End of Well Report
NLW-GT-03 & NLW-GT-03-S1

Trias Westland B.V.

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GLOSSARY

AH	Along hole
BGL	Below ground level
BTC	Buttress thread connection
BOP	Blow out preventer
B/U	Bottoms up
CHH	Casing head housing
Cr	Chrome
CRA	Corrosion resistant alloy
CRT	Casing running tool
DSV	Drilling supervisor
ETSR	European Terrestrial Reference System
Fm	Formation
FMS	Flush mounted spider
GL	Ground level
GT	Geothermie
GRE	Glass reinforced epoxy
HMR	High magnesium resistant
Hrs	Hours
HSE	Health, Safety & Environment
Lpm	Litre per minute
LPR	Lower Pipe Ram
m	Meter
MD	Measured depth
MW	Mud weight
NAP	Normaal Amsterdams Peil
NDSV	Night drilling supervisor
NPT	Non Productive Time
OBM	Oil based mud
OH	Open hole
PDC	Polycrystalline diamond compact
PDM	Positive displacement motor
POOH	Pull out of hole
ppf	pounds per foot
PR	Performance requirement
PSL	Product specification level
PV	Plastic viscosity
RD	Rijksdriehoekstelsel
R/D	Rig down
RIH	Run in hole
ROP	Rate of penetration
RT	Rotary table
R/U	Rig up
s.g.	Specific gravity
SPP	Stand Pipe Pressure
TD	Total depth
TOC	Top of cement
TVD	True vertical depth
TWCV	Two-way check valve
VBR	Variable Bore Rams
WBM	Water based mud
WEP	Well Engineering Partners
YP	Yield point

1. Project Details

1.1 Organisation

Project Management:

Project Director	Marco van Soerland
Project Manager	Olaf Bresser
Drilling Manager	Gerrit Schurink
Sr. Drilling Engineer	Bert Jan Koers
Sr. Well Site Geologist	Julien Smeulders
HSE Manager	Peter v.d. Burg
Logistic supervisors	René Kooger & Henk van der Veen

Drilling Supervisors on a two-week rotational scheme:

Drilling Supervisor	John Boeijen	10-07-2020 / 16-07-2020
		30-07-2020 / 13-08-2020
		27-08-2020 / 29-08-2020
Drilling Supervisor	Mark de Jong	16-07-2020 / 30-07-2020
		13-08-2020 / 27-08-2020
Night Drilling Supervisor	Jack Schelvis	10-07-2020 / 14-07-2020
		05-08-2020 / 18-08-2020
Night Drilling Supervisor	Chris van Vulpen	14-07-2020 / 28-07-2020
		18-08-2020 / 29-08-2020
Night Drilling Supervisor	Johan Schutte	28-07-2020 / 05-08-2020

1.2 Operational summary

Location	Naaldwijk (onshore), Netherlands
Well Number	NLW-GT-03 and NLW-GT-03-S1
Well Name	Naaldwijk-GT
Well Type	Geothermal producer
Spud date	10-07-2020; 12:00 hr start of rig rate
Start rig down (end of well)	29-08-2020; 11:00 hr
Days Operational	49.9 days
Operator	Trias Westland B.V.

	Latitude & Longitude (ETSR89)	Geographical (Rijksdriehoek)
Surface Location	51°59'23.0"N 4° 14' 22.2"E	X: 76,169m Y: 445,215m

Grid Coordinate System	Rijksdriehoeksmeting / Netherlands New
Depth reference	Rotary Table (RT)

1.3 Drilling rig

Drilling Contractor	DrillTec
Drilling Rig	VDD 370.2 VarioRig

2. Well summary

The table below gives a summary of the drilling operations. Unless stated otherwise all depths mentioned are in meters MD below RT.

Table 1: Well summary

Item	MDRT (m)	TVDRT (m)	Comments
26" Conductor	133	133	26" Conductor was pre-installed to 133m by Haitjema.
24" Hole	907	907	Drilled to 907m with a rotary BHA. Washed OOH.
20" Casing	904	904	Ran 20" 133# K55 and NT95DE BTC casing to 851m. Stabbed 5 ½" DP Cement stinger into a double valve float shoe. Cemented casing to surface. Installed 20 ¾" 3K CHH and BOP CHH and 13 ⅝" BOP.
16" Hole	2550	2409	Drilled out shoe track with a 9 ⅝" PDM with PDC bit and 3m new formation. Performed FIT to 1.50 s.g. At 1191m (base Chalk), temporarily lost circulation, reduced MW to 1.16s.g. Drilled to 1275m (in Holland Marl), loss rate reduced from 12m^3/hr to zero. Displaced well to 1.10 s.g. OBM. Drilled to 1686m. POOH to change out failed PDM. RIH new PDC and PDM, drilled to 2550m, no more progress. POOH, bit severely undergauged (1 ½") and sleeve stab worn off. RIH new PDC, PDM and MWD to 1392m. Reamed down to 1487m, string got stuck. Worked / jarred string free, increased MW to 1.16 s.g. Reamed down to 1739m. RIH on elevators, string got stuck at 1813m. Worked string up to 1803m, no more progress. Back-off string. Top of fish at 1724m. Two cement kick-off plugs were set on top of each other with TOC at 1450m. A 20m^3 cement plug was pumped at 1075m and squeeze with 15m^3 in an attempt to cure the loss zone.
16" Hole (Sidetrack)	2600	2496	Sidetrack was initiated by time drilling. Drilled to 2332m, no more progress. POOH, PDC bit worn on the outer rows. A new motor and PDC bit drilled to TD. POOH. Performed wireline logging (GR, Neutron porosity, formation density, 6-arm calliper, dipole sonic, digital spectralog).
13 ⅜" Casing	2596	2490	Ran a mixed string 13 ⅜" casing. Plug type cemented casing. Displaced cement with 1.08 s.g. brine, lost returns after 68m^3 displacement. No bump observed, no pressure test performed. No inflow observed after bleeding of the pressure.
Suspend well			N/D BOP and installed tubing head spool. Installed tubing hanger. Installed tubing head adapter and master valve.

2.1 Depths and trajectory

Primary Objective		Delft Sandstone	
Primary Objective Depth		2377 m MD	2289m TVD
Total Depth		2600 m MD	2496 m TVD
Elevation	RT – GL	8.7 m	
	GL – NAP	-0.9 m (NAP is 0.9m below ground level)	
	NAP – RT	7.8 m	

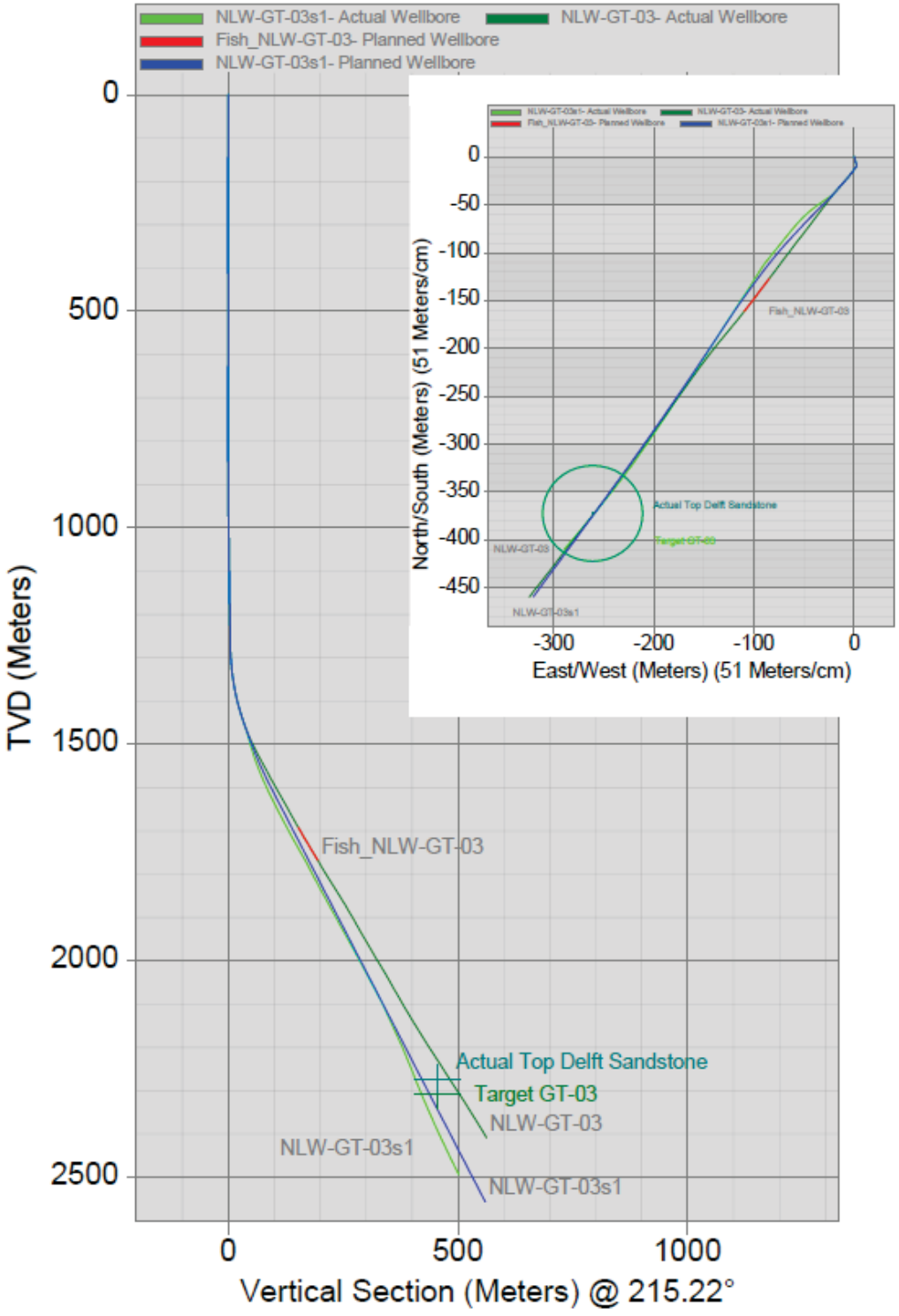


Figure 1. Vertical section and plan view

2.2 Technical summary

2.2.1 Casing

Table 2: NLW-GT-03-S1 tubular summary

Item	Top (m MDRT)	Bottom (m MDRT)	Weight	Grade	Connection
26" Conductor	0	133	0.39" WT	S235	Welded
20" Casing	0	904	133 ppf	K55 & NT95DE	BTC
13 ⅜" mixed string casing	0	2372	78.7 ppf	L80 GRE-lined	VAMTOP
	2372	2467	68 ppf	13Cr L80	VAMTOP
	2467	2492	78.7 ppf	L80 GRE-lined	VAMTOP
	2492	2528	68 ppf	13Cr L80	VAMTOP
	2528	2549	78.7 ppf	L80 GRE-lined	VAMTOP
	2549	2573	68 ppf	13Cr L80	VAMTOP
	2573	2596	68 ppf	L80	BTC

2.2.2 Cement

Table 3: NLW-GT-03-S1 cement summary

Item	TOC (m MDRT)	Lead Slurry Volume (m^3)	Lead Slurry Weight (s.g.)	Tail Slurry Volume (m^3)	Tail Slurry Weight (s.g.)	Type
20" Casing	Surface	166	1.40	29	1.90	Light weight lead and Class G tail
13 ⅜" Casing	1272mMD (based on RBT log)	80.39	1.35	16.41	1.46	Lightweight lead / HMR+ tail

2.2.3 Pressure test overview

No.	Test	Test against	Test fluid	Surface Test pressure (bar)	Depth (m TVD)	Test Date
1	CHH H-seals, via test port	FS-seals	Oil	88 bar	-	18/07/2020
2	20 ¾" wellhead connection and SOV	Blind rams, Cup type tester	Water	100 bar	-	19/07/2020
3	20" casing	Grey cement (against blind shear ram)	1.18 s.g. WBM	100 bar	904	19/07/2020
4	LIM 20" shoe	Ommelanden fm.	1.18s.g. WBM	28 bar (1.50 s.g. EMW)	904	20/07/2020
5	13 ⅜" casing hanger seals and ring gasket on CHH via test port	Hanger neck seals	Water	206 bar	-	28/08/2020
6	13 ⅜" casing	Inflow tested	1.08 s.g. brine inside. Cement + mud outside	100 bar to 0 bar	2494	27/08/2020
7	X-mas Tree and Tubing Head Adaptor connections	Blind flange, Wing valve, TWCV	Water	206 bar	-	28/08/2020

2.2.4 Well schematic NLW-GT-03

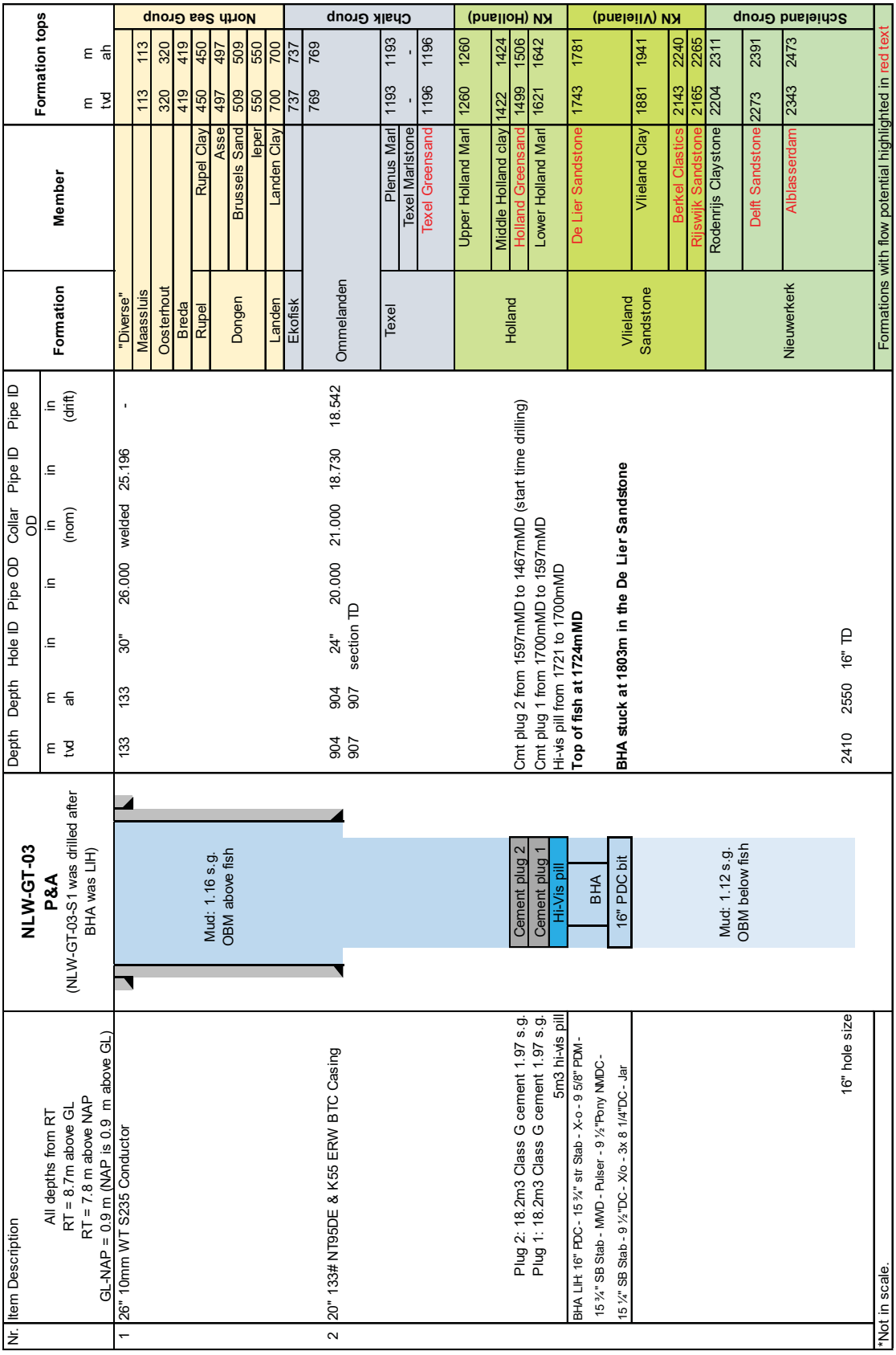


Figure 2. Well schematic NLW-GT-03

2.2.5 Well schematic NLW-GT-03-S1

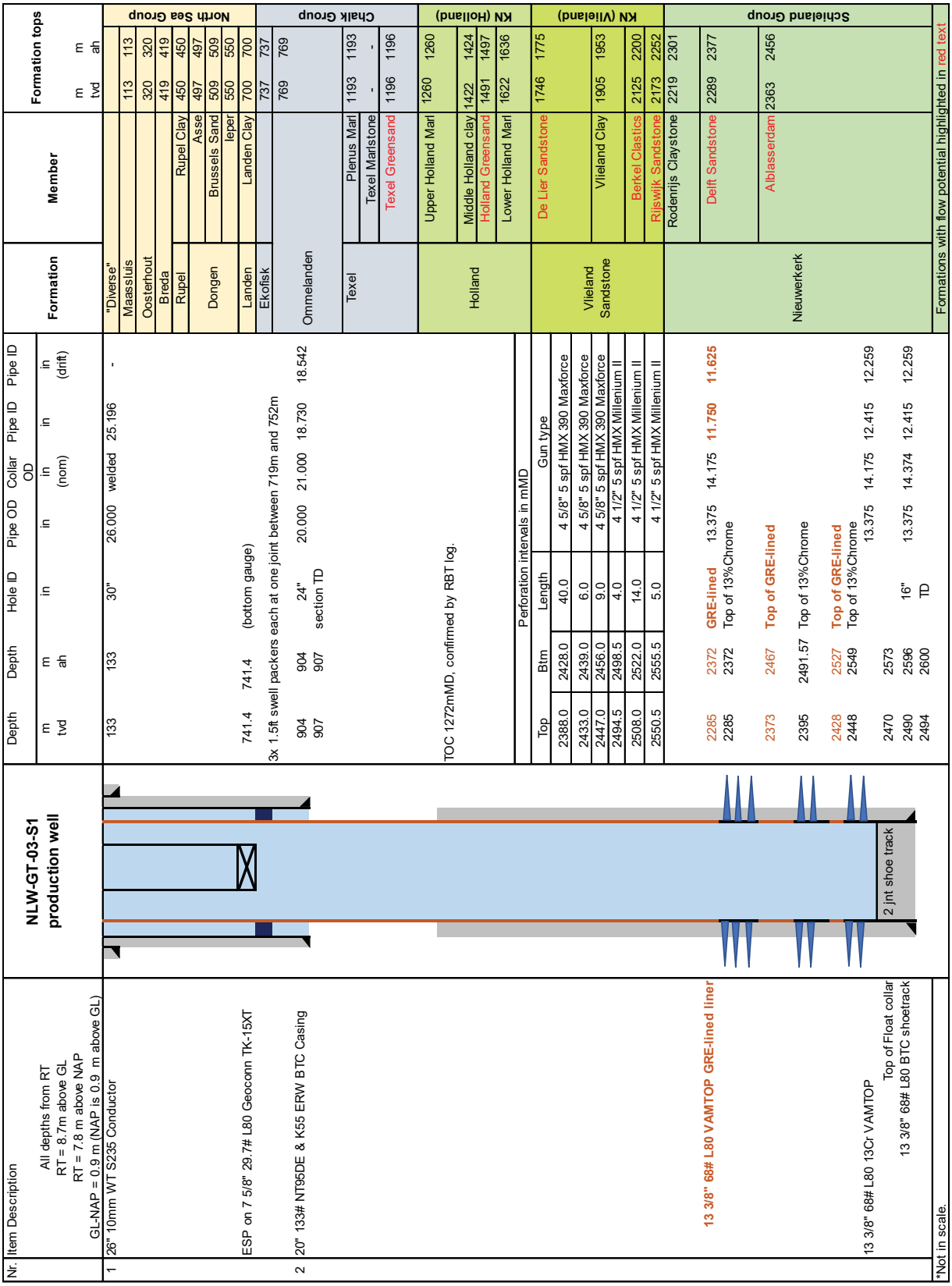


Figure 3: Well schematic NLW-GT-03-S1

3. Drilling fluid summary

Per section the following drilling fluid types have been used:

Table 4: Drilling fluid summary

Section	Type	Density (s.g.) Min – Max	PV (cP) Min – Max	YP (lbf/100ft2) Min – Max
24”	Bentonite spud mud & KCl Glycol WBM	1.02– 1.20	9 - 14	17 – 27
16”	KCl Glycol WBM	1.14 – 1.24	4 - 10	7 - 19
16”	LTOBM (Enviromul)	1.07 – 1.14	13 - 20	16 – 28
16” Sidetrack	LTOBM (Enviromul)	1.14 – 1.20	20 - 25	20 - 33

The figure below shows the mud weight versus depth during drilling operations.

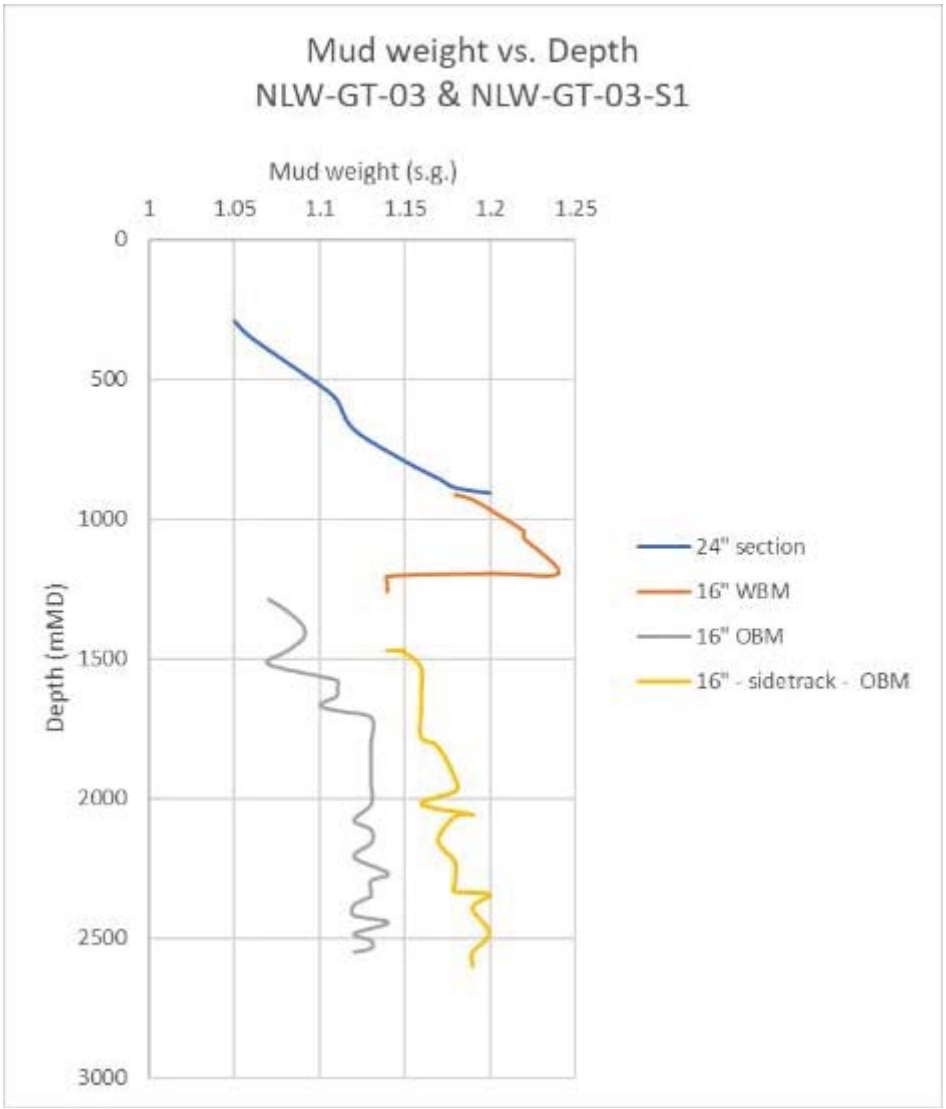


Figure 4: Mud weight vs. depth

4. Geology

4.1 Lithostratigraphic column

Below the geological column with vertical and along hole depths below RT.

Lithostratigraphic Column NLW-GT-03-S1						Expected		Actual	
Era	Group	Formation	Epoch (Age)	Member	Lithology	TV-RT Depth (m)	AH-RT Depth (m)	TV-RT Depth (m)	AH-RT Depth (m)
Cenozoicum	Upper North Sea NU	"Diverse"	*Holocene-Pleistocene*		Diverse continental deposits, mostly fluvial sands and silts intercalated by some thin layers of grey or greenish-grey, silty clays.	8.7	**8.7**	8.7	**8.7**
		Maassluis NUMS	*Early Pleistocene*		Coastal sands, very fine to medium coarse, calcareous, shell bearing, mica rich. Silty to sandy, grey to dark grey clay containing shells and mica.	113	**113**	113	**113**
		Oosterhout NUOT	*Pliocene*		Deposits of shallow marine greenish clays, sandy clays, silts and coastal sands.	320	**320**	320	**320**
		Breda NUBA	*Miocene*		Sequence of marine, glauconitic sands, silty to sandy clays and clayey silts. In many places a glauconite-rich layer occurs at the base.	406	**406**	419	**419**
	Middle North Sea NM	Rupel NMRF	*Oligocene/Eocene* Rupelian to Chattian	Rupel Clay NMRFC	Marine clays that become more silty towards base and top. It is rich in pyrite, contains hardly any glauconite & CaCO3 tends to be concentrated in the septaria layers.	437	**437**	450	**450**
	Lower North Sea NL	Dongen NLFF	*Middle to Late Eocene* Lutetian to Bartonian	Asse NLFFB	Marine dark greenish-grey and blue-grey, plastic clays. The unit locally shows indications of bioturbation, and may be glauconitic and micaceous.	480	**480**	497	**497**
			Early to Middle Eocene Ypresian to Lutetian	Brussels Sand NLFFM	Succession of green-grey, glauconitic, very fine-grained sand . Towards the base of the unit the clay content increases, and the calcium carbonate content and amount of glauconite decreases.	494	**495**	509	**509**
			Early Eocene Ypresian	Ieper NLFFI	Soft, tough and sticky to hardened and friable clay.	535	**537**	550	**550**
		Landen NLLF	*Late Paleocene* Thanetian	Landen Clay NLLFC	Generally dark-green, hard, flaky clay, somewhat silty, containing glauconite, pyrite and mica.	695.5	**711**	700	**700**
	Chalk CK	Ekofisk CKEK	*Late Paleocene* Danian		White, chalky limestones containing rare white and grey nodular and bedded chert layers, and thin, grey to green (glauconitic) clay laminae.	721	**740**	737	**737**
Mesozoicum		Ommelanden CKGR	*Upper Cretaceous* Turonian to Maastrichtian		Succession of white, yellowish-white or light-grey, fine grained, dense limestones, in places argillaceous. Thick intervals of chert are present. Tongues of sandstone occur in the middle section (eg. 870m to 890m TVD).	741	**763.5**	769	**769** 24" section TD @ 907,6m
		Texel CKTX	*Cenomanian*	Plenus Marl CKTXP	Dark-grey, partly black, calcareous, laminated claystone.	1172	**1172**	1193.5	**1193.5**
				Texel Marlstone CKTXM	Interval of white to light grey chalks, chalky marls and limestones. Increasingly marly with depth.	1174	**1174**	-	**-**
				Texel Greensand CKTXG	Greenish, glauconitic, calcareous sandstones with intercalated marls.	1176	**1176**	1196	**1196**
	Rijnland KN	Holland KNGL	*Lower Cretaceous* Late Albian	Upper Holland Marl KNGLU	Grey and red-brown (argillaceous) marls, carbonate content gradually increases towards the top. Very fine mica and glauconite, pyrite, Inoceramidae, Foraminifera.	1226	**1226**	1260	**1260.5**
			Late Aptian to Early Albian	Middle Holland Claystone KNGLM	Grey and/or red-brown calcareous shaly claystone with a distinctly lower lime content than the under- and overlying members.	1390	**1392**	1422	**1424**
					Kick off sidetrack @ 1467m MD				
			Early Albian	Holland Greensand KNGLG	Alternation of greenish grey, very glauconitic, very fine- to fine-grained, argillaceous sandstones, locally silt-stones with calcareous or sideritic cement, and olive-grey claystones or grey marlstones.	1499	**1505**	1491	**1497**
			Early Aptian	Lower Holland Marl KNGLL	Fossiliferous, glauconitic and intensely bioturbated, greenish grey, silty to very silty or sandy, glauconitic (grey + red-brown) marls and fissile claystones.	1621	**1638**	1622	**1636**
		Vlieland Sandstone KNNS	Late Barremian to Early Aptian	De Lier Sandstone KNNSL	Alternation of thin-bedded, (very) fine-grained argillaceous sandstones, glauconitic and lignitic, and sandy claystones with shell fragments and frequent bioturbation. Siderite concretions are common.	1743	**1774**	1746	**1775**
			Late Barremian	Vlieland Clay KNNCM	Dark brownish-grey to grey claystone. Mica and very fine lignitic matter are common. The formation can be very silty to sandy. It's also slightly calcareous.	1909	**1958**	1905	**1953**
			Late Hauterivian to Mid Barremian	Berkel Clastics KNNSC	Sandstone, light-grey, very fine- to coarse-grained, locally gravelly, lignitic, locally glauconitic or with sideritic concretions. Especially in the upper part calcareous cemented beds are common.	2143	**2220**	2125	**2200**
			Hauterivian	Rijswijk Sandstone KNNSR	Light- to medium-grey sandstones with a very fine to medium and locally gravelly grain size; mica, lignitic matter and siderite concretions are common.	2165	**2243**	2173	**2252**

	Schieland SL	**Nieuwerkerk** SLDN	*Late Valanginian to Early Hauterivian*	**Rodenrijs Claystone** SLDNR	**Medium- to dark-grey and dark brown, silty to sandy lignitic claystones with laminated or contorted bedding, and lignite/coal beds. The lower half has more and thicker layers of coal and sand. Traces of mollusc shells, pyrite and siderite.**	2204	**2287**	2219	**2301,5**
			Valanginian	**Delft Sandstone** SLDND	**Light-grey massive sandstone sequence, fine to coarse-gravelly, fining upward, lignitic. Shale/claystone intercalations.**	2273	**2363**	2289,5	**2377**
			Ryazanian to Valanginian	**Alblasserdam** SLDNA	**A succession of red and dark to light (brownish) grey clay(stones) and siltstones, fine to medium grained sandstones and massive, thick-bedded, coarse grained sandstones. Coal & lignite beds.**	2344	**2442**	2363	**2456**
RT to NAP = 7,8m; RT-GL= 8,7; GL-NAP= 0,9m; GL = 0,9m below NAP							TD	2496	**2600**

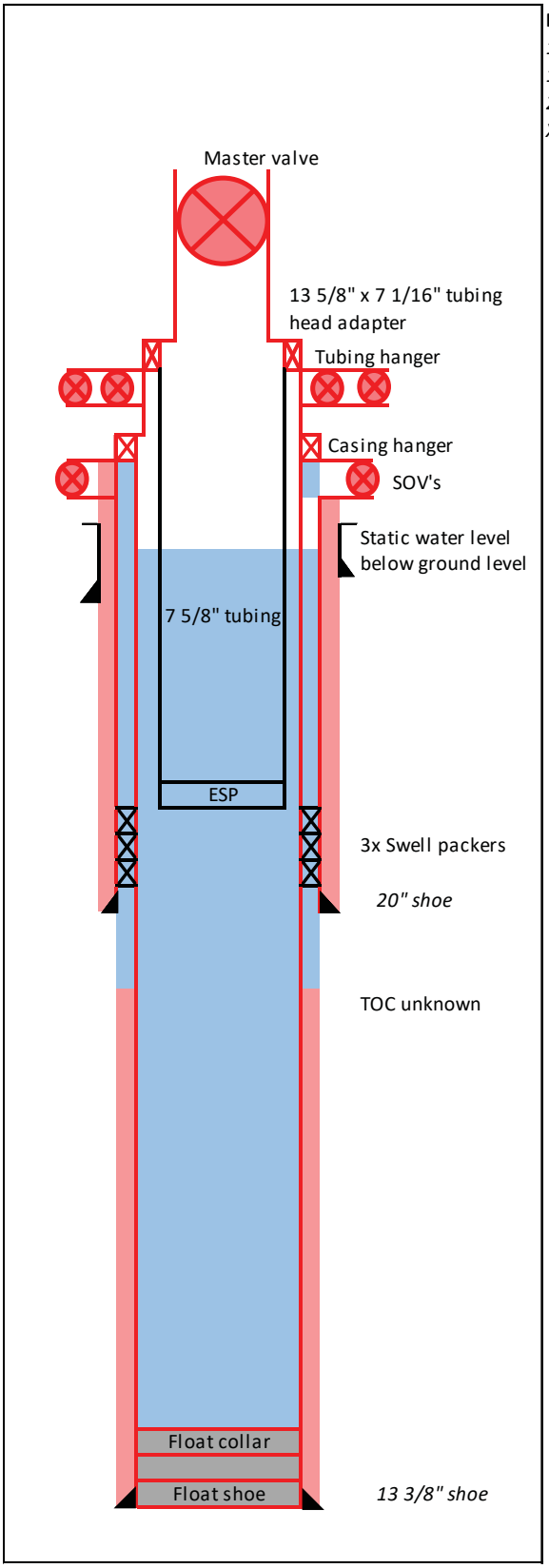
Table 5: Geological lithostratigraphic column

5. Well suspension status

5.1 Well status

Well is perforated and completed with an ESP on 7 5/8” 29.7# L80 GeoConn TK-15XT coated tubing. X-mas tree is installed (tubing head adapter and one 7 1/16” ball valve). Well is ready for production.

5.2 Well barrier schematic

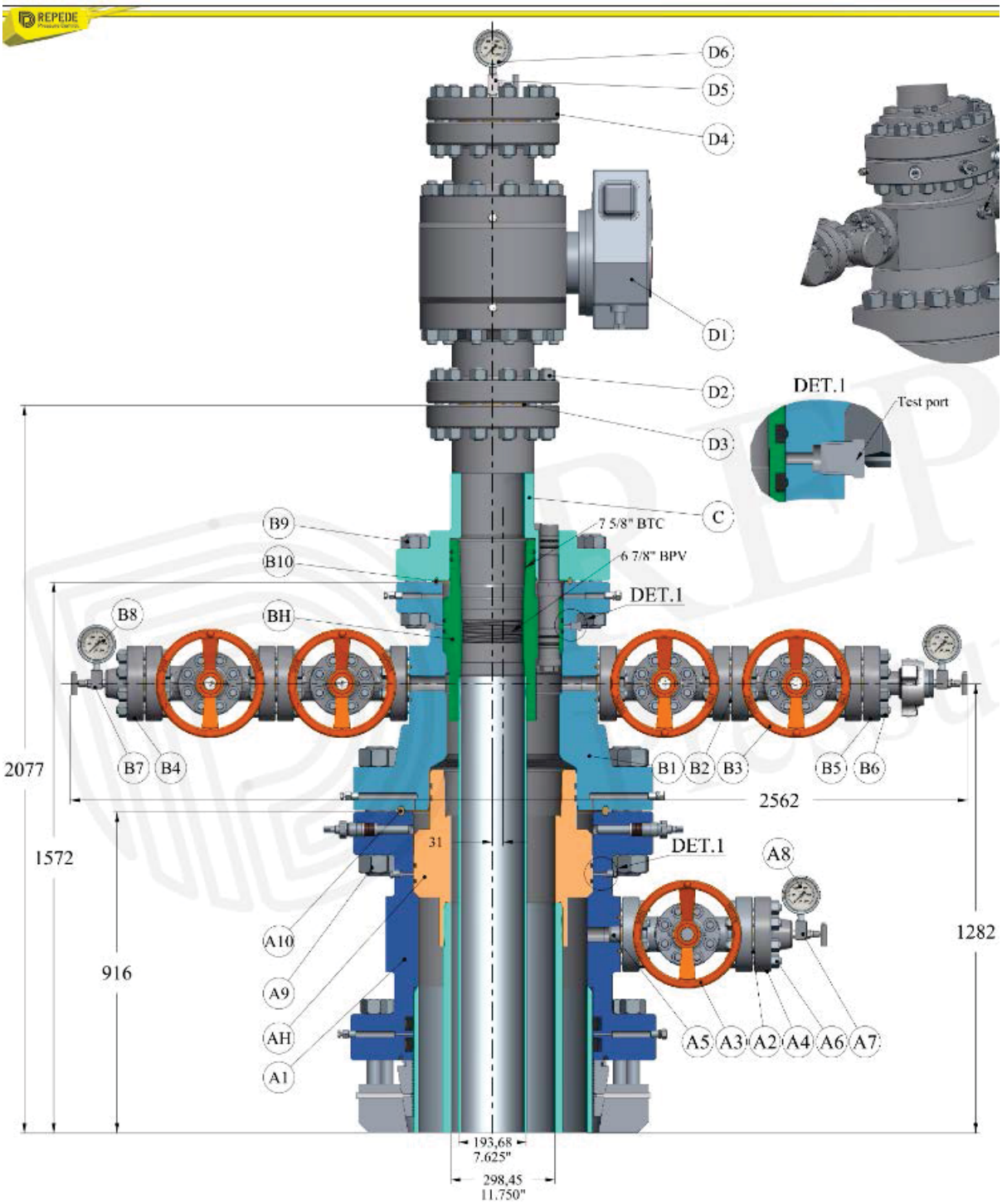


Primary barrier(s):
13 3/8" cemented casing
13 3/8" casing hanger seals
20" cemented casing
X-mas tree
Master valve
SOV's

Figure 5. Well barrier schematic after the drilling phase.

5.3 Wellhead and Christmas tree drawing

Below the schematic of the wellhead as it was suspended.
Pressure rating: 3000 psi
Temperature class: PU (-29 to 121°C)



Description	Material grade	Testing criteria	Status
CHH 20 ¾" 3K top flange	BB	PSL 2, PR1	-
2 1/16" SOV's (gate valve)	BB	PSL 2, PR1	Closed
20 ¾" Casing hanger (13 ⅜" VAMTOP box x box)	CC	PSL 2, PR2	
20 ¾" x 13 ⅝" Tubing head spool	CC	PSL 2, PR1	
13 ⅝" x 9 ⅝" Casing hanger (VAMTOP box x box)	CC	PSL 2, PR2	
4x 2 1/16" SOV's (gate valve)	CC	PSL 2, PR2	Closed
13 ⅝" tubing hanger Bottom: 7 ⅝" New VAM box Top: 7 ⅝" BTC (landing joint)	CC	PSL 2, PR2	6 ⅞ HBPV tread Ports: 1x ESP RMS penetrator 2x 1" LP 1x ½" LP
13 ⅝" 3K x 7 1/16" 3K Tubing head adapter	CC	PSL 2, PR2	
7 1/16" 3K Master valve (ball valve, soft seats, gear box hand operated)	CC	PSL 2, PR2	Closed