: 1970 l/min
RPM bit: 303
RPM string: 80

Cretaceous
Rijnland Group
Vlieland Subgroup
Rijswijk Mb
Cretaceous
Rijnland Group
Vlieland Subgroup
Rijswijk Mb
Cretaceous
Delfland Subgroup
Schieland Group
Rodenrijs Mb

Sandstone, light grey to medium grey, brownish grey, friable to moderately hard, very fine to fine grained, well rounded, transparent and translucent grains, grading to siltstone, well sorted, subblocky, often pyritic, none to very weak calcareous, traces of glauconite

Top of Rijswijk at
2381.5 m MD / 2069.47 m TVD

Sandstone, predominantly brown grey, also light to medium grey, friable to moderately hard, very fine to fine, rare medium grains, predominantly well rounded, moderately to well sorted, weak calcareous, in places pyritic, traces of glauconite

Sandstone, brownish grey, light to medium grey, friable to moderately hard, fine, medium - coarse loose grains, subspherical - spherical, subrounded - well rounded, moderately to poorly sorted, weak calcareous, pyrite in places, traces of glauconite, no visible porosity

Sandstone, light to medium grey, minor brownish grey, friable to moderately hard, fine - medium - coarse, subspherical - spherical, subrounded - well rounded, moderately to poorly sorted, weak calcareous, pyrite in places, traces of glauconite, no visible porosity

Top of Rodenrijs at
2444.2 m MD / 2117.34 m TVD

Claystone, light brownish - grey, medium grey, dark brown grey, moderately hard, predominantly sub-platy, also sub - blocky, in part elongated, silty in part, micromicaceous, dispersed pyrite, non-calcareous, **Siltstone**, light brown - beige, firm to moderately hard, argillaceous, dispersed pyrite, sparse organic matter, non- calcareous
Traces of **Coal**

Sandstone, loose, medium quartz

MW: 1.35 kg/l

Losses at 2415 m -
26 m3/h

MW: 1.33 kg/l

30/0d

8 1/6" PDC MA616NEPX

07/09/2010

08/09/2010

20 40 60 80 100 120 140

5 10 15 20 25

2495 2500 2505 2510 2515 2520 2525 2530 2535 2540 2545 2550 2555 2560 2565 2570 2575 2580 2585 2590 2595 2600 2605 2610 2615 2620 2625 2630 2635 2640

Change of drilling parameters

Incl at 2528.70 m
39.31 °
AZ : 80.59 °
TOT DEV: 1025.47 m
TVD : 2183.01 m

WOB: 2 t
SPP: 152 bar
Flow: 1090 l/min
RPM: 74 r/min

WWS from 2671.51 to 2572.79 m

WOB: 2 t
SPP: 138 bar
Flow: 1188 l/min
RPM: 86 r/min

Incl at 2622.90 m
44.73 °
AZ : 80.10 °
TOT DEV: 1088.34 m
TVD : 2253.10 m

Cretaceous

Cretaceous

Cretaceous

Cretaceous

Delft and Subgroup

Schieland Group

Delft Sandstone

Delfland Subgroup

Schieland Group

Sandstone, loose, medium quartz graines, moderately sorted, angular to subrounded, subspherical to elongated, transparent and translucent

Claystone, light brown - grey, occasionally grey, friable to moderate hard, sub platy platy, sub fissile to fissile, splintery, grading to **Shale**, silty, in transition to **Siltstone**, light grey to grey, rare dark grey, moderate hard to hard, sub blocky to blocky, traces of organic material, slightly micaceous, locally pyritized, sandy in places.

Coal, black, friable, locally **Lignite**.

Top of Delft Sandstone at 2545.9 m MD / 2196.27 m TVD

Sandstone, predominant loose Quartz, clear, off white in places, transparent to translucent, very fine to coarse, sub rounded to rounded; when cemented, off white, creamy, friable to moderate hard, predominant poor sorted to moderate sorted, weak to fair visible porosity, sillicaceous, occasionally argillaceous. In places: off white, milled by bit quartz - rock flour.

Claystone, grey, grey-brownish, beige, friable to moderately hard, occasionally with micro Pyrite, subplaty to subblocky, non- calcareous.

Sandstone, off white, friable to moderately hard, very fine to fine grained, rarely medium grains, subrounded, moderately sorted, argillaceous-siliceous cement, non-calcareous, fair visible porosity, mainly milled to loose Quartz grains, transparent and translucent, sporadically milky.

Sandstone, loose Quartz grains, transparent and translucent, sporadically milky, medium to fine grained, subrounded, sub spherical, moderately to well sorted.

Sandstone, loose Quartz, clear, milky

20 40 60 80

0.01 0.1 1

MW: 1.09 kg/l

Formation gas, max. C1: 0,097% @ 2578 m

MW: 1.09 kg/l

11/09/2010

2645
2650
2655
2660
2665
2670
2675
2680
2685
2690
2695
2700
2705
2710
2715

Incl at 2663.20 m
48.25 °
AZ : 81.07 °
TOT DEV: 1117.46 m
TVD : 2280.95 m

WOB: 1.6 t
SPP: 138 bar
Flow: 1205 l/min
RPM: 101 r/min

Incl at 2694.60 m
49.34 °
AZ : 80.24 °
TOT DEV: 1141.08 m
TVD : 2301.64 m

HAG GT-01 Well TD at 2702 MD
2306.38m TVD

Cretaceous

Delft Sandstone
Delfland Subgroup
Schieland Group

Cretaceous

Sandstone, loose Quartz, clear, milky, transparent to translucent, very fine to medium, locally coarse, sub angular to subrounded, occasionally rounded, sub spherical to sub elongated; when cemented, predominant moderate to poor sorted, occasionally moderate to well sorted, poor to fair visible porosity, rarely good visible porosity, quartzic, partly milled by bit - rock flour.

Claystone, beige, grey, brownish, friable to moderately hard, sub platy, shaly, rarely subblocky, locally micro Pyrite, with Coal (Lignite?) inclusions, non- calcareous.

Sandstone, loose Quartz grains, fine to medium grained, subangular to subrounded, sub spherical, moderately to well sorted, Quartz grains are transparent and translucent.

Formation gas, max. C1: 0,054% @ 2680 m

MW: 1.08 kg/l

Table # 2b

HAG GT-01

WASHED and DRIED SAMPLES		
SET A If Technology B.V.	SET B TNO Central Kernhuis	BOX NO
[m]		
270 - 360	270 - 360	1
365 - 410	365 - 410	2
415 - 460	415 - 460	3
465 - 505	465 - 505	4
510 - 545	510 - 545	5
550 - 620	550 - 620	6
625 - 680	625 - 680	7
685 - 725	685 - 725	8
730 - 770	730 - 770	9
775 - 815	775 - 815	10
820 - 890	820 - 890	11
895 - 940	895 - 940	12
945 - 985	945 - 985	13
990 - 1030	990 - 1030	14
1035 - 1095	1035 - 1095	15
1100 - 1160	1100 - 1160	16
1165 - 1215	1165 - 1215	17
1220 - 1250	1220 - 1250	18
1255 - 1365	1255 - 1365	19
1370 - 1440	1370 - 1440	20
1445 - 1530	1445 - 1530	21
1535 - 1625	1535 - 1625	22
1630 - 1710	1630 - 1710	23
1715 - 1990	1715 - 1990	24
1995 - 2330	1995 - 2330	25
2335 - 2615	2335 - 2615	26
2617 - 2702	2617 - 2702	27

HAG GT-01 STRATIGRAPHY

Chronostratigraphy		Group	Formation	Member		Prognosis		TVD difference [m]	Actual		Basis of Pick
						MD BRT [m]	TVD SS [m]		MD BRT [m]	TVD SS [m]	
Tertiary		**North Sea**	**Basal Dongen Sand**		NLFFD	---	---	---	465	457	GR & samples
			Landen		NLLF	---	---	---	472	464	GR & samples
Cretaceous	**Upper**	**Chalk**	**Ommelanden**		CKGR	450	450	-47	505	497	GR & samples
			Texel	Plenus Marl	CKTXP	---	---	---	725	716	GR & samples
				Texel Marlstone	CKTXM	---	---	---	727	718	GR & samples
				Texel Greensand	CKTXG	---	---	---	815	805	GR & samples
	Lower	**Rijnland**	**Holland**	Upper Holland Marl	KNGLU	800	800	-20	831	820	Samples
				Middle Holland Claystone	KNGLM	---	---	---	1113	1082	Samples & Calcimetry
				Holland Greensand	KNGLG	1298	1230	20	1273	1210	GR & samples, HC shows
				Lower Holland Marl	KNGLS	---	---	---	1332	1256	GR & samples, HC shows
			Vlieland Sandstone	De Lier	KNNSL	1602	1466	-11	1619	1477	GR & samples
			Vlieland Claystone		KNNC	---	---	---	1727	1560	GR & samples
			Vlieland Sandstone	Berkel Sandstone	KNNSB	---	---	---	2149	1890	Drilling break, GR & samples
				Berkel Sand-Claystone	KNNSC	---	---	---	2170	1906	GR & ROP
				Rijswijk	KNNSR	2328	2031	-30	2382	2061	GR & samples
		Schieland	**Nieuwerkerk**	Rodenrijs	SLDNR	2382	2073	-36	2444	2109	GR & samples
				Delft Sand	SLDND	2497	2162	-26	2546	2188	GR & samples

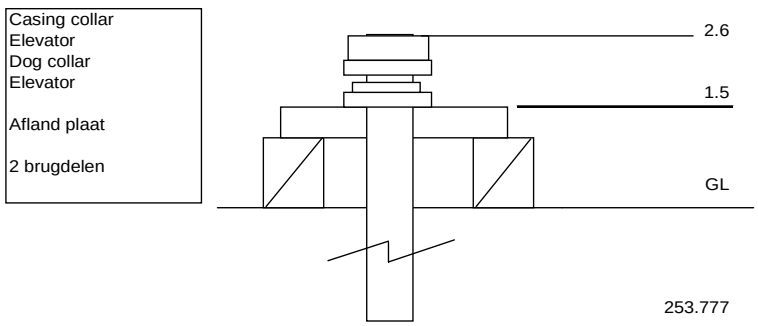
Appendix 7, Pipe tallies

Final 13 3/8" casing running tally

18/03/2010 10:31

Well:	HAG GT1			**Comp. Rep:**	S. Kaldenbach		**Date:** 11-mrt-10
Company:	ADH	**Csg. OD [in]:**	13 3/8	**Connection:**	BTC	**Collapse [bar]:** 78	**Buoyancy F.:** 0.8688
Rig / Contr.:	WPMI - Haitjema	**Csg. ID [in]:**	12.615	**Csg Grade:**	K-55	**Burst [bar]:** 189	**Capacity l/m]:** 80.64
Shoe MD [m]:	253.78	**Csg Wt. [kg/m]:**	81.1	**Csg Wt. [ppf]:**	54.5	**Tensile: [kdaN]:** 380	**Displ. [l/m]:** 90.65
Shoe TD [m]:	253.78	**Csg WT [mm]:**	9.700	**Mud Wt [kg/l]:**	1.03	**Block Wt. [to]:** 0.0	**M/U [ft.lbs]:** 7200 +/-25%
Hole TD:	258.00					**MU to triangle**	**M/U loss [m]** 0.12270

Joint No.	Measured Length [m]	MU length [m]	In string [Y/N]	Cum. Length [m]	Top of joint [m]	String weight in mud [ton]	Displace-ment [m3]	Capacity [m3]	Remarks
1	11.610	11.610	Y	11.61	242.17	0.82	1.05	0.94	Shoe (inc. float) 13.625 x 17"Centralizer
2	11.722	11.599	Y	23.21	230.57	1.64	2.10	1.87	Landing collar 13.625 x 17"Centralizer
3	10.990	10.867	Y	34.08	219.70	2.40	3.09	2.75	13.625 x 17"Centralizer
4	11.230	11.107	Y	45.18	208.60	3.18	4.10	3.64	13.625 x 17"Centralizer
5	11.236	11.113	Y	56.30	197.48	3.97	5.10	4.54	13.625 x 17"Centralizer
6	10.934	10.811	Y	67.11	186.67	4.73	6.08	5.41	
7	11.206	11.083	Y	78.19	175.59	5.51	7.09	6.31	
8	11.202	11.079	Y	89.27	164.51	6.29	8.09	7.20	
9	11.418	11.295	Y	100.57	153.21	7.09	9.12	8.11	13.625 x 17"Centralizer
10	11.188	11.065	Y	111.63	142.15	7.87	10.12	9.00	
11	11.114	10.991	Y	122.62	131.16	8.64	11.12	9.89	
12	11.240	11.117	Y	133.74	120.04	9.42	12.12	10.78	
13	10.840	10.717	Y	144.46	109.32	10.18	13.09	11.65	13.625 x 17"Centralizer
14	11.604	11.481	Y	155.94	97.84	10.99	14.14	12.57	
15	11.162	11.039	Y	166.98	86.80	11.77	15.14	13.46	
16	11.752	11.629	Y	178.61	75.17	12.59	16.19	14.40	13.625 x 17"Centralizer
17	11.232	11.109	Y	189.72	64.06	13.37	17.20	15.30	
18	11.368	11.245	Y	200.96	52.82	14.16	18.22	16.20	
19	11.698	11.575	Y	212.54	41.24	14.98	19.27	17.14	13.625 x 17"Centralizer
20	11.118	10.995	Y	223.53	30.25	15.75	20.26	18.02	13.625 x 17"Centralizer
21	11.158	11.035	Y	234.57	19.21	16.53	21.26	18.91	13.625 x 17"Centralizer
22	11.108	10.985	Y	245.55	8.23	17.30	22.26	19.80	13.625 x 17"Centralizer
23	10.946	10.823	Y	256.38	-2.60	18.07	23.24	20.67	13.625 x 17"Centralizer



10 3/4" Casing Running Tally

Well HAG GT-01
Rig LOC-400 No limit 01
Date : 27-jul-10
Drilling Supervisor: Koop Eleveld /Chris Madley

Casing	10 3/4	10 3/4 shoetrack	
Grade	VM110	K55	
Weight Lbs/ft	45,5	51	
Casing ID	9,95	9,85	
Drift Dia	9,79	9,69	
Connection	VAM TOP	VAM TOP	
M/u Torque Opt	13000	12300	ft.lbs
M/u Torque Max	14300	13500	ft.lbs
90% Burst	445		bar
90% Collapse	162		bar
Tensile Strength	650		MT
Metal displacement	8,3900		ltr/m
Capacity	50,1700		ltr/m

Pocket	2,000	m
Mud wt	1,2	sg
Bouyancy factor	0,8333	
Block wt	18	MT

DRILL TO >	1250,00	m
Shoe Depth =	**1248,00**	m
10 3/4" VAMTOP Make-up loss	0,143	m (5,634")
All casing measured incl. pin		
All centralizers on the joint. No stopcollars used.		

Joint no	Length	Less m/u loss	Cum m	Jt TOP m	Remarks	No. of joints	Centralizers	Block wt MT	Displacement m3
Shoe depth				**1248,00**				18	0,00
Shoe	0,520	0,520	0,52	1247,48		1		18	0,00
Shoejnt	14,480	14,480	15,00	1233,00	Baker lock		BOW	19	0,13
Bakerlock	14,510	14,510	29,51	1218,49	Baker lock	2	BOW	20	0,25
Float	0,620	0,477	29,99	1218,01	VAMTOP	3		20	0,25
Floatcollar jnt	14,480	14,480	44,47	1203,53	Bakerlock		BOW	21	0,37
1	12,220	12,077	56,54	1191,46	Bakerlock pin	4	BOW	21	0,47
2	13,830	13,687	70,23	1177,77	VAMTOP	5	BOW	22	0,59
3	0,000	0,000	70,23	1177,77	VAMTOP	6	BOW	22	0,59
4	13,780	13,637	83,87	1164,13	VAMTOP	7	BOW	23	0,70
5	14,330	14,187	98,06	1149,95	VAMTOP	8	BOW	24	0,82
6	0,000	0,000	98,06	1149,95	VAMTOP	9	BOW	24	0,82
7	14,450	14,307	112,36	1135,64	VAMTOP	10	BOW	24	0,94
8	14,060	13,917	126,28	1121,72	VAMTOP	11	BOW	25	1,06
9	12,400	12,257	138,54	1109,46	VAMTOP	12		26	1,16
10	14,600	14,457	152,99	1095,01	VAMTOP	13	BOW	27	1,28
11	14,320	14,177	167,17	1080,83	VAMTOP	14		28	1,40
12	12,860	12,717	179,89	1068,11	VAMTOP	15	BOW	28	1,51
13	14,010	13,867	193,75	1054,25	VAMTOP	16		29	1,63
14	13,630	13,487	207,24	1040,76	VAMTOP	17	BOW	30	1,74
15	14,260	14,117	221,36	1026,64	VAMTOP	18		31	1,86
16	14,610	14,467	235,83	1012,18	VAMTOP	19	BOW	31	1,98
17	14,030	13,887	249,71	998,29	VAMTOP	20		32	2,10
18	13,640	13,497	263,21	984,79	VAMTOP	21	BOW	33	2,21
19	12,410	12,267	275,48	972,52	VAMTOP	22		34	2,31
20	14,620	14,477	289,95	958,05	VAMTOP	23	BOW	34	2,44
21	12,710	12,567	302,52	945,48	VAMTOP	24		35	2,54
22	14,600	14,457	316,98	931,02	VAMTOP	25	BOW	36	2,66
23	14,240	14,097	331,07	916,93	VAMTOP	26		37	2,78
24	14,600	14,457	345,53	902,47	VAMTOP	27	BOW	38	2,90
25	14,600	14,457	359,99	888,01	VAMTOP	28		38	3,02
26	12,210	12,067	372,06	875,95	VAMTOP	29	BOW	39	3,12
27	14,420	14,277	386,33	861,67	VAMTOP	30		40	3,24
28	14,600	14,457	400,79	847,21	VAMTOP	31	BOW	41	3,37
29	14,610	14,467	415,26	832,74	VAMTOP	32		42	3,49
30	14,290	14,147	429,40	818,60	VAMTOP	33	BOW	42	3,61
31	14,300	14,157	443,56	804,44	VAMTOP	34		43	3,73
32	12,520	12,377	455,94	792,06	VAMTOP	35	BOW	44	3,83
33	14,590	14,447	470,38	777,62	VAMTOP	36		45	3,95
34	14,610	14,467	484,85	763,15	VAMTOP	37	BOW	46	4,07
35	14,200	14,057	498,91	749,09	VAMTOP	38		46	4,19
36	14,470	14,327	513,24	734,77	VAMTOP	39	BOW	47	4,31
37	13,040	12,897	526,13	721,87	VAMTOP	40		48	4,42
38	14,600	14,457	540,59	707,41	VAMTOP	41	BOW	49	4,54
39	12,610	12,467	553,06	694,94	VAMTOP	42		49	4,64
40	12,400	12,257	565,31	682,69	VAMTOP	43	BOW	50	4,75
41	12,810	12,667	577,98	670,02	VAMTOP	44		51	4,85

42	14,160	14,017	592,00	656,00	VAMTOP	45	BOW	52	4,97
43	14,600	14,457	606,45	641,55	VAMTOP	46		52	5,09
44	13,210	13,067	619,52	628,48	VAMTOP	47	BOW	53	5,20
45	12,400	12,257	631,78	616,22	VAMTOP	48		54	5,31
46	12,910	12,767	644,55	603,46	VAMTOP	49	BOW	55	5,41
47	13,790	13,647	658,19	589,81	VAMTOP	50		55	5,53
48	14,050	13,907	672,10	575,90	VAMTOP	51	BOW	56	5,64
49	14,080	13,937	686,04	561,96	VAMTOP	52		57	5,76
50	14,000	13,857	699,89	548,11	VAMTOP	53	BOW	58	5,88
51	14,240	14,097	713,99	534,01	VAMTOP	54		59	6,00
52	14,250	14,107	728,10	519,90	VAMTOP	55	BOW	59	6,11
53	12,670	12,527	740,62	507,38	VAMTOP	56		60	6,22
54	13,990	13,847	754,47	493,53	VAMTOP	57	BOW	61	6,34
55	14,600	14,457	768,93	479,07	VAMTOP	58		62	6,46
56	12,600	12,457	781,39	466,62	VAMTOP	59	BOW	62	6,56
57	13,920	13,777	795,16	452,84	VAMTOP	60		63	6,68
58	14,610	14,467	809,63	438,37	VAMTOP	61	BOW	64	6,80
59	14,030	13,887	823,52	424,48	VAMTOP	62		65	6,92
60	14,130	13,987	837,50	410,50	VAMTOP	63	BOW	66	7,03
61	13,960	13,817	851,32	396,68	VAMTOP	64		66	7,15
62	14,450	14,307	865,63	382,37	VAMTOP	65	BOW	67	7,27
63	12,100	11,957	877,58	370,42	VAMTOP	66		68	7,37
64	14,600	14,457	892,04	355,96	VAMTOP	67	BOW	69	7,49
65	14,600	14,457	906,50	341,50	VAMTOP	68		70	7,61
66	13,840	13,697	920,20	327,81	VAMTOP	69	BOW	70	7,73
67	13,140	12,997	933,19	314,81	VAMTOP	70		71	7,84
68	14,520	14,377	947,57	300,43	VAMTOP	71	BOW	72	7,96
69	14,620	14,477	962,05	285,95	VAMTOP	72		73	8,08
70	14,560	14,417	976,46	271,54	VAMTOP	73	BOW	74	8,20
71	14,600	14,457	990,92	257,08	VAMTOP	74		74	8,32
72	12,240	12,097	1003,02	244,98	VAMTOP	75	RIDG	75	8,42
73	14,180	14,037	1017,05	230,95	VAMTOP	76		76	8,54
74	13,000	12,857	1029,91	218,09	VAMTOP	77	RIDG	77	8,65
75	14,600	14,457	1044,37	203,63	VAMTOP	78		77	8,77
76	14,380	14,237	1058,61	189,40	VAMTOP	79	RIDG	78	8,89
77	13,690	13,547	1072,15	175,85	VAMTOP	80		79	9,00
78	14,040	13,897	1086,05	161,95	VAMTOP	81		80	9,12
79	13,000	12,857	1098,91	149,09	VAMTOP	82	RDG	81	9,23
80	13,970	13,827	1112,73	135,27	VAMTOP	83		81	9,35
81	14,060	13,917	1126,65	121,35	VAMTOP	84	RIDG	82	9,46
82	11,960	11,817	1138,47	109,53	VAMTOP	85		83	9,56
83	14,040	13,897	1152,36	95,64	VAMTOP	86	RIDG	84	9,68
84	14,500	14,357	1166,72	81,28	VAMTOP	87		84	9,80
85	14,600	14,457	1181,18	66,82	VAMTOP	88	RIDG	85	9,92
86	12,410	12,267	1193,45	54,56	VAMTOP	89		86	10,02
87	14,150	14,007	1207,45	40,55	VAMTOP	90	RIDG	87	10,14
88	13,610	13,467	1220,92	27,08	VAMTOP	91		87	10,25
89	13,650	13,507	1234,43	13,57	VAMTOP	92		88	10,37
XX	14,130	13,987	1248,41	-0,41	VAMTOP	93		89	10,48
Overstand				-0,41					

HAG GT- 01 7" Liner Running Tally

Date	: 03/09/2010
DSV:	Koop / Chris
Well	: HAG GT-01

Casing	7,000	inch
Grade	K55	
Weight	23,0	lbs/ft
ID	6,366	inch
Drift ID	6,241	inch
Connection	VAGT	
Make-up Torque, minimum	7700	Nm
Make-up Torque, optimum	8500	Nm
Make-up Torque, maximum	9400	Nm
Burst pressure	301	bar
Collapse pressure	225	bar
Tensile Strength	166	ton
Capacity	20,532	liters/m
Metal Displacement	4,293	liters/m
Closed End Displ.	24,826	liters/m

Note:

If joints are damaged when handling then pick up next joint in sequence and inform the DSV.

Final tally will be issued prior to landing casing.

Rat hole	36,00	m
Mud wt	1,33	sg
	11,1	ppg
Bouyancy factor	0,830	
Block wt	NA	Klbs
	15,0	MT
HOP	10,0	m
Section TD	2503,00	m
Shoe Depth	2467,00	m
Make-up loss	0,120	m
All casing measured incl. pin		

Copies to: Corep, Toolpusher, Driller, AD, DQ, Petrolog.

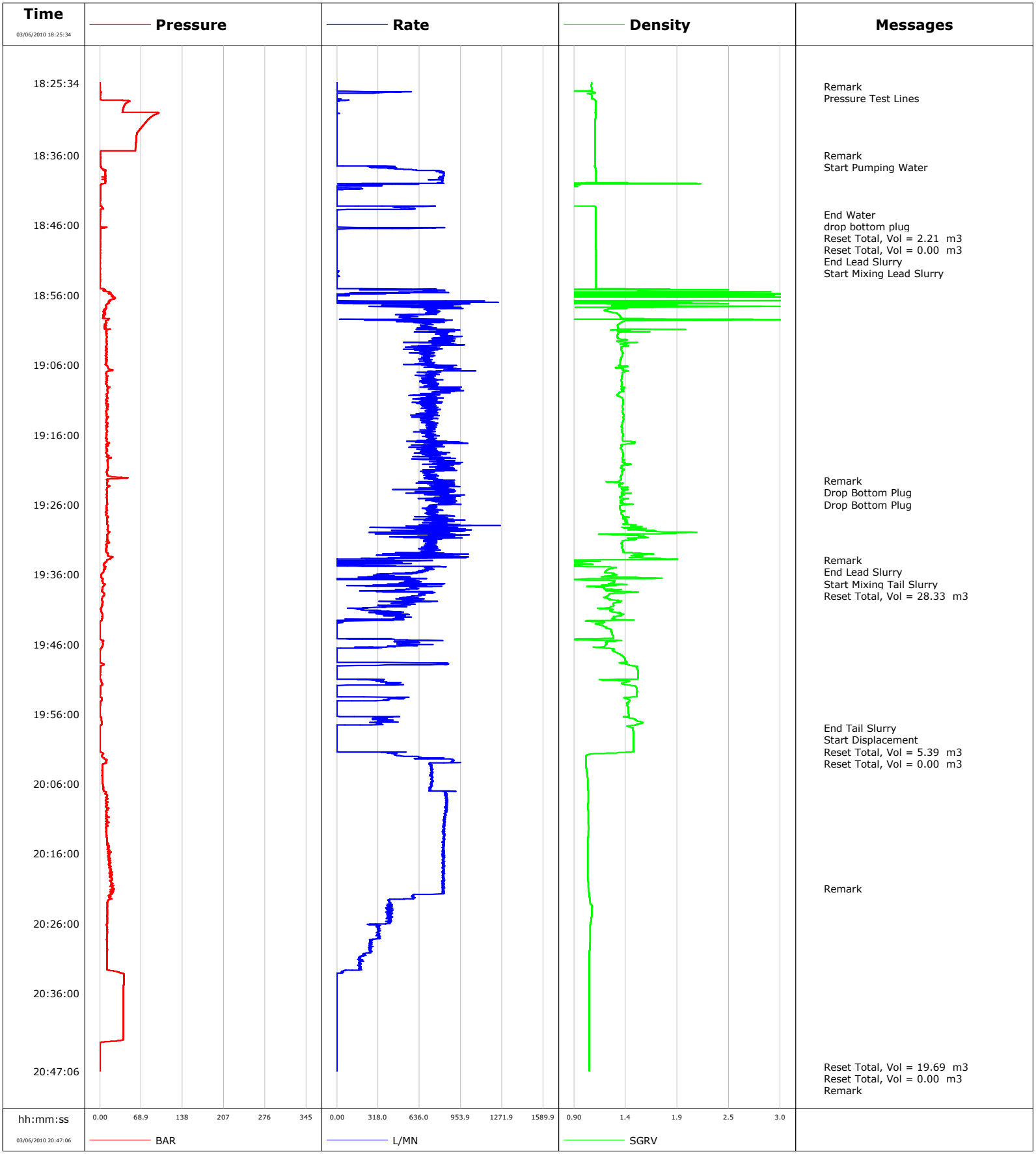
Run #	Joint no.	Length mtrs	Lenght - M/U mtrs	Cumul mtrs	Jt Bottom mtrs	Jt Top mtrs		Block wt MT	Metal Displ. m3
1	Shoe	12,100	12,100	12,10	2467,00	2454,90	26# - L80	15	0,1
2	FC	11,830	11,830	23,93	2454,90	2443,07	26# - L80	16	0,1
3	Land	11,540	11,540	35,47	2443,07	2431,53	26# - L80	16	0,2
4	1	11,320	11,200	46,67	2431,53	2420,33	Centek centr 26# - L80	16	0,2
5	2	11,620	11,500	58,17	2420,33	2408,83	Centek centr 26# - L80	17	0,2
6	3	11,300	11,180	69,35	2408,83	2397,65	Centek centr 26# - L80	17	0,3
7	4	10,780	10,660	80,01	2397,65	2386,99	Centek centr 26# - L80	17	0,3
8	5	11,810	11,690	91,70	2386,99	2375,30	Centek centr 26# - L80	18	0,4
9	6	11,250	11,130	102,83	2375,30	2364,17	Centek centr 26# - L80	18	0,4
10	7	11,540	11,420	114,25	2364,17	2352,75	Centek centr 26# - L80	18	0,5
11	8	12,410	12,290	126,54	2352,75	2340,46	Centek centr 23# - K55	19	0,5
12	9	12,400	12,280	138,82	2340,46	2328,18	Centek centr 23# - K55	19	0,6
13	10	12,260	12,140	150,96	2328,18	2316,04	Centek centr 23# - K55	19	0,6
14	11	12,420	12,300	163,26	2316,04	2303,74	Centek centr 23# - K55	20	0,7
15	12	12,340	12,220	175,48	2303,74	2291,52	23# -K55	20	0,8
16	13	12,190	12,070	187,55	2291,52	2279,45	Centek centr 23# - K55	20	0,8
17	14	12,380	12,260	199,81	2279,45	2267,19	23# -K55	21	0,9
18	15	12,600	12,480	212,29	2267,19	2254,71	Centek centr 23# - K55	21	0,9
19	16	12,290	12,170	224,46	2254,71	2242,54	23# -K55	21	1,0
20	17	12,390	12,270	236,73	2242,54	2230,27	Centek centr 23# - K55	22	1,0
11	18	12,410	12,290	249,02	2230,27	2217,98	23# -K55	22	1,1
22	19	12,310	12,190	261,21	2217,98	2205,79	Centek centr 23# - K55	22	1,1
23	20	12,280	12,160	273,37	2205,79	2193,63	23# -K55	23	1,2
24	21	12,350	12,230	285,60	2193,63	2181,40	Centek centr 23# - K55	23	1,2
25	22	12,260	12,140	297,74	2181,40	2169,26	23# -K55	23	1,3
26	23	12,240	12,120	309,86	2169,26	2157,14	Centek centr 23# - K55	24	1,3
27	24	12,370	12,250	322,11	2157,14	2144,89	23# -K55	24	1,4
28	25	12,360	12,240	334,35	2144,89	2132,65	Centek centr 23# - K55	25	1,4
29	26	12,300	12,180	346,53	2132,65	2120,47	23# -K55	25	1,5
30	27	10,830	10,710	357,24	2120,47	2109,76	Centek centr 23# - K55	25	1,5
31	28	12,440	12,320	369,56	2109,76	2097,44	23# -K55	26	1,6
32	29	12,360	12,240	381,80	2097,44	2085,20	Centek centr 23# - K55	26	1,6
33	30	12,320	12,200	394,00	2085,20	2073,00	23# -K55	26	1,7
34	31	12,270	12,150	406,15	2073,00	2060,85	Centek centr 23# - K55	27	1,7
35	32	12,310	12,190	418,34	2060,85	2048,66	23# -K55	27	1,8
36	33	12,450	12,330	430,67	2048,66	2036,33	23# -K55	27	1,8
37	34	12,260	12,140	442,81	2036,33	2024,19	23# -K55	28	1,9
38	35	12,410	12,290	455,10	2024,19	2011,90	23# -K55	28	2,0
39	36	12,470	12,350	467,45	2011,90	1999,55	23# -K55	28	2,0
40	37	12,360	12,240	479,69	1999,55	1987,31	23# -K55	29	2,1
41	38	12,430	12,310	492,00	1987,31	1975,00	23# -K55	29	2,1
42	39	12,460	12,340	504,34	1975,00	1962,66	23# -K55	29	2,2
43	40	12,370	12,250	516,59	1962,66	1950,41	23# -K55	30	2,2
44	41	12,400	12,280	528,87	1950,41	1938,13	23# -K55	30	2,3

Run #	Joint no.	Length mtrs	Lenght - M/U mtrs	Cumul mtrs	Jt Bottom mtrs	Jt Top mtrs		Block wt MT	Metal Displ. m3
45	42	12,440	12,320	541,19	1938,13	1925,81	23# -K55	30	2,3
46	43	12,430	12,310	553,50	1925,81	1913,50	23# -K55	31	2,4
47	44	12,420	12,300	565,80	1913,50	1901,20	23# -K55	31	2,4
48	45	12,360	12,240	578,04	1901,20	1888,96	23# -K55	31	2,5
49	46	12,400	12,280	590,32	1888,96	1876,68	23# -K55	32	2,5
50	47	12,390	12,270	602,59	1876,68	1864,41	23# -K55	32	2,6
51	48	12,390	12,270	614,86	1864,41	1852,14	23# -K55	32	2,6
52	49	12,330	12,210	627,07	1852,14	1839,93	23# -K55	33	2,7
53	50	12,430	12,310	639,38	1839,93	1827,62	23# -K55	33	2,7
54	51	12,390	12,270	651,65	1827,62	1815,35	23# -K55	34	2,8
55	52	12,500	12,380	664,03	1815,35	1802,97	23# -K55	34	2,9
56	53	12,420	12,300	676,33	1802,97	1790,67	23# -K55	34	2,9
57	54	12,360	12,240	688,57	1790,67	1778,43	23# -K55	35	3,0
58	55	12,430	12,310	700,88	1778,43	1766,12	23# -K55	35	3,0
59	56	12,360	12,240	713,12	1766,12	1753,88	23# -K55	35	3,1
60	57	12,510	12,390	725,51	1753,88	1741,49	23# -K55	36	3,1
61	58	12,460	12,340	737,85	1741,49	1729,15	23# -K55	36	3,2
62	59	12,390	12,270	750,12	1729,15	1716,88	23# -K55	36	3,2
63	60	12,420	12,300	762,42	1716,88	1704,58	23# -K55	37	3,3
64	61	12,380	12,260	774,68	1704,58	1692,32	23# -K55	37	3,3
65	62	12,410	12,290	786,97	1692,32	1680,03	23# -K55	37	3,4
66	63	12,410	12,290	799,26	1680,03	1667,74	23# -K55	38	3,4
67	64	12,460	12,340	811,60	1667,74	1655,40	23# -K55	38	3,5
68	65	12,380	12,260	823,86	1655,40	1643,14	23# -K55	38	3,5
69	66	12,440	12,320	836,18	1643,14	1630,82	23# -K55	39	3,6
70	67	12,470	12,350	848,53	1630,82	1618,47	23# -K55	39	3,6
71	68	12,380	12,260	860,79	1618,47	1606,21	23# -K55	39	3,7
72	69	12,435	12,315	873,11	1606,21	1593,90	23# -K55	40	3,7
73	70	12,380	12,260	885,37	1593,90	1581,64	23# -K55	40	3,8
74	71	12,370	12,250	897,62	1581,64	1569,39	23# -K55	41	3,9
75	72	12,430	12,310	909,93	1569,39	1557,08	23# -K55	41	3,9
76	73	12,390	12,270	922,20	1557,08	1544,81	23# -K55	41	4,0
77	74	12,350	12,230	934,43	1544,81	1532,58	23# -K55	42	4,0
78	75	12,450	12,330	946,76	1532,58	1520,25	23# -K55	42	4,1
79	76	12,220	12,100	958,86	1520,25	1508,15	23# -K55	42	4,1
80	77	12,440	12,320	971,18	1508,15	1495,83	23# -K55	43	4,2
81	78	12,420	12,300	983,48	1495,83	1483,53	23# -K55	43	4,2
82	79	12,320	12,200	995,68	1483,53	1471,33	23# -K55	43	4,3
83	80	12,410	12,290	1007,97	1471,33	1459,04	23# -K55	44	4,3
84	81	12,495	12,375	1020,34	1459,04	1446,66	23# -K55	44	4,4
85	82	12,380	12,260	1032,60	1446,66	1434,40	23# -K55	44	4,4
86	83	12,440	12,320	1044,92	1434,40	1422,08	23# -K55	45	4,5
87	84	12,430	12,310	1057,23	1422,08	1409,77	23# -K55	45	4,5
88	85	12,315	12,195	1069,43	1409,77	1397,58	23# -K55	45	4,6
89	86	12,435	12,315	1081,74	1397,58	1385,26	23# -K55	46	4,6
90	87	12,440	12,320	1094,06	1385,26	1372,94	23# -K55	46	4,7
91	88	12,350	12,230	1106,29	1372,94	1360,71	23# -K55	46	4,7
92	89	12,420	12,300	1118,59	1360,71	1348,41	23# -K55	47	4,8
93	90	12,460	12,340	1130,93	1348,41	1336,07	23# -K55	47	4,9
94	91	12,340	12,220	1143,15	1336,07	1323,85	23# -K55	47	4,9
95	92	12,280	12,160	1155,31	1323,85	1311,69	23# -K55	48	5,0
96	93	12,280	12,160	1167,47	1311,69	1299,53	23# -K55	48	5,0
97	94	12,440	12,320	1179,79	1299,53	1287,21	23# -K55	49	5,1
98	95	12,420	12,300	1192,09	1287,21	1274,91	23# -K55	49	5,1
99	96	12,320	12,200	1204,29	1274,91	1262,71	23# -K55	49	5,2
100	97	12,370	12,250	1216,54	1262,71	1250,46	23# -K55	50	5,2
101	98	12,360	12,240	1228,78	1250,46	1238,22	23# -K55	50	5,3
102	99	12,455	12,335	1241,12	1238,22	1225,89	23# -K55	50	5,3
103	100	12,460	12,340	1253,46	1225,89	1213,55	23# -K55	51	5,4
104	101	12,330	12,210	1265,67	1213,55	1201,34	23# -K55	51	5,4
105	102	12,430	12,310	1277,98	1201,34	1189,03	23# -K55	51	5,5
106	103	12,475	12,355	1290,33	1189,03	1176,67	Centek centr 23# - K55	52	5,5
107	104	12,250	12,130	1302,46	1176,67	1164,54	23# -K55	52	5,6
108	105	12,465	12,345	1314,81	1164,54	1152,20	Centek centr 23# - K55	52	5,6
109	106	12,370	12,250	1327,06	1152,20	1139,95	23# -K55	53	5,7
110	107	12,305	12,185	1339,24	1139,95	1127,76	Centek centr 23# - K55	53	5,7
111	108	3,040	2,920	1342,16	1127,76	1124,84	23# -K55	53	5,8
112	Below hanger	1,200	1,080	1343,24	1124,84	1123,76	Hang off Depth	53	5,8
	Above hanger	4,000	4,000	1347,24	1123,76	1119,76	Top PBR		

Appendix 8, Cement Reports

Schlumberger Cementing Job Report

Well	HAG-GT1	**Client**	Verkley Leidingbow BV
Field		**SIR No.**	
Engineer	Ilshat A.	**Job Type**	13 38 Casing
Country	The Netherlands	**Job Date**	03-06-2010



Cementing Service Report

Customer	Job Number

Well	Location (legal)	Schlumberger Location	Job Start
			Mar/06/2010

Field	Formation Name/Type	Deviation	Bit Size	Well MD	Well TVD

County	State/Province	BHP	BHST	BHCT	Pore Press. Gradient

Well Master	API/UWI

Rig Name	Drilled For	Service Via

Offshore Zone	Well Class	Well Type

Drilling Fluid Type	Max. Density	Plastic Viscosity

Service Line	Job Type
Cementing	

Max. Allowed Tubing Press	Max. Allowed Ann. Press	WellHead Connection

Service Instructions

Casing/Liner

Depth,	Size,	Weight,	Grade	Thread

Tubing/Drill Pipe

Depth,	Size,	Weight,	Grade	Thread

Perforations/Open Hole

Top,	Bottom,		No. of Shots	Total Interval
				Diameter

Treat Down	Displacement	Packer Type	Packer Depth

Tubing Vol.	Casing Vol.	Annular Vol.	Openhole Vol.

Casing/Tubing Secured ☐	1 Hole Volume Circulated prior to Cement ☐	Casing Tools	Squeeze Job
Lift Pressure		Shoe Type	Squeeze Type
Pipe Rotated ☐	Pipe Reciprocated ☐	Shoe Depth	Tool Type
No. Centralizers	Top Plugs / Bottom Plugs	Stage Tool Type	Tool Depth
Cement Head Type		Stage Tool Depth	Tail Pipe Size
Job Scheduled For: Mar/06/2010	Arrived on Location: Mar/06/2010	Collar Type	Tail Pipe Depth
Leave Location: Mar/06/2010		Collar Depth	Sqz. Total Vol.

Date	Time 24-hr clock	Treating Pressure BAR	Flow Rate L/MN	Density SGRV	Volume M3	Message
03/06/2010	17:20:56					Started Acquisition
03/06/2010	18:25:34	0.6	0.00	1.08	0.0	
03/06/2010	18:25:56	0.6	0.00	1.08	0.0	
03/06/2010	18:26:05					Remark
03/06/2010	18:26:05	0.6	0.00	1.08	0.0	
03/06/2010	18:26:26	0.6	0.00	1.08	0.0	
03/06/2010	18:26:56	2.1	495.54	1.10	0.0	
03/06/2010	18:27:18					Pressure Test Lines
03/06/2010	18:27:18	0.9	0.00	1.08	0.1	
03/06/2010	18:27:26	0.6	0.00	1.08	0.1	
03/06/2010	18:27:56	0.6	31.77	1.10	0.1	
03/06/2010	18:28:26	45.7	0.00	1.12	0.1	
03/06/2010	18:28:56	41.0	0.00	1.12	0.1	
03/06/2010	18:29:26	38.8	0.00	1.12	0.1	
03/06/2010	18:29:56	98.1	0.00	1.12	0.1	
03/06/2010	18:30:26	86.4	0.00	1.12	0.1	
03/06/2010	18:30:56	80.1	0.00	1.12	0.1	
03/06/2010	18:31:26	75.1	0.00	1.12	0.1	
03/06/2010	18:31:56	70.3	0.00	1.12	0.1	
03/06/2010	18:32:26	65.6	0.00	1.12	0.1	
03/06/2010	18:32:56	61.8	0.00	1.12	0.1	
03/06/2010	18:33:26	61.2	0.00	1.12	0.1	

Well	Field	Job Start	Customer	Job Number
		Mar/06/2010		

Date	Time 24-hr clock	Treating Pressure BAR	Flow Rate L/MN	Density SGRV	Volume M3	Message
03/06/2010	18:33:56	60.9	0.00	1.12	0.1	
03/06/2010	18:34:26	60.5	0.00	1.12	0.1	
03/06/2010	18:34:56	59.9	0.00	1.12	0.1	
03/06/2010	18:35:26	1.2	0.00	1.12	0.1	
03/06/2010	18:35:56	0.6	0.00	1.12	0.1	
03/06/2010	18:35:57					Remark
03/06/2010	18:35:57	0.6	0.00	1.12	0.1	
03/06/2010	18:36:19					Start Pumping Water
03/06/2010	18:36:19	1.8	0.00	1.12	0.1	
03/06/2010	18:36:26	1.2	0.00	1.12	0.1	
03/06/2010	18:36:56	0.9	0.00	1.12	0.1	
03/06/2010	18:37:26	0.9	0.00	1.12	0.1	
03/06/2010	18:37:56	4.7	470.13	1.12	0.2	
03/06/2010	18:38:26	9.7	816.38	1.13	0.6	
03/06/2010	18:38:56	9.7	816.38	1.13	1.0	
03/06/2010	18:39:26	3.7	781.44	1.13	1.4	
03/06/2010	18:39:56	9.4	775.08	1.02	1.8	
03/06/2010	18:40:26	1.2	0.00	0.92	1.9	
03/06/2010	18:40:56	0.9	0.00	0.18	1.9	
03/06/2010	18:41:26	0.6	0.00	0.17	1.9	
03/06/2010	18:41:56	0.9	0.00	0.17	1.9	
03/06/2010	18:42:26	0.9	0.00	0.18	1.9	
03/06/2010	18:42:56	0.6	0.00	0.18	1.9	
03/06/2010	18:43:26	3.7	447.90	1.12	2.0	
03/06/2010	18:43:56	0.9	0.00	1.12	2.2	
03/06/2010	18:44:26					End Water
03/06/2010	18:44:26	0.6	0.00	1.12	2.2	
03/06/2010	18:44:33					drop bottom plug
03/06/2010	18:44:33	0.6	0.00	1.12	2.2	
03/06/2010	18:44:40					Reset Total, Vol = 2.21 m3
03/06/2010	18:44:40	0.6	0.00	1.12	2.2	
03/06/2010	18:44:56	0.6	0.00	1.12	2.2	
03/06/2010	18:44:57					Reset Total, Vol = 0.00 m3
03/06/2010	18:44:57	0.9	0.00	1.12	2.2	
03/06/2010	18:45:26	0.6	0.00	1.12	0.0	
03/06/2010	18:45:56	0.6	0.00	1.12	0.0	
03/06/2010	18:46:26	4.4	695.67	1.12	0.1	
03/06/2010	18:46:56	0.9	0.00	1.12	0.1	
03/06/2010	18:47:26	0.6	0.00	1.12	0.1	
03/06/2010	18:47:45					End Lead Slurry
03/06/2010	18:47:45	0.9	0.00	1.12	0.1	
03/06/2010	18:47:50					Start Mixing Lead Slurry
03/06/2010	18:47:50	0.9	0.00	1.12	0.1	
03/06/2010	18:47:56	0.9	0.00	1.12	0.1	
03/06/2010	18:48:26	0.6	0.00	1.12	0.1	
03/06/2010	18:48:56	0.9	0.00	1.12	0.1	
03/06/2010	18:49:26	0.6	0.00	1.12	0.1	
03/06/2010	18:49:56	0.9	0.00	1.13	0.1	
03/06/2010	18:50:26	0.6	0.00	1.13	0.1	
03/06/2010	18:50:56	0.6	0.00	1.13	0.1	
03/06/2010	18:51:26	0.6	0.00	1.13	0.1	
03/06/2010	18:51:56	0.6	0.00	1.13	0.1	
03/06/2010	18:52:26	0.6	0.00	1.13	0.1	
03/06/2010	18:52:56	0.9	0.00	1.13	0.1	
03/06/2010	18:53:26	0.6	0.00	1.13	0.1	

Well	Field	Job Start	Customer	Job Number
		Mar/06/2010		

Date	Time 24-hr clock	Treating Pressure BAR	Flow Rate L/MN	Density SGRV	Volume M3	Message
03/06/2010	18:53:56	0.6	0.00	1.13	0.1	
03/06/2010	18:54:26	0.6	0.00	1.13	0.1	
03/06/2010	18:54:56	0.6	0.00	1.13	0.1	
03/06/2010	18:55:26	10.4	698.84	1.56	0.3	
03/06/2010	18:55:56	19.2	0.00	3.00	0.5	
03/06/2010	18:56:26	25.5	0.00	-0.38	0.6	
03/06/2010	18:56:56	15.4	327.19	1.53	0.6	
03/06/2010	18:57:26	10.7	832.26	1.63	0.9	
03/06/2010	18:57:56	10.4	790.97	1.44	1.2	
03/06/2010	18:58:26	6.6	762.38	1.29	1.6	
03/06/2010	18:58:56	5.9	489.19	1.37	1.9	
03/06/2010	18:59:26	14.1	794.14	1.73	2.2	
03/06/2010	18:59:56	9.7	794.14	1.38	2.5	
03/06/2010	19:00:26	9.7	692.49	1.35	2.9	
03/06/2010	19:00:56	12.2	622.61	1.37	3.2	
03/06/2010	19:01:26	11.3	806.85	1.35	3.6	
03/06/2010	19:01:56	11.6	886.26	1.34	4.0	
03/06/2010	19:02:26	11.2	873.56	1.44	4.4	
03/06/2010	19:02:56	11.6	898.97	1.41	4.8	
03/06/2010	19:03:26	10.3	679.79	1.38	5.2	
03/06/2010	19:03:56	9.5	673.43	1.38	5.6	
03/06/2010	19:04:26	11.1	708.37	1.40	5.9	
03/06/2010	19:04:56	12.2	695.67	1.38	6.3	
03/06/2010	19:05:26	10.2	686.14	1.37	6.6	
03/06/2010	19:05:56	9.0	511.43	1.37	7.0	
03/06/2010	19:06:26	14.2	870.38	1.34	7.4	
03/06/2010	19:06:56	12.9	717.90	1.43	7.8	
03/06/2010	19:07:26	10.9	698.84	1.39	8.1	
03/06/2010	19:07:56	12.4	724.26	1.39	8.5	
03/06/2010	19:08:26	10.5	746.49	1.38	8.9	
03/06/2010	19:08:56	11.7	727.43	1.39	9.2	
03/06/2010	19:09:26	13.0	949.79	1.38	9.6	
03/06/2010	19:09:56	13.5	813.20	1.36	10.0	
03/06/2010	19:10:26	12.3	702.02	1.35	10.4	
03/06/2010	19:10:56	10.9	768.73	1.40	10.8	
03/06/2010	19:11:26	10.8	628.96	1.40	11.1	
03/06/2010	19:11:56	14.0	721.08	1.40	11.5	
03/06/2010	19:12:26	12.4	778.26	1.40	11.8	
03/06/2010	19:12:56	11.4	695.67	1.40	12.2	
03/06/2010	19:13:26	14.6	682.96	1.40	12.5	
03/06/2010	19:13:56	10.8	663.90	1.40	12.9	
03/06/2010	19:14:26	12.5	705.20	1.39	13.2	
03/06/2010	19:14:56	11.5	708.37	1.39	13.6	
03/06/2010	19:15:26	12.5	708.37	1.39	13.9	
03/06/2010	19:15:56	11.5	692.49	1.40	14.3	
03/06/2010	19:16:26	10.6	705.20	1.39	14.7	
03/06/2010	19:16:56	11.6	790.97	1.41	15.0	
03/06/2010	19:17:26	11.1	663.90	1.39	15.4	
03/06/2010	19:17:56	11.1	740.14	1.38	15.8	
03/06/2010	19:18:26	11.7	651.20	1.40	16.1	
03/06/2010	19:18:56	13.8	756.02	1.40	16.5	
03/06/2010	19:19:26	14.8	765.55	1.39	16.9	
03/06/2010	19:19:56	13.3	841.79	1.39	17.3	
03/06/2010	19:20:26	13.5	860.85	1.39	17.7	
03/06/2010	19:20:56	13.0	775.08	1.41	18.1	

Well	Field	Job Start	Customer	Job Number
		Mar/06/2010		

Date	Time 24-hr clock	Treating Pressure BAR	Flow Rate L/MN	Density SGRV	Volume M3	Message
03/06/2010	19:21:26	11.6	663.90	1.39	18.5	
03/06/2010	19:21:56	15.5	730.61	1.38	18.8	
03/06/2010	19:22:26	11.4	816.38	1.38	19.2	
03/06/2010	19:22:37					Remark
03/06/2010	19:22:37	13.4	854.50	1.36	19.4	
03/06/2010	19:22:43					Drop Bottom Plug
03/06/2010	19:22:43	12.9	632.14	1.29	19.4	
03/06/2010	19:22:44					Drop Bottom Plug
03/06/2010	19:22:44	12.8	759.20	1.24	19.5	
03/06/2010	19:22:56	12.0	708.37	1.40	19.6	
03/06/2010	19:23:26	14.9	864.03	1.36	20.0	
03/06/2010	19:23:56	11.4	848.14	1.43	20.4	
03/06/2010	19:24:26	12.0	730.61	1.44	20.8	
03/06/2010	19:24:56	11.4	873.56	1.36	21.2	
03/06/2010	19:25:26	11.6	803.67	1.37	21.6	
03/06/2010	19:25:56	12.5	956.15	1.50	22.0	
03/06/2010	19:26:26	11.6	759.20	1.37	22.4	
03/06/2010	19:26:56	11.2	740.14	1.41	22.8	
03/06/2010	19:27:26	10.6	762.38	1.39	23.1	
03/06/2010	19:27:56	12.0	854.50	1.40	23.5	
03/06/2010	19:28:26	12.4	902.14	1.44	23.9	
03/06/2010	19:28:56	13.4	695.67	1.53	24.3	
03/06/2010	19:29:26	13.4	736.96	1.64	24.7	
03/06/2010	19:29:56	16.6	679.79	2.00	25.1	
03/06/2010	19:30:26	12.5	873.56	1.55	25.5	
03/06/2010	19:30:56	12.6	797.32	1.51	25.8	
03/06/2010	19:31:26	16.0	721.08	1.39	26.2	
03/06/2010	19:31:56	11.9	676.61	1.39	26.5	
03/06/2010	19:32:26	10.0	752.85	1.40	26.9	
03/06/2010	19:32:56	13.0	740.14	1.51	27.3	
03/06/2010	19:33:26	18.0	838.61	1.57	27.6	
03/06/2010	19:33:55					Remark
03/06/2010	19:33:55	12.4	0.00	0.99	27.8	
03/06/2010	19:33:56	12.3	0.00	0.73	27.8	
03/06/2010	19:34:26	8.1	295.42	0.77	27.9	
03/06/2010	19:34:56	9.9	838.61	1.20	28.0	
03/06/2010	19:35:12					End Lead Slurry
03/06/2010	19:35:12	9.2	695.67	1.26	28.2	
03/06/2010	19:35:13					Start Mixing Tail Slurry
03/06/2010	19:35:13	8.9	711.55	1.26	28.2	
03/06/2010	19:35:21					Reset Total, Vol = 28.33 m3
03/06/2010	19:35:21	6.0	679.79	1.24	28.3	
03/06/2010	19:35:26	6.9	657.55	1.23	28.4	
03/06/2010	19:35:56	3.1	343.07	1.31	28.7	
03/06/2010	19:36:26	2.4	270.01	1.53	28.9	
03/06/2010	19:36:56	4.0	559.08	1.32	29.0	
03/06/2010	19:37:26	8.5	463.78	1.42	29.3	
03/06/2010	19:37:56	4.7	571.78	1.21	29.6	
03/06/2010	19:38:26	3.5	635.31	1.35	29.9	
03/06/2010	19:38:56	7.7	679.79	1.26	30.2	
03/06/2010	19:39:26	4.0	562.25	1.24	30.5	
03/06/2010	19:39:56	5.3	727.43	1.38	30.8	
03/06/2010	19:40:26	4.5	397.07	1.31	31.0	
03/06/2010	19:40:56	1.6	162.00	1.24	31.2	
03/06/2010	19:41:26	3.1	352.60	1.32	31.3	

Well	Field	Job Start	Customer	Job Number
		Mar/06/2010		

Date	Time 24-hr clock	Treating Pressure BAR	Flow Rate L/MN	Density SGRV	Volume M3	Message
03/06/2010	19:41:56	4.3	479.66	1.37	31.6	
03/06/2010	19:42:26	3.9	358.95	1.30	31.8	
03/06/2010	19:42:56	0.5	9.53	1.20	31.8	
03/06/2010	19:43:26	0.6	0.00	1.20	31.8	
03/06/2010	19:43:56	0.6	0.00	1.28	31.8	
03/06/2010	19:44:26	0.6	0.00	1.29	31.8	
03/06/2010	19:44:56	0.6	0.00	1.30	31.8	
03/06/2010	19:45:26	4.4	543.19	1.27	31.9	
03/06/2010	19:45:56	5.2	486.01	1.24	32.2	
03/06/2010	19:46:26	3.7	250.95	1.10	32.4	
03/06/2010	19:46:56	0.7	0.00	1.30	32.5	
03/06/2010	19:47:26	0.6	0.00	1.37	32.5	
03/06/2010	19:47:56	0.6	0.00	1.41	32.5	
03/06/2010	19:48:26	0.6	0.00	1.42	32.5	
03/06/2010	19:48:56	7.2	717.90	1.45	32.7	
03/06/2010	19:49:26	0.9	0.00	1.54	32.8	
03/06/2010	19:49:56	0.9	0.00	1.55	32.8	
03/06/2010	19:50:26	0.8	0.00	1.55	32.8	
03/06/2010	19:50:56	0.6	0.00	1.55	32.8	
03/06/2010	19:51:26	3.1	384.36	1.43	32.9	
03/06/2010	19:51:56	2.0	0.00	1.51	33.1	
03/06/2010	19:52:26	0.9	0.00	1.54	33.1	
03/06/2010	19:52:56	0.8	0.00	1.54	33.1	
03/06/2010	19:53:26	0.8	0.00	1.54	33.1	
03/06/2010	19:53:56	3.8	403.42	1.46	33.3	
03/06/2010	19:54:26	0.9	0.00	1.44	33.3	
03/06/2010	19:54:56	0.7	0.00	1.45	33.3	
03/06/2010	19:55:26	0.6	0.00	1.45	33.3	
03/06/2010	19:55:56	0.6	0.00	1.46	33.3	
03/06/2010	19:56:26	1.8	346.25	1.41	33.3	
03/06/2010	19:56:56	2.8	384.36	1.54	33.5	
03/06/2010	19:57:26	3.5	327.19	1.55	33.7	
03/06/2010	19:57:56	0.7	0.00	1.49	33.7	
03/06/2010	19:57:59					End Tail Slurry
03/06/2010	19:57:59	0.7	0.00	1.50	33.7	
03/06/2010	19:58:11					Start Displacement
03/06/2010	19:58:11	0.6	0.00	1.50	33.7	
03/06/2010	19:58:19					Reset Total, Vol = 5.39 m3
03/06/2010	19:58:19	0.6	0.00	1.50	33.7	
03/06/2010	19:58:26	0.6	0.00	1.50	33.7	
03/06/2010	19:58:27					Reset Total, Vol = 0.00 m3
03/06/2010	19:58:27	0.6	0.00	1.50	33.7	
03/06/2010	19:58:56	0.6	0.00	1.50	0.0	
03/06/2010	19:59:26	0.6	0.00	1.51	0.0	
03/06/2010	19:59:56	0.6	0.00	1.51	0.0	
03/06/2010	20:00:26	0.6	0.00	1.51	0.0	
03/06/2010	20:00:56	0.6	0.00	1.51	0.0	
03/06/2010	20:01:26	0.9	371.66	1.46	0.0	
03/06/2010	20:01:56	3.6	476.48	1.03	0.2	
03/06/2010	20:02:26	7.5	803.67	1.02	0.5	
03/06/2010	20:02:56	10.2	889.44	1.02	1.0	
03/06/2010	20:03:26	4.5	724.26	1.02	1.3	
03/06/2010	20:03:56	4.4	730.61	1.03	1.7	
03/06/2010	20:04:26	4.5	736.96	1.04	2.1	
03/06/2010	20:04:56	4.5	733.79	1.04	2.4	

Well	Field	Job Start	Customer	Job Number
		Mar/06/2010		

Date	Time 24-hr clock	Treating Pressure BAR	Flow Rate L/MN	Density SGRV	Volume M3	Message
03/06/2010	20:05:26	4.4	733.79	1.04	2.8	
03/06/2010	20:05:56	4.5	724.26	1.04	3.2	
03/06/2010	20:06:26	5.8	724.26	1.04	3.5	
03/06/2010	20:06:56	6.1	721.08	1.05	3.9	
03/06/2010	20:07:26	8.7	844.97	1.05	4.3	
03/06/2010	20:07:56	10.1	841.79	1.05	4.7	
03/06/2010	20:08:26	9.6	851.32	1.05	5.1	
03/06/2010	20:08:56	11.5	848.14	1.04	5.6	
03/06/2010	20:09:26	13.8	844.97	1.04	6.0	
03/06/2010	20:09:56	10.5	841.79	1.05	6.4	
03/06/2010	20:10:26	10.4	829.08	1.05	6.8	
03/06/2010	20:10:56	10.0	825.91	1.05	7.2	
03/06/2010	20:11:26	11.6	825.91	1.05	7.7	
03/06/2010	20:11:56	12.6	829.08	1.05	8.1	
03/06/2010	20:12:26	10.7	822.73	1.05	8.5	
03/06/2010	20:12:56	10.9	819.55	1.05	8.9	
03/06/2010	20:13:26	11.5	832.26	1.05	9.3	
03/06/2010	20:13:56	11.8	819.55	1.04	9.7	
03/06/2010	20:14:26	12.4	816.38	1.04	10.1	
03/06/2010	20:14:56	15.4	822.73	1.04	10.5	
03/06/2010	20:15:26	14.7	816.38	1.04	10.9	
03/06/2010	20:15:56	13.7	816.38	1.04	11.4	
03/06/2010	20:16:26	15.3	822.73	1.04	11.8	
03/06/2010	20:16:56	14.7	819.55	1.04	12.2	
03/06/2010	20:17:26	15.4	822.73	1.04	12.6	
03/06/2010	20:17:56	17.1	819.55	1.04	13.0	
03/06/2010	20:18:26	18.1	816.38	1.04	13.4	
03/06/2010	20:18:56	18.7	819.55	1.04	13.8	
03/06/2010	20:19:26	18.4	813.20	1.04	14.2	
03/06/2010	20:19:56	18.9	819.55	1.04	14.6	
03/06/2010	20:20:26	19.8	816.38	1.05	15.0	
03/06/2010	20:20:56	21.4	816.38	1.05	15.5	
03/06/2010	20:20:57					Remark
03/06/2010	20:20:57	21.7	816.38	1.05	15.5	
03/06/2010	20:21:26	17.7	822.73	1.05	15.9	
03/06/2010	20:21:56	15.7	587.66	1.06	16.2	
03/06/2010	20:22:26	19.8	590.84	1.06	16.5	
03/06/2010	20:22:56	12.9	403.42	1.07	16.8	
03/06/2010	20:23:26	12.6	400.25	1.08	17.0	
03/06/2010	20:23:56	12.5	416.13	1.08	17.2	
03/06/2010	20:24:26	12.6	406.60	1.08	17.4	
03/06/2010	20:24:56	12.2	400.25	1.08	17.6	
03/06/2010	20:25:26	12.6	412.95	1.08	17.8	
03/06/2010	20:25:56	12.6	406.60	1.07	18.0	
03/06/2010	20:26:26	12.2	304.95	1.07	18.1	
03/06/2010	20:26:56	12.3	320.83	1.07	18.3	
03/06/2010	20:27:26	12.3	330.36	1.07	18.4	
03/06/2010	20:27:56	12.2	320.83	1.07	18.6	
03/06/2010	20:28:26	11.9	273.18	1.07	18.8	
03/06/2010	20:28:56	12.3	266.83	1.06	18.9	
03/06/2010	20:29:26	12.1	254.13	1.06	19.0	
03/06/2010	20:29:56	12.3	254.13	1.06	19.1	
03/06/2010	20:30:26	12.2	206.48	1.06	19.3	
03/06/2010	20:30:56	11.9	168.36	1.06	19.4	
03/06/2010	20:31:26	11.6	177.89	1.06	19.4	

Well	Field	Job Start	Customer	Job Number
		Mar/06/2010		

Date	Time 24-hr clock	Treating Pressure BAR	Flow Rate L/MN	Density SGRV	Volume M3	Message
03/06/2010	20:31:56	11.7	171.53	1.06	19.5	
03/06/2010	20:32:26	11.7	181.06	1.06	19.6	
03/06/2010	20:32:56	30.1	44.47	1.06	19.7	
03/06/2010	20:33:26	40.4	0.00	1.06	19.7	
03/06/2010	20:33:56	40.3	0.00	1.06	19.7	
03/06/2010	20:34:26	40.3	0.00	1.06	19.7	
03/06/2010	20:34:56	40.0	0.00	1.06	19.7	
03/06/2010	20:35:26	40.0	0.00	1.06	19.7	
03/06/2010	20:35:56	40.0	0.00	1.06	19.7	
03/06/2010	20:36:26	40.0	0.00	1.06	19.7	
03/06/2010	20:36:56	40.0	0.00	1.06	19.7	
03/06/2010	20:37:26	40.0	0.00	1.06	19.7	
03/06/2010	20:37:56	40.0	0.00	1.06	19.7	
03/06/2010	20:38:26	40.0	0.00	1.06	19.7	
03/06/2010	20:38:56	40.0	0.00	1.06	19.7	
03/06/2010	20:39:26	40.0	0.00	1.06	19.7	
03/06/2010	20:39:56	40.0	0.00	1.06	19.7	
03/06/2010	20:40:26	40.0	0.00	1.06	19.7	
03/06/2010	20:40:56	40.0	0.00	1.06	19.7	
03/06/2010	20:41:26	39.7	0.00	1.06	19.7	
03/06/2010	20:41:56	39.7	0.00	1.06	19.7	
03/06/2010	20:42:26	39.7	0.00	1.06	19.7	
03/06/2010	20:42:56	8.8	0.00	1.06	19.7	
03/06/2010	20:43:26	0.5	0.00	1.06	19.7	
03/06/2010	20:43:56	0.6	0.00	1.06	19.7	
03/06/2010	20:44:26	0.8	0.00	1.06	19.7	
03/06/2010	20:44:56	0.6	0.00	1.06	19.7	
03/06/2010	20:45:26	0.6	0.00	1.06	19.7	
03/06/2010	20:45:56	0.6	0.00	1.06	19.7	
03/06/2010	20:46:26	0.6	0.00	1.06	19.7	
03/06/2010	20:46:32					Reset Total, Vol = 19.69 m3
03/06/2010	20:46:32					Reset Total, Vol = 0.00 m3
03/06/2010	20:46:32	0.6	0.00	1.06	19.7	
03/06/2010	20:46:33					Remark
03/06/2010	20:46:33	0.6	0.00	1.06	0.0	
03/06/2010	20:46:39					End Displacement
03/06/2010	20:46:39	0.6	0.00	1.06	0.0	
03/06/2010	20:46:41					Start Job
03/06/2010	20:46:41					End Job
03/06/2010	20:46:41	0.6	0.00	1.06	0.0	
03/06/2010	20:46:56	0.6	0.00	1.06	0.0	
03/06/2010	20:47:07					Stopped Acquisition

Post Job Summary

Average Pump Rates,				Volume of Fluid Injected,			
Slurry	N2	Mud	Maximum Rate	Total Slurry	Mud	Spacer	N2

Treating Pressure Summary,					Breakdown Fluid		
Maximum	Final	Average	Bump Plug to	Breakdown	Type	Volume	Density

Avg. N2 Percent	Designed Slurry Volume	Displacement	Mix Water Temp	Cement Circulated to Surface? ☐	Volume
				Washed Thru Perfs ☐	To

Customer or Authorized Representative	Schlumberger Supervisor	Circulation Lost ☐	Job Completed ☐
		-	-

FINAL V1 Cementing Program 10 3/4" Casing
HAG-GT-01, WPMI

TO	:	**Koop Eleveld, WPMI DSV**
CC	:	**Slb Cementer, Slb Coordinator**
From	:	**J. Woodrow**
Date	:	**Wednesday, 21 July 2010**

Objectives :

The main objectives of the 10 3/4" casing cement job are:

- To case off open hole formations and get Top of Cement to surface
- To provide good shoe strength to drill next section.

Well considerations :

Based on a mud weight of 1.2 SG and following the proposed pumping schedule, the maximum estimated ECD is 1.6 SG at the 10 3/4" shoe.
10 3/4in casing shoe run to 1250 m MD –

- 10 ¾ in 55.5 lbf/ft from 1250 m to 1050 m
- then 10 ¾ in 45.5 lbf/ft from 1050 to surface.
- Assume 10 ¾ casing collar set at 1225.0 m MD. Using conventional top and bottom cement plugs.

Centralization:

- **1 bow spring centraliser / per 1 joint from 1250m to 1130m**
- **1 bow spring centraliser / per 2 joints from 1130m to 250m**
- **1 positive centraliser/ per 2 joints from 250m to surface**

Slurry considerations:

Based on 25% open hole excess over the 14in OH, it is planned to pump 51.4 m^3 of 1.58 SG PozzoCemoil lead slurry (cement column +/- 1150 m), followed by minimal 6.3 m^3 of 1.65 SG PozzoCemoil tail slurry (annular column +/- 100 m)

Note: open hole excess to be re-evaluated (if 25% excess is pumped, be ready to recieve 10m3 of cement slurry back to surface if hole in gauge)

Spacer considerations :

- 1.5 m^3 Fresh water (1.0 SG) spacer ahead to flush the lines and perform pressure test 100 bar
- 5.0 m^3 Fresh water (1.0 SG) spacer ahead of the lead slurry
- 0.5 m^3 Fresh water spacer to be pumped behind to clean surface lines and place a barrier between the slurry and mud system

Displacement:

The total displacement volume is approximately 61.1 m^3, (check on-site with actual pipe-tally).
Once the top plug is bumped, pressure test the casing sting and hold the pressure. Bleed off and check returns.

Operational Considerations:

One Onshore Twin-Pump unit, 10 3/4in Cement Head (with Quick Latch if available), 2 CEBO bulk trucks with min 55 MT PozzoCemoil. Antifoam for the slurry mix water and D177 retarder (incl. CemNET - loss circulation material). Cement bulkers are to be fully emptied on location to reduce return cement charges.

FINAL V1 Cementing Program 10 3/4" Casing
HAG-GT-01, WPMI

Pumping and Operational Program :

1. RIH casing and circulate 120 % of casing content to clean the hole once casing is on depth.
2. Hold pre job safety meeting and assign roles, ensure all personnel are familiar with job objectives and safety procedures
3. Make sure casing is full of fluid. Make sure space out is sufficient to leave reasonable working height to connect cement line.
4. Perform circulation test to ensure proper stab-in and circulate 120 % annular content.
5. Rig up cement head

	Pump Rate	Approx Time
6. Pump **1.5 m^3** Fresh water spacer to fill lines	750-850 LPM	(2 min)
7. Pressure test procedure		
• Apply a **low** pressure test to the line of 20 bar (300 psi) to 35 bar (500 psi) Inspect for any leaks.		
• If there are no leaks, slowly increase the pressure to the final test pressure		
• Perform **high** pressure test to 100 bar		(15 min)
8. Pump **5.0 m^3** Fresh water spacer	750-850 LPM	(10 min)
9. Release bottom plug		(10 min)
10. Pump **51.4 m^3 1.58 SG** PozzoCemoil Lead slurry	750-850 LPM	(70 min)
11. Pump **6.3 m^3** of **1.65 SG** PozzoCemoil Tail Slurry	700-800 LPM	(10 min)
12. Release top plug		(10 min)
13. Start displacement: (total displacement including spacer = **61.1 m^3**).		
• Pump **0.5 m^3** Fresh water spacer	700-800 LPM	(1 min)
• Pump **27.3 m^3** of WBM (first cement across chalk)	700-800 LPM	(25 min)
• Pump **31.0 m^3** of WBM (reduce rate to avoid losses)	600-700 LPM	(50 min)
• Pump **2.3 m^3** of WBM (reduce rate to bump the plug)	300-400 LPM	(10 min)
(Estimated pressure at end of displacement = 45 bar)		**Minimum Job Time =210 min** (3h 30 min)

14. Pressure test the casing to 100 bar for 15 mins upon bumping the plug
15. Bleed off and check for back-flow.
16. Continue as per DDP.

Quality Control - Verified by WSDE

Check that chemical lot numbers being used are the same as quoted on Lab report

Size of Samples:
a. Base water: 5.0 ltr (Mud Engineer)
b. Mix fluid: 5.0 ltr (SLB)
c. Additives: 0.5 ltr (SLB)
d. Cement bulk: 10.0 kg (SLB)
e. Mud Engineer to check **cement water**.

Labelling of samples

Put the following information on each sample: **date**, **type**, **client**, **rig**, **well**, **job, batch #s, silo, name**

Note: Keep all samples on rig until next section, or until advised by SWE.

Prepared by:	Comments;	**Signature**	**Date:**
Jonathan Woodrow Schlumberger – WS Field Engineer	FINAL V1 – ECD outlining potential losses, updated final lab recipes		21 July 2010
Reviewed by:	**Comments;**	**Signature**	**Date:**
Atila Olansz Schlumberger – WS Cell Leader Coevorden	FINAL V1 – review		21 July 2010
Submitted to:	**Submitted to:**	**Signature**	**Date:**
Koop Eleveld WPMI – Drilling Supervisor			

Pre-Job

1. Inventory checks - ensure sufficient chemical inventory for 2 jobs (100% excess as contingency)
2. All equipment STEM I Performed
3. Review FINAL Cementing Programme/Recipe sent from Schlumberger Staff Engineer
4. Hold pre-job meeting with company representative and agree on final procedures, any major deviations to be discussed with town - following Management of Change guidelines
5. Ensure a risk assessment (HARC) has been performed on site for the job including third party equipment, and is reviewed with all personnel involved in the operation and onshore staff during KSQR review. Please review attached HARC sheet for the job and amend if necessary.
6. All volumes to be recalculated on the rig prior to the job and agreed by both Schlumberger cementer and WMPI drilling representative
7. Samples of mix fluid (2.0 gals), cement (10.0 kgs) and slurry must be taken using the correct sampling equipment as per KSQR.
8. Ensure that a calibrated pressurised mud balance is available and is reading correctly

Contingencies:

1. If floats fails to hold. This will be evident if the return to the cement displacement tank is more than 0.3 m^3 than what was expected. It is normal to have some return as this is the line volume returning via gravity from rig floor to cement unit and the volume used to pressure up the casing.
    - Pump the volume of fluid that returned
    - WOC in this case 4 hrs, bleed off pressure and isolate again if pressure increases then cement is still not set and need to WOC further 1.5 hrs, repeat process until cement is set
2. Fail to bump top plug. Before the cement job, cementer has to agree with client representative displacement volume to be used. If volume has been reached and no pressure increases,
    - Pump half the shoe track volume, if still no pressure indication, bleed off pressure and check for return. Do not pump anymore to avoid possible wet shoe.
    - Check floats, if holding, WOC

Cementing fluids:

CEMENT PROPERTIES			CEMENT FORMULATION	
Lead Slurry				
Slurry Density	1.58	SG	Pozzocemoil	
Slurry Yield	1096.29	Litres/tonne	Fresh Water	729.47 litres/tonne
			B143 Antifoam	0.5 litres/tonne
			D177 Retarder	7.0 litres/tonne
			Mix Fluid	733.97 litres/tonne

CEMENT PROPERTIES			CEMENT FORMULATION	
Tail Slurry				
Slurry Density	1.65	SG	Pozzocemoil	
Slurry Yield	978.59	Litres/tonne	Fresh Water	912.82 litres/tonne
			B143 Antifoam	0.5 litres/tonne
			D177 Retarder	2.95 litres/tonne
			Mix Fluid	616.27 litres/tonne

FINAL V1 Cementing Program 10 3/4" Casing
HAG-GT-01, Cemet Slurry Recipes

LOC 400 HAG GT 1 10 3-4 Csg Lead

						Signatures
Test no.	**10-lead**	Client	Verkley	Rig	LOC 400	
Date	05-07-2010	Well Name	HAG GT 1	Field	Hague	

Job Type	Casing	Depth	1250 m	TVD	1200 m
BHST	56 degC	Test Temp	38 degC	BHP	18 MPa
Starting Temp.	25 degC	Time to Temp.	25 min	Heating Rate	0.5 ℃/min
Starting Press.	7 MPa	Time to Press.	25 min	Schedule	USER

Composition

Code	Component	Concentration	Lot
Pozzo Cemoil	Cement		
Fresh water	Base Fluid	729.47 L/tonne	

B143	ANTIFOAM	0.5000 L/tonne
D177	Retarder	4.0000 L/tonne

Density	**1.580 kg/l**
Yield	**1096.29 L/tonne**
Mix Fluid	**733.97 L/tonne**
Porosity	67.0 %

Tests Results

Rheology

(rpm)	(deg)	(deg)
300		
200		
100		
60		
30		
6		
3		
Ty (lbf/100ft2)		
Pv (cP)		
Temperature	27 degC	38 degC

Thickening Time

Consistency	Time
POD	08:15 hr:mn
40 Bc	09:06 hr:mn
100 Bc	12:05 hr:mn
Batch Mix Time : (min)	at (degC)

Comments

FINAL V1 Cementing Program 10 3/4" Casing
HAG-GT-01, Cemet Slurry Recipes

LOC 400 HAG GT 1 10 3-4 Csg (T-2.95L D177)

						Signatures
Test no.	**10-267**	Client	Verkley	Rig	LOC 400	GJ
Date	05-07-2010	Well Name	HAG GT 1	Field	Hague	15-Jul-10

Job Type	Casing	Depth	1250 m	TVD	1200 m
BHST	56 degC	Test Temp	38 degC	BHP	18 MPa
Starting Temp.	25 degC	Time to Temp.	25 min	Heating Rate	0.5 ℃/min
Starting Press.	7 MPa	Time to Press.	25 min	Schedule	USER

Composition

Code	Component	Concentration	Lot
Pozzo Cemoil	Cement		
Fresh water	Base Fluid	612.82 L/tonne	

B143	ANTIFOAM	0.5000 L/tonne
D177	Retarder	2.9500 L/tonne

Density	**1.650 kg/l**
Yield	**978.59 L/tonne**
Mix Fluid	**616.27 L/tonne**
Porosity	63.0 %

Tests Results

Rheology

(rpm)	(deg)	(deg)
300		
200		
100		
60		
30		
6		
3		
Ty (lbf/100ft2)		
Pv (cP)		
Temperature	27 degC	38 degC

Thickening Time

Consistency	Time
POD	05:41 hr:mn
40 Bc	06:31 hr:mn
100 Bc	07:31 hr:mn

Comments

FINAL V1 Cementing Program 10 3/4" Casing
HAG-GT-01, Cemet Slurry Recipes

CemCADE* Cementing Recommendation for 10 3/4 in Casing

FINAL V1

Operator	**: WPMI**	**Well**	**: HAG-GT-01**
Country	: The Netherlands	Field	:
State	:		
Prepared for	**: Koop Eleveld**	**Location**	**: The Hague**
Proposal No.	: FINAL V1	Service Point	: Coevorden
Date Prepared	: 20-Jul-10	Business Phone	: +31 70 310 5449
		FAX No.	: +31 70 310 5437

Prepared by : Jonathan Woodrow
Phone : +31 652 61 32 25
E-Mail : jwoodrow@coevorden.oilfield.slb.com

Well Description

Configuration	**Casing**	**Stage : Single**	**Rig Type : Land**
Prev.String	MD : 250.0 m	OD : 13 3/8 in	Weight : 54.5 lb/ft
Csg/Liner	MD : 1250.0 m	OD : 10 3/4 in	Weight : 55.5 lb/ft
Landing Collar MD		1225.0 m	
Casing/liner Shoe MD		1250.0 m	
Mud Line		0.0 m	
Total MD		1252.0 m	
BHST		56.0 degC	
Bit Size		13 1/2 in	
Mean OH Diameter		14.0 in	
Mean Annular Excess		25.0 %	
Mean OH Equivalent Diameter		14.7 in	
Total OH Volume		109.7 m3 (including excess)	

* Mark of Schlumberger

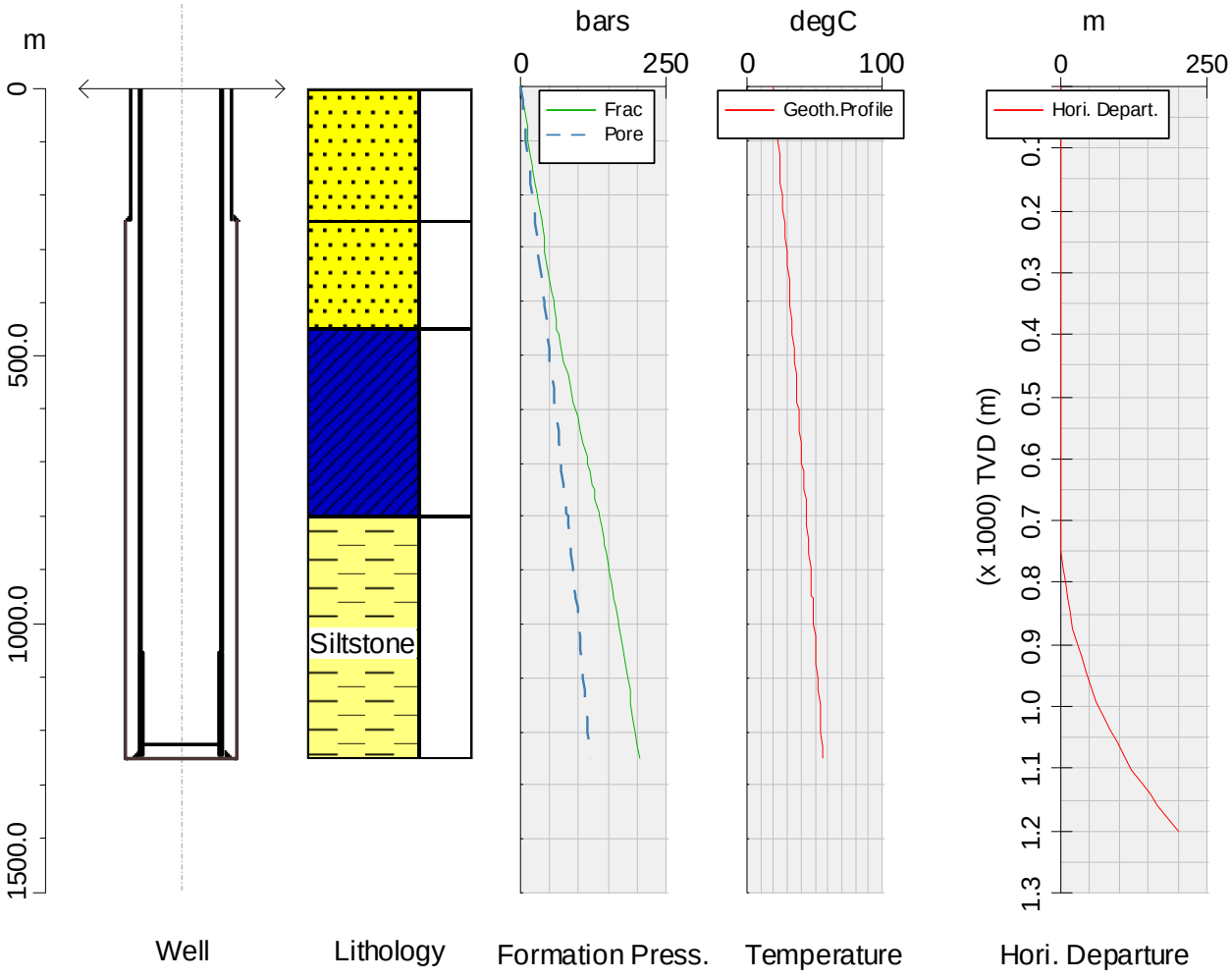
Section 1: Fluid Sequence

Original fluid	WBM - KCl - Polymer - PHPA	1.25 SG	
	P_V : 10.0 cP		T_Y : 11.97 Pa
Displacement Volume	61.1 m3		
Total Volume	125.3 m3		
TOC	0.0 m		

Fluid Sequence

Name	Volume (m3)	Ann. Len (m)	Top (m)	Density (SG)	Rheology	
Fresh Water	6.5	0.0		1.03	viscosity:1.0 cP	
Lead Slurry	51.4	1150.0	0.0	1.58	P_V:20.0 cP	T_Y:4.79 Pa
Tail Slurry	6.3	100.0	1150.0	1.65	P_V:25.0 cP	T_Y:4.79 Pa
Fresh Water	0.5		1214.6	1.03	viscosity:1.0 cP	
WBM - KCl - Polymer - PHPA	60.6		0.0	1.25	P_V:10.0 cP	T_Y:11.97 Pa

Static Security Checks :		
Frac	-6.7 bars	at 450.0 m
Pore	13.7 bars	at 250.0 m
Collapse	100.9 bars	at 1054.9 m
Burst	246.8 bars	at 0.0 m
Csg.Pump out	47415 kg	



Section 2: Centralizer Placement

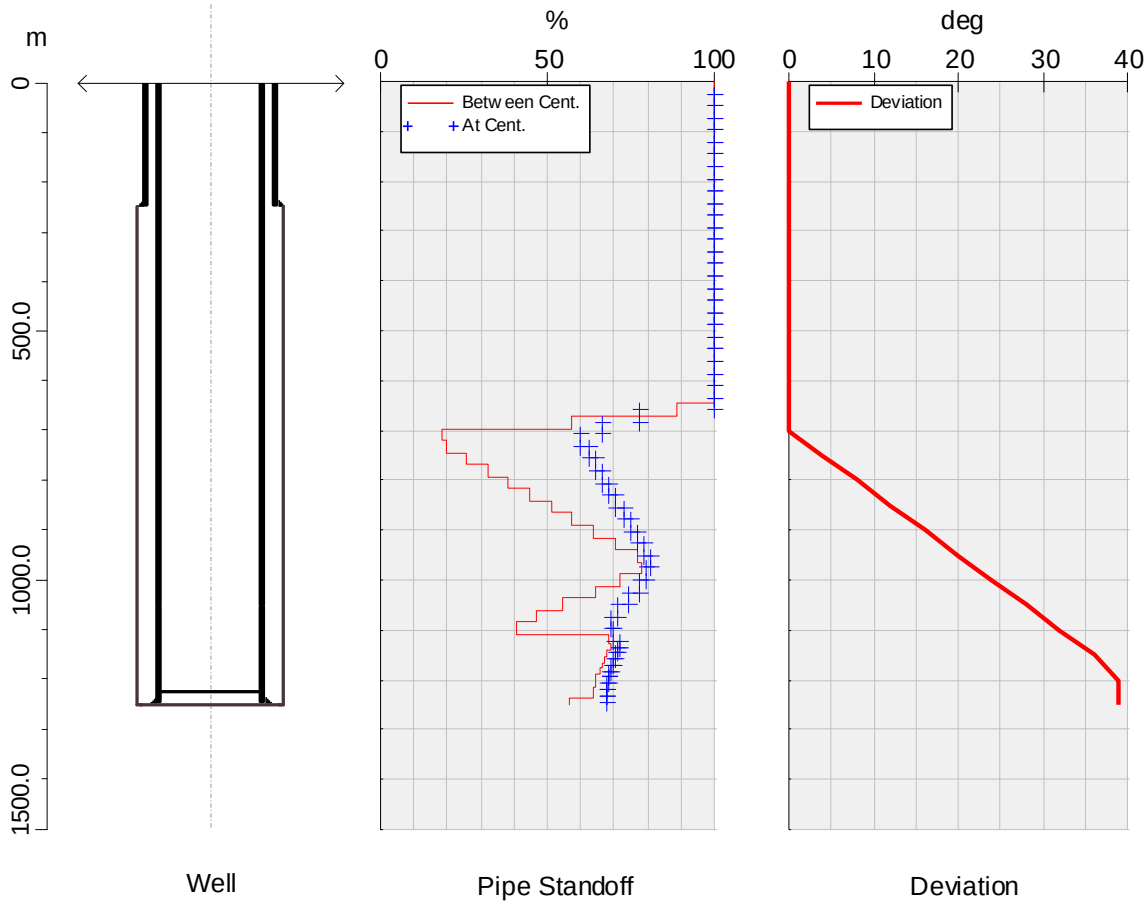
Top of centralization : 0.0 m
Bottom Cent. MD : 1243.9 m
Casing Shoe : 1250.0 m
NB of Cent. Used : 56
NB of Floating Cent. : 56

Centralizer Placement

Bottom MD (m)	Nbr.	Cent. / Joint	Cent. Name	Code	Min. STO (%)	@ Depth (m)
250.3	10	1/2	1501210-10 3/4-6-POSITIVE		100.0	244.2
1128.1	36	1/2	NW-ST-10 3/4-6-ST A2	W10F	18.2	719.6
1250.0	10	1/1	NW-ST-10 3/4-6-ST A2	W10F	56.4	1250.0

Centralizer Description							Centralizer Tests		
Cent. Name	Code	Casing OD (in)	Max. OD (in)	Min. OD (in)	Rigid	Origin	Hole Size (in)	Running Force (N)	Restoring Force (N)
NW-ST-10 3/4-6-ST A2	W10F	10 3/4	14.0	12.0	No	Hannover	12.5	2190.00	8260.00
1501210-10 3/4-6-POSITIVE		10 3/4	12.0	12.0	No	Houma	N.A.	N.A.	N.A.

(1) - Centralizer performance data is based on tests by WEATHERFORD as per the current API 10D specifications



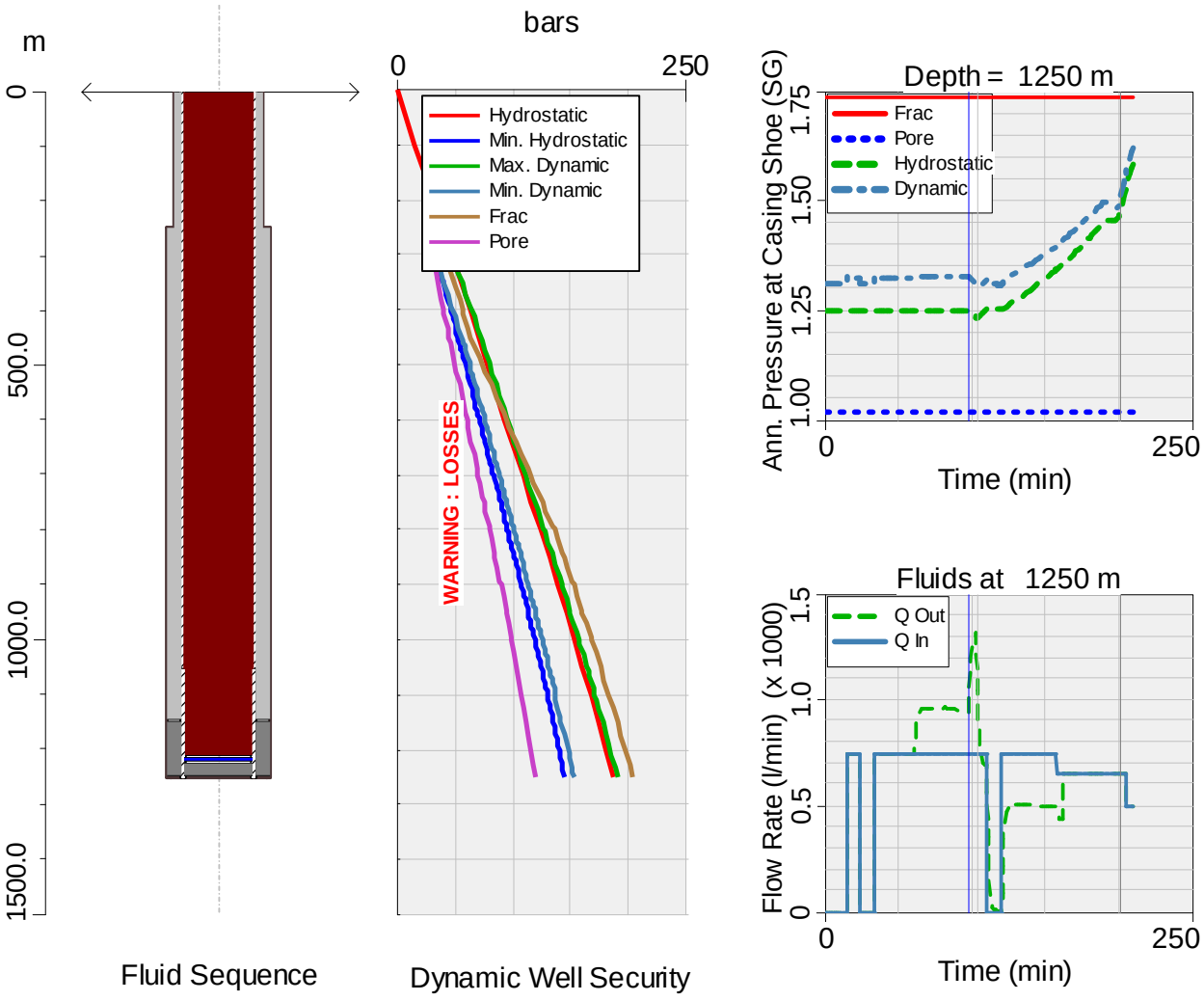
Section 3: Pumping Schedule

Due to the low fracture pressare across the Clalk formation losses maybe encountered, returns must be monitored during the job to check for losses.

Dynamic Security Checks :		
Frac	-8.7 bars	at 450.0 m
Pore	0.3 bars	at 250.0 m
Collapse	100.9 bars	at 1054.9 m
Burst	201.8 bars	at 0.0 m

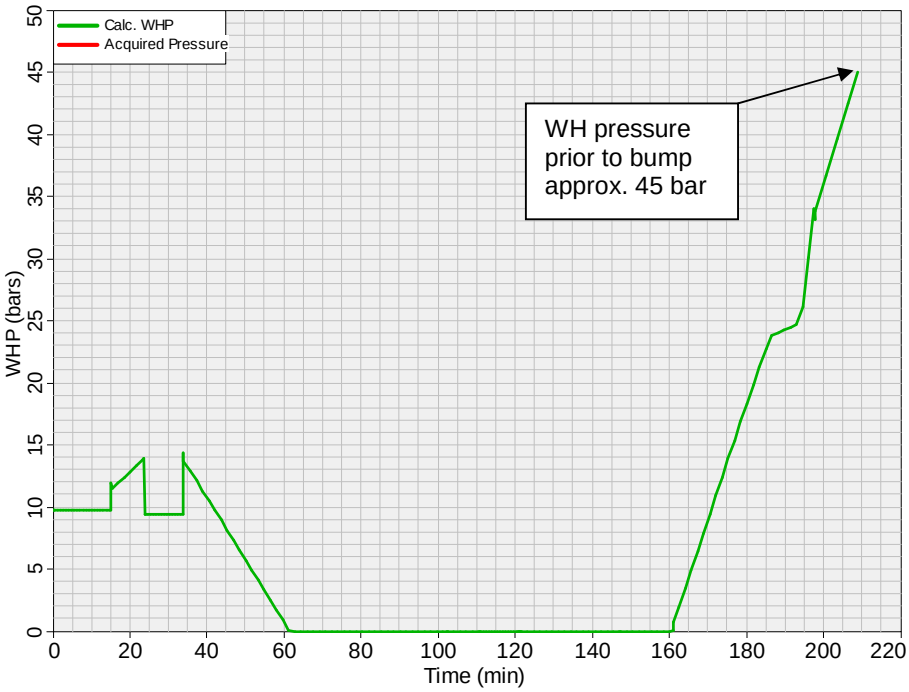
Temperature Results			
BHCT	38.2 degC	Simulated Max HCT	56.0 degC
Simulated BHCT	35.4 degC	Max HCT Depth	1250.0 m
CT at TOC	31.6 degC	Max HCT Time	00:00:00 hr:mn:sc

Static temperatures :			
At Time	(hr:mn)	(hr:mn)	Geo. Temp.
Top of Cement	(degC)	(degC)	20.0 degC
Bottom Hole	(degC)	(degC)	56.0 degC

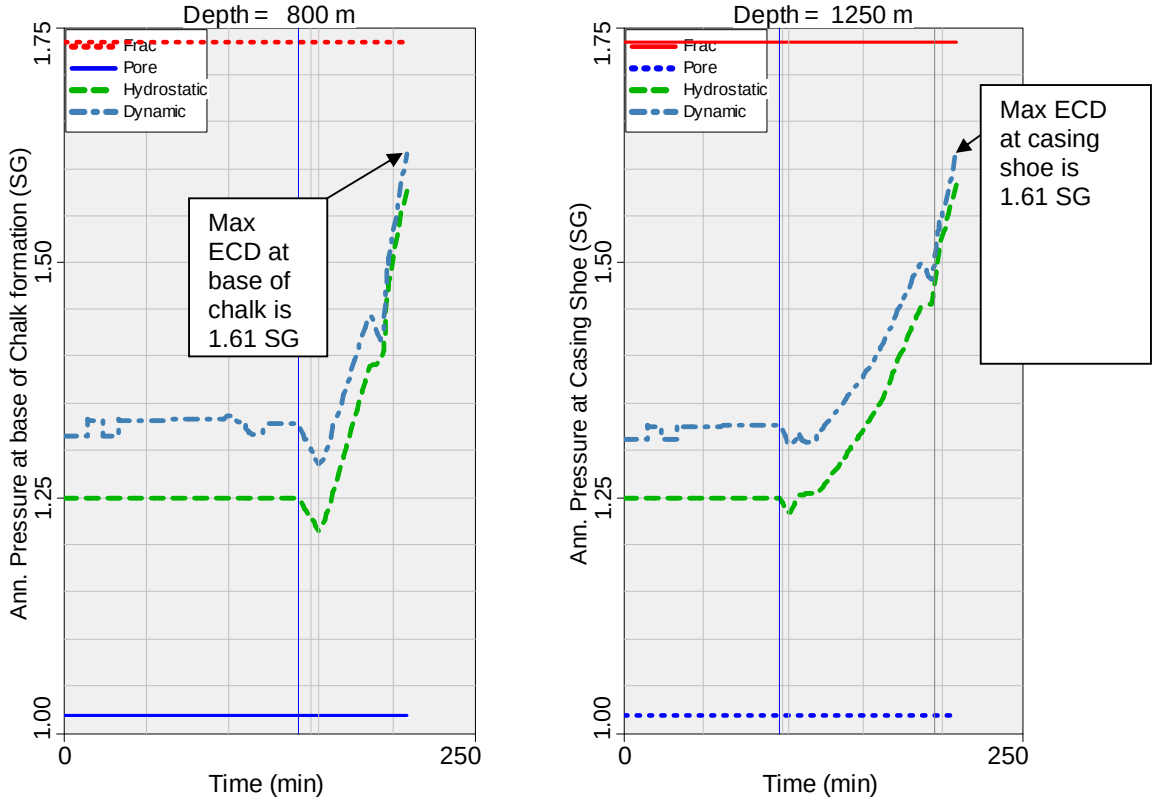


Fluid Sequence

Dynamic Well Security



Expected Wellhead pressure profile during the 10 ¾ in casing cemneting job



Expected ECD at base of the chalk and casing shoe during the 10 ¾ in casing cemneting job

Section 4: Operator Summary

Start Job: Pre-job briefing with crew and assigned personnel

Operator Pumping Schedule					
Name	**Flow Rate** (l/min)	**Volume** (m3)	**Stage Time** (min)	**Cum Vol** (m3)	**Comments**
Pause	0.00	0.0	15.0	0.0	Pressure test as per std 5
Fresh Water	750.00	6.5	8.7	6.5	Wash ahead of slurry
Pause	0.00	0.0	10.0	0.0	Release bottom plug
Lead Slurry	750.00	51.4	68.5	51.4	Pozzocemoil Lead
Tail Slurry	750.00	6.3	8.4	6.3	Pozzocemoil Tail
Pause	0.00	0.0	10.0	0.0	Release top plug
Fresh Water	750.00	0.5	0.7	0.5	Spacer behind
WBM - KCl - Polymer - PHPA	750.00	27.3	36.4	27.3	Displacement
WBM - KCl - Polymer - PHPA	650.00	31.0	47.7	58.3	First cement across the chalk
WBM - KCl - Polymer - PHPA	300.00	2.3	7.8	60.6	Slow prior to bump

Total Pumping Time **:** 03:33 hr:mn

End Job: Pressure test casing and bleed off pressure, check returns

TOTAL MATERIAL REQUIREMENTS

Dead Volumes

Operator Volumes				
Name	**PumpedVolume** (m3)	**Dead Vol.** (m3)	**Applies to**	**Blend Dead Mass** (kg)
Lead Slurry	51.4	1.0	Total Fluid	0.00
Tail Slurry	6.3	1.0	Total Fluid	0.00

Additives	**Total Quantity**	**Item Quantity**	**Pack. Name**	**Packaging**	**Comments**
Pozzocemoil	55047.29 kg	1224	sack	45.00 kg	
B143	27.5 l	2	CAN	20.0 l	
D177	212.4 l	2	drum	208.2 l	

Mix Water Requirements:

Cement slurry	Fresh water	39.5 m3
Spacer and wash up	Fresh Water	10.0 m3

MIXING PREPARATION

Lead Slurry	
Volume : 52.4 m3	**Density** **:** 1.58 SG **Yield** **:** 1100.09 L/tonne

Dry Phase			**Liquid Phase**			
Blend :	47607.85 kg	**Design**	**Mix Water**	35.1 m3	1.6 m3 LAS	**Design**
pozzocemoil	47607.848 kg		Fresh water	34.910 m3	1.580 m3	
			B143	23.804 l	1.078 l	0.500 L/tonne blend
			D177	190.431 l	8.621 l	4.000 L/tonne blend

Tail Slurry	
Volume : 7.3 m3	**Density** : 1.65 SG **Yield** : 981.45 L/tonne

Dry Phase			**Liquid Phase**			
Blend :	7439.45 kg	**Design**	**Mix Water**	4.6 m3	1.6 m3 LAS	**Design**
pozzocemoil	7439.448 kg		Fresh water	4.580 m3	1.581 m3	
			B143	3.720 l	1.284 l	0.500 L/tonne blend
			D177	21.946 l	7.576 l	2.950 L/tonne blend

DRAFT V1 Cementing Program 7 in Liner
HAG-GT-01, WPMI

TO	:	**Bas Hengeveld, WPMI DSV**
CC	:	**Slb Cementer, Slb Coordinator**
From	:	**J. Woodrow**
Date	:	**Friday, 06 August 2010**

Objectives:

The main objectives of the 7 in Liner cement job are:
- To case off open hole formations and get Cement across the liner lap to achieve zonal isolation
- To provide good shoe strength to drill next section.

Well considerations:

Based on a WBM weight of 1.2-1.45 SG and following the proposed pumping schedule, the maximum estimated ECD is 1.61 SG at the 7 in liner shoe.
7 in liner shoe run to 2525 m MD –
- 7 in liner 23 lbf/ft from 2525 m to 1200 m
- 5 in drill pipe 19.5 lbf/ft from 1200 m to surface.
- Assume 7 in liner landing collar set at 2500 m MD.
- Liner plug type cementation, using drill pipe and liner wiper tan-dem plugs.

Centralization;
Simulation on both the current centraliser running program and a recommended centraliser completed and included in the program

	Current Plan	Recommended Plan
• **Bow spring centraliser from 2525 m to 2400 m MD**	**1 cent / 1 joint**	**2 cent / 1 joint**
• **Bow spring centraliser from 2400 m to 1245 m MD**	**1 cent / 2 joint**	**1 cent / 1 joint**
• **Positive centraliser from 1245 m MD to 1150 m MD**	**1 cent / 1 joint**	**1 cent / 1 joint**
	60 centraliser's	**118 centraliser's**

Slurry considerations:

Based on 25% open hole excess over the 8.5 in OH;
- it is planned to batch mix and a single slurry system with fluid loss agents to improve slurry properties
- Required to mix minimum 22.2 m^3 of 1.67 SG PozzoCemoil liner slurry (annular column +/- 1375 m)
- Target cement top at 1150 m MD 50 m above liner hanger setting depth of 1200 m MD

Note: on open hole excess assumed (if 25% excess is pumped, there is a possibility of significantly more cement on top of the liner running tool should the hole be in gauge. In the event the hole is in gauge the top of cement would be expected at 1050 m MD)

Spacer considerations:
- 1.5 m^3 Fresh water (1.0 SG) spacer ahead to flush the lines and perform pressure test 100 bar
- 6.0 m^3 MUDPUSH II Spacer (1.5 SG) spacer ahead of the liner slurry to displace the drill mud in hole
- 1.0 m^3 MUDPUSH II Spacer to be pumped behind top plug to clean surface lines and place a barrier between the slurry and mud system
- 2.0 m^3 MUDPUSH II Spacer to be pumped mid displacement to place a columen of spacer across the liner lap to ensure cement and mud do not mix

Displacement:

The total displacement volume is approximately 37.8 m^3, (check on-site with actual pipe-tally).
Once the top plug is bumped, pressure test the casing sting to 100 bar and hold the pressure for 15 mins as per client instruction. Bleed off and check returns ensure the floats are holding.

Operational Considerations:

- One Onshore Twin-Pump unit, with soundproofed engine compartment
- 1 3 x 10 m3 batch mix tank trailer for mixing the slurry required for mixing the liner slurry
- 1 x flat bed supply truck for hose basket, chemicals and dust collector
- 1 CEBO bulk truck with min 23 MT PozzoCemoil. Cement bulkers are to be fully emptied on location to reduce return cement charges.
- MUDPUSH II spacer mixing, Barite required, to be supplied by client 7-8 MT required to weigh up the spacer

DRAFT V1 Cementing Program 7 in Liner
HAG-GT-01, WPMI

Pumping and Operational Program :

1. Circulate 120 % of system content to clean the hole and condition the mud - lower viscosity as low as practicable
2. Hold pre job safety meeting and assign roles, ensure all personnel are familiar with job objectives and safety procedures
3. Make sure casing is full of fluid. Make sure space out is sufficient to leave reasonable working height to connect cement line.
4. Batch mix minimum **23.0 m^3** of **1.67 SG** PozzoCemoil Liner Slurry

	Pump Rate	Approx Time
5. Pump **1.5 m^3** Fresh water spacer to fill lines	750-850 LPM	(2 min)
6. Pressure test procedure		
• Apply a **low** pressure test to the line of 20 bar (300 psi) to 35 bar (500 psi) Inspect for any leaks.		
• If there are no leaks, slowly increase the pressure to the final test pressure		
• Perform **high** pressure test to 100 bar		(15 min)
7. Pump **6.0 m^3** MUDPUSH II spacer	750-850 LPM	(10 min)
8. Release bottom dart		(10 min)
9. Pump **22.2 m^3** of **1.67 SG** PozzoCemoil Liner Slurry	700-800 LPM	(10 min)
10. Release top dart		(10 min)
11. Start displacement: (total displacement including spacer = **37.8 m^3**).		
• Pump **1.0 m^3** MUDPUSH II spacer	700-800 LPM	(1 min)
• Pump **24.5 m^3** of WBM	700-800 LPM	(25 min)
• Pump 2**.0 m^3** of MUDPUSH II (spacer across liner lap)	700-800 LPM	(50 min)
• Pump **8.0 m^3** of WBM	700-800 LPM	(25 min)
• Pump **2.3 m^3** of WBM (reduce rate to bump the plug)	300-400 LPM	(10 min)
(Estimated pressure at end of displacement = 57 bar)		**Minimum Job Time =164 min** (2h 44 min)

12. Pressure test the casing to 100 bar for 15 mins upon bumping the plug
13. Bleed off and check for back-flow.
14. Set the top packer and release the running tool – ensure this does not take excessive time due to cement slurry setting time
15. Reverse circulate excess fluids above the liner hanger out the well, observe returns to surface for indication of cement/spacer fluid volume above hanger
16. Continue as per DDP.

Prepared by:	Comments;	**Signature**	**Date:**
Jonathan Woodrow Schlumberger – WS Field Engineer	DRAFT V1		6 August 2010
Reviewed by:	**Comments;**	**Signature**	**Date:**
Attila Olasz Schlumberger – WS Cell Leader Coevorden	Review		6 August 2010
Submitted to:	**Submitted to:**	**Signature**	**Date:**
Koop Eleveld WPMI – Drilling Supervisor			

Pre-Job

1. Inventory checks - ensure sufficient chemical inventory for 2 jobs (100% excess as contingency)
2. All equipment STEM I Performed
3. Review FINAL Cementing Programme/Recipe sent from Schlumberger Staff Engineer
4. Hold pre-job meeting with company representative and agree on final procedures, any major deviations to be discussed with town - following Management of Change guidelines
5. Ensure a risk assessment (HARC) has been performed on site for the job including third party equipment, and is reviewed with all personnel involved in the operation and onshore staff during KSQR review. Please review attached HARC sheet for the job and amend if necessary.
6. All volumes to be recalculated on the rig prior to the job and agreed by both Schlumberger cementer and WMPI drilling representative
7. Samples of mix fluid (2.0 gals), cement (10.0 kgs) and slurry must be taken using the correct sampling equipment as per KSQR.
8. Ensure that a calibrated pressurised mud balance is available and is reading correctly
9. Circulate and condition drill mud prior to job, break gel strength and lower rhelogies as much as practical Yp = 8-10 lbf/100sqft

Contingencies:

1. If floats fail to hold. This will be evident if the return to the cement displacement tank is more than 0.3 m^3 than what was expected. It is normal to have some return as this is the line volume returning via gravity from rig floor to cement unit and the volume used to pressure up the casing.
    - Pump the volume of fluid that returned
    - WOC in this case 4 hrs, bleed off pressure and isolate again if pressure increases then cement is still not set and need to WOC further 1.5 hrs, repeat process until cement is set
2. Fail to bump top plug. Before the cement job, cementer has to agree with client representative displacement volume to be used. If volume has been reached and no pressure increases,
    - Pump half the shoe track volume, if still no pressure indication, bleed off pressure and check for return. Do not pump anymore to avoid possible wet shoe.

Quality Control - Verified by WSDE

Check that chemical lot numbers being used are the same as quoted on Lab report

Size of Samples:

a. Base water: 5.0 ltr (Mud Engineer)
b. Mix fluid: 5.0 ltr (SLB)
c. Additives: 0.5 ltr (SLB)
d. Cement bulk: 10.0 kg (SLB)
e. Mud Engineer to check **cement water**.

Labelling of samples

Put the following information on each sample: **date**, **type**, **client**, **rig**, **well**, **job, batch #s, silo, name**
Note: Keep all samples on rig until next section, or until advised by SWE.

Reminders:

1. Start mixing slurry mix fluid when the liner is on bottom, liner hanger is set and circulation is established (D153 and D167 could pre-hydrated in advance)
2. Add retarder and dispersant last to avoid aging of the mix fluid (aging of the mix fluid could shorten thickening time of the cement slurry)
3. Density tolerance for batch mixed slurry is +/- 0.1 ppg. Avoid overweighing of the cement slurry as this will impact thickening time (slurry mixed at higher than designed density will have a shorter thickening time)
4. Minimize the static time after bumping (max 30 min for pressure test and setting liner top packer), this will avoid premature gelation that might lead to stuck pipe

Mix Fluid/Cement slurry Mixing Procedure:

1. In the batch tank measure out the water then add B143, pre-hydrate D153 and D167 in fresh water for min of 1 hour,
2. Add the B165 dispersant and D177 retarder just before addition of the cement powder;
3. Ensure accurate measurement of the retarder D801 as it will have the greatest effect on the thickening time and compressive strength development.

Spacer Fluids:

SPACER for 1st STAGE			CEMENT FORMULATION	
MUDPUSH II				
Spacer Density**	**1.50**	**SG**	**Fresh Water**	0.846 m3/m3 of Spacer
			B143 Antifoam	1.0 L/m3 Base Fluid
			B174 MUDPUSH II	4.0 kg/m3 Base Fluid
			D031 Barite	652.06 kg/m3 of Spacer

Cementing fluids:

CEMENT PROPERTIES			CEMENT FORMULATION	
Tail Slurry				
Slurry Density	**1.67**	**SG**	**Pozzocemoil**	
Slurry Yield	982.38	Litres/tonne	**Fresh Water**	607.27 litres/tonne
			B143 Antifoam	0.5 litres/tonne
			D153 Anti-Settling	0.1 % BWOC
			D167 Fluid Loss	0.25 % BWOC
			B165 Dispersant	4.0 litres/tonne
			D177 Retarder	6.0 litres/tonne
			Mix Fluid	617.77 litres/tonne

DRAFT V1 Cementing Program 7 in Liner
HAG-GT-01, Cement Slurry Recipes

NDDC LOC 400 HAG GT 1 7 in Liner (T-6.0L D177)

						Signatures
Test no.	**10-298**	Client	Verkley	Rig	LOC 400	5-8-2010
Date	04-08-2010	Well Name	HAG GT 1	Field	Hague	HElfrink

Job Type	Liner	Depth	2525 m	TVD	2190 m
BHST	84 degC	Test Temp	68 degC	BHP	34 MPa
Starting Temp.	25 degC	Time to Temp.	30 min	Heating Rate	1.4 ℃/min
Starting Press.	25 MPa	Time to Press.	30 min	Schedule	USER

Composition

Code	Component	Concentration	Lot
Pozzo Cemoil	Cement		
Fresh water	Base Fluid	607.27 L/tonne	

B143	ANTIFOAM	0.5000 L/tonne
D153	Anti-settling	0.1 %BWOC
D167	Fluid Loss	0.25 %BWOC
B165	Dispersant	4.0 L/tonne
D177	Retarder	6.0 L/tonne

Density	**1.670 kg/l**
Yield	**952.58 L/tonne**
Mix Fluid	**587.97 L/tonne**
Porosity	61.7 %

Tests Results

Rheology

(rpm)	(deg)	(deg)
300	122.0	79.0
200	91.0	61.0
100	55.0	35.5
60	40.0	26.0
30	27.0	16.0
6	18.5	6.0
3	16.0	4.0
Ty (lbf/100ft2)	17.3	11.3
Pv (cP)	106	71
Temperature	27 degC	68 degC

Thickening Time

Consistency	Time
40 Bc	(hr:mn)
100 Bc	(hr:mn)
Batch Mix Time : (min)	at (degC)

Comments

Schlumberger

CemCADE* Cementing Recommendation for 7 in Liner

DRAFT V1

Operator	**: WPMI**	**Well**	**: HAG-GT-01**
Country	: The Netherlands	Field	:
State	:		
Prepared for	**: Koop Eleveld**	**Location**	**: The Hague**
Proposal No.	: DRAFT V1	Service Point	: Coevorden
Date Prepared	: 05-Aug-2010	Business Phone	: +31 70 310 5449
		FAX No.	: +31 70 310 5437

Prepared by : Jonathan Woodrow
Phone : +31 652 61 32 25
E-Mail : jwoodrow@coevorden.oilfield.slb.com

Well description

Configuration	**Liner**	**Stage : Single**	**Rig Type : Land**
Prev.String	MD : 1245.0 m	OD : 10 3/4 in	Weight : 55.5 lb/ft
Csg/Liner	MD : 2525.0 m	OD : 7 in	Weight : 23.0 lb/ft
Drill Pipe	MD : 1200.0 m	OD : 5 in	Weight : 19.5 lb/ft
Liner Hanger		1200.0 m	
Landing Collar MD		2500.6 m	
Casing/liner Shoe MD		2525.0 m	
Mud Line		0.0 m	
Total MD		2530.0 m	
BHST		83.5 degC	
Bit Size		8 1/2 in	
Mean OH Diameter		8.5 in	
Mean Annular Excess		25.0 %	
Mean OH Equivalent Diameter		8.8 in	
Total OH Volume		50.8 m3 (including excess)	

* Mark of Schlumberger

Section 1: Fluid Sequence

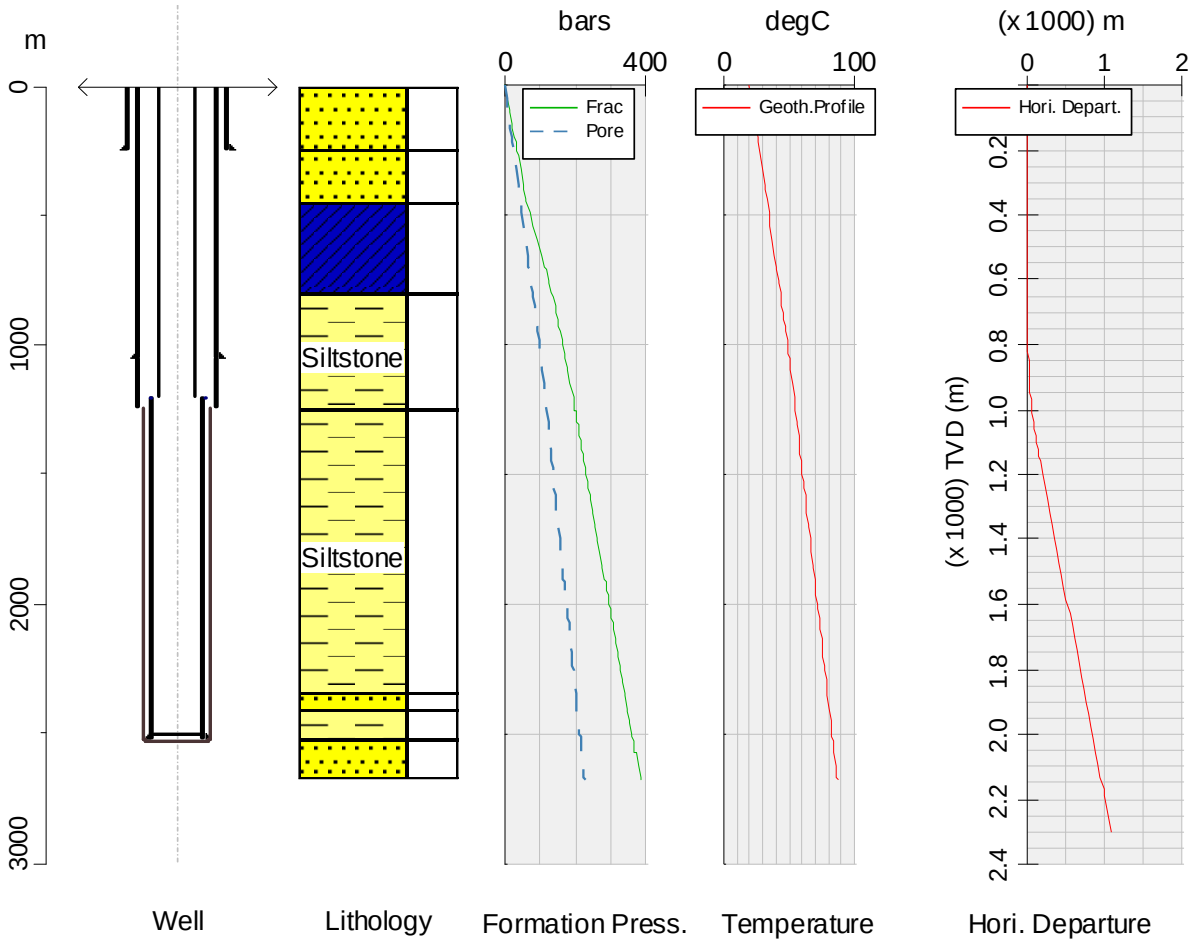
Original fluid	WBM - KCl- Glycol	1.35 SG	
	P_V : 8.0 cP		T_Y : 14.00 lbf/100ft2
Displacement Volume	37.8 m3		
Drill Pipe Volume	11.1 m3		
Total Volume	68.0 m3		
TOC	1150.0 m		

Fluid Sequence

Name	Volume (m3)	Ann. Len (m)	Top (m)	Density (SG)	Rheology	
MUDPUSH II	8.0	218.4	931.6	1.50	P_V:15.9 cP	T_Y:15.58 lbf/100ft2
Liner Slurry	22.2	1375.0	1150.0	1.67	P_V:20.0 cP	T_Y:20.00 lbf/100ft2
MUDPUSH II	1.0		2451.9	1.50	P_V:15.9 cP	T_Y:15.58 lbf/100ft2
WBM - KCl- Glycol	24.5		1258.8	1.35	P_V:8.0 cP	T_Y:14.00 lbf/100ft2
MUDPUSH II	2.0		1114.5	1.50	P_V:15.9 cP	T_Y:15.58 lbf/100ft2
WBM - KCl- Glycol	10.3		0.0	1.35	P_V:8.0 cP	T_Y:14.00 lbf/100ft2

Static Security Checks :

Frac	35.8 bars	at 1245.0 m
Pore	46.2 bars	at 1245.0 m
Collapse	165.7 bars	at 2500.6 m
Burst	300.6 bars	at 2500.6 m
Csg.Pump out	49393 kg	



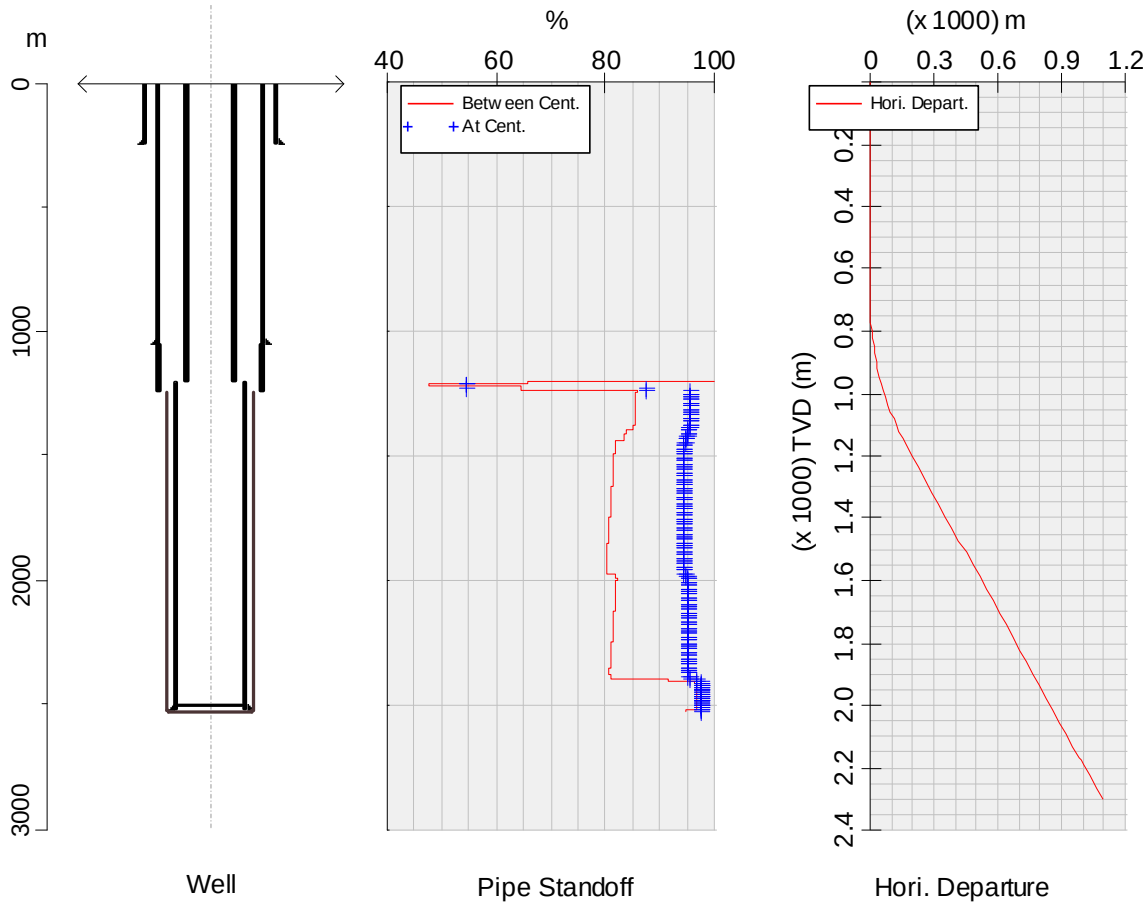
Section 2: Recommended Centralizer Placement

Top of centralization : 1200.0 m
Bottom Cent. MD : 2522.0 m
Casing Shoe : 2525.0 m
NB of Cent. Used : 118
NB of Floating Cent. : 3

Centralizer Placement						
Bottom MD (m)	**Nbr.**	**Cent. / Joint**	**Cent. Name**	**Code**	**Min. STO** (%)	**@ Depth** (m)
1232.6	2	1/1	1501570-7-6-POSITIVE		47.8	1220.5
2403.1	96	1/1	541 - STL-7 -4-30 (3/16")		64.4	1232.6
2525.0	20	2/1	541 - STL-7 -4-30 (3/16")		94.7	2525.0

Centralizer Description							Centralizer Tests		
Cent. Name	**Code**	**Casing OD** (in)	**Max. OD** (in)	**Min. OD** (in)	**Rigid**	**Origin**	**Hole Size** (in)	**Running Force** (N)	**Restoring Force** (N)
541 - STL-7 -4-30 (3/16")		7	9.5	7.1	No	Houma	8.5	1850.00	12860.00
1501570-7-6-POSITIVE		7	8.5	8.5	No	Houma	N.A.	N.A.	N.A.

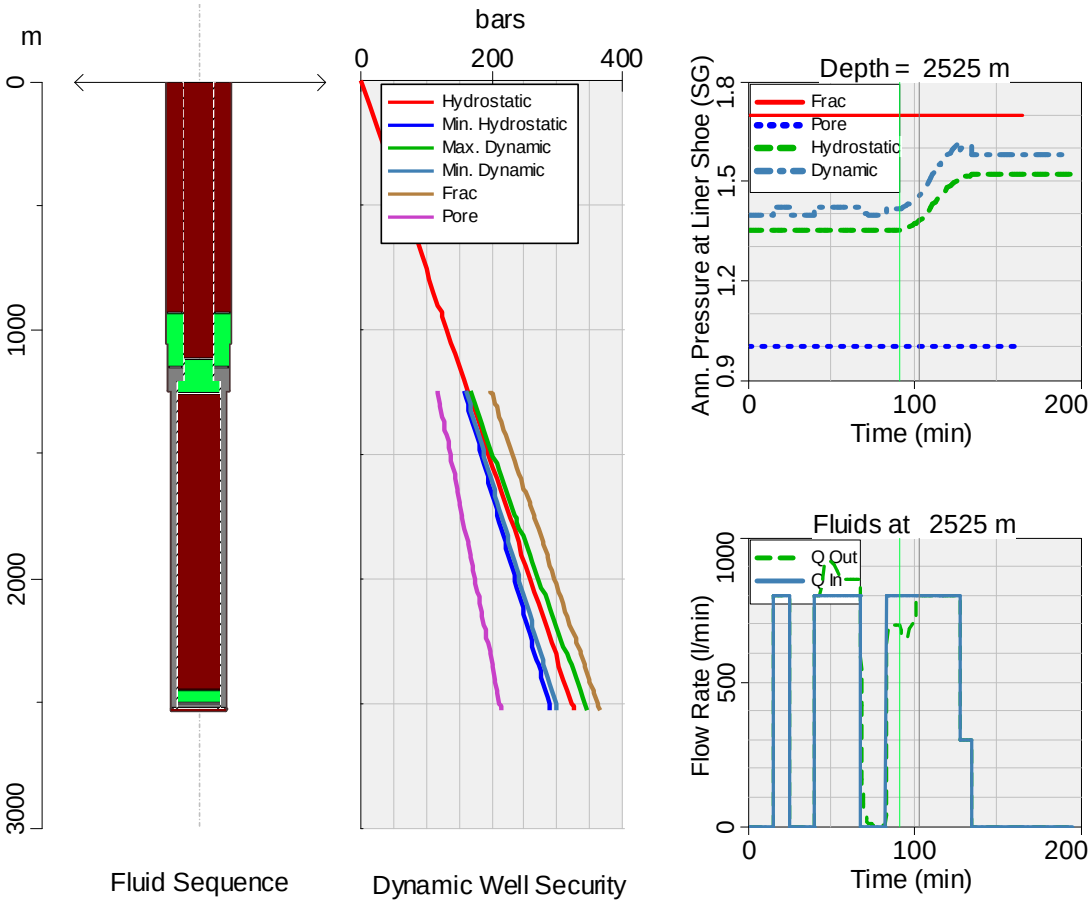
(1) - Centralizer performance data is based on tests by WEATHERFORD as per the current API 10D specifications

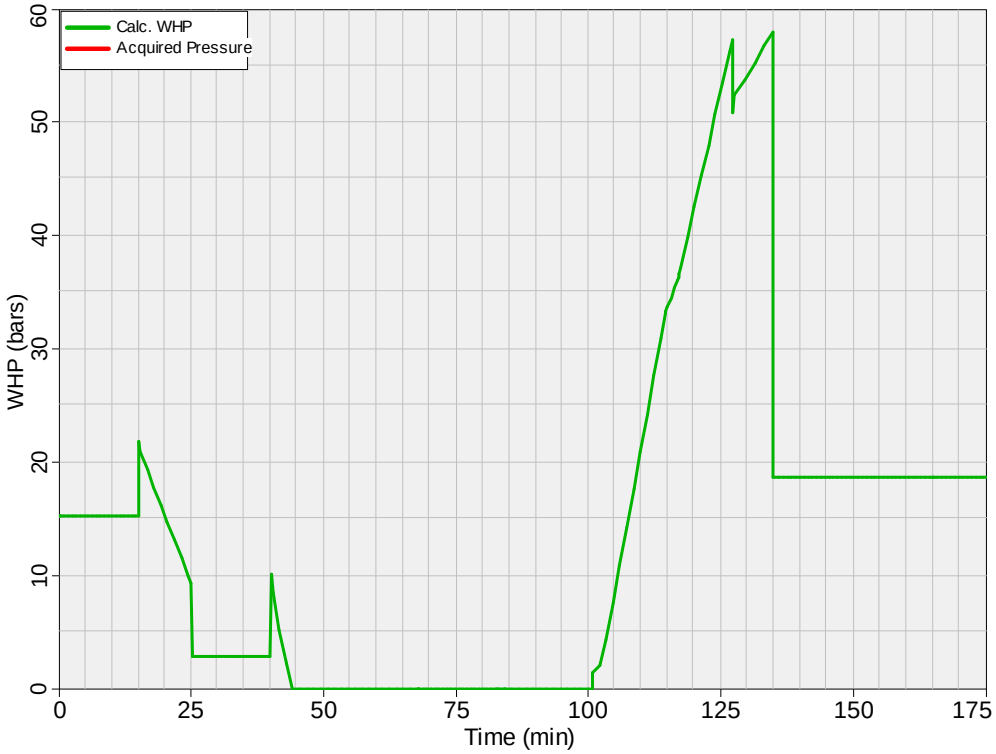


Section 3: Pumping Schedule

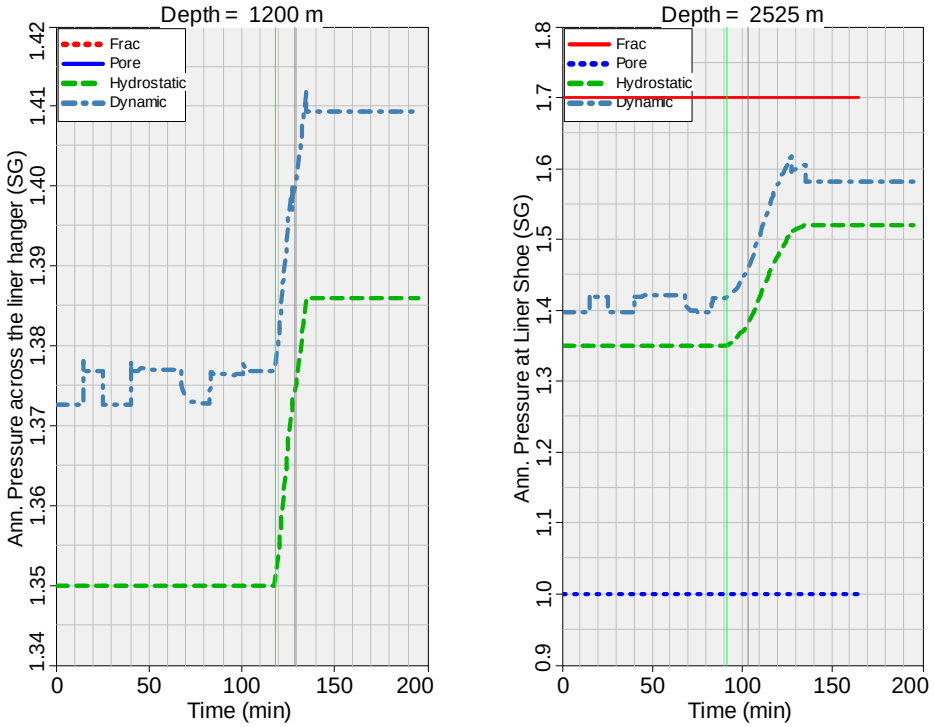
Dynamic Security Checks :		
Frac	17.8 bars	at 2525.0 m
Pore	41.0 bars	at 1245.0 m
Collapse	164.7 bars	at 2500.6 m
Burst	250.2 bars	at 1200.0 m

Temperature Results			
BHCT	54.2 degC	Simulated Max HCT	83.5 degC
Simulated BHCT	68.6 degC	Max HCT Depth	2525.0 m
CT at TOC	53.5 degC	Max HCT Time	00:00:00 hr:mn:sc
Static temperatures :			
At Time	(hr:mn)	00:30 hr:mn	Geo. Temp.
Top of Cement	(degC)	53.4 degC	52.5 degC
Bottom Hole	(degC)	73.0 degC	83.5 degC





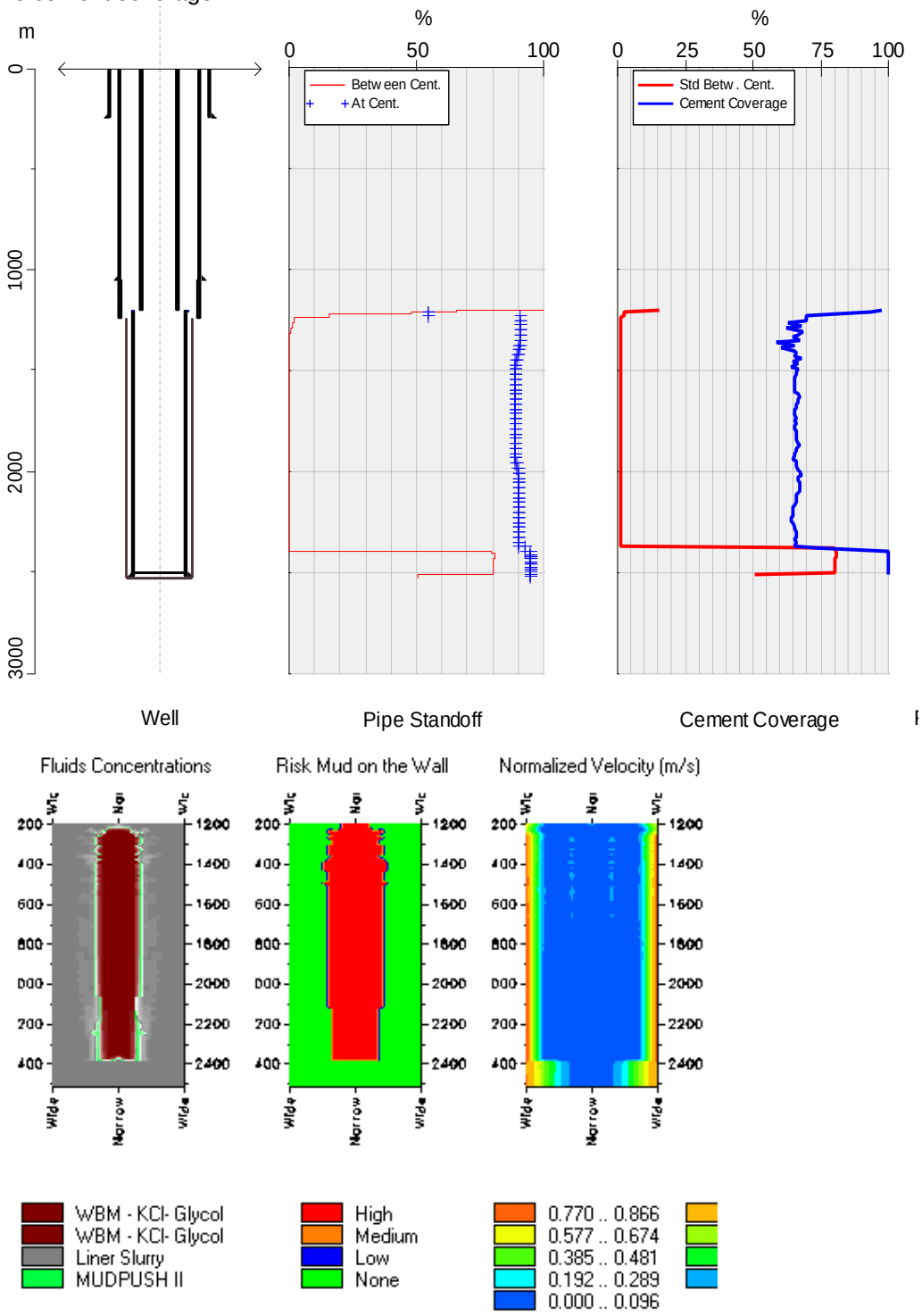
Expected Well head pressure during the 7 in liner cementing execution



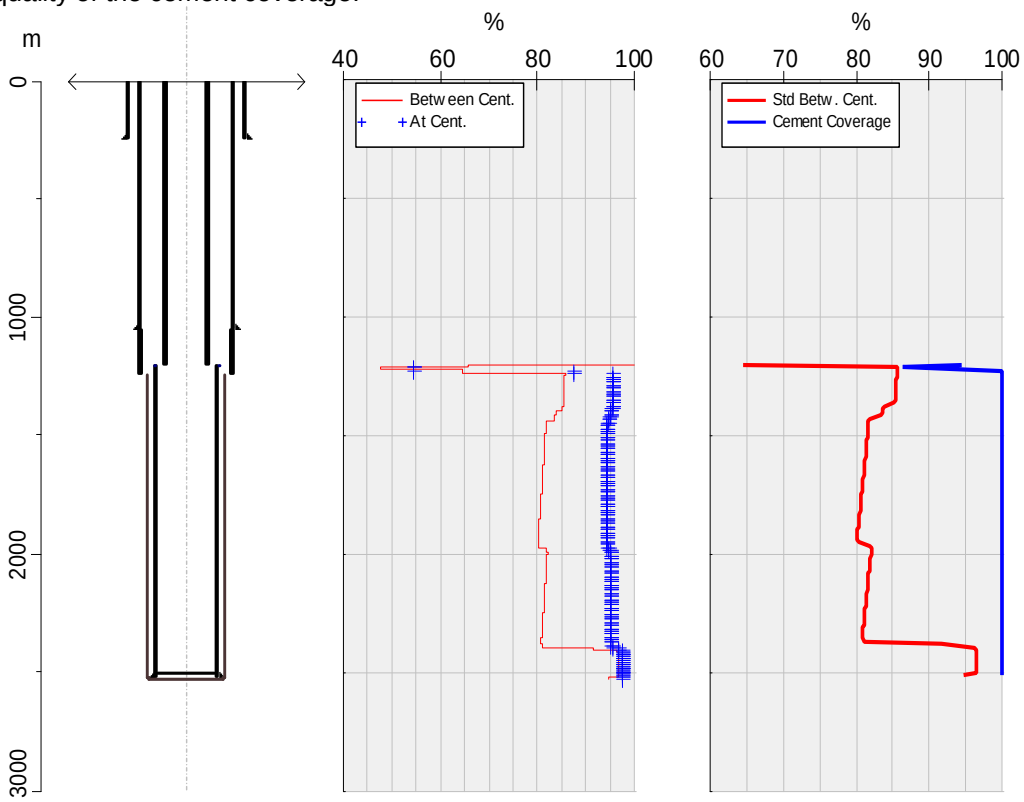
Expected ECD at the liner hanger and at the 7 in liner shoe during the 7 in liner cementing execution

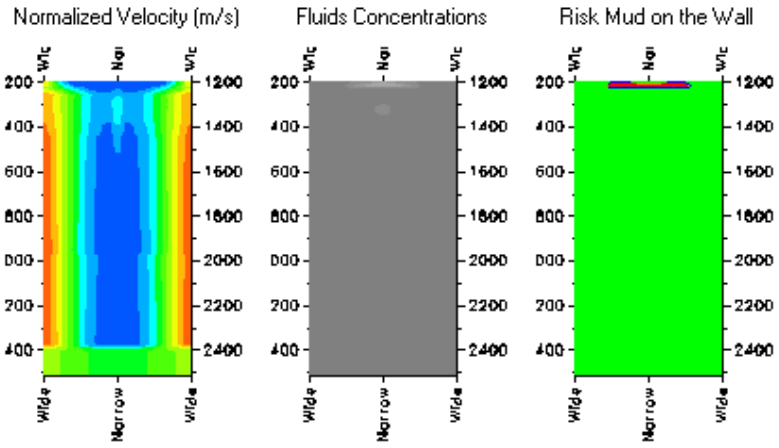
Section 4: WELLCLEAN II Simulator

WELLCLEAN II simulation results based on current centalisation program assming 25% annular excess over the open hole, simulation indicates the lack of centralisation along the liner could potentially form a channel reducing the effectiveness of the mud removal and reducing the quality of the cement coverage.



WELLCLEAN II simulation results based on recommended centalisation program assming 25% annular excess over the open hole, simulation indicates good centralisation (greater thean 75% stand-off) along the liner ensuring greater effectiveness of the mud removal and increasing the quality of the cement coverage.





Section 5: Operator Summary

Start Job: Pre-job briefing with crew and assigned personnel

Operator Pumping Schedule					
Name	**Flow Rate** (l/min)	**Volume** (m3)	**Stage Time** (min)	**Cum Vol** (m3)	**Comments**
Pause	0.00	0.0	15.0	0.0	Pressure test the lines
MUDPUSH II	800.00	6.0	7.5	6.0	Spacer ahead of slurry
Pause	0.00	0.0	15.0	0.0	Drop bottom dart
Liner Slurry	800.00	22.2	27.7	22.2	Pump Liner Slurry
Pause	0.00	0.0	15.0	0.0	Drop top dart
MUDPUSH II	800.00	1.0	1.3	1.0	Spacer behind dart
WBM - KCl-Glycol	800.00	24.5	30.6	24.5	Displacement
MUDPUSH II	800.00	2.0	2.5	2.0	Spacer across liner hanger
WBM - KCl-Glycol	800.00	8.0	10.0	8.0	Continue WBM displacement
WBM - KCl-Glycol	300.00	2.3	7.8	10.3	Slow to bump the top plug
Pause	0.00	0.0	30.0	0.0	Set Packer
Shut-In	0.00	0.0	30.0	0.0	Start Reverse Circulation

Total Pumping Time **:** 02:42 hr:mn

End Job: Pressure test casing and bleed off pressure, check returns

Batch Mixing Schedule			
Name	**Pump.Time** (hr:mn)	**Batch Mixing** (hr:mn)	**Time Lag** (hr:mn)
Liner Slurry	02:44	01:00	07:00

TOTAL MATERIAL REQUIREMENTS

Dead Volumes

Operator Volumes				
Name	**PumpedVolume** (m3)	**Dead Vol.** (m3)	**Applies to**	**Blend Dead Mass** (kg)
Liner Slurry	22.2	1.0	Total Fluid	0.00
MUDPUSH II	9.0	1.0	Total Fluid	0.00

Additives	**Total Quantity**	**Item Quantity**	**Pack. Name**	**Packaging**	**Comments**
B186	23600.93 kg	24	Bulk	1000.00 kg	
D153	23.60 kg	3	sack	11.34 kg	
D167	59.00 kg	6	sack	11.34 kg	
B143	21.8 l	2	CAN	20.0 l	
B165	94.4 l	1	TOTE TANK	1000.0 l	
D177	141.6 l	1	drum	208.2 l	
B174	40.00 kg	4	Sack	11.34 kg	
D031	6518.38 kg	131	sack	49.90 kg	

Mix Water Requirements:

Fresh water 22.8 m3

MIXING PREPARATION

MUDPUSH II	**Volume :** 10.0 m3	**Density :** 1.50 SG
Code	**Quantity**	**Design**
Fresh water	8.458 m3	
B143	10.000 l	1.000 L/m3 of spacer
B174	40.000 kg	4.000 kg/m3 of spacer
D031	6518.383 kg	651.84 kg/m3 of spacer

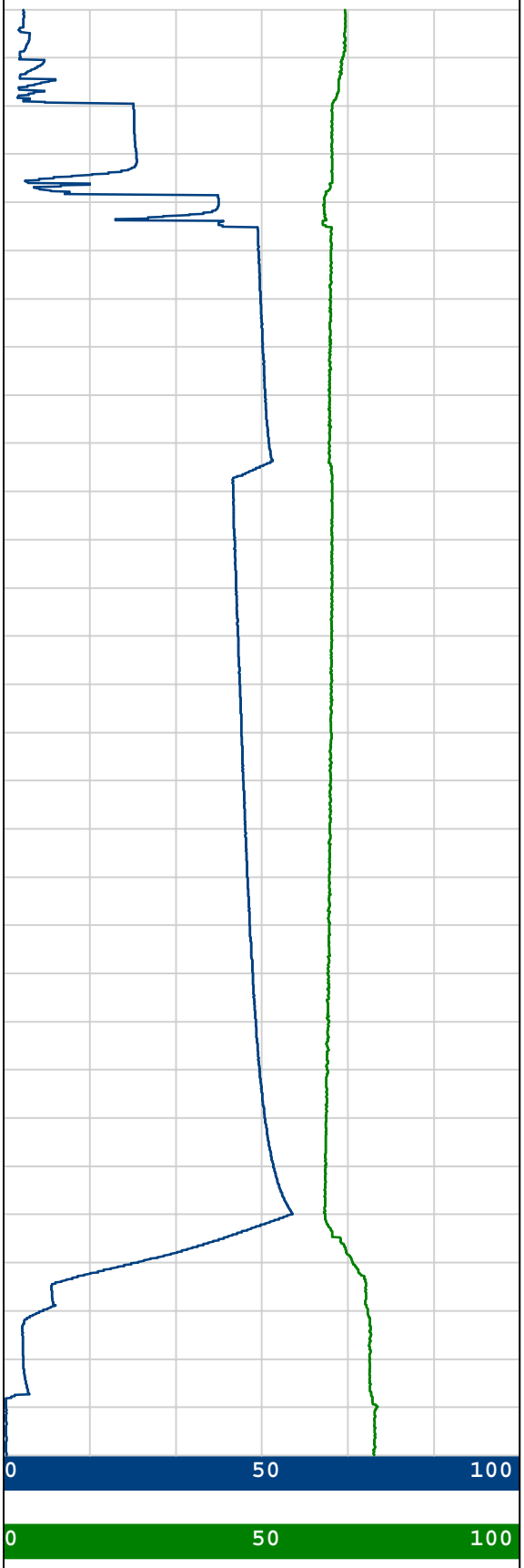
Liner Slurry	
Volume : 23.2 m3	**Density** : 1.67 SG **Yield** : 982.38 L/tonne

Dry Phase			**Liquid Phase**			
Blend :	23683.53 kg	**Design**	**Mix Water**	14.6 m3	1.6 m3 LAS	**Design**
PozzoCemoil	23600.928 kg		Fresh water	14.332 m3	1.563 m3	
D153	23.601 kg	0.100 %BWOC	B143	11.800 l	1.287 l	0.500 L/tonne blend
D167	59.002 kg	0.250 %BWOC	B165	94.404 l	10.295 l	4.000 L/tonne blend
			D177	141.606 l	15.443 l	6.000 L/tonne blend

Appendix 9, FIT’s

HAG GT-01

WPMI
File 20100801.Tag
Rig No Limit 01
01.08.2010
13:55 - 13:25



Time	SPP	WOH
Non	bar	tf
current	current	current
13:55	3,8	66,1
13:54	3,0	65,6
13:53	25,1	63,6
13:52	25,7	63,6
13:51	41,6	62,1
13:50	49,3	63,4
13:49	49,8	63,3
13:48	50,1	63,3
13:47	50,7	63,0
13:46	51,4	62,9
13:45	44,4	63,6
13:44	44,7	63,6
13:43	45,0	63,6
13:42	45,4	63,5
13:41	45,7	63,4
13:40	46,0	63,5
13:39	46,4	63,3
13:38	46,8	63,2
13:37	47,3	63,1
13:36	47,7	63,0
13:35	48,2	62,8
13:34	48,8	62,9
13:33	49,5	62,8
13:32	50,6	62,4
13:31	52,3	62,4
13:30	54,9	62,3
13:29	26,0	67,6
13:28	7,6	70,5
13:27	3,7	70,9
13:26	0,5	72,4
13:25	0,5	71,8

Appendix 10, Daily drilling reports

Appendix 11, Well test report