



## **SODM FINAL REPORT BAS-2 P&A**

Frisia Zout B.V.

|                  |                                                                                     |
|------------------|-------------------------------------------------------------------------------------|
| Prepared by      | Well Engineering Partners                                                           |
| Author           |  |
| Version          | 1.0                                                                                 |
| Publication Date | December 2017                                                                       |

## CONTENTS

|           |                                        |           |
|-----------|----------------------------------------|-----------|
| <b>1.</b> | <b>GENERAL PROJECT DATA .....</b>      | <b>3</b>  |
| 1.1       | PROJECT MANAGEMENT:                    | 3         |
| 1.2       | WELL DATA                              | 4         |
| <b>2.</b> | <b>WELL SUMMARY .....</b>              | <b>5</b>  |
| 2.1       | DIRECTIONAL PLOTS                      | 6         |
| 2.2       | TECHNICAL SUMMARY                      | 7         |
| 2.3       | SUMMARY OF OPERATIONS                  | 8         |
| 2.4       | WELL DIAGRAM                           | 10        |
| <b>3.</b> | <b>DRILLING FLUID TYPE .....</b>       | <b>12</b> |
| <b>4.</b> | <b>GEOLOGY .....</b>                   | <b>13</b> |
| <b>5.</b> | <b>WELLHEAD AFTER OPERATIONS .....</b> | <b>13</b> |
| <b>6.</b> | <b>SIGN SHEET .....</b>                | <b>14</b> |

| Revision no. | Version | Date       | Change Items                                                             | Initials             |
|--------------|---------|------------|--------------------------------------------------------------------------|----------------------|
| 0            | 0.1     | 06-12-2017 | Initial version                                                          | <input type="text"/> |
|              | 0.2     | 21-12-2017 | Draft version for client review                                          | <input type="text"/> |
|              | 1.0     | 24-1-2018  | Final version after client review and wellhead/cellar removal operations | <input type="text"/> |
|              |         |            |                                                                          |                      |

## 1. GENERAL PROJECT DATA

### 1.1 PROJECT MANAGEMENT:

| Title               | Name                 | Company                   | Period from | To         |
|---------------------|----------------------|---------------------------|-------------|------------|
| Project Manager     | <input type="text"/> | Frisia Zout BV            | 10-06-2017  | 09-12-2017 |
| Workover Advisor    | <input type="text"/> | Well Engineering Partners | 10-06-2017  | 09-12-2017 |
| Operations Manager  | <input type="text"/> | Well Engineering Partners | 10-06-2017  | 09-12-2017 |
| WEP Project Manager | <input type="text"/> | Well Engineering Partners | 10-06-2017  | 09-12-2017 |
| HSE Manager         | <input type="text"/> | AdviSafe                  | 10-06-2017  | 09-12-2017 |
| Workover Engineer   | <input type="text"/> | Well Engineering Partners | 10-06-2017  | 09-12-2017 |
| Well Examiner       | <input type="text"/> | D3C                       | 10-06-2017  | 09-12-2017 |

### Drilling Supervisors Coil Tubing operations

| Title                     | Name                 | Company                   | Period from | To         |
|---------------------------|----------------------|---------------------------|-------------|------------|
| Wellsite Supervisor       | <input type="text"/> | Well Engineering Partners | 10-06-2017  | 16-06-2017 |
| Night Wellsite Supervisor | <input type="text"/> | Well Engineering Partners | 10-06-2017  | 14-06-2017 |

### Drilling Supervisors HWU operations

| Title                     | Name                 | Company                   | Period from | To         |
|---------------------------|----------------------|---------------------------|-------------|------------|
| Wellsite Supervisor       | <input type="text"/> | Well Engineering Partners | 13-10-2017  | 21-11-2017 |
| Wellsite Supervisor       | <input type="text"/> | Well Engineering Partners | 22-11-2017  | 01-12-2017 |
| Wellsite Supervisor       | <input type="text"/> | Well Engineering Partners | 02-12-2017  | 9-12-2017  |
| Night Wellsite Supervisor | <input type="text"/> | Well Engineering Partners | 17-11-2017  | 27-11-2017 |

|                                                                                     |                 |     |                 |         |
|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|---------|
|  | Document number | Rev | (Revision) date | Page    |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 3 of 14 |

## 1.2 WELL DATA

|                           |                                            |              |  |
|---------------------------|--------------------------------------------|--------------|--|
| Field                     | Barradeel Salt                             |              |  |
| Well number               | 2                                          |              |  |
| Well name                 | BARRADEEL SALT-02                          |              |  |
| Well type                 | Suspended brine producer (shut-in in 2003) |              |  |
| Operator                  | Frisia Zout B.V.                           |              |  |
| Surface Location          | Latitude & Longitude                       | Geographical |  |
|                           | N 53.2069953                               | X: 160558    |  |
|                           | E 5.47167811                               | Y: 579960    |  |
| Grid coordinate system    | Rijksdriehoeksmeting / Netherlands New     |              |  |
| Primary objective         | Plug and abandonment                       |              |  |
| Start of CT operations    | 10/06/2017                                 | 07:30 hr     |  |
| End of CT operations      | 16/06/2017                                 | 19:30 hr     |  |
| Days operational with CT  | 6,5                                        |              |  |
| CT contractor             | Well Services Group                        |              |  |
| CT unit                   | 2" Coil Tubing unit                        |              |  |
| Start of HWU operations   | 13/11/2017                                 | 07:00 hr     |  |
| End of HWU operation      | 9/12/2017                                  | 18:30 hr     |  |
| Days operational with HWU | 19,6                                       |              |  |
| HWU contractor            | Wellgear                                   |              |  |
| HWU                       | 340K HWO Unit                              |              |  |

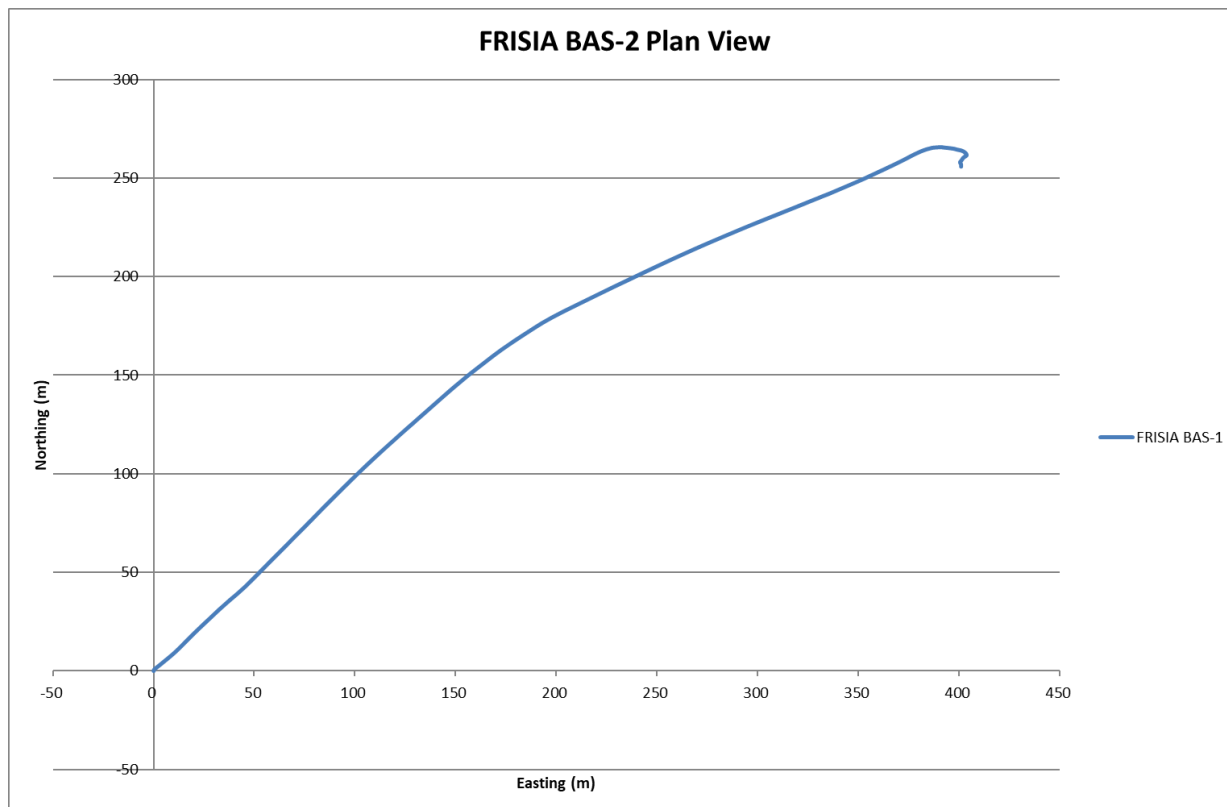
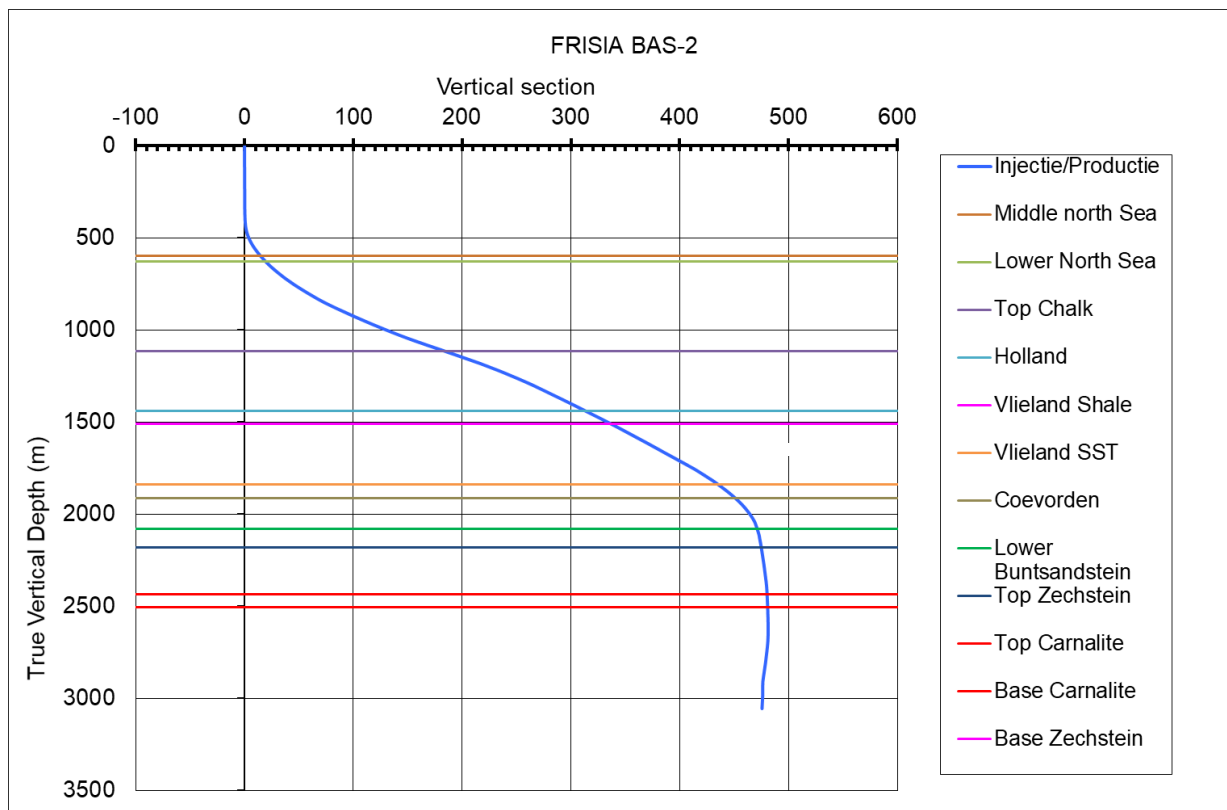
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|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|---------|
|  | Document number | Rev | (Revision) date | Page    |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 4 of 14 |

## 2. WELL SUMMARY

|                       |                                                         |            |            |
|-----------------------|---------------------------------------------------------|------------|------------|
| <b>Elevation</b>      | GL - NAP                                                | +0.912 m   |            |
| <b>Total depth</b>    | GL                                                      | 2549 m BGL | 2629 m TVD |
| <b>Max. deviation</b> | Kicked off @ 418m BGL, EOB at 2503m, max. 26.69 degrees |            |            |

|                                                                                     |                 |     |                 |         |
|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|---------|
|  | Document number | Rev | (Revision) date | Page    |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 5 of 14 |

## 2.1 DIRECTIONAL PLOTS



|  |                 |     |                 |         |
|--|-----------------|-----|-----------------|---------|
|  | Document number | Rev | (Revision) date | Page    |
|  | BAS-2 SodM EOWR | 0   | 24 January 2018 | 6 of 14 |

## 2.2 TECHNICAL SUMMARY

### 2.2.1 Casing

Table 1 – Tubular summary, before operations. See also the well diagram in section 2.4

| BAS2 completion casing details |       |        |            |         |         |
|--------------------------------|-------|--------|------------|---------|---------|
| Size                           | Grade | Weight | Connection | Top     | Bottom  |
| inch                           |       | Lbs/ft | Type       | m MD    | m MD    |
| 18 7/8"                        | K55   | 111    | Big Omega  | 0,00    | 1169.4  |
| 13 3/8"                        | N80   | 61     | Buttress   | 0,00    | 1452,00 |
| 13 3/8"                        | N80   | 68     | Buttress   | 1452,00 | 2223,00 |
| 13 3/8"                        | N80   | 92     | Buttress   | 2223,00 | 2612,40 |
| 10 3/4"                        | N80   | 55,5   | MAT        | 0,00    | 1405,00 |
| 10 3/4"                        | N80   | 51     | MAT        | 1405,00 | 2172,00 |
| 10 3/4"                        | K55   | 51     | MAT        | 2172,00 | 2629,00 |
| 7"                             | P110  | 26     | VAM TOP    | 0,00    | 260.89  |
| 7"                             | N80   | 23     | NEW VAM    | 260.89  | 419.84  |
| 7"                             | N80   | 29     | NEW VAM    | 419.84  | 1179,00 |

Table 2 – Tubular summary after operations. See also the well diagram in section 2.4

| BAS2 completion casing details |       |        |            |         |         |
|--------------------------------|-------|--------|------------|---------|---------|
| Size                           | Grade | Weight | Connection | Top     | Bottom  |
| inch                           |       | Lbs/ft | Type       | m MD    | m MD    |
| 18 7/8"                        | K55   | 111    | Big Omega  | 0,00    | 1169.4  |
| 13 3/8"                        | N80   | 61     | Buttress   | 0,00    | 1452,00 |
| 13 3/8"                        | N80   | 68     | Buttress   | 1452,00 | 2223,00 |
| 13 3/8"                        | N80   | 92     | Buttress   | 2223,00 | 2612,40 |
| 10 3/4"                        | N80   | 55,5   | MAT        | 0,00    | 1405,00 |
| 10 3/4"                        | N80   | 51     | MAT        | 1405,00 | 2172,00 |
| 10 3/4"                        | K55   | 51     | MAT        | 2172,00 | 2629,00 |

### 2.2.2 Cement

Several cementing operations have been performed on BAS-2 as part of the abandonment operations:

| Description                          | Class | Weight | Volume pumped  | Top                                        | Bottom                                     |
|--------------------------------------|-------|--------|----------------|--------------------------------------------|--------------------------------------------|
|                                      |       | s.g.   | m <sup>3</sup> | m MD                                       | m MD                                       |
| Plug inside 10-3/4" casing (with CT) | G     | 1.92   | 5.8            | 2409                                       | 2519                                       |
| Plug inside 10-3/4" casing (with CT) |       | 1.92   | 7.9            | 2238                                       | 2409                                       |
| Primary abandonment plug             | G     | 1.94   | 10.4           | 2115 (13-3/8" x 10-3/4")<br>2000 (10-3/4") | 2165 (13-3/8" x 10-3/4")<br>2171 (10-3/4") |
| Annular cementation                  | G     | 1.9    | 35.5           | 0                                          | 1528                                       |
| Secondary abandonment plug           | G     | 1.92   | 5.8            | 951                                        | 1065                                       |
| Environmental plug                   | G     | 1.92   | 5.6            | 0                                          | 100                                        |

|                                                                                     |                 |     |                 |         |
|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|---------|
|  | Document number | Rev | (Revision) date | Page    |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 7 of 14 |

In compliance with mining regulations as per 7-7-2015, article 8.5.2;

- Integrity of the first cement plug set inside the 10-3/4" casing using Coil Tubing was confirmed by:
  - tagging with 1mT using the Coil Tubing
  - Inflow tested with 0 bar WHP
  - Pressure test with 250 bar WHP.
- Integrity of the second cement plug set inside the 10-3/4" casing using Coil Tubing was confirmed by:
  - tagging with 1mT using Coil Tubing
  - Pressure test with 250 bar WHP.
- Integrity of the primary abandonment plug was confirmed by:
  - tagging with the HydraHemera BHA run on 3-1/2" x 5" drill string to 10mT
  - Pressure test with 250 bar WHP.
- Integrity of the annular cementation was confirmed by:
  - USI and CBL log run on wireline by Schlumberger (*"USIT\_cement\_Evaluation\_01Dec17\_174851"*).
- Integrity of the secondary abandonment plug was confirmed by:
  - tagging with 10mT using 5" DP.
  - Pressure test with 250 bar WHP.

## 2.3 SUMMARY OF OPERATIONS

### 2.3.1 Objective

The objective of this operation is to seal the cavern off with a permanent abandonment. When the well is abandoned, a permanent situation is created in which the barriers in the well bore are at least as competent as the formations outside the well. This requirement is based on the philosophy that the well bore should never become a conduit for fluids leaking from the cavern.

The objective of the CT operation is to seal the cavern off with a 100 m cement plug, followed by an additional 100 m cement plug as safety precaution, in preparation of final abandonment operations and prior to installation of the hydraulic workover unit. The cement plugs will be set inside the 10 3/4" casing on top of an inflatable plug. Purpose of setting the cement plugs with CT is to allow for a change-out the X-mas tree for the HWU BOP with no pressure on the 10 3/4" x 7" annulus and 7" tubing. Plugging the 7" tubing is not an option due to the limited amount of tie-down bolts installed; only two bolts will not hold the pump-out force acting on a plugged 7" tubing. The cement plugs will be the only two barriers in place (exemption request granted by SodM, dated 14-06-2017).

Following the CT operations and rig-up of the HWU, the 7" hanger will be retrieved in order to gain full-bore access. Subsequently, the 10 3/4" casing will be perforated and a 50 m cement plug will be set at the Zurich formation using the HydraWell HydraHemera tool. After setting the primary abandonment plug, a cement squeeze job will be performed on the 13 3/8" x 10 3/4" annulus from 1530 m MD to surface. If cement integrity of squeeze job is confirmed by a USIT log, a 100 m cement plug (secondary abandonment plug) will be set above the 18 5/8" shoe. If 13 3/8" x 10 3/4" cement integrity was not confirmed, a window of 50 m will be section milled at the depth of the patch to improve integrity of the casing patch. Cementation will then be performed over the patch, and up to 50 m above the 18 5/8" shoe. Finally, an environmental plug of 100 m will be set from 100 m to surface.

|                                                                                     |                 |     |                 |         |
|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|---------|
|  | Document number | Rev | (Revision) date | Page    |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 8 of 14 |

After the workover operations, all casings were cut off at 3 m BGL and the cellar and wellhead removed.

### 2.3.2 Operation summary

Below a summary of operational steps is given for all the operational steps performed on BAS-2. This final report describes in detail the operations performed on BAS-2

*Overview of planned objectives and actual operations:*

| Planned                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Actual                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> <li>Wireline and CT preparations (set two 100m cement plugs in preparation of wellhead with X-mas tree change-out)</li> <li>Remove X-mas tree and rig-up WellGear 340K snubbing unit</li> <li>Retrieve 7" hanger and 1169m of 7" tubing</li> <li>RIH TCP guns and Hydrahemera assembly</li> <li>Perforate 10 3/4" casing</li> <li>Jet clean 13 3/8" x 10 3/4" annulus and set 50m cement plug</li> <li>Tag cement with 10 ton and POOH</li> <li>RIH 10 3/4" BP on wireline and set at 1530m</li> <li>Punch 10 3/4" casing above BP and perform circulation tests</li> <li>Run cement retainer on DP and set at 1520m</li> <li>Perform annular cementation and POOH cement stinger</li> <li>Perform cement log using wireline</li> <li>RIH and set 100m cement plug on CST at 1169m</li> <li>Tag cement plug with 10 ton</li> <li>POOH and spot 100m environmental plug on CST at 100m</li> <li>Rig-down Wellgear 340K snubbing unit</li> <li>Remove wellhead and clean location</li> <li>Handover location to Frisia</li> </ol> | <ol style="list-style-type: none"> <li>Wireline and CT preparations (set 110m cement plug and 171m cement plug)</li> <li>Remove X-mas tree and rig-up WellGear 340K snubbing unit</li> <li>Retrieve 7" hanger and 1169 m of 7" tubing</li> <li>RIH TCP guns and Hydrahemera assembly</li> <li>Perforate 10 3/4" casing</li> <li>Jet clean 13 3/8" x 10 3/4" annulus and set 50m cement plug</li> <li>Tag cement at 2000m with 10 ton, pressure test cement plug and POOH</li> <li>Perform scraper run to 1540 m</li> <li>RIH 10 3/4" BP on wireline and set at 1531 m</li> <li>Punch 10 3/4" casing above BP and perform circulation tests</li> <li>Run cement retainer on DP and set at 1514 m</li> <li>Perform 13-3/8" x 10-3/4" annular cementation and POOH cement stinger</li> <li>Perform cement log using wireline</li> <li>RIH to 1065m and pump down CST (CST stuck)</li> <li>POOH and retrieve stuck CST</li> <li>RIH and set cement plug on CST at 1065m</li> <li>Tag cement plug with 10 ton at 951m and pressure test cement plug</li> <li>POOH and spot environmental plug on CST from 100m to 0m</li> <li>Rig-down Wellgear 340K snubbing unit</li> <li>Handover location to Frisia</li> <li>Remove wellhead and clean location</li> </ol> |

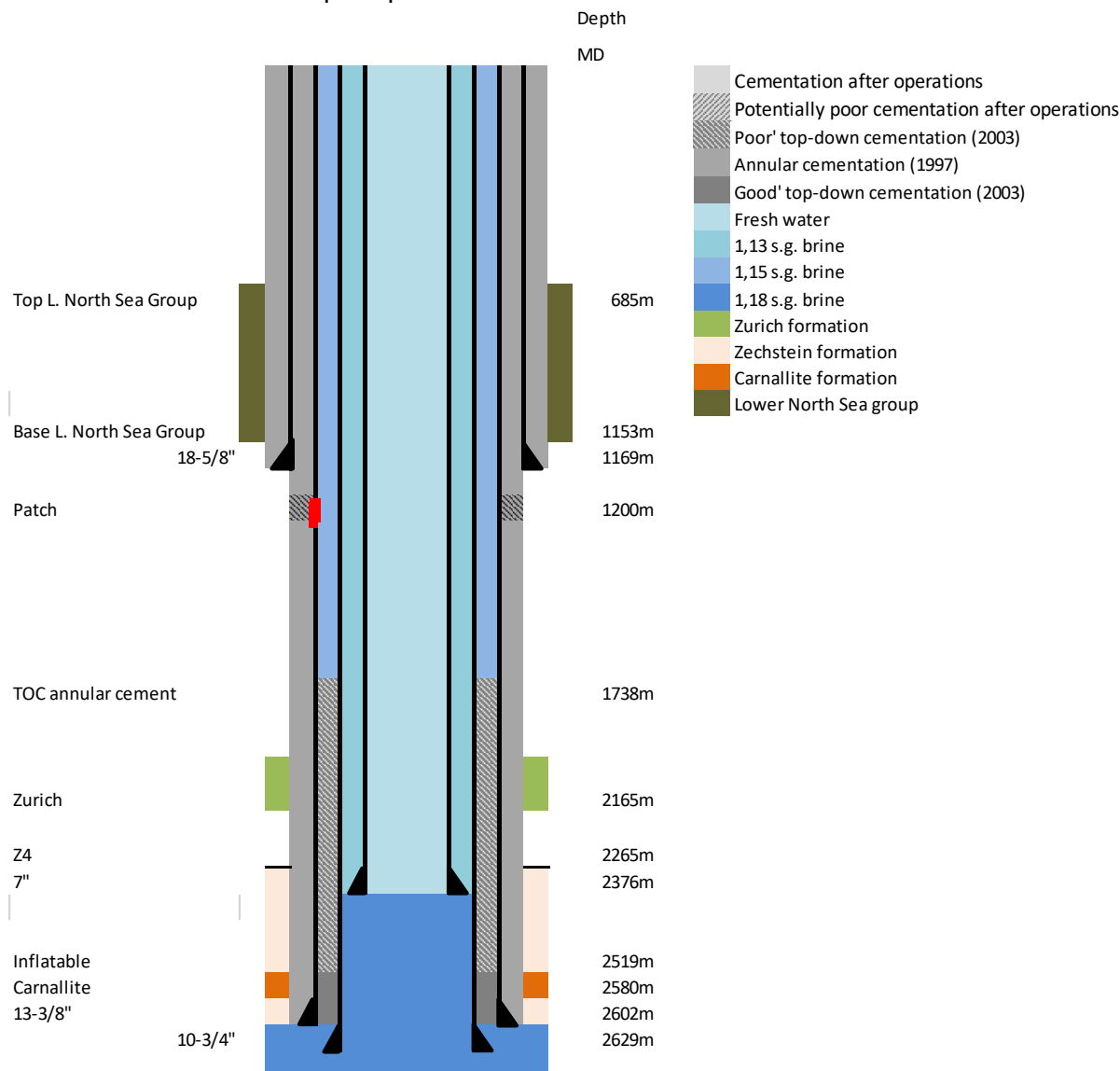
See section 2.4 for a detailed well schematic prior to and after the workover operations.

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|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|---------|
|  | Document number | Rev | (Revision) date | Page    |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 9 of 14 |

## 2.4 WELL DIAGRAM

### 2.4.1 Schematic before operations

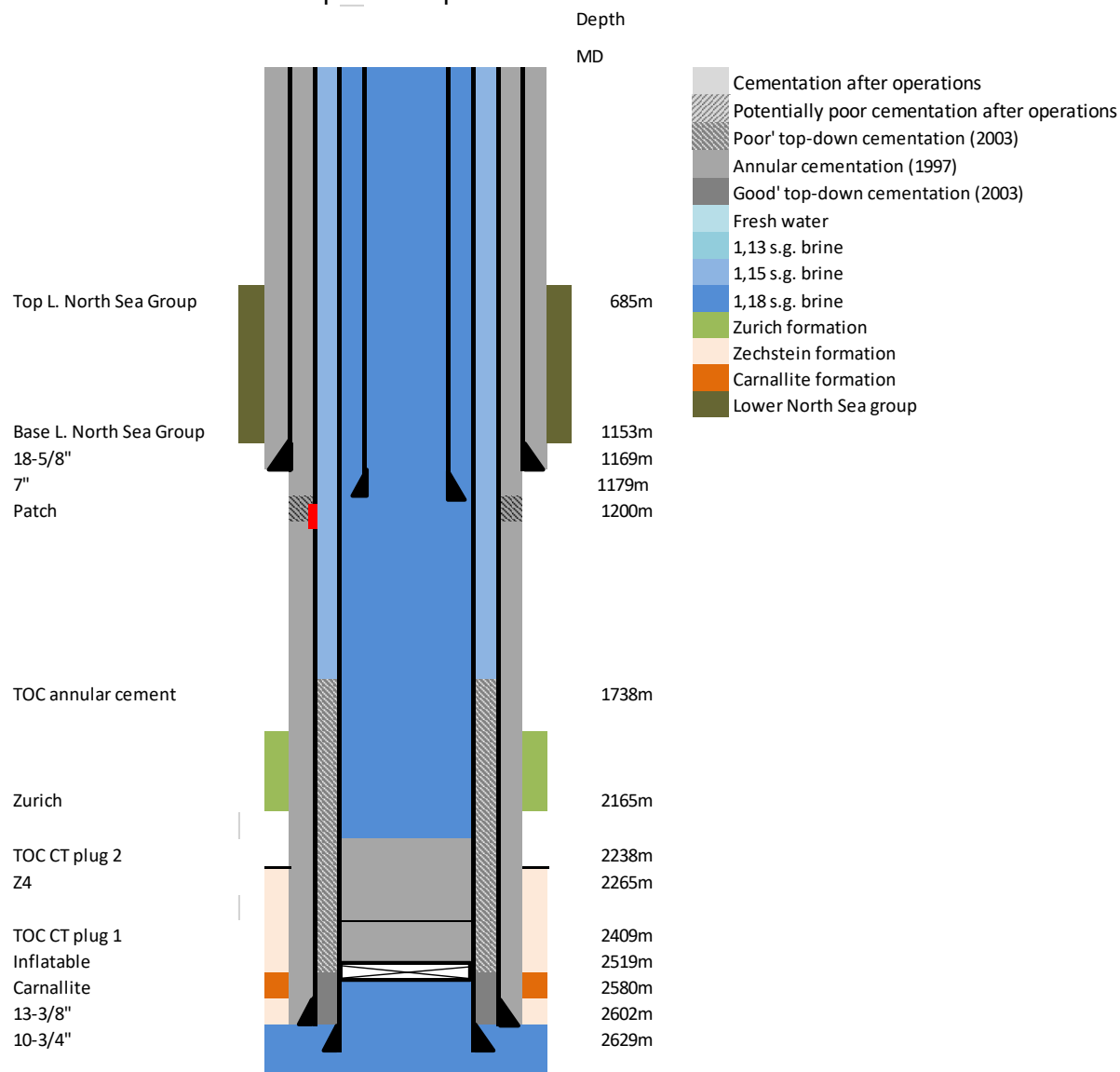
A detailed well schematic pre-operations is shown below.



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|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|----------|
|  | Document number | Rev | (Revision) date | Page     |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 10 of 14 |

### 2.4.1 Schematic after CT operations

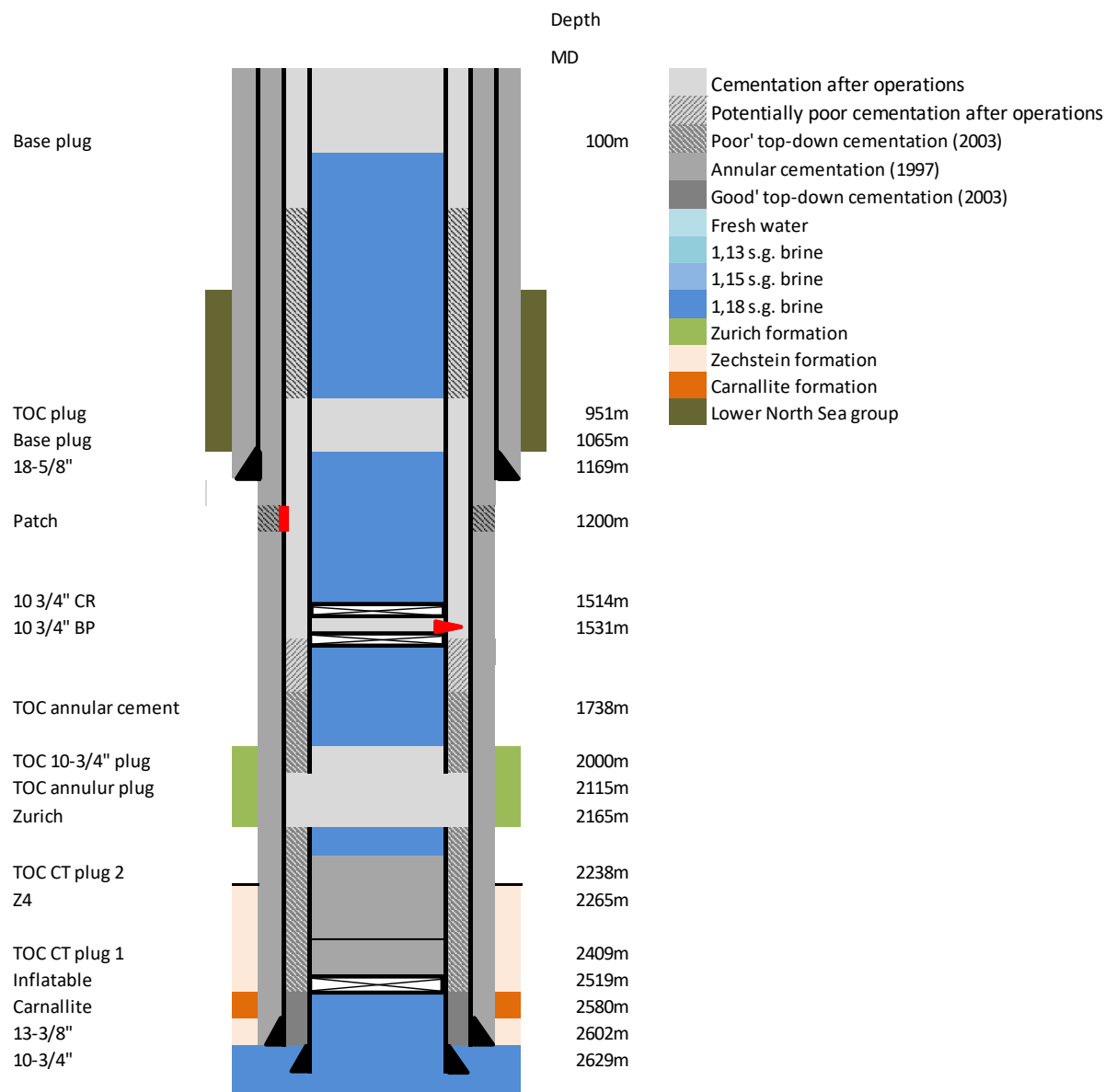
A detailed well schematic post-CT operations is shown below.



|                                                                                     |                 |     |                 |          |
|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|----------|
|  | Document number | Rev | (Revision) date | Page     |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 11 of 14 |

## 2.4.2 Schematic after HWU operations

A detailed well schematic post-HWU operations is shown below.



|                                                                                     |                 |     |                 |          |
|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|----------|
|  | Document number | Rev | (Revision) date | Page     |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 12 of 14 |

### 3. DRILLING FLUID TYPE

In compliance with mining regulations as per 7-7-2015, article 8.5.1.2; at the end of abandonment operations, the well is filled with a clear 1.18sg NaCl brine (see schematic in section 2.4.2), which provides an overbalance to all formations outside the casing, which are considered as hydrostatically charged as no over-pressures were observed when the well was drilled. The brine does not have any degradation and corrosive impact on the set plugs or casings.

Furthermore, the cavern is filled with 1.18sg NaCl brine with no diesel left in the cavern. For more details, see “*Detail overzicht vloeistof migratie in BAS-2 v1*”, submitted to SodM on the 25<sup>th</sup> of July 2017.

Finally, during the period from February 1999 through September 2000, a volume of 373 m<sup>3</sup> has migrated from the BAS-2 well into the Ommelanden Chalk through the 13-3/8” casing patch, installed at 1200m. The diesel could not be recovered from the Ommelanden Chalk. For more information see “*FRIMA BAS 2 Final Report*” submitted to SodM on May 26<sup>th</sup> 2000 and “*Onderbouwing technische haalbaarheid terugwinning diesel BAS-2*” submitted to the ministry of Economic Affairs on the 11<sup>th</sup> of October 2017.

### 4. GEOLOGY

Cement plugs were set across the following formations:

- The Coil Tubing plugs (2519m to 2238m) were set over the Zechstein salt formation (top cavern at 2602m to 2265m)
- The primary abandonment plug (2165m to 2115m) is set over the Zurich formation (2165m to 1923m), which is considered the first sealing formation (confinement zone) above the Lower Bunter formation (containment zone).
- The secondary abandonment plug (1065m to 951m) is set over the Ieper formation (1095m to 808m) which is part of the North Sea Claystones (confinement zone).

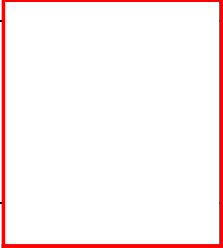
For more detail and reasoning of the placement of the abandonment plugs, refer to “*Geo-mechanical and Technical Aspects of BAS-2 final abandonment version 2*”, submitted to SodM on the 22<sup>nd</sup> of August, 2017.

### 5. WELLHEAD AFTER OPERATIONS

The well (casings) has been cut at 3m below ground level in compliance with mining regulations as per 7-7-2015, article 8.5.2.7. The cellar is removed and the hole is filled with sand. Further removal and clean-up of the location will be handled in het ‘sluitingsplan’ when production is halted on B123 location.

|                                                                                     |                 |     |                 |          |
|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|----------|
|  | Document number | Rev | (Revision) date | Page     |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 13 of 14 |

## 6. SIGN SHEET

|                        |                                                                                   |                                                                                    |
|------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Frisia Project Manager |  |                                                                                    |
|                        |                                                                                   |  |

|                                                                                     |                 |     |                 |          |
|-------------------------------------------------------------------------------------|-----------------|-----|-----------------|----------|
|  | Document number | Rev | (Revision) date | Page     |
|                                                                                     | BAS-2 SodM EOWR | 0   | 24 January 2018 | 14 of 14 |