Overview mining activities

Quarterly meeting

Frisia Zout B.V. -SODM

9th of January 2018

Your Partners in Value Creation

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1. Updates BAS-1
2. Updates BAS-2
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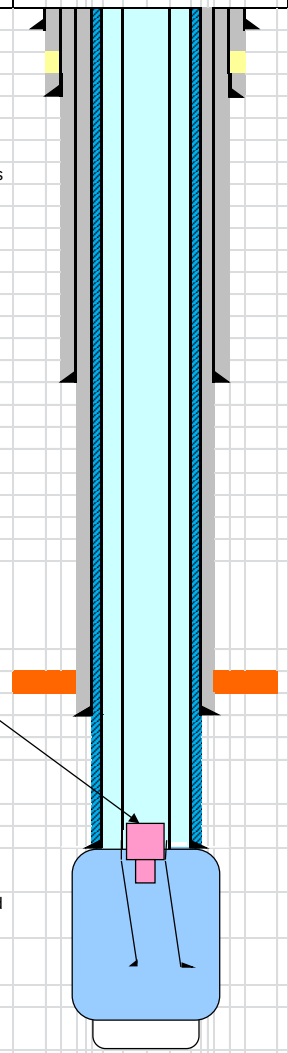
4. Updates BAS-4
   - Cavern end volume and production
5. Update subsidence
6. Update Havenmond
7. Wvttk

BAS-1

Item Description	Wellhead and Xmastree BAS 1 140527	Depth m tvd	Depth m ah	Pipe OD in	Collar OD in	Pipe ID in
36" stove pipe		40	40	28,000		
24" x 1/2" casing		494	494	24,000		
Top cement in 18 5/8 " x 13 3/8" annulus						
18 5/8" casing		1175	1175	18,625	20,000	17,688
13.3/8" Annulus filled with diesel/brine solution as of January 2013.						
Straddle Jan 2010; Top at; 2584md Minimum ID; 3.34" Bottom at;2589 md						
Base of Carnalite		2522	2522			
13 3/8" casing		2543	2543	13,375	14,375	12,895
Roof height from March 2011 neck echo measurement		2567	2567			
7" Leak at ~2586 m						
10 3/4" outer leaching string, internally coated		2587	2587	10,75	11,75	9,76
7" inner leaching string, internally coated		2787	2787	7,000	7,375	6,276
Sump Dec 2004		2832	2832			
Total Depth Cavern		2882	2882			



Freshwater
Water/Diesel Solution
1.20s.g. brine
Casing cement
Carnalite

* All depths are from ground level

Status

- **Maintain max pressure 10 3/4" at 232bar**
- **Bleed-off pressure every 4 weeks**
- **13 3/8" contains water, however at higher pressure then 10 ¾"**

Planned

- **HP-shut-in**

BAS-1

October 2017

2	Re-pressurize 13 3/8” annulus
16 - 18	Pressure bleed-off
19,20	Re-pressurize 13 3/8” annulus after bleed-off

November 2017

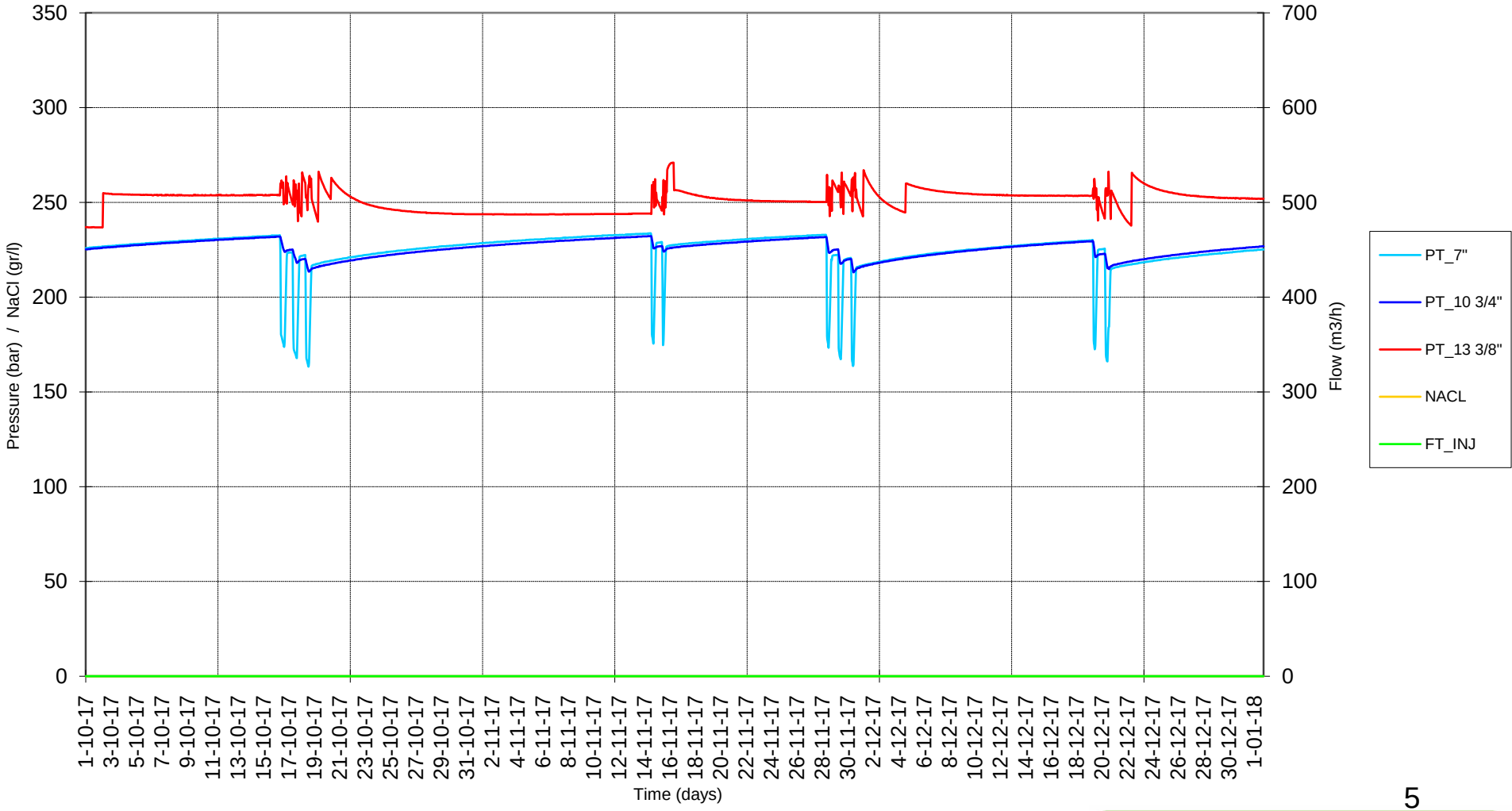
14, 15, 28, 29, 30	Pressure Bleed-off
15	Re-pressurize 13 3/8” after pressure bleed-off
16	De-pressurize 13 3/8” annulus

December 2017

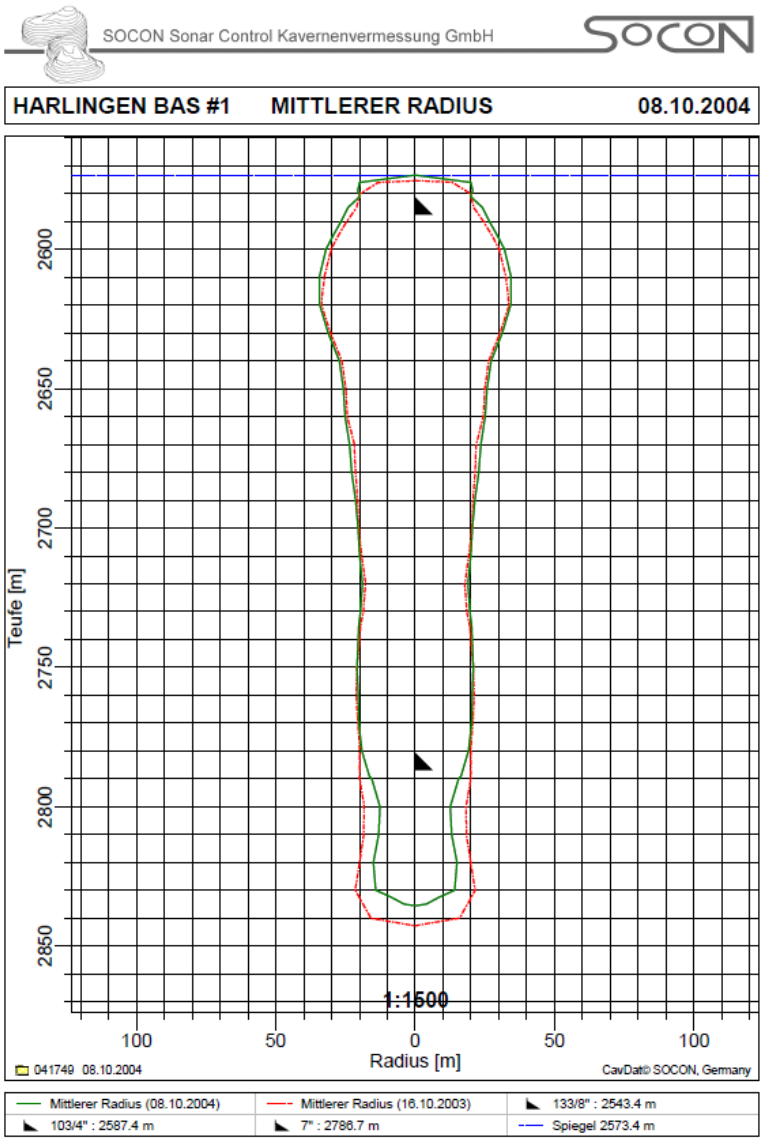
1, 5	Re-pressurize 13 3/8” after pressure bleed-off
19 - 20	Pressure Bleed-off
22	Re-pressurize 13 3/8” after pressure bleed-off

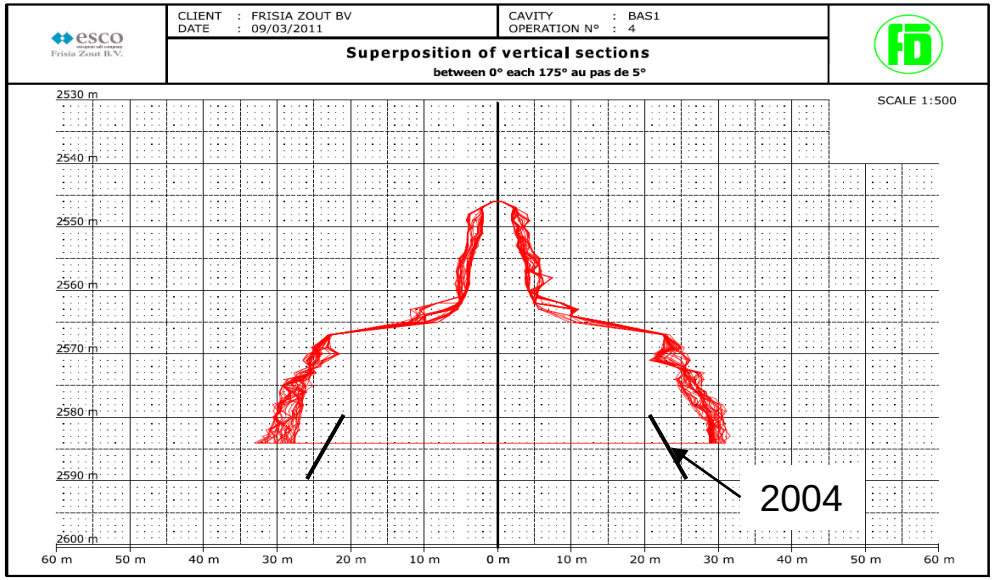
BAS-1

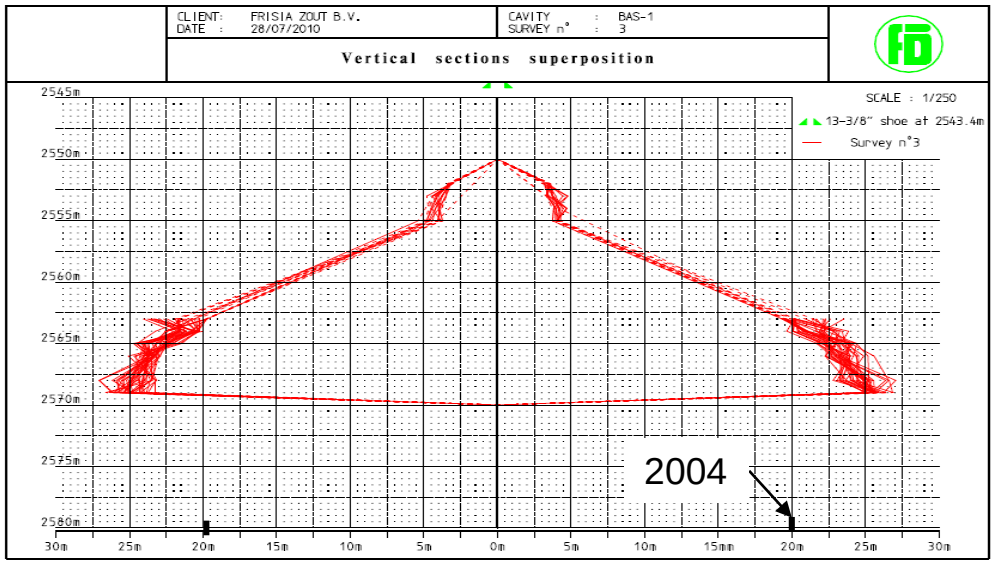
Trends BAS-1



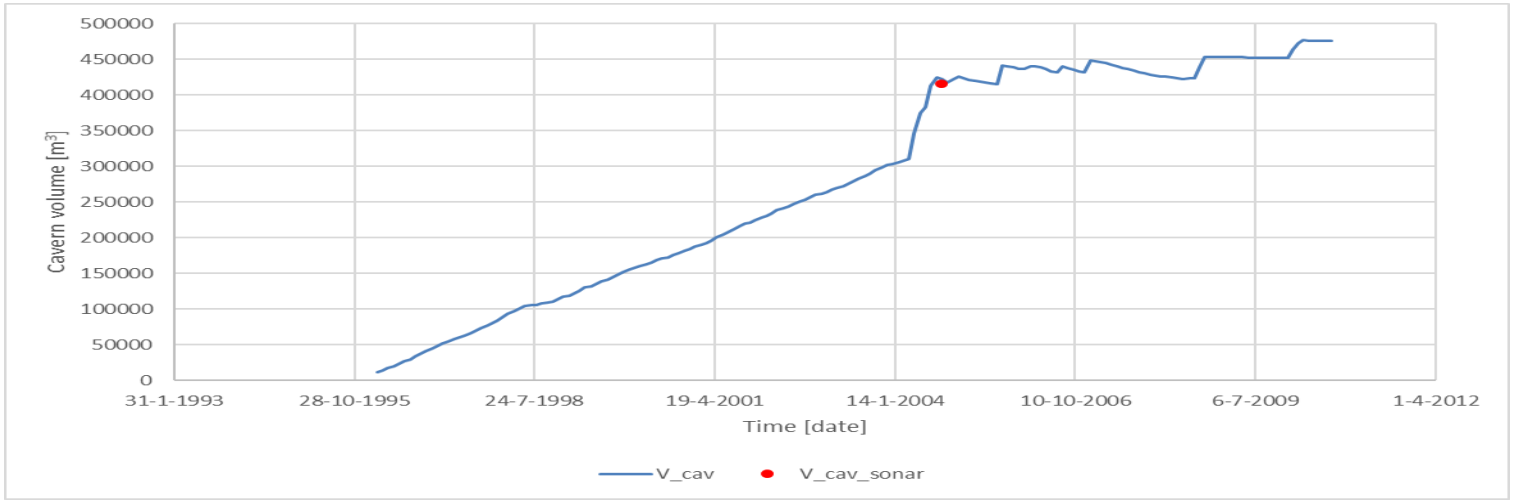
BAS-1 Sonar 2004 en 2010/2011

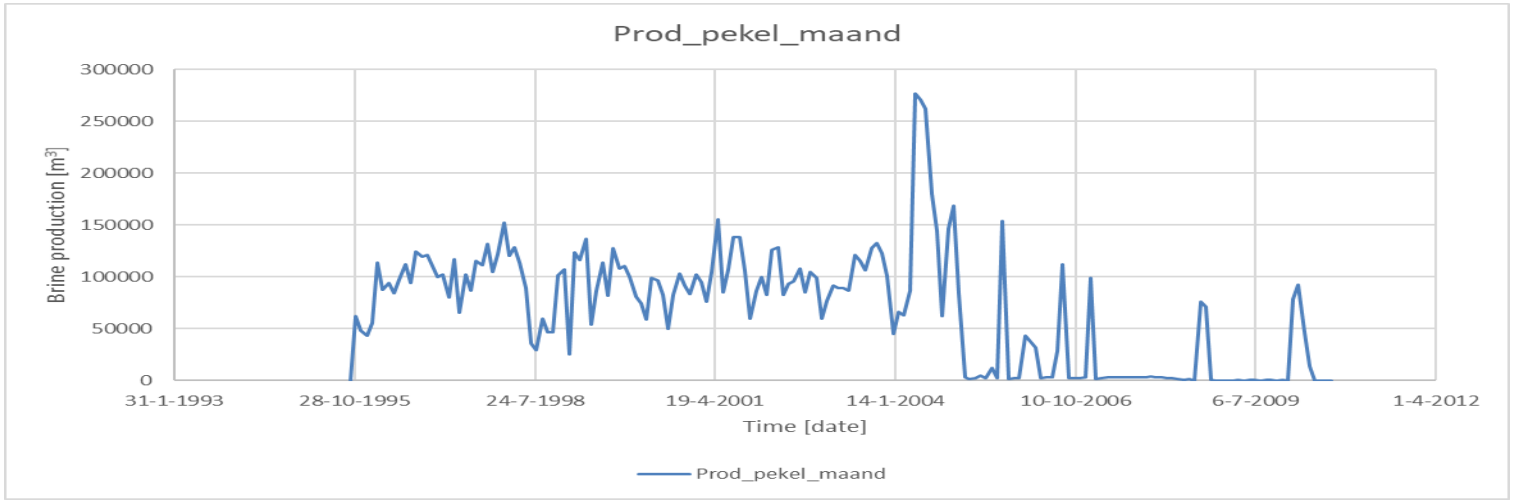




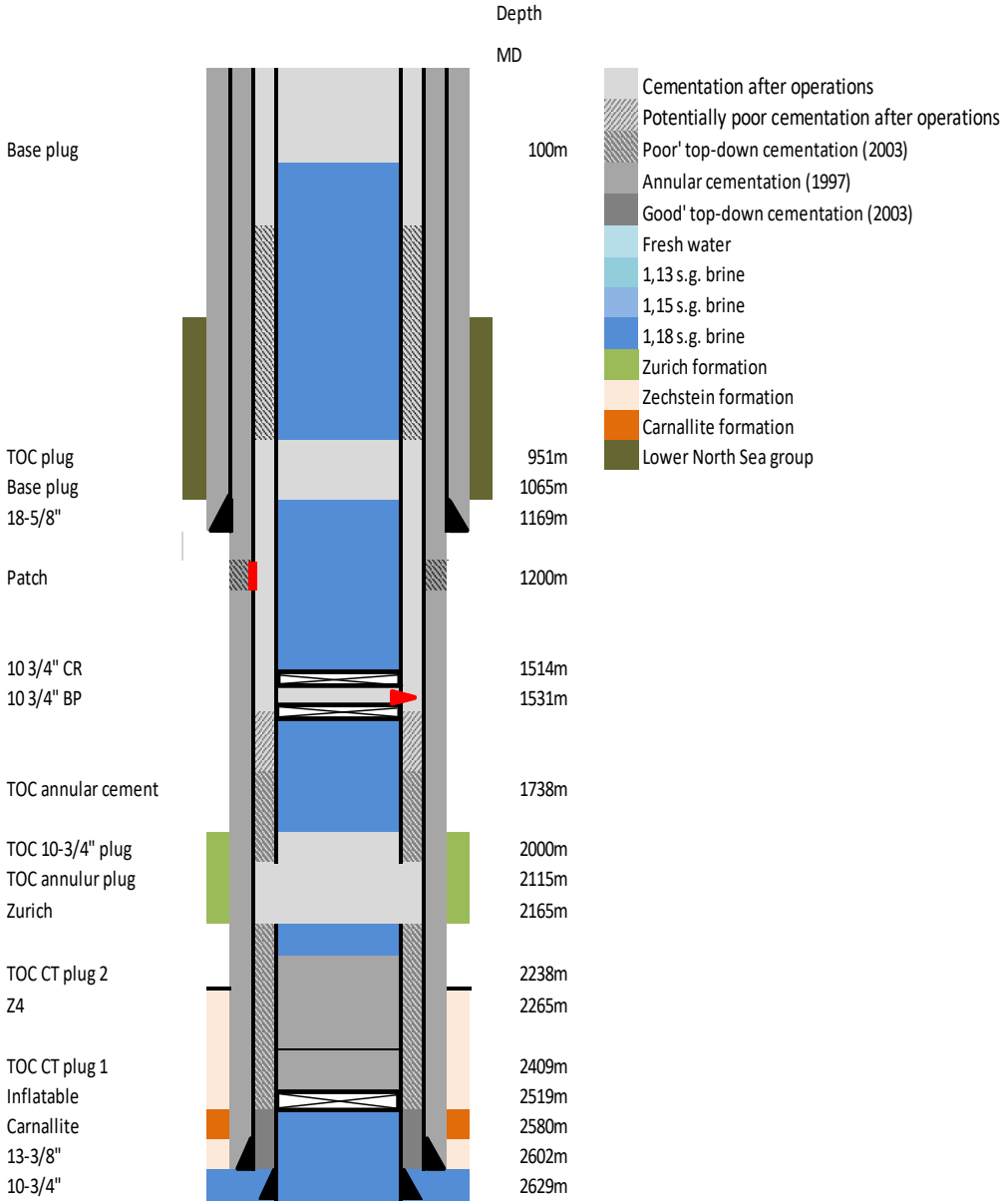


BAS-1
production and volume balance





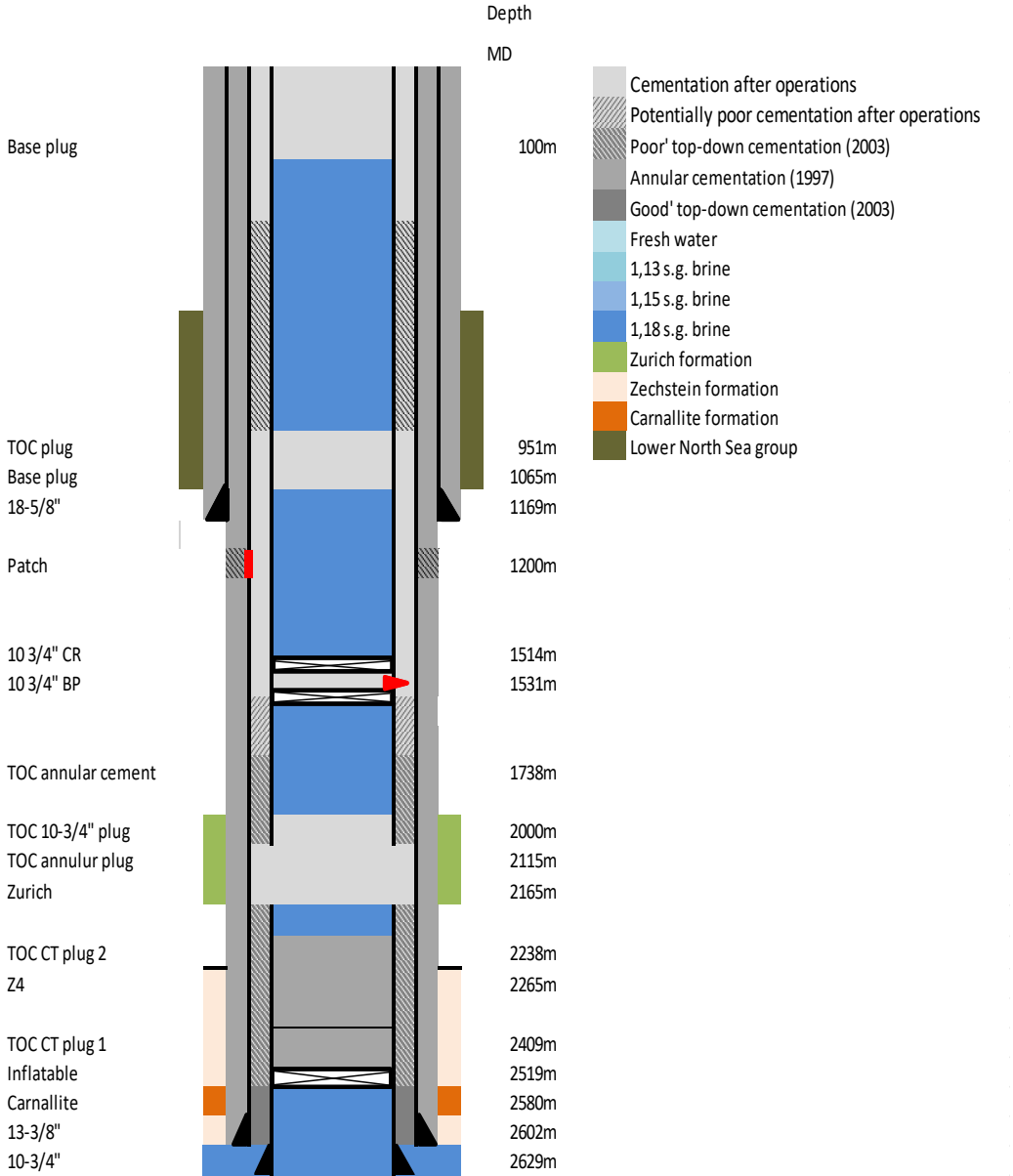
BAS-2



Status

- **Current:** Abandoned
- **Abandonment operations:**
  1. HydraWell plug as per program
     - No cavern pressure observed after perforations at 2115 m
     - No pressure observed on 13-3/8”
     - Performed 10T tag at 2000m and pressure tested to 250 bar from above (fluid volume required confirmed plug depth)
  2. Performed scraper run *(not initially in program)*
  3. Wireline operations
     1. Set 10-3/4” plug at 1530m
     2. Perforated 10-3/4” at 1525m and performed circulation tests

BAS-2



Status

4. Set CR at 1514m and performed annular cementation
   - Performed USI/CBL on annular cementation
6. Set secondary abandonment plug with base at 1065m on CST (MOC #3 shared with SodM 03-12-2017)
   - No slumping of plug observed
   - Plug tagged with 10T at 951m
4. Set environmental plug from 100 mBGL to surface
   - No slumping of plug observed

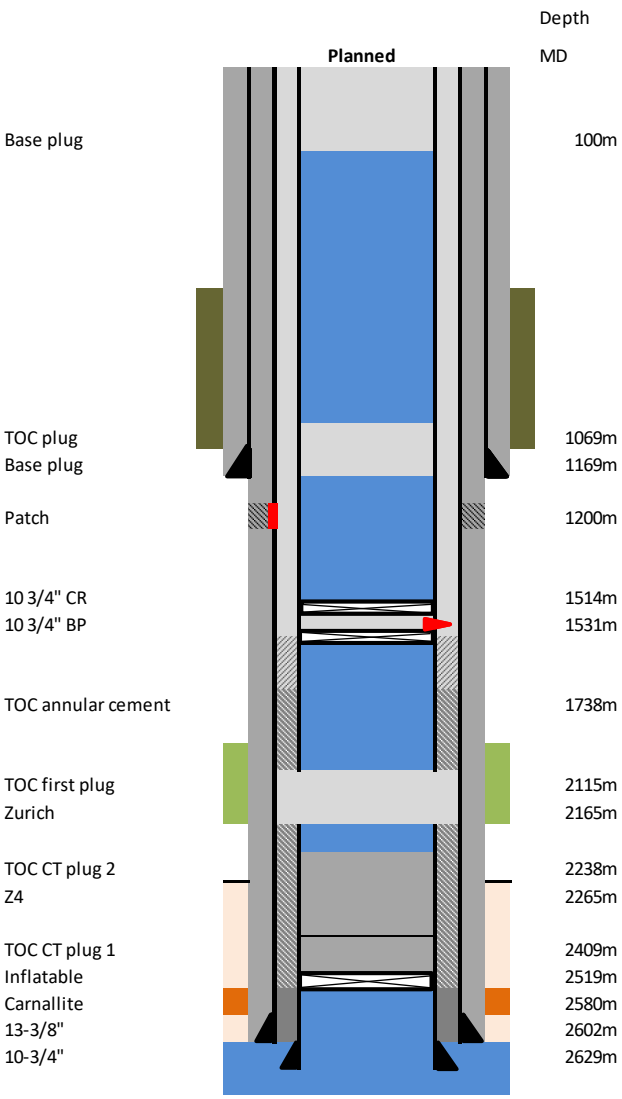
➢**Planned:**

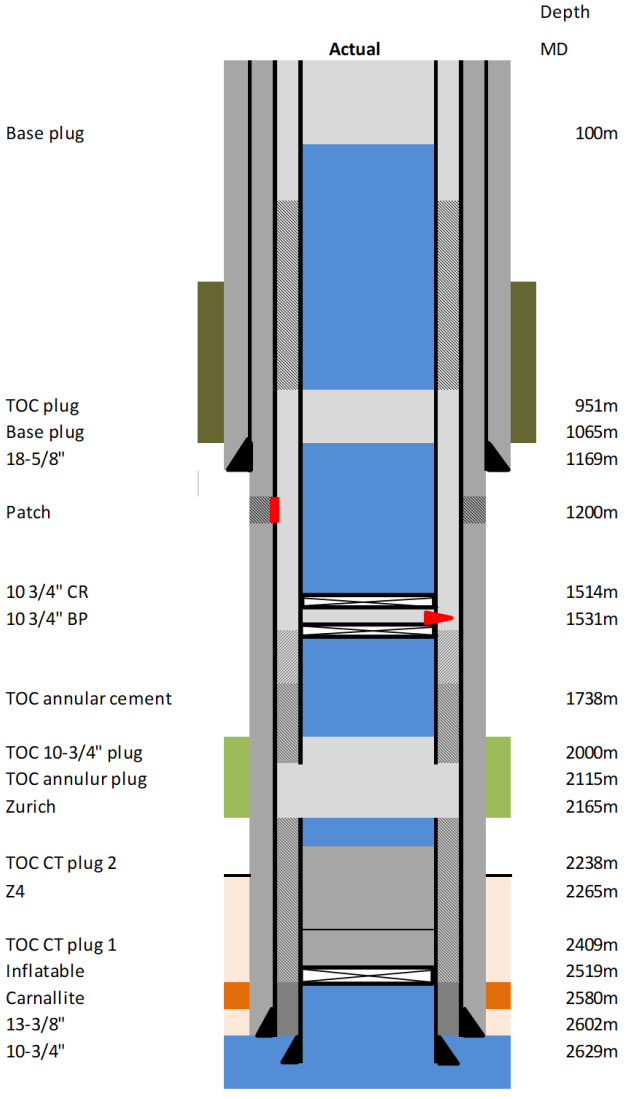
➢Remove casing/wellhead and cellar:

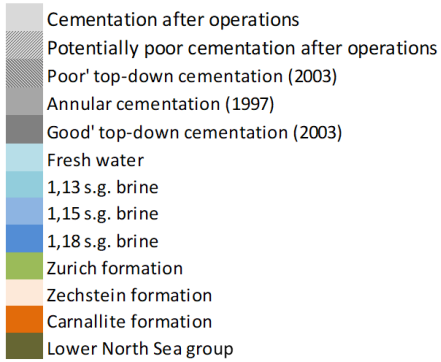
➢Ops. to start 15th of January

➢Casing to be cut 3 mBGL

BAS-2 P&A







BAS-2

October 2017

2	Bleed-off 7”, 10 ¾” x 7” and 13 3/8” for observation reasons

November 2017

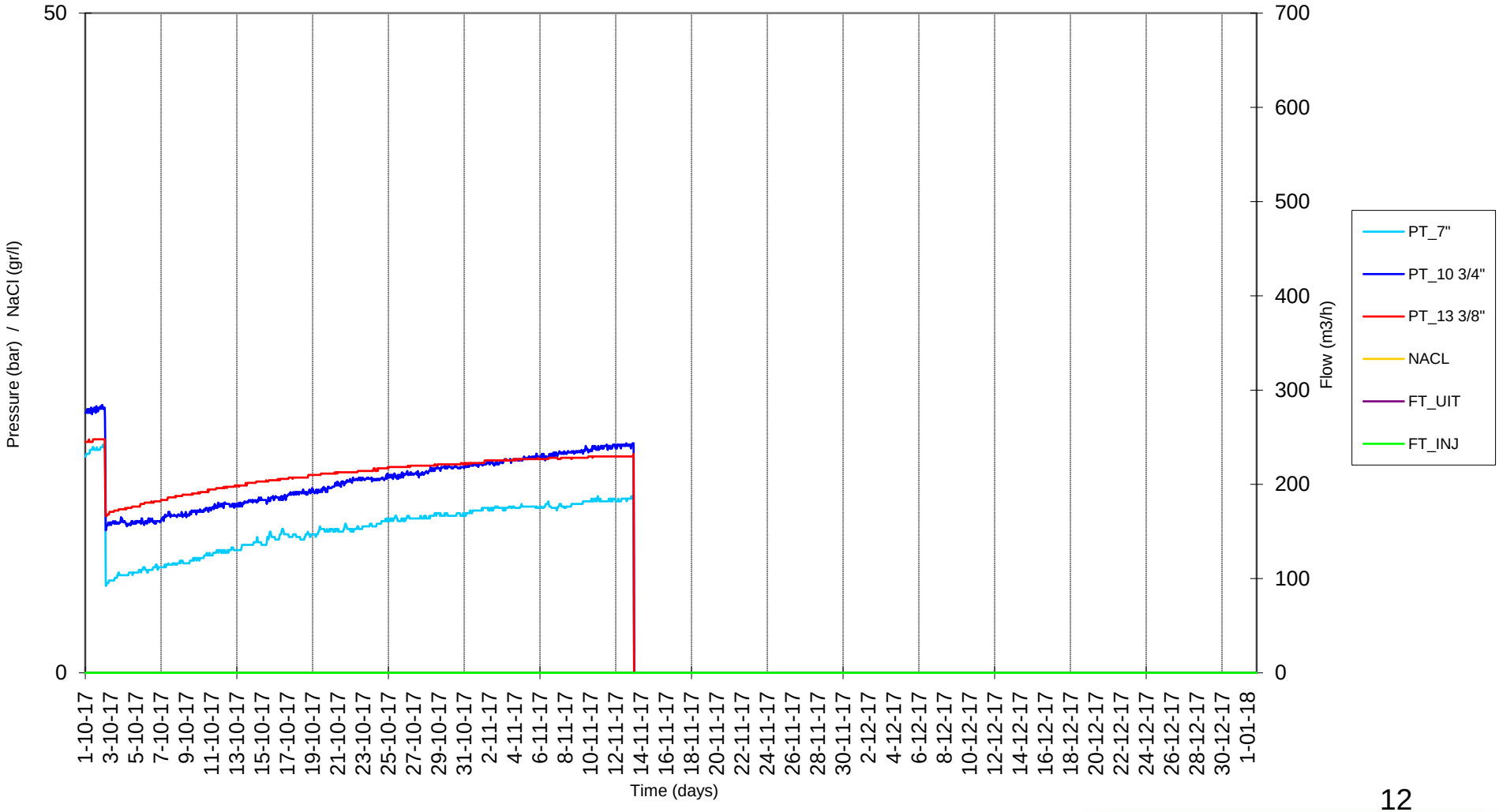
13 - 30	Abandonment operations

December 2017

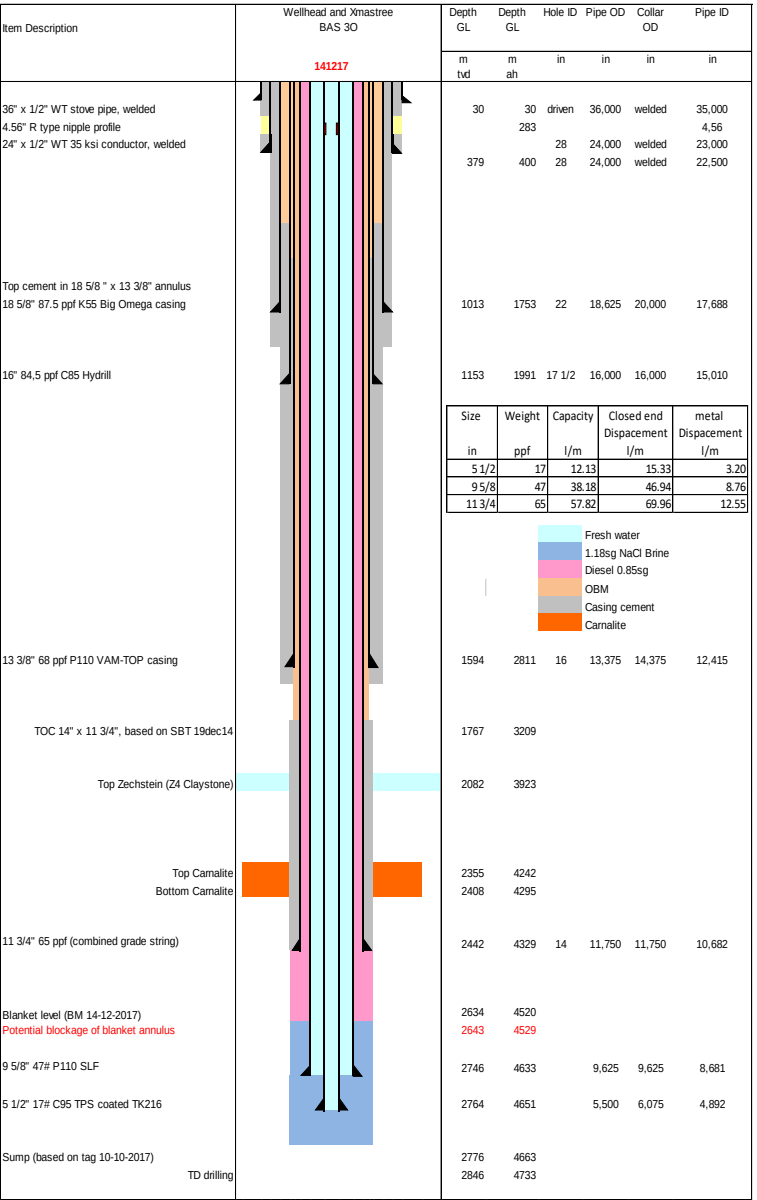
1-9	Abandonment operations

BAS-2

Trends BAS-2



BAS-3 Original



Status

- Top injection mode since May 2016
- Last echo measurement in May 2017, measured cavern volume: 338.144 m^3
  - Estimated cavern volume October 2017: 492.500 m^3
  - Next cavern measurement April 2018

Planned

- Continue top injection mode
- Blanket measurements every 4-8 weeks
- Workover → Change configuration inner/outer leaching string April 2018
- Remove blanket annulus blockage

BAS-3O

October 2017

2 - 4	Neck wash operations
10	Wireline blanket measurement
26, 30	Injection stop due to blocked filter
28	Production stop due to stop injection water supply

November 2017

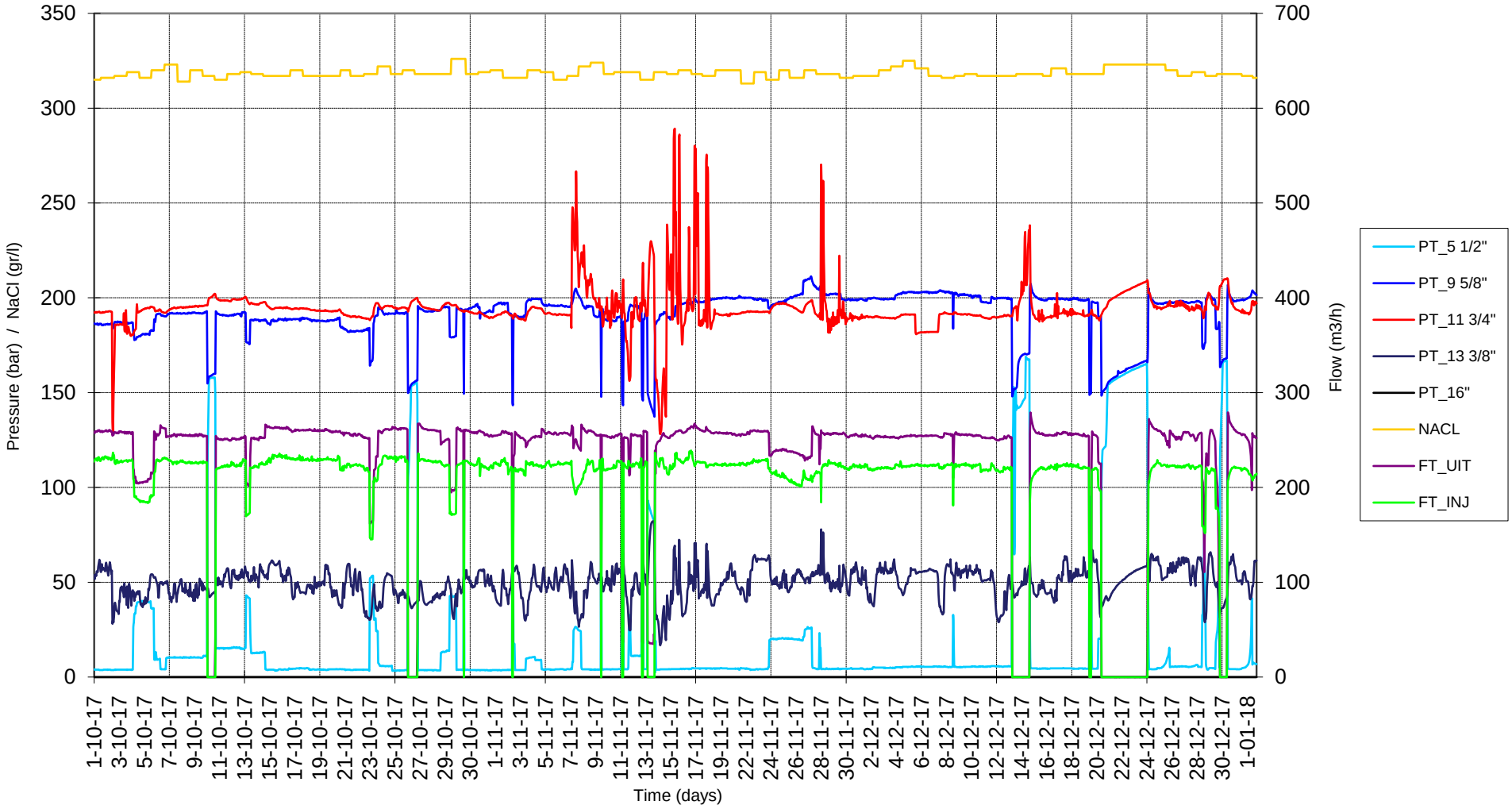
8-19, 28-30	13 3/8” annulus blockage
3, 10, 12	Injection stop due to pump failure

December 2017

5-7	Neck wash
13-14	Wireline blanket measurement
19	Injection stop due to maintenance pump
20-24	Injection stop due to maintenance at the factory
29-30	Counter flush

BAS-3O

Trends BAS-3O



BAS-4

Item Description	Depth GL m tvd	Depth GL m ah	Hole ID in	Pipe OD in	Collar OD in	Pipe ID in
Wellhead and Xmastree BAS 4 11112017						
28" x 1" X 52E conductor shoe	15	15	driven	28,000	welded	28,000
7" 29 ppf N80 VAM TOP inner leaching string, internally coated	319	319				
7" 26 ppf L80/N80Q VAM TOP inner leaching string, internally coated	366	366				
24" x 1/2" WT 35 ksi conductor, welded	279	279	26,00	24,000	welded	23,000
7" 29 ppf N80 VAM TOP inner leaching string, internally coated	319	319				
7" 26 ppf L80/N80Q VAM TOP inner leaching string, internally coated	366	366				
7" 29 ppf N80 VAM TOP inner leaching string, internally coated	577	577				
7" 23 ppf N80 VAM TOP inner leaching string	591	591				
7" 29 ppf N80 VAM TOP inner leaching string, internally coated	604	604				
7" wireline profile 5.75" Otis 'RPT'	966	966				5,75
Top cement in 18 5/8 " x 13 3/8" annulus	916	916				
18 5/8" 87.5 ppf K55 Big Omega casing	1126	1126	22,00	18,625	20,000	17,688
Freshwater / Brine 1.18 s.g. / Diesel 0.85 s.g. / Drilling Fluid / Casing cement / Carnalite						
13 3/8" 68 ppf P110 VAM-TOP casing	1980	1980	16,00	13,375	14,375	12,415
Base of Carnalite	2382	2382				
14" heavy wall VAM TOP 106 ppf N80	2410	2410	16,00	14,000	14,000	12,500
BM 23-10-2017	2470,6	2470,6				
EM (Oct 2015, Roof = 2478m) Mar 2012, Not possible to inject more diesel below 2496m ->indicating leak at that point in 11 3/4" connection.						
11 3/4" 65 ppf VM 80HC, VAM FJL outer leaching string, internally coated	2506	2506	26	11,750	11,965	10,682
	2509	2509				
	2530	2530				
7" 26 ppf N80 VAM TOP inner leaching string, internally coated. Explosive cut.	2628	2628	17 1/2"	7,000	7,375	6,276
Sump level Oct 2017 (EM)	2639	2639				
Total Depth Cavern	2810	2810				

* All depths are from ground level

Remarks

- Production to fit factory requirements
- Workover to restore 7” casing performed early November
  - HUD observed during WL operations
  - Cut 7” and added new joints 7”
  - Sonar measurement: 1.040.000 m^3 (incorrect)
- Current cavern volume (volume balance): 976.900 m^3

Planned

- Sonar measurement end of January 2018
- Continue bottom injection mode
- Blanket measurement (every 6 months)
- Increase back-pressure
- Update winningsplan

BAS-4

October 2017

1-14	Production / injection stop due to repair on brine flow line
14-20	Pressure bleed-off to restart production
18	Partial blockage in production annulus due to high salt concentrations. Production annulus was counter flushed with fresh water
20	Restart production
26	Injection stop due to maintenance on injection pump

November 2017

1-3	Wireline operations in preparation to workover
3-11	Workover; cut and add 7” casing
17	Start production

December 2017

20-25	Injection stop due to maintenance at the factory

BAS-4 WO

Item Description	Wellhead and Xmastree BAS 4	Depth GL m tvd	Depth GL m ah	Hole ID in	Pipe OD in	Collar OD in	Pipe ID in
	Pre-HWU ops						
28" x 1" X 52E conductor shoe		15	15	driven	28,000	welded	28,000
7" 29 ppf N80 VAM TOP inner leaching string, internally coated		129	129				
7" 26 ppf L80/N80Q VAM TOP inner leaching string, internally coated		176	176				
24" x 1/2" WT 35 ksi conductor, welded		279	279	26,00	24,000	welded	23,000
7" 29 ppf N80 VAM TOP inner leaching string, internally coated		387	387				
7" 23 ppf N80 VAM TOP inner leaching string, internally coated		401	401				
7" 29 ppf N80 VAM TOP inner leaching string, internally coated		414	414				
7" wireline profile 5.75" Otis 'RPT'		778	778				5,75
Top cement in 18 5/8 " x 13 3/8" annulus		916	916				
18 5/8" 87.5 ppf K55 Big Omega casing		1126	1126	22,00	18,625	20,000	17,688
	Freshwater / Brine 1.18 s.g. / Diesel 0.85 s.g. / Drilling Fluid / Casing cement / Carnalite						
13 3/8" 68 ppf P110 VAM-TOP casing		1980	1980	16,00	13,375	14,375	12,415
Base of Carnalite		2382	2382				
14" heavy wall VAM TOP 106 ppf N80		2410	2410	16,00	14,000	14,000	12,500
BM 21-02-2017, (2472,5 m)		2473	2473				
EM (Oct 2015, Roof = 2478m) Mar 2012, Not possible to inject more diesel below 2496m ->indicating leak at that point in 11 3/4" connection.							
11 3/4" 65 ppf VM 80HC, VAM FJL outer leaching string, internally coated		2508	2508	17 1/2"	11,750	11,965	10,682
Observed HUD in 7" with Camera (11-May-2017)		2509	2509				
29-9-2016: observed unusual CCL and inclination results (0-3 degrees) from 2530m to 2543m		2530	2530				
7" 26 ppf N80 VAM TOP inner leaching string, internally coated.		2636	2636	17 1/2"	7,000	7,375	6,276
Sump level (calculated)		2641	2641				
Total Depth Cavern		2810	2810				
* All depths are from ground level							

- **Wireline operations**
  - **Cut 7” casing with explosive cutter (unsuccessful)**
  - **Perform camera investigation of cuts**
  - **Perform additional cutting operation (successful)**
  - **Set 7” internal barrier (bridge plug)**
    - **Casing collapsed after pressure bleed-off**
  - **Perform casing integrity measurement**
    - **Poor section found just above bridge plug; probably re-used casing. Remainder of casing in good condition**
  - **Additional 7” cut above bad section**
  - **Set internal barriers 7” casing above bad section.**

BAS-4 WO

Item Description	Depth GL m tvd	Depth GL m ah	Hole ID in	Pipe OD in	Collar OD in	Pipe ID in
Wellhead and Xmastree BAS 4 11112017						
28" x 1" X 52E conductor shoe	15	15	driven	28,000	welded	28,000
7" 29 ppf N80 VAM TOP inner leaching string, internally coated	319	319				
7" 26 ppf L80/N80Q VAM TOP inner leaching string, internally coated	366	366				
24" x 1/2" WT 35 ksi conductor, welded	279	279	26,00	24,000	welded	23,000
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7" wireline profile 5.75" Otis 'RPT'	966	966				5,75
Top cement in 18 5/8 " x 13 3/8" annulus	916	916				
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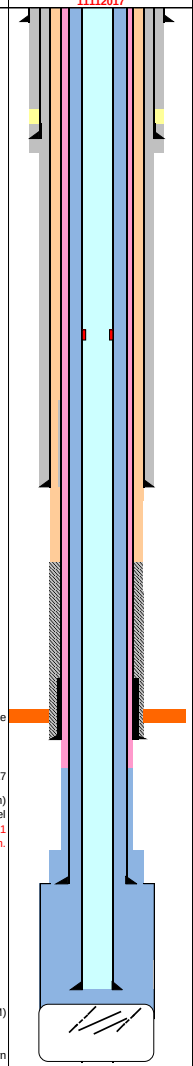
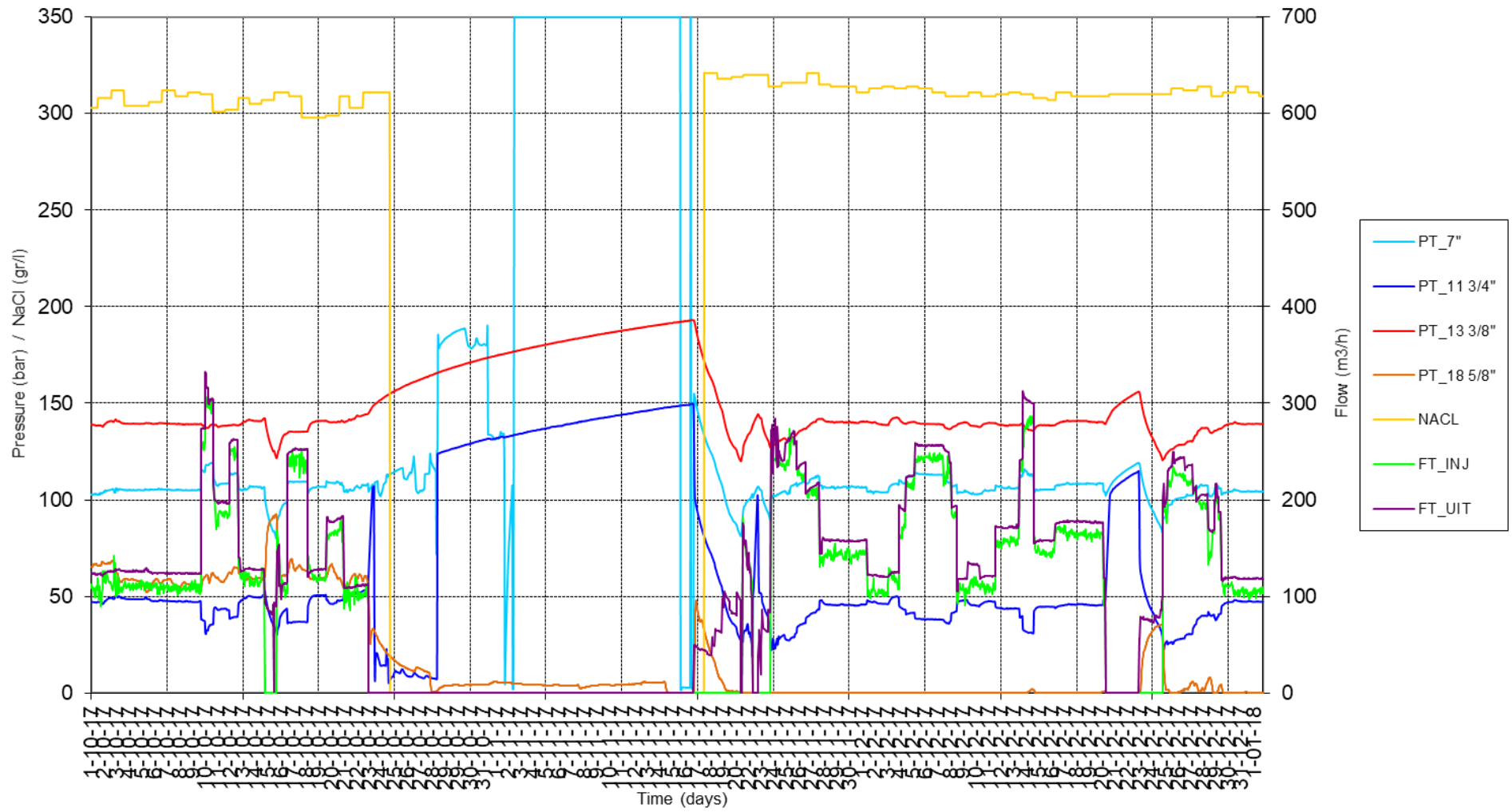
Base of Carnalite	2382	2382				
14" heavy wall VAM TOP 106 ppf N80	2410	2410	16,00	14,000	14,000	12,500
BM 23-10-2017	2470,6	2470,6				
EM (Oct 2015, Roof = 2478m) Mar 2012, Not possible to inject more diesel below 2496m ->indicating leak at that point in 11 3/4" connection.						
11 3/4" 65 ppf VM 80HC, VAM FJL outer leaching string, internally coated	2506	2506	26	11,750	11,965	10,682
	2509	2509				
	2530	2530				
7" 26 ppf N80 VAM TOP inner leaching string, internally coated. Explosive cut.	2628	2628	17 1/2"	7,000	7,375	6,276
Sump level Oct 2017 (EM)	2639	2639				
Total Depth Cavern	2810	2810				



* All depths are from ground level

- **With HWU**
  - **added 15 joints of 7” casing**
- **With wireline**
  - **Retrieved 7” internal barriers**

BAS-4



BAS-4
Cavern end volume

Letter from SodM to Frisia: August 28th 2017

- Larger cavern end volume of 1,3 mil m^3 (winningsplan Barradeel II states indicative end-volume of: 0,5 mil m^3 to 1,0 mil m^3)
- Significant change in mining method from squeeze mining at steady state cavern volume to solution mining with growing cavern volume.

BAS-4
Cavern end volume

Reaction from Frisia to SodM: November 1st 2017

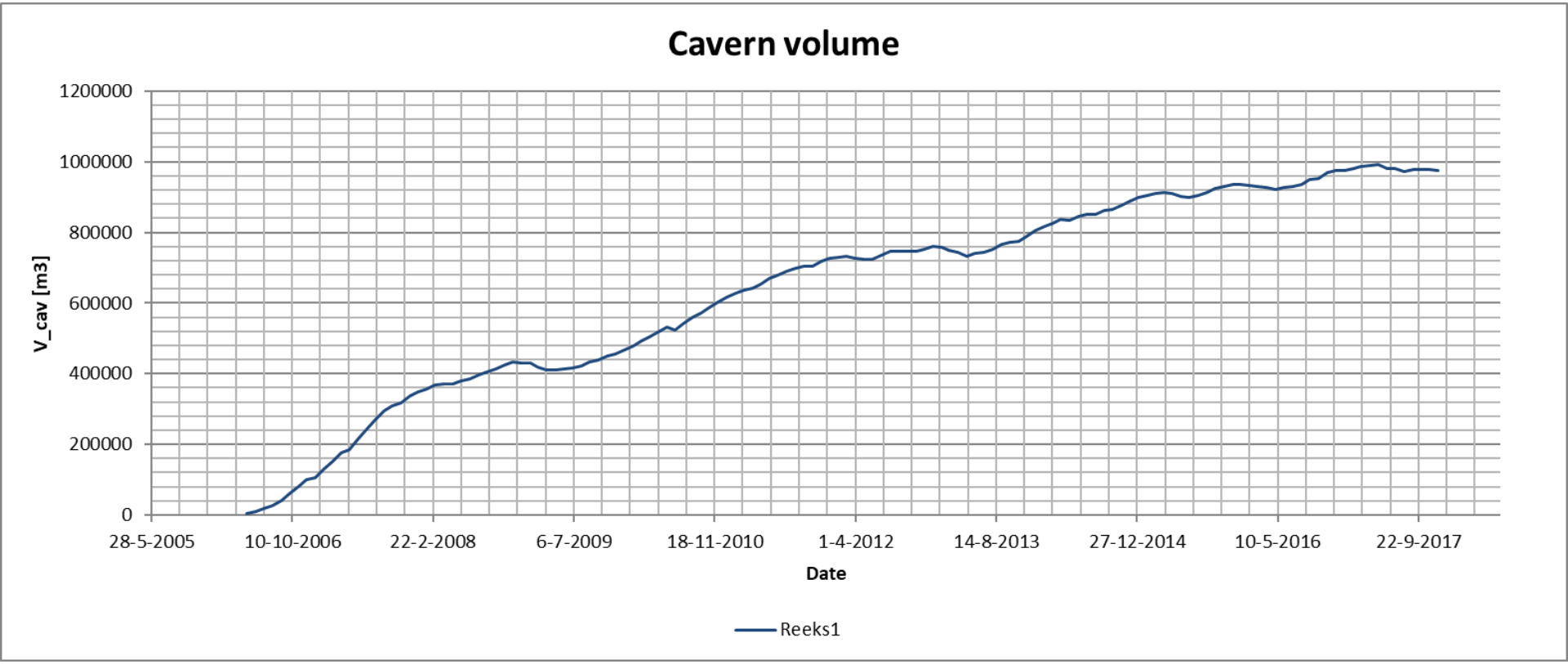
- It is not unlikely BAS-4 will temporarily grow to a volume more than 1.000.000 m^3. However, end volume of the cavern will not necessarily be more than 1.000.000 m^3.
- The pressures to be applied with the new pumps of BAS-4 are within specifications of the wells and are already regularly applied to the wells. BAS-4 production is now secondary to BAS-3O production depending on production requirements. These changes are within the Barradeel II concession.

BAS-4
Cavern end volume

Letter from SodM to Frisia: December 5th 2017

- Cavern end volume of 1.000.000 m^3 until approval of actualisation of winningsplan
- Curren cavern volume over 1.000.000 m^3 will be deducted from subsidence budget
- Production at higher pressures is within limits of current winningsplan
- Remaining production from the 1st of December 2017 onwards: 300.000 tons (within current winningsplan)

Volume balance BAS-4



Waterpassing

M&R 2017

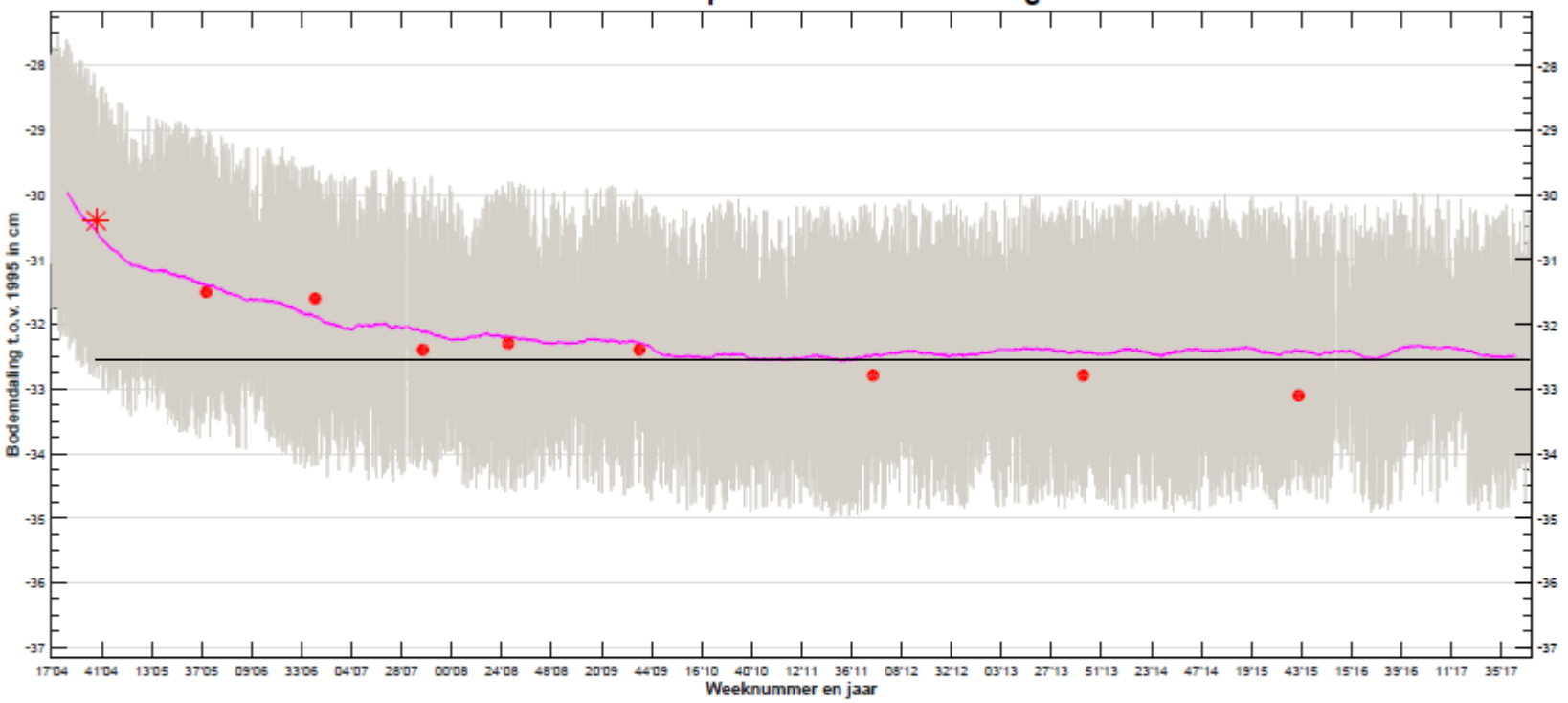
- Measurements were performed November/December 2017, to be analyzed by Antea Jan 2018

Subsidence winningsplan:	**BAS-3O**	**BAS-4**
Winningsplan (Barradeel II):	300 mm	300 mm
Current GPS:	177,8 mm	267,7 mm
Subsidence above the cavern:	197,3 mm	267,7 mm
Subsidence / year current*:	6,0 mm/y	17,7 mm/y

** Based on full previous year*

GPS BAS 1/2

Bodemdaling GPS station Barradeel*
Resultaten uit permanente GPS meting***

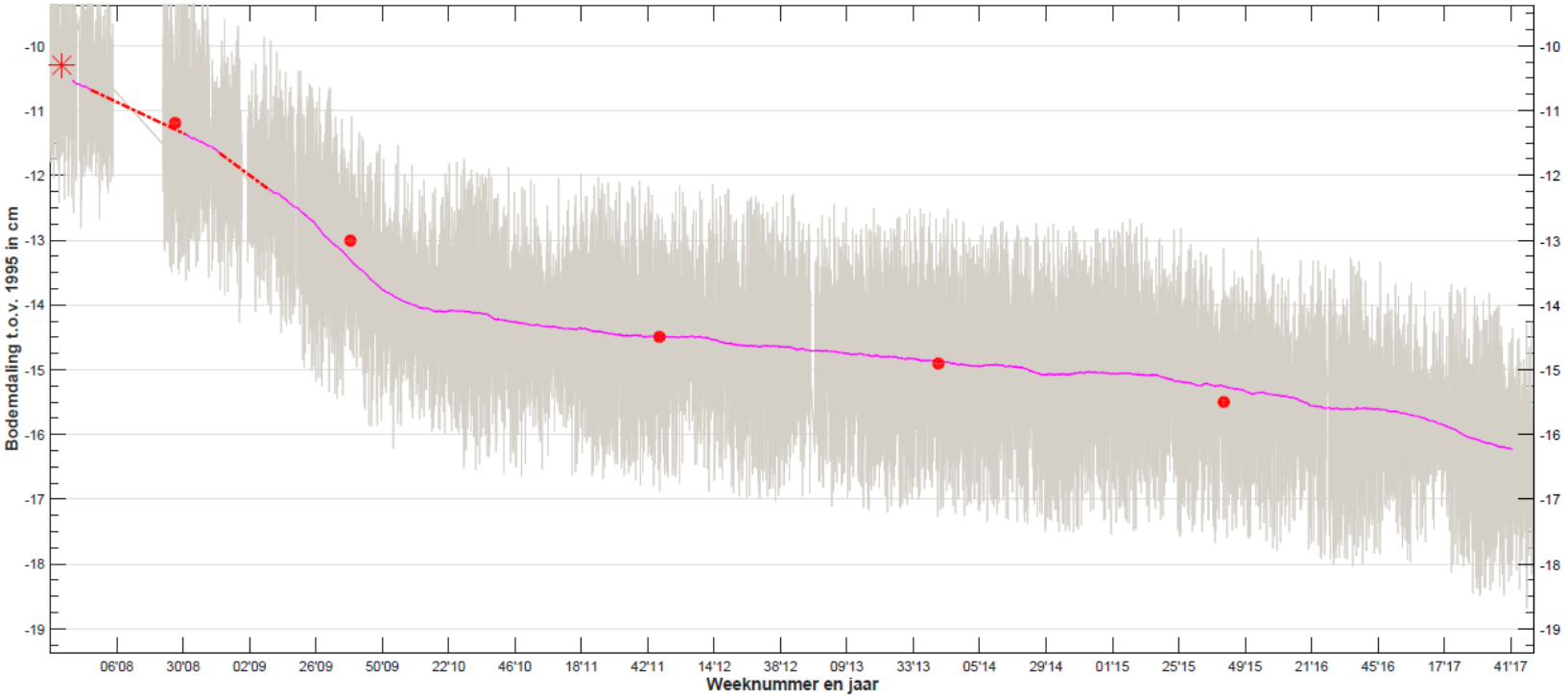


- Moving Average 16 weken
- Gemeten bodemdaling
- Week 40 2004 = -30.4 cm**
- Week 40 2005 = -31.5 cm**
- Week 40 2006 = -31.6 cm**
- Week 40 2007 = -32.4 cm**
- Week 29 2008 = -32.3 cm**
- Week 40 2009 = -32.4 cm**
- Week 47 2011 = -32.8 cm**
- week 44 2013 = -32.8 cm**
- week 43 2015 = -33.1 cm**

* Op basis van WEP Analyse WP 2015 bedraagt in 2015 daling van diepste punt in winningsvergunning Barradeel 1,65 cm meer dan daling van GPS-station Barradeel.
** Daling GPS station berekend uit "best fit' dalingskommen. (ref. WP 2015 Zweins, glijdende PM, 3 kommen v1.2- Dkrit 13 mm, gamma 4,3)
*** GPS is een relatieve meting tussen station Barradeel en het station te Zweins. De relatieve GPS meting is gekoppeld aan de abolute daling vastgesteld in WP 2004 (rode ster)

GPS BAS 3/3O

Bodemdaling Barradeel II GPS station BAS-3* & BAS-3-O
Resultaten uit permanente GPS meting***

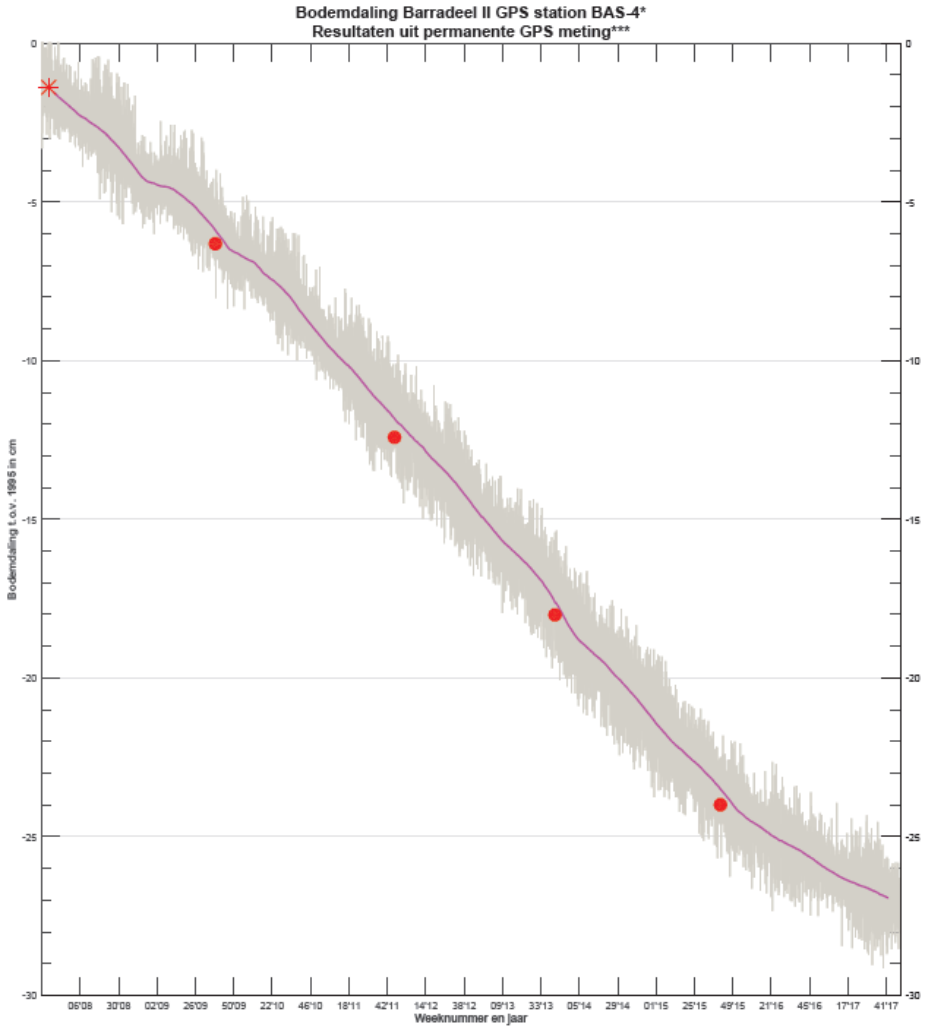


* week 40 2007 = -10.3 cm**
week 29 2008 = -11.2 cm**
week 40 2009 = -13.0 cm**
week 47 2011 = -14.5 cm**
week 44 2013 = -14.9 cm**
week 43 2015 = -15.5 cm**

Gemeten bodemdaling
uitval verbinding
Moving Average 16 weken

* Op basis van WEP Analyse WP 2015 bedraagt in 2015 bodemdaling boven caverne BAS-3 1,95 cm meer dan daling van GPS-station BAS-3.
** Daling GPS station berekend uit "best fit' dalingskommen. (ref. WP 2015 Zweins, glijdende PM, 3 kommen v1.2- Dkrit 13 mm, gamma 4,3)
*** GPS is een relatieve meting tussen station BAS-3 en het station te Zweins. De relatieve GPS meting is gekoppeld aan de abolute daling vastgesteld in WP 2007 (rode ster)

GPS BAS-4



* Op basis van WEP Analyse WP 2015 bedraagt in 2015 bodemdaling boven caverne BAS-4 0,3 cm meer dan daling van GPS-station BAS-4.

** Daling GPS station berekend uit "best fit' dalingskommen. (ref. WP 2015 Zweins, glijdende PM, 3 kommen v1.2- Dirrit 13 mm, gamma 4,3)

*** GPS is een relatieve meting tussen station BAS-4 en het station te Zweins. De relatieve GPS meting is gekoppeld aan de absolute daling vastgesteld in WP 2007 (rode ster)

GPS logbook

28-08-2017	*Alle*	*Storing station Zweins, 28-08-2017 09.00 uur t/m 29-08-2017 12.00 uur.*

Waterpassing

M&R 2015 – Addendum II

➢Actiepunt M&R 2015: kanttekening vanuit SodM bij Gaussische modellering van bodemdaling, die in de beheerscyclus wordt toegepast:

1. Verwerpingsprocedure van individuele peilmerken en de gemiddelde afwijking van de peilmerkhoogten in de modellering van bodemdaling

De modelleringsparameter Gem.PM-afw is een globale restwaarde, die aangeeft hoeveel de gemeten daling van de peilmerken gemiddeld afwijkt van de gemodelleerde daling.

Nulhypothese: in epoche ‘oktober 2015’ is op positie y de gemeten peilmerkhoogte h_{gem} gelijk aan de Gaussisch gemodelleerde komhoogte h_{mod}, die is bepaald met behulp van de hoogten van alle gebruikte peilmerken. Indien de gemeten hoogte h_{gem} meer dan 13 mm afwijkt van h_{mod} is met 80% zekerheid aan te nemen dat de gemeten hoogte niet past bij de gemodelleerde kom.

Waterpassing

M&R 2015 – Addendum II

➢Actiepunt M&R 2015: kanttekening vanuit SodM bij Gaussische modellering van bodemdaling, die in de beheerscyclus wordt toegepast:

2. Modellering van bodemdaling vanaf de start in 2008 van zoutproductie uit caverne BAS-4 met inschakeling van een flexibele komvorm-parameter gamma.

Modelleringsresultaten in termen van RMS en Gem.PM-afw worden verbeterd bij gebruik van flexibele gamma-parameter. Echter gaat dit ten koste van toegenomen maximum daling in de respectievelijke dalingskommen.

Uit analyse van BAS-4 bodemdaling gemeten door GPS en waterpassingen blijkt dat de GPS-antenne metingen praktisch identiek is aan de waterpassingen (respectievelijk 223 mm en 220 mm).

Waterpassing

M&R 2015 – Addendum II / Proposal subsidence analysis procedure 2017

➢Voorstel voor procedure 2017: toepassen van conventionele contourkaarten, gecorrigeerd voor autonome bodemdaling, in plaats van Gaussische iteratieve voorwaartse modellering

➢Voorgestelde procedure:

1. De peilmerkbewegingen worden gemeten ten behoeve van de beheerscyclus

2. Uit de totale bodemdaling wordt bodemdaling door zoutwinning gefilterd, met toepassing van correcties voor lokale autonome peilmerkbewegingen

3. Een kaart met bodemdalingscontouren wordt samengesteld die representatief is voor het effect aan het maaiveld van alleen de zoutwinning van Frisia.

Waterpassing

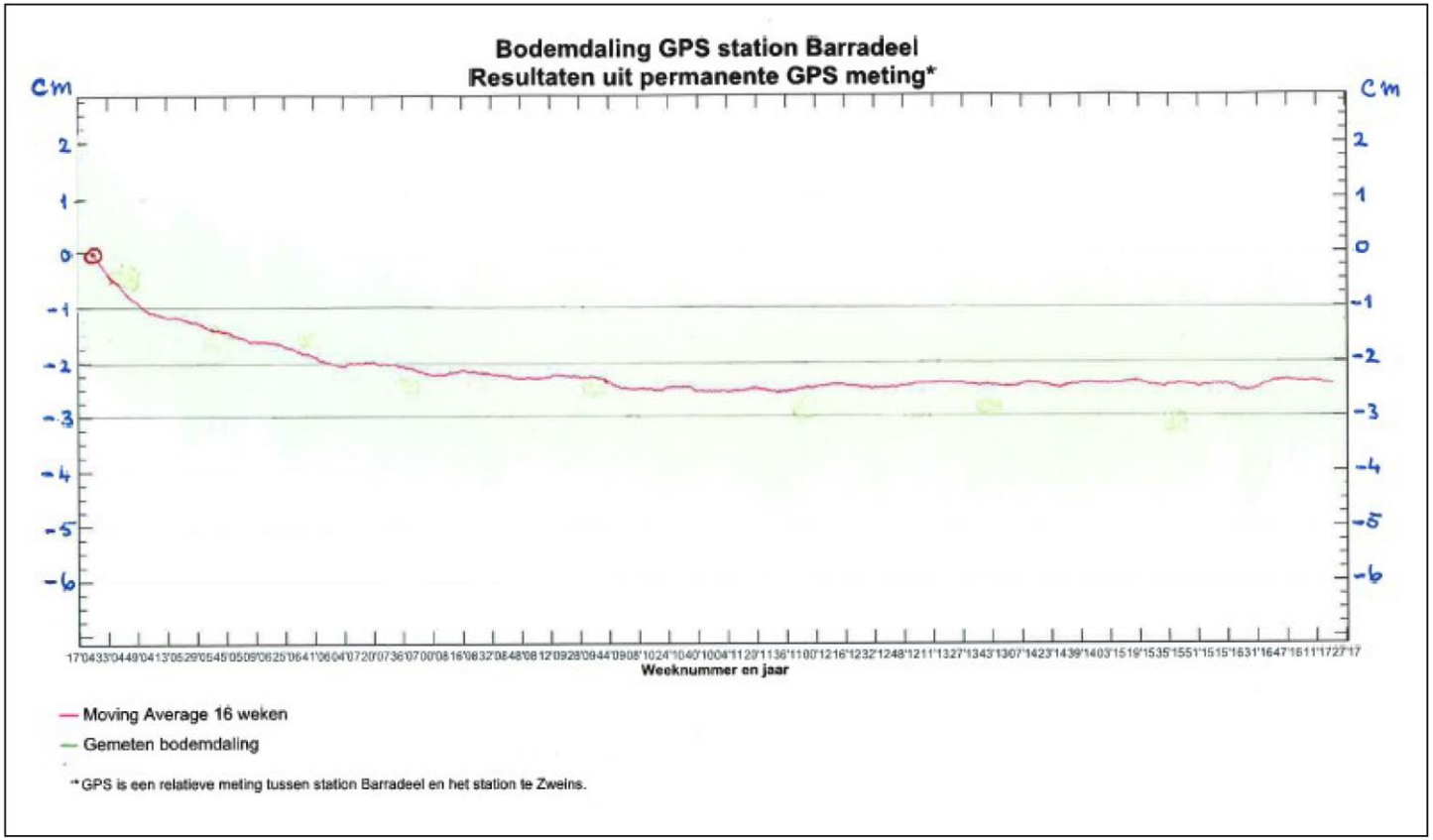
M&R 2015 – Addendum II / Proposal subsidence analysis procedure 2017

- GPS forms an independent source of subsidence data. Identified drawbacks are:
  1. Coupled benchmark that determines start level of the trendline changes
  2. Modifying the extra subsidence to be added to the GPS to ‘know’ the deepest point after every leveling survey
  3. Leveled benchmarks are subject to non-negligible autonomous subsidence and therefore detract from the reliability of permanent GPS observations

- Proposal: GPS data of all three observation stations will be published according to new layout, not disturbed by autonomous trends from benchmark leveling surveys

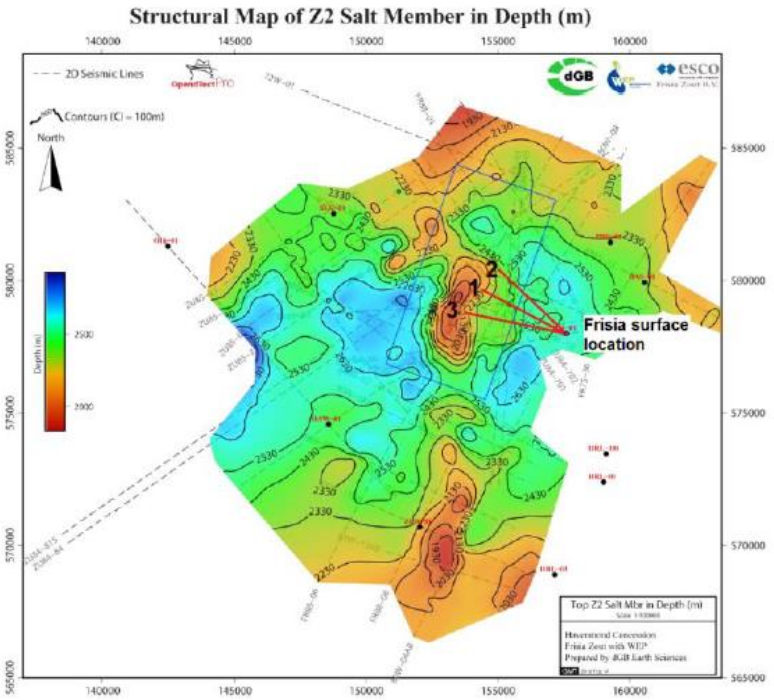
Waterpassing

M&R 2015 – Addendum II / Proposal subsidence analysis procedure 2017



Havenmond

- Zero measurements can start, installation of poles planned for Q1 2018. Licence received.
- Review of geological study by dGB
- Alternative blanket fluid, under investigation
- Finalize engineering mid 2018
- Start drilling early 2019
- Sluitingsplan before start production



WVTTK

- Next meeting 11th of April 2018, 10:00-15:00 SODM
- Risk ID, state of the sector
- Site inspection BAS-2 P&A operations