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Forsmark site investigation

Boremap mapping of telescopic drilled borehole KFM02B

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Geosigma AB

Juni 2007

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Abstract

This report presents the result from the Boremap mapping of core drilled borehole KFM02B at drill site 2 in the Forsmark candidate area. Drill site 2 (DS 2) is situated in the south-east of Bolundsfjärden in the south-central part of the candidate area. The borehole was drilled with the bearing 313° and the inclination –80°. The borehole length is 573.87 m. The aim of the drilling of KFM02B is to drill through the deformation zone ZFMA2, to measure the in situ stresses of the rock with the overcoring technique and study how the zone is affecting the stress field. Additionally a tracer test will be performed between KFM02A and KFM02B. The results from the stress measurements and from the tracer test are not in the scope of this activity.

The dominant rock type in KFM02B is a generally lineated metagranite-granodiorite (~ 59%) followed by a lineated pegmatite or pegmatitic granite (~ 19%) and lineated fine- to medium-grained granite (~ 14%). Subordinate rock types are amphibolite (~ 3.5%), fine- to medium-grained metagranitoid (~ 2.7%), medium-grained metadiorite-gabbro (1.4%), aplitic metagranite (< 1%), quartz-dominated hydrothermal veins (< 1%), calc-silicate rock (< 1%) and felsic to intermediate metavolcanic rock (< 1%).

The borehole shows fracture frequencies of 2.4 open and partly open fractures/m (crush excluded) and 2.6 sealed fractures/m (sealed fracture networks excluded). The fractures are generally concentrated to two sections: one at 100–200 m, where also minor occurrences of vuggy rock are observed together with chloritization and albitization of the rock. The second borehole section with increased fracture frequency is at 400–500 m, this section exhibits generally fresh rock with some faint to weakly oxidized sections, one minor section is strongly oxidized. Other alteration types occur, but they are mostly sporadic.

Sammanfattning

Denna rapport redovisar resultatet från Boremapkartering av kärnborrhålet KFM02B vid borrplats 2 i Forsmark kandidatområde. Borrplats 2 är belägen sydost om Bolundsfjärden, centralt inom undersökningsområdet. Borrhålet är borrat med riktning 313° och lutning –80°. Borrhålets längd är 573,87 m. Syftet med KFM02B var att borra igenom deformationszonen ZFMA2 och att utföra bergspänningsmätningar ovanför denna zon. Detta skapar möjlighet att studera zonens inverkan på spänningsfältet. Dessutom kommer spårförsök att utföras mellan KFM02A och KFM02B. Resultatet från spänningsmätningarna och från spårförsöken ingår inte i denna rapport.

Den dominerande bergarten i KFM02B är en generellt linjerad metagranit-granodiorit (~ 59 %), följt av en linjerad pegmatit till pegmatitisk granit (~ 19 %) och linjerad fin- till medelkornig granit (~ 14 %). Underordnade bergarter är amfibolit (~ 3,5 %), fin- till medelkornig metagranitoid (~ 2,7 %), medelkornig metadiorit-gabbro (1,4 %), aplitisk metagranit (< 1 %), kvartsdominerad hydrotermal gångbergart (< 1 %), breccia (< 1 %) och felsisk- till intermediär metavulkanit (< 1 %).

Borrhålet uppvisar sprickfrekvenser på 2,4 öppna och delvis öppna sprickor/m (krossar exkluderade) och 2,6 läkta sprickor/m (läkta spricknätverk exkluderade). Sprickorna är koncentrerade till två sektioner: en sektion finns vid 100–200 m, där även mindre förekomster av porösa bergarter, kloritisering och albitisering av bergarterna förekommer. Den andra sektionen finns vid 400–500 m. Sektionen innehåller ställvis svagt oxiderade partier, endast en mindre sektion är starkt oxiderad. Andra omvandlingstyper förekommer, men de är för det mesta sporadiska.

Contents

1 Introduction

This document reports the data gained by the Boremap mapping of the core drilled borehole KFM02B, which is one of the activities performed within the site investigation at Forsmark. The work was carried out in accordance with Activity Plan SKB PF 400-06-108. In Table 1-1 controlling documents for performing this activity are listed. Both Activity Plan and Method Descriptions are SKB's internal controlling documents.

The borehole KFM02B was drilled from drill site 2 (DS 2), situated south-east of Bolundsfjärden (Figure 2-1) in the north-western part of the tectonic lens, which is of interest for future nuclear waste disposal /1/. The borehole was drilled in order to study how the deformation zone ZFMA2 is affecting the stress field and for tracer test between KFM02A and KFM02B. The drilling of KFM02B was finished on Feb 13th 2007. The Boremap mapping of the borehole started on Nov 27th 2006 and was finished on Feb 26th 2007. Some details in the mapping were revised on Mar 7th 2007.

The geological documentation of core drilled boreholes according to the Boremap method is based on the use of BIPS-images of the borehole wall and the simultaneous study of the drill core. Position, aperture and orientation data of features are based on the adjusted BIPS-image, while other data such as rock type, alteration, fracture mineralogy and surface are observed in the drill core. The Boremap mapping will be used for further 3D-modelling in the Forsmark area.

Original data from the reported activity are stored in the primary database Sicada, where they are traceable by the Activity Plan number AP PF 400-06-108. Only data in SKB's databases are accepted for further interpretation and modelling. The data presented in this report are regarded as copies of the original data. Data in the databases may be revised, if needed. Such revisions will not necessarily result in a revision of the P-report, although the normal procedure is that major data revisions entail a revision of the P-report. Minor data revisions are normally presented as supplements, available at www.skb.se.

Table 1-1. Controlling documents for the performance of the activity.

Activity Plan	Number	Version
Boremapkartering av kärnborrhål KFM02B	AP PF 400-06-108	1.0
Method Descriptions	**Number**	**Version**
Metodbeskrivning för Boremapkartering	SKB MD 143.006	2.0
Mätsystembeskrivning för Boremap	SKB MD 146.001	1.0
Nomenklatur vid Boremapkartering	SKB MD 143.008	1.0
Instruktion: Regler för bergarters benämningar vid platsundersökningen i Forsmark	SKB MD 132.005	1.0

2 Objective and scope

The aim of this activity was to verify the existence of the deformation zone ZFMA2 and to document lithologies, alterations, ductile structures and the occurrence and character of fractures in the bedrock penetrated by the core drilled borehole KFM02B. The detailed documentation will be used in 3D-modelling of the area.

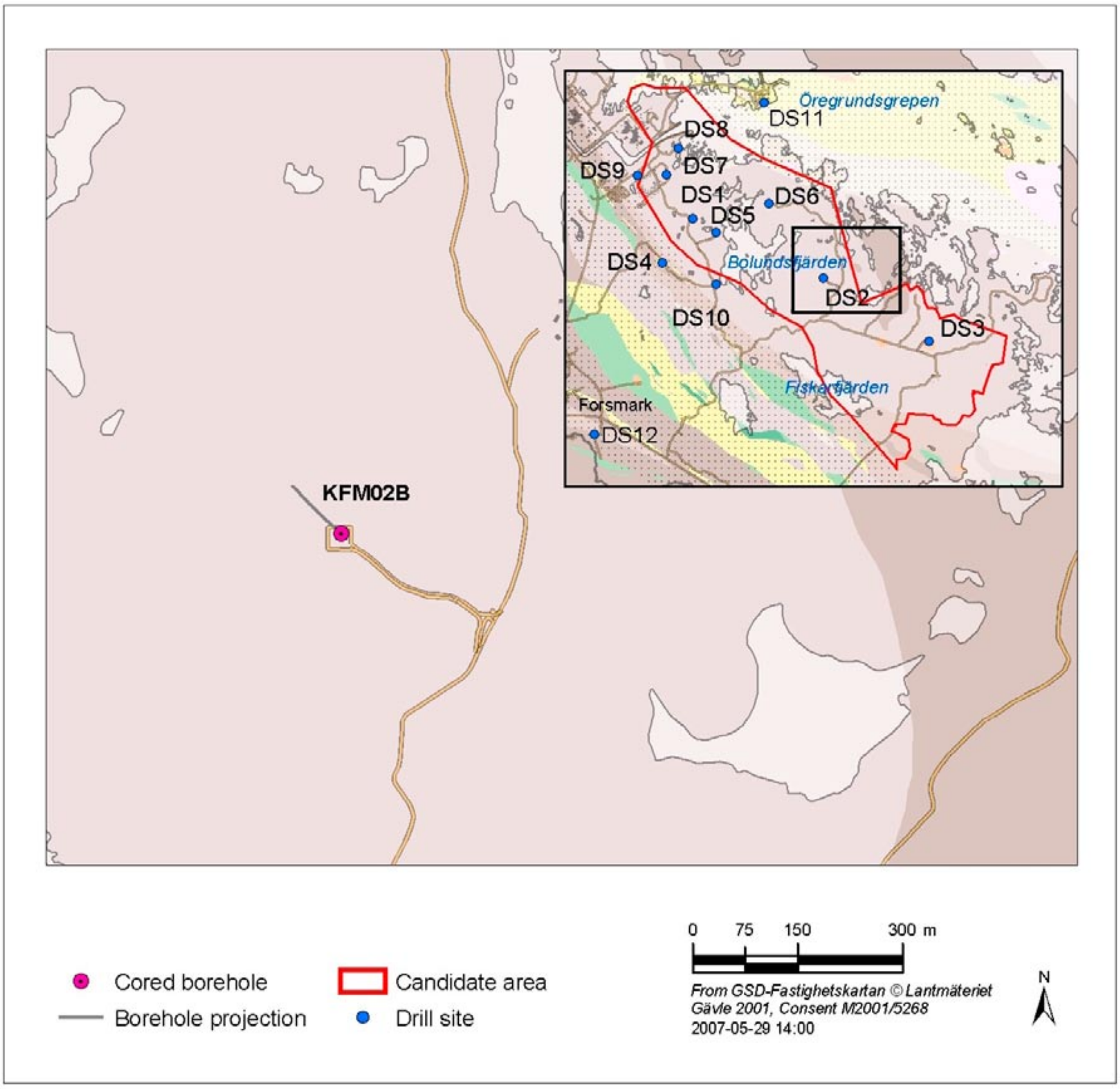


Figure 2-1. *Location of borehole KFM02B.*

3 Equipment

3.1 Description of equipment and interpretation tools

Mapping of BIPS-images and drill core was performed with the software Boremap v. 3.7.5.4. The Boremap software is loaded with the bedrock and mineral standard used for surface mapping at the Forsmark investigation site to enable correlation with the surface geology. The Boremap software calculates actual directions (strike and dip) of planar structures penetrated by the borehole (foliations, fractures, fracture zones, rock contacts etc). Data on inclination, bearing and diameter of the borehole are used as in-data for the calculations (Table 4-2, Appendix 2). The BIPS-image lengths were calibrated (Table 4.1).

Additional software used during mapping are BIPS Image Viewer and Microsoft Access 2002. The schematic data presentation was made in WellCAD v. 4.0.

The following equipment was used to facilitate the core documentation: folding rule, 10% hydrochloric acid, rock hardness tool, hand lens, paint brush and a tap of water.

3.1.1 BIPS-image quality

The following factors may disturb the mapping:

1) blackish coatings probably related to the drilling equipment,
2) vertical bleached bands from the drill cuttings in suspension,
3) light and dark bands at high angle to the borehole related to the automatic aperture of the video camera,
4) vertical enlargements of pixels due to stick-slip movement of the camera probe.

Mainly in the lower part of KFM02B, the BIPS-image contains blackish coatings from the drill rod. In some intervals the BIPS-image is diffuse probably due to suspended material in the water. Judgement of the BIPS-image quality along the borehole is listed in Table 3-1.

Table 3-1. BIPS Image Quality.

From	To	% visible	Comment
88.56	92.00	80	Acceptable. Sporadic blackish coatings from drill rod.
92.00	94.05	50	Acceptable. The image is over-exposed in smaller intervals. White strips parallel to the borehole, probably due to water on the window of the camera probe.
94.05	94.90	100	Acceptable. White strips parallel to the borehole, probably due to water on the window of the camera probe.
94.90	97.00	80	Acceptable. Sporadic blackish coatings from drill rod and horizontal dark bands (slot cuts).
97.00	97.40	10	Bad. Black spots and horizontal bands (slot cuts). Closely spaced white strips parallel to the borehole. Over-exposed.
97.40	99.70	95	Good. Smaller over-exposed intervals.
99.70	101.25	50	Bad. Over-exposed. Brownish spots (hematite). White strips parallel to the borehole.
101.25	101.60	100	Good. But with some diffuse coatings from drill rod.
101.60	108.95	70	Acceptable. Diffuse image, over-exposed and with suspended material in the water. Brownish coatings from drill rod.
108.95	109.60	70	Good. Brownish coatings from drill rod.
109.60	111.30	100	Good.
111.30	114.00	60	Acceptable. Diffuse image, over-exposed and with suspended material in the water. Brownish coatings from drill rod.
114.00	123.00	10	Bad. Very diffuse image, suspended material in the water. Brownish coatings from drill rod.
123.00	125.00		Acceptable. Diffuse image, suspended material in the water. Sporadic brownish coatings from drill rod.
125.00	127.30	75	Good. Brownish coatings from drill rod. White strips parallel to the borehole.
127.30	131.50	60	Acceptable. Brownish coatings from drill rod. White strips parallel to the borehole.
131.50	197.20	100	Good. White strips parallel to the borehole.
197.20	201.15	60	Acceptable.With some diffuse coatings from drill rod and closely spaced white strips parallel to the borehole.
201.15	203.60	80	Good. Closely spaced white strips parallel to the borehole.
203.60	217.00	90	Good. Blackish coatings from drill rod and closely spaced white strips parallel to the borehole. Reddish coating (rust/hematite) covering the image sporadically.
217.00	236.00	100	GoodAcceptable. Reddish coating (rust/hematite) covering the image sporadically. White strips parallel to the borehole.
236.00	236.12	50	Bad. Stick-slip. White strips parallel to the borehole.
236.12	236.65	100	Good. White strips parallel to the borehole.
236.65	236.85	50	Bad. Stick-slip. White strips parallel to the borehole.
236.85	252.00	100	Good. White strips parallel to the borehole.
252.00	329.00	100	Good. White transparent coating on the lower part of the borehole wall.
329.00	434.78	100	Good.
434.78	450.75	100	Good. White transparent coating on the lower part of the BIPS-image.
450.75	472.56	100	Good. White strips parallel to the borehole.
472.56	473.53	100	Good. With some diffuse black/brownish coatings.
473.53	557.85	100	Good.
557.85	572.51	100	Good. Diffuse image at the lower part of the BIPS-image.

4 Execution

4.1 General

Boremap mapping of the drill core KFM02B was performed and documented in accordance with the Activity Plan AP PF 400-06-108 (SKB, internal document) and the Method Description for Boremap mapping (SKB, MD 143.006, Version 2.0, Metodbeskrivning för Boremap-kartering, SKB, internal controlling document). The mapping was preceded by an overview documentation of the geology in the borehole by Kenneth Åkerström.

The Boremap mapping was performed between Nov 27th, 2006 and Feb 26th, 2007 by Eva Samuelsson, Peter Dahlin and Emil Lundberg from Geosigma AB. Core from KFM02B was recovered between 88.56 and 573.54 m borehole length. A borehole section of approximately 30 m, 512.24–542.27 m, was mapped with only BIPS-image, due to removal of core samples for matrix pore water analysis. The last section of the borehole, 572.51–573.54 m, was mapped without access to BIPS-image.

4.2 Preparations

The lengths registered during the BIPS-logging deviates from the true length, which usually increases with depth. Therefore length adjustments were made. The length of the BIPS-image was adjusted with reference to slots cut into the borehole wall approximately every 50th metres and with reference to the end of casing (Table 4-1).

Background data (Appendix 2) prior to the Boremap mapping included:

- Borehole diameter.
- Reference slots for length adjustments.
- Borehole deviation.

Table 4-1. Length adjustments.

Rec. length (m)	Adj. length (m)	Difference (m)
88.50	88.50	0
110.005	110.000	–0.005
149.825	150.000	+ 0.175
199.660	200.000	+ 0.340
249.510	250.000	+ 0.490
299.323	300.000	+ 0.677
349.167	350.000	+ 0.833
398.973	400.000	+ 1.027
450.740	452.000	+ 1.260
507.623	510.000	+ 2.377

4.3 Execution of measurements

Concepts used during the core mapping, are defined in this chapter.

4.3.1 Fracture definitions

Definitions of different fracture types, apertures, crush zones and sealed fracture network are found in SKB MD 143.008 (Nomenklatur vid Boremapkartering, internal controlling document).

Two types of fractures are mapped in Boremap, broken and unbroken. Non-artificial fractures that break the drill core are classified as broken fractures. Non-artificial fractures that do not break the drill core into two separate pieces, are classified as unbroken fractures.. All fractures are described with their fracture minerals and other characteristics, e.g. width, aperture and roughness. The width of the open part of a fracture, the fracture aperture, is estimated from the BIPS-image down to 1 mm. Apertures less than 1 mm, which are not visible in the BIPS-image, are denoted a value of 0.5 mm.

The aperture confidence is based on the degree of weathering and the fit of the two opposing faces of the fracture. The fit is considered to be good if the aperture between the fracture planes is negligible. Poorly fitting fracture planes are in some cases a result of the drilling process or the subsequent handling of the drill core. Such fractures are generally considered to have a good fit.

Fractures with an estimated aperture of 1 mm or more (i.e. the aperture is clearly distinguishable in the BIPS-image) are considered "certain".

Fractures with poor fit of the two opposing faces of the fracture, and with an aperture of 0.5 mm (not visible on the BIPS image), are considered "probable".

Fractures with apertures of 0.5 mm that have well fitting opposing faces and filling minerals affected by alteration are considered "possible".

Fractures with apertures > 0 mm are treated as open in the SICADA database. Unbroken fractures usually have apertures = 0 mm. One special case is when a fracture is unbroken and have aperture > 0 mm, the fracture is interpreted as partly open and is included in the open-category in SICADA. A second special case is when broken fractures are given the aperture = 0 mm, that is when the fit between the fracture surfaces is good and the fracture surface is not altered. Fracture frequencies of open and sealed fractures are shown in Appendix 1.

4.3.2 Fracture alteration and joint alteration number

Joint alteration number is principally related to the thickness of, and the clay content in a fracture /2/. Fractures > 1 mm thick and filled with clay minerals are usually given joint alteration numbers between 2 and 4. The majority of the broken fractures are very thin to extremely thin and do rarely contain clay minerals. These fractures receive joint alteration numbers between 1 and 2.

A subdivision of fractures with joint alteration numbers between 1 and 2 was introduced to facilitate both the evaluation process for fracture alterations, and the possibility to compare the alterations between different fractures in the boreholes. The subdivision is in accordance with the subdivision introduced by Ehrenborg and Steiskal /3/.

4.3.3 Mapping of fractures not visible in the BIPS-image

Not all fractures are visible in the BIPS-image, and these fractures are oriented using the *guideline method* /3/, with one modification. The orientation performed in this work is based on the following data:

- Amplitude (measured along the drill core) which is the interval between fracture extremes along the drill core.
- The relation between the rotation of the fracture trace and a well defined structure visible in both drill core and BIPS-image. This rotation is measured with measuring tape on the drill core.
- Absolute depth relative to a well defined structure visible in both drill core and BIPS-image.

The fractures mapped with *the guide-line method* are mapped as "non-visible in BIPS" and can therefore be separated from fractures visible in BIPS which probably have a more accurate orientation.

4.3.4 Definition of veins and dikes

A rock sequence that covers less than 1 m of the drill core is mapped as a "rock occurrence" in Boremap. Rock occurrences that cover more than 1 m of the drill core are mapped as a separate *rock type.*

Essentially two different types of rock occurrences are mapped: veins and dikes. These two are separated by their respectively length in the drill core; veins are set to 0–20 cm and dikes are set to 20–100 cm if evidence for intrusion is visible in the drill core. If the rock occurrence cannot be classified as a vein or a dyke, the occurrence type is mapped as "unspecified". In Forsmark there are boudinaged veins, xenoliths, blobs etc and the occurrence type is usually difficult to determine from the drill core.

4.3.5 Mineral codes

In cases where properties or minerals are not represented in the mineral list, the following mineral codes have been used in the mapping of KFM02B:

- X1 = Bleached fracture walls.
- X2 = Interpreted grouting, which is only observed in the borehole wall and hence in the BIPS-image (not used in this borehole).
- X3 = The drill core is broken at a right angle and the broken surfaces have a polished appearance. This is caused by rotation of two core pieces along an intermediate fracture wearing away possible mineral filling. It is impossible to say whether this fracture was open or sealed in situ.
- X4 = Dull fracture surface, no visible fracture mineral.
- X5 = Fresh fracture surface, no detectable fracture mineral.
- X6 = Striated surfaces, probably slickensided.

4.4 Data handling

In order to obtain the best possible data security, the mapping was performed on the Geosigmas network, with regular back-ups on the local drive in accordance with the consultants' quality plan. Each day, a summary report was printed in order to find possible misprints. If misprints were observed, they were corrected before the mapping proceeded. A WellCAD-diagram was also plotted before the drill cores were changed on the roller table. When the mapping was completed, data was checked once more for possible misprints. Before exporting data to SICADA, borehole lengths, mapping lengths, deviation data and length adjustments were checked again where after the mapping was checked by a routine in Boremap which detects logical defects.

4.5 Nonconformities

4.5.1 Late in-data

Not all necessary in-data were available in the SICADA database, neither was the data available during the Boremap mapping activity. Absent technical data were received from the persons responsible for drilling and measurements /4/.

4.5.2 Core loss

Unusually many core losses are documented in KFM02B. Most core losses are mechanical and are related to the rock stress measurement technique or removal of core samples for the matrix pore water analysis. A larger core sample has been removed between 512.24 and 542.27 m, this section has been separately mapped entirely with the BIPS image.

4.5.3 Overrepresented fracture mineral

The frequency of calcite in fractures is overrepresented relative to other minerals, since it is detected by reaction with diluted hydrochloric acid even though it is macroscopically invisible.

4.5.4 Fracture roughness and surface

The estimation of roughness of fractures in this work diverges rather much from the mappings by Vattenfall Power Consultant. For example: Geosigma considers over half of the fractures as undulating, while the rest are planar, irregular and stepped. The proportion of planar, undulating, stepped and irregular fractures in the mappings of Vattenfall Power Consultant is different. This is because the personal interpretation of the definitions of fractures /5/, since the definitions are made for another scale, i.e. tunnels and excavations, and not for boreholes.

5 Results

The Boremap mapping of KFM02B is stored in SICADA and it is only these data that shall be used for further interpretation and modelling. The interpreter should be aware of the assumptions mentioned in Chapter 4.

Results from the Boremap mapping are briefly described in this chapter and the graphical presentation of the data is given in Appendix 1 (WellCAD-diagram).

5.1 Rock type

The dominant rock type in KFM02B is a generally lineated metagranite-granodiorite (~ 59%) followed by a lineated pegmatite or pegmatitic granite (~ 19%) and lineated fine- to medium-grained granite (~ 14%). Subordinate rock types are amphibolite (~ 3.5%), fine- to medium-grained metagranitoid (~ 2.7%), medium-grained metadiorite-gabbro (1.4%), aplitic metagranite (< 1%), quartz-dominated hydrothermal veins (< 1%), calc-silicate rock (< 1%) and felsic to intermediate metavolcanic rock (< 1%).

5.2 Fractures and crushed sections

A number of 1,214 unbroken and 718 broken fractures were documented in KFM02B (88.56–573.54 m). Of the unbroken fractures 25 show an aperture, while 53 of the broken fractures are considered artificial and have an aperture set to 0. This result in the following interpreted fracture frequencies: 2.6 sealed fractures/m (sealed network excluded), 1.4 open fractures/m (crushed sections excluded) and 0.05 partly open fractures/m.

The open and sealed fractures are concentrated to the intervals 100–200 m and 400–500 m. In these intervals a few fracture apertures range up to 10 or 20 mm and a few fractures show moderate alteration on their fracture surfaces. However, most fracture surfaces are fresh to slightly altered. The most frequent fracture minerals in the first section are calcite, chlorite, adularia, hematite, and oxidized walls. Chlorite, calcite, X5 (no detectable minerals), prehnite, clay minerals and oxidized walls are most frequent in the latter section.

Six sections with crushed core, associated with core sections containing increased fracture frequencies, occur between 400 and 500 m borehole length. They occur at 449.42–449.50 m, 471.46–471.49 m, 471.58–471.67 m, 499.95–500.02 m, 500.64–500.71 and 501.00–501.02 m and are oriented 000/52, 007/29, 098/30, 041/16, 092/46 and 339/13, respectively. The crushed section at 471.58 m borehole length is highly altered, containing clay minerals, hematite and calcite. The remaining crush sections contain chlorite, clay minerals, calcite, prehnite and also epidote and the crush section at 449.42 m shows high alteration.

Minor core sections with increased frequency of sealed fractures and sealed fracture networks occur at 187–194 m, 464–472 m and 487–490 m. Minor sections with increased frequency of open fractures occur at 102–103 m, 157–159 m, 420–430 m, 470–472 m and 497–502 m. Only few fractures in the section mentioned show apertures in BIPS. The most frequent filling minerals associated with open fracture are calcite, chlorite, X5 (no detectable minerals), clay minerals, pyrite and oxidized walls.

5.3 Sealed brittle to ductile deformation

The rock types in borehole KFM02B show commonly weak to moderate lineation. The lineation is undulating in the borehole, with a dominant orientation of 139/46 (see Appendix 1). A section of brittle to brittle-ductile deformation is observed around 498 m, these structures precedes the crush section at 500.64 m.

At approximately 450 m borehole length, the structure of the rock type changes from lineated to foliated. In the last 30 m of the borehole lineation is the dominating structure (Appendix 1).

5.4 Alteration

The borehole interval 166.79–168.90 m is affected by weak to medium quartz dissolution together with strong oxidation and chloritization.

Albitization is usually observed in the contacts to amphibolites /6/. Other alteration types are sporadic and usually very minor. These are epidotization, chloritization, sassuritization, sericitization and silicification.

5.5 Core discing and other probably drill induced features

One minor core discing is observed at in the interval 174.36–174.52 m.

Fractures with no visible fracture mineral, no reaction with hydrochloric acid, very fresh surfaces and visible aperture in the BIPS-image, are relatively common in KFM02B. This kind of fractures can be observed for instance in the intervals 422–426 m and 429–439 m.

Mechanical crush occurs in the intervals 102.31–102.41 m, 102.51–102.71 m, 152.76–157.83 m, 152.98–153.12 m, and 233.78–234.03 m.

References

/1/ **SKB, 2005.** Preliminary site description, Forsmark area – version 1.2. SKB R-05-18, Svensk Kärnbränslehantering AB.

/2/ **Barton N, 2002.** Some new Q-value correlations to assist in site characterization and tunnel design. International Journal of Rock Mechanics & Mining Sciences Vol. 39 (2002), pp 185–216.

/3/ **Ehrenborg J, Steiskal V, 2004.** Oskarshamn Site Investigation. Boremap mapping of core drilled boreholes KSH01A and KSH01B. SKB P-04-01, Svensk Kärnbränslehantering AB.

/4/ **Claesson, L-Å, Nilsson, G, Ullberg, A, 2006.** Forsmark site investigation**.** Drilling of the telescopic borehole KFM02B at drill site DS2. SKB P-07-44, Svensk Kärnbränslehantering AB.

/5/ **International Society for Rock Mechanics Commission on Standardization of Laboratory and Field Tests, 1978.** Suggested Methods for the Quantitative Description of Discontinuities in Rock Masses. International Journal of Rock Mechanics & Mining Sciences, Vol.15 (1978), pp.319–368.

/6/ **Petersson J, Berglund J, Danielsson P, Skogsmo G, 2005.** Forsmark Site Investigation. Petrographic and geochemical characterisitics of bedrock samples from boreholes KFM04A-06A, and a whitened alteration rock. SKB-P-05-156, Svensk Kärnbränslehantering AB.

Appendix 1

WellCad-diagram and legend

Title	LEGEND FOR FORSMARK	KFM02B	Appendix: 1

Site FORSMARK
Borehole KFM02B
Plot Date 2007-06-03 23:15:13
Signed data

ROCKTYPE FORSMARK
- Granite, fine- to medium-grained
- Pegmatite, pegmatitic granite
- Granitoid, metamorphic
- Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained
- Granite, metamorphic, aplitic
- Granite to granodiorite, metamorphic, medium-grained
- Granodiorite, metamorphic
- Tonalite to granodiorite, metamorphic
- Diorite, quarts diorite and gabbro, metamorphic
- Ultramafic rock, metamorphic
- Amphibolite
- Calc-silicate rock (skarn)
- Magnetite mineralization associated with calc-silicate rock (skarn)
- Sulphide mineralization
- Felsic to intermediate volcanic rock, metamorphic
- Mafic volcanic rock, metamorphic
- Sedimentary rock, metamorphic

ROCK ALTERATION
- Oxidized
- Chloritisized
- Epidotisized
- Weathered
- Tectonized
- Sericitisized
- Quartz dissolution
- Silicification
- Argillization
- Albitization
- Carbonatization
- Saussuritization
- Steatitization
- Uralitization
- Laumontitization
- Fract zone alteration

MINERAL
- Epidote
- Calcite
- Chlorite
- Quartz
- Pyrite
- Clay Minerals
- Laumontite
- Prehnite
- Oxidized Walls

STRUCTURE
- Cataclastic
- Schistose
- Gneissic
- Mylonitic
- Ductile Shear Zone
- Brittle-Ductile Zone
- Veined
- Banded
- Massive
- Foliated
- Brecciated
- Lineated

TEXTURE
- Hornfelsed
- Porphyritic
- Ophitic
- Equigranular
- Augen-Bearing
- Unequigranular
- Metamorphic

GRAINSIZE
- Aphanitic
- Fine-grained
- Fine to medium grained
- Medium to coarse grained
- Coarse-grained
- Medium-grained

STRUCTURE ORIENTATION
- Schistose
- Gneissic
- Bedded
- Cataclastic
- Ductile Shear Zone
- Brittle-Ductile Shear Zone
- Veined
- Banded
- Lineated
- Brecciated
- Mylonitic
- Foliated

ROCK ALTERATION INTENSITY
- No intensity
- Faint
- Weak
- Medium
- Strong

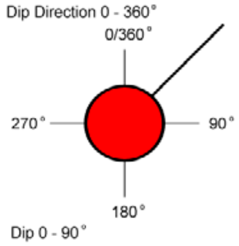
ROUGHNESS
- Planar
- Undulating
- Stepped
- Irregular

SURFACE
- Rough
- Smooth
- Slickensided

CRUSH ALTERATION
- Slightly Altered
- Moderately Altered
- Highly Altered
- Completley Altered
- Gouge
- Fresh

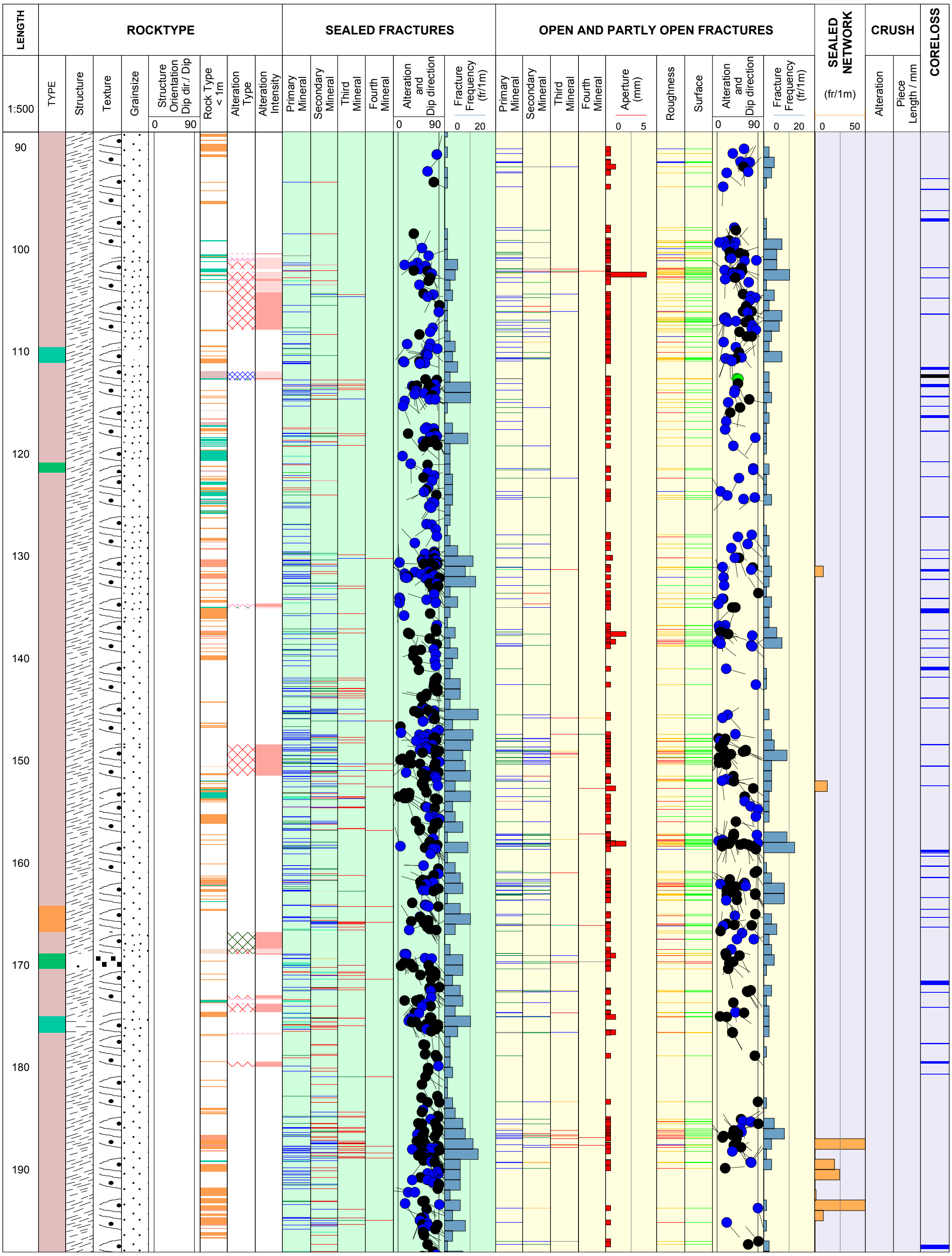
FRACTURE ALTERATION
- Fresh
- Gouge
- Completely Altered
- Highly Altered
- Moderately Altered
- Slightly Altered

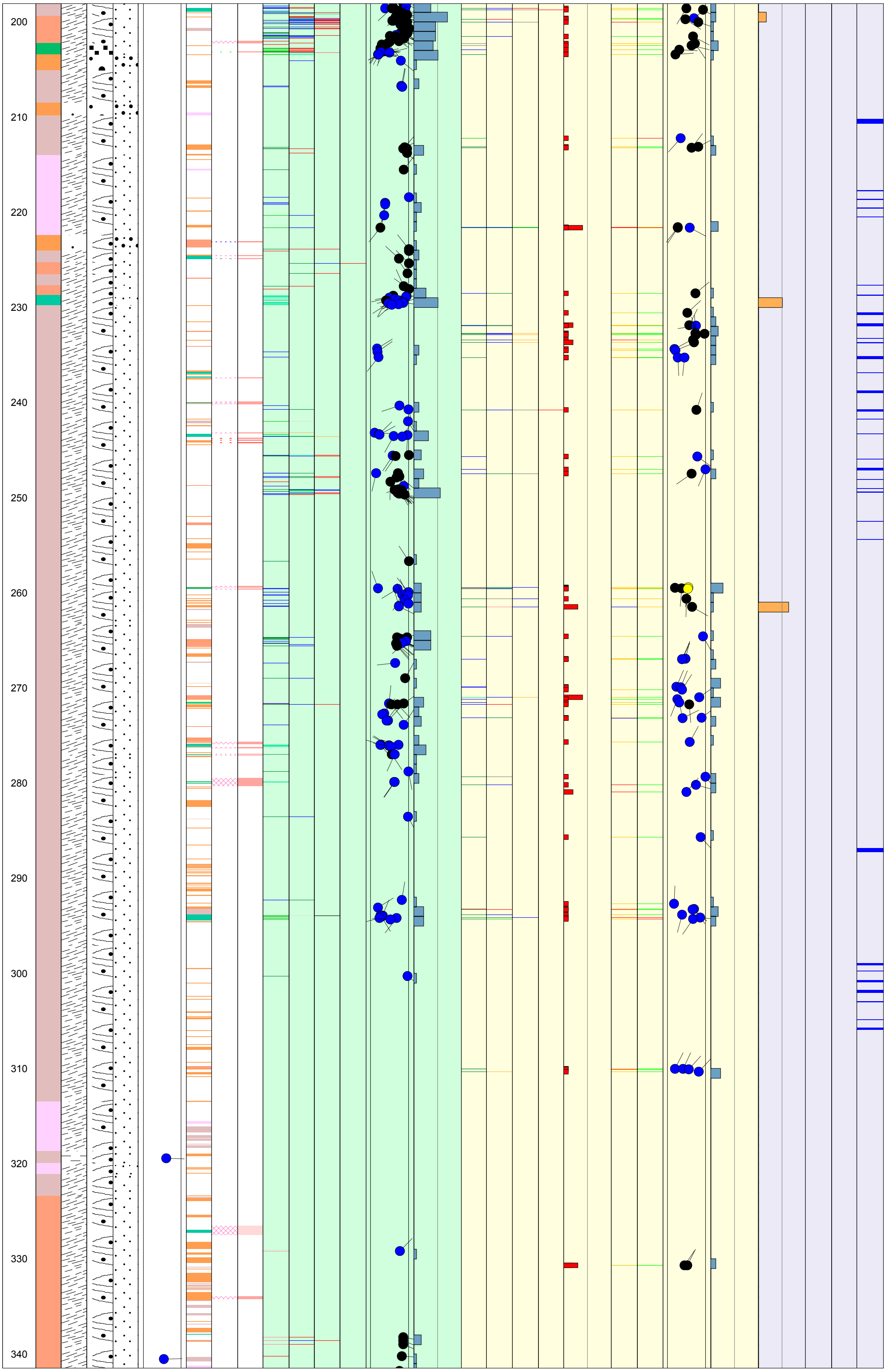
FRACTURE DIRECTION
STRUKTURE ORIENTATION



Title **GEOLOGY IN KFM02B** **Appendix: 1**

Site	FORSMARK	**Coordinate System**	RT90-RHB70
Borehole	KFM02B	**Northing [m]**	6698719.19
Diameter [mm]	76	**Easting [m]**	1633186.29
Length [m]	573.870	**Elevation [m.a.s.l.]**	7.62
Bearing [°]	313.06	**Drilling Start Date**	2006-06-06 00:00:00
Inclination [°]	-80.26	**Drilling Stop Date**	2007-02-13 00:00:00
Date of coremapping	2006-11-27 13:41:00	**Plot Date**	2007-06-03 23:15:13
Rocktype data from	p_rock	**Signed data**	

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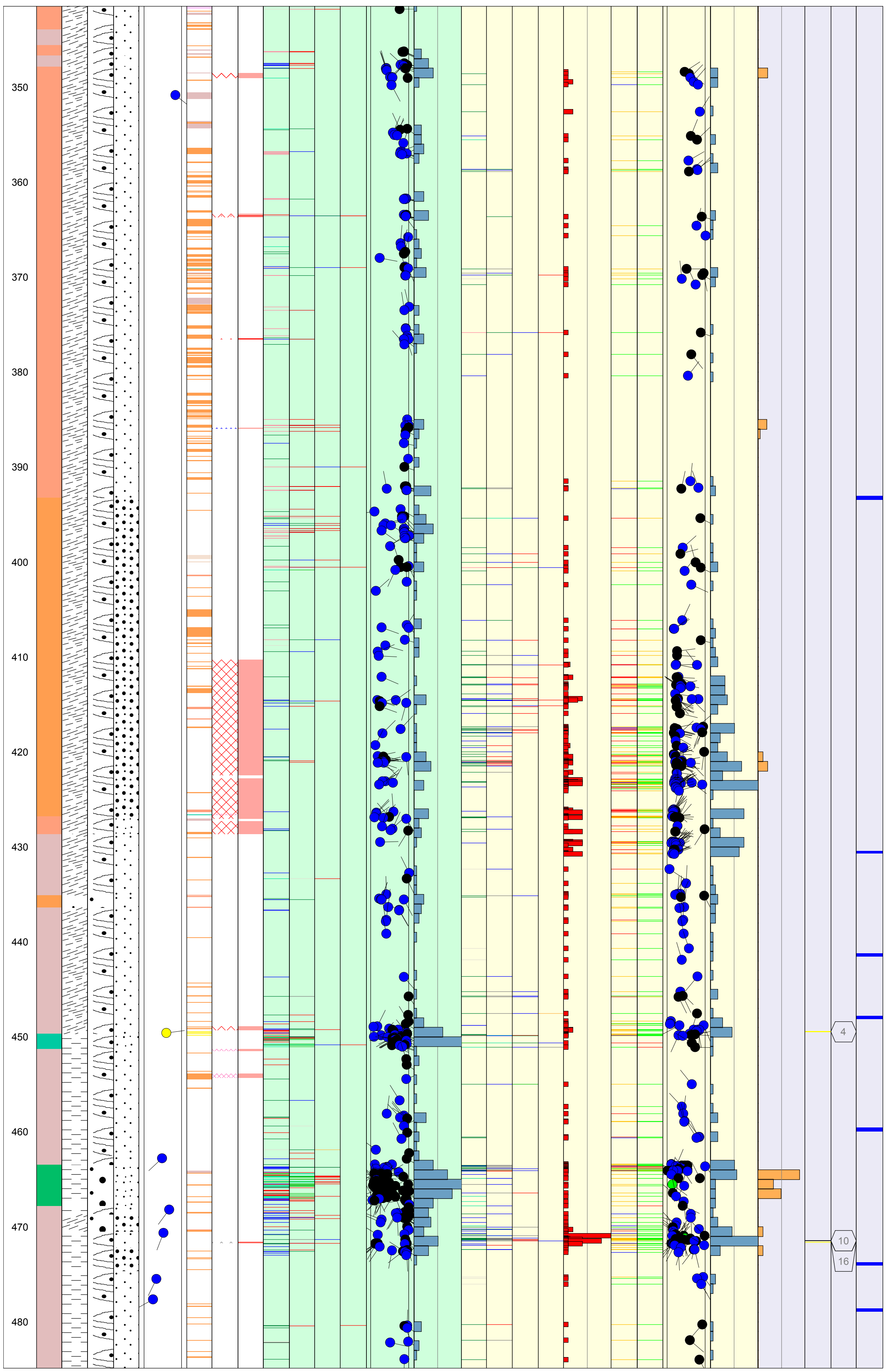
230
240
250
260
270
280
290
300
310
320
330
340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370
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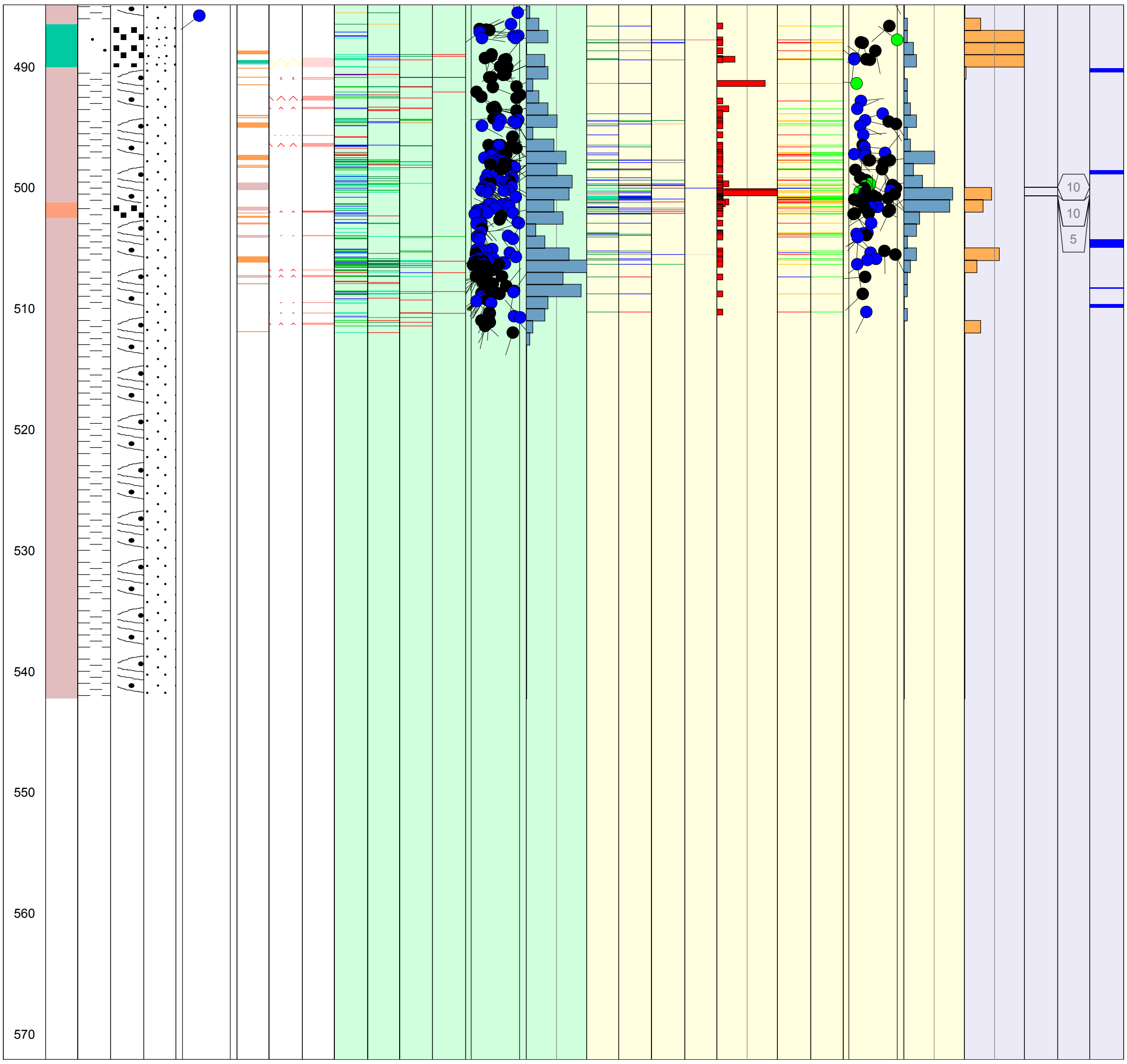
390
400
410
420
430
440
450
460
470
480
4
10
16



490
500
510
520
530
540
550
560
570
10
10
5

Appendix 2

Indata: Length reference marks, borehole diameter and borehole length

Reference Mark T – Reference mark in drillhole

KFM02B, 2007-02-08 09:00:00 – 2007-09-08 12:30:00 (110.000–510.000 m)

Bhlen (m)	Rotation Speed (rpm)	Start Flow (l/h)	Stop Flow (l/h)	Stop Pressure (bar)	Cutter Time (s)	Trace Detectable	Cutter Diameter (mm)	Comment	QC
110.00	400.00	400	250	30.0	47	JA	82.0	111.68/111.78	*
150.00	400.00	400	250	35.0	42	JA	82.0	151.83/151.93	*
200.00	400.00	400	250	35.0	53	JA	82.0	202.11/202.21	*
250.00	400.00	400	250	35.0	47	JA	82.0	252.38/252.48	*
300.00	400.00	400	250	38.0	57	JA	82.0	302.62/302.72	*
350.00	400.00	400	250	39.0	45	JA	82.0	352.92/353.02	*
400.00	400.00	400	250	40.0	57	JA	82.0	403.18/403.28	*
452.00	400.00	400	250	40.0	57	JA	82.0	455.49/455.59	*
510.00	400.00	400	250	40.0	63	JA	82.0	513.82/513.92	*

Printout from SICADA 2007-05-30 10:28:29.

Hole Diam T – Drilling: Borehole diameter

KFM02B, 2006-06-06 00:00:00 – 2007-02-13 00:00:00 (0.000–573.870 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment	QC
87.150	88.610	0.0860	cement från 86.57–87.15	*
88.610	573.870	0.0758	atlas corac wl	*

Printout from SICADA 2007-05-30 10:53:18.

Maxibor T – Borehole deviation: Maxibor

KFM02B, 2007-02-14 11:00:00 – 2007-02-14 15:00:00 (3.000–567.000 m)

Length (m)	Northing (m)	Easting (m)	Elevation (m)	Coord System	Inclination (degrees)	Bearing (degrees)	Local A (m)	Local B (m)	Local C (m)	Extrapol Flag	QC
3.00	6698719.54	1633185.92	4.66	RT90-RHB70	–80.27	313.06	0.0000	0.0000	0.0000		*
6.00	6698719.89	1633185.55	1.70	RT90-RHB70	–80.22	313.14	0.5100	0.0000	0.0000		*
9.00	6698720.23	1633185.18	–1.25	RT90-RHB70	–80.23	313.09	1.0200	0.0000	0.0000		*
12.00	6698720.58	1633184.81	–4.21	RT90-RHB70	–80.25	313.17	1.5300	0.0000	0.0000		*
15.00	6698720.93	1633184.44	–7.17	RT90-RHB70	–80.37	312.57	2.0300	0.0000	0.0100		*
18.00	6698721.27	1633184.07	–10.12	RT90-RHB70	–80.40	312.03	2.5400	0.0000	0.0000		*
21.00	6698721.60	1633183.69	–13.08	RT90-RHB70	–80.38	312.03	3.0400	–0.0100	–0.0100		*
24.00	6698721.94	1633183.32	–16.04	RT90-RHB70	–80.47	312.37	3.5400	–0.0200	–0.0100		*
27.00	6698722.27	1633182.95	–19.00	RT90-RHB70	–80.58	312.69	4.0300	–0.0300	–0.0200		*
30.00	6698722.61	1633182.59	–21.96	RT90-RHB70	–80.61	312.24	4.5200	–0.0300	–0.0400		*
33.00	6698722.94	1633182.23	–24.92	RT90-RHB70	–80.61	311.98	5.0100	–0.0400	–0.0600		*
36.00	6698723.26	1633181.87	–27.88	RT90-RHB70	–80.70	312.10	5.5000	–0.0500	–0.0700		*
39.00	6698723.59	1633181.51	–30.84	RT90-RHB70	–80.72	311.67	5.9900	–0.0500	–0.1000		*
42.00	6698723.91	1633181.15	–33.80	RT90-RHB70	–80.72	311.58	6.4700	–0.0700	–0.1200		*
45.00	6698724.23	1633180.78	–36.76	RT90-RHB70	–80.78	311.39	6.9600	–0.0800	–0.1400		*
48.00	6698724.55	1633180.42	–39.72	RT90-RHB70	–80.75	311.04	7.4400	–0.0900	–0.1700		*
51.00	6698724.87	1633180.06	–42.68	RT90-RHB70	–80.72	310.63	7.9200	–0.1100	–0.2000		*
54.00	6698725.18	1633179.69	–45.64	RT90-RHB70	–80.77	310.99	8.4000	–0.1300	–0.2200		*
57.00	6698725.50	1633179.33	–48.60	RT90-RHB70	–80.92	311.80	8.8800	–0.1500	–0.2500		*
60.00	6698725.81	1633178.98	–51.57	RT90-RHB70	–81.04	311.83	9.3600	–0.1600	–0.2800		*
63.00	6698726.12	1633178.63	–54.53	RT90-RHB70	–81.05	311.60	9.8200	–0.1700	–0.3200		*
66.00	6698726.43	1633178.28	–57.49	RT90-RHB70	–80.96	310.95	10.2900	–0.1800	–0.3600		*
69.00	6698726.74	1633177.92	–60.46	RT90-RHB70	–80.98	310.54	10.7600	–0.2000	–0.4000		*
72.00	6698727.05	1633177.57	–63.42	RT90-RHB70	–81.05	310.50	11.2300	–0.2200	–0.4400		*
75.00	6698727.35	1633177.21	–66.38	RT90-RHB70	–81.03	310.39	11.7000	–0.2400	–0.4800		*
78.00	6698727.65	1633176.86	–69.35	RT90-RHB70	–80.93	310.31	12.1600	–0.2600	–0.5200		*
81.00	6698727.96	1633176.49	–72.31	RT90-RHB70	–80.87	310.60	12.6400	–0.2800	–0.5500		*
84.00	6698728.27	1633176.13	–75.27	RT90-RHB70	–80.84	310.97	13.1100	–0.3000	–0.5900		*
87.00	6698728.58	1633175.77	–78.23	RT90-RHB70	–80.83	311.42	13.5900	–0.3200	–0.6200		*
90.00	6698728.90	1633175.41	–81.19	RT90-RHB70	–80.84	311.50	14.0700	–0.3300	–0.6500		*
93.00	6698729.22	1633175.06	–84.16	RT90-RHB70	–80.84	311.50	14.5400	–0.3500	–0.6800		*
96.00	6698729.53	1633174.70	–87.12	RT90-RHB70	–80.84	311.51	15.0200	–0.3600	–0.7100		*
99.00	6698729.85	1633174.34	–90.08	RT90-RHB70	–80.84	311.40	15.5000	–0.3700	–0.7400		*
102.00	6698730.17	1633173.98	–93.04	RT90-RHB70	–80.80	311.43	15.9800	–0.3900	–0.7700		*
105.00	6698730.48	1633173.62	–96.00	RT90-RHB70	–80.74	311.64	16.4600	–0.4000	–0.7900		*
108.00	6698730.80	1633173.26	–98.96	RT90-RHB70	–80.70	311.80	16.9400	–0.4100	–0.8200		*
111.00	6698731.13	1633172.90	–101.92	RT90-RHB70	–80.68	311.90	17.4200	–0.4200	–0.8400		*
114.00	6698731.45	1633172.54	–104.88	RT90-RHB70	–80.68	312.04	17.9100	–0.4300	–0.8600		*
117.00	6698731.78	1633172.18	–107.84	RT90-RHB70	–80.66	312.13	18.3900	–0.4400	–0.8800		*
120.00	6698732.10	1633171.82	–110.80	RT90-RHB70	–80.63	312.28	18.8800	–0.4500	–0.9000		*
123.00	6698732.43	1633171.46	–113.76	RT90-RHB70	–80.64	312.36	19.3700	–0.4600	–0.9200		*
126.00	6698732.76	1633171.10	–116.72	RT90-RHB70	–80.66	312.35	19.8600	–0.4600	–0.9400		*
129.00	6698733.09	1633170.74	–119.68	RT90-RHB70	–80.66	312.39	20.3400	–0.4700	–0.9600		*
132.00	6698733.42	1633170.38	–122.64	RT90-RHB70	–80.66	312.52	20.8300	–0.4700	–0.9800		*
135.00	6698733.75	1633170.02	–125.61	RT90-RHB70	–80.65	312.58	21.3200	–0.4800	–1.0000		*
138.00	6698734.08	1633169.66	–128.57	RT90-RHB70	–80.63	312.53	21.8000	–0.4800	–1.0200		*
141.00	6698734.41	1633169.30	–131.53	RT90-RHB70	–80.62	312.54	22.2900	–0.4900	–1.0400		*

Length (m)	Northing (m)	Easting (m)	Elevation (m)	Coord System	Inclination (degrees)	Bearing (degrees)	Local A (m)	Local B (m)	Local C (m)	Extrapol Flag	QC
144.00	6698734.74	1633168.94	–134.49	RT90-RHB70	–80.61	312.52	22.7800	–0.4900	–1.0600		*
147.00	6698735.07	1633168.58	–137.44	RT90-RHB70	–80.58	312.45	23.2700	–0.5000	–1.0800		*
150.00	6698735.40	1633168.22	–140.40	RT90-RHB70	–80.52	312.50	23.7600	–0.5000	–1.1000		*
153.00	6698735.73	1633167.85	–143.36	RT90-RHB70	–80.50	312.60	24.2600	–0.5100	–1.1100		*
156.00	6698736.07	1633167.49	–146.32	RT90-RHB70	–80.49	312.69	24.7500	–0.5100	–1.1200		*
159.00	6698736.40	1633167.12	–149.28	RT90-RHB70	–80.48	312.74	25.2500	–0.5100	–1.1300		*
162.00	6698736.74	1633166.76	–152.24	RT90-RHB70	–80.46	312.85	25.7400	–0.5200	–1.1400		*
165.00	6698737.08	1633166.39	–155.20	RT90-RHB70	–80.45	313.00	26.2400	–0.5200	–1.1500		*
168.00	6698737.42	1633166.03	–158.16	RT90-RHB70	–80.45	313.03	26.7400	–0.5200	–1.1600		*
171.00	6698737.76	1633165.67	–161.12	RT90-RHB70	–80.42	313.09	27.2400	–0.5200	–1.1700		*
174.00	6698738.10	1633165.30	–164.07	RT90-RHB70	–80.40	313.23	27.7400	–0.5200	–1.1800		*
177.00	6698738.44	1633164.94	–167.03	RT90-RHB70	–80.39	313.27	28.2400	–0.5200	–1.1900		*
180.00	6698738.78	1633164.57	–169.99	RT90-RHB70	–80.37	313.22	28.7400	–0.5100	–1.1900		*
183.00	6698739.13	1633164.21	–172.95	RT90-RHB70	–80.35	313.29	29.2400	–0.5100	–1.2000		*
186.00	6698739.47	1633163.84	–175.90	RT90-RHB70	–80.35	313.42	29.7400	–0.5100	–1.2000		*
189.00	6698739.82	1633163.48	–178.86	RT90-RHB70	–80.34	313.40	30.2400	–0.5100	–1.2100		*
192.00	6698740.16	1633163.11	–181.82	RT90-RHB70	–80.32	313.38	30.7500	–0.5100	–1.2100		*
195.00	6698740.51	1633162.74	–184.78	RT90-RHB70	–80.30	313.39	31.2500	–0.5000	–1.2100		*
198.00	6698740.86	1633162.38	–187.73	RT90-RHB70	–80.30	313.47	31.7600	–0.5000	–1.2100		*
201.00	6698741.21	1633162.01	–190.69	RT90-RHB70	–80.29	313.58	32.2600	–0.5000	–1.2200		*
204.00	6698741.55	1633161.64	–193.65	RT90-RHB70	–80.27	313.62	32.7700	–0.4900	–1.2200		*
207.00	6698741.90	1633161.27	–196.60	RT90-RHB70	–80.25	313.71	33.2800	–0.4900	–1.2200		*
210.00	6698742.26	1633160.91	–199.56	RT90-RHB70	–80.24	313.79	33.7800	–0.4800	–1.2200		*
213.00	6698742.61	1633160.54	–202.52	RT90-RHB70	–80.22	313.84	34.2900	–0.4700	–1.2100		*
216.00	6698742.96	1633160.17	–205.47	RT90-RHB70	–80.21	313.87	34.8000	–0.4700	–1.2100		*
219.00	6698743.31	1633159.80	–208.43	RT90-RHB70	–80.24	313.85	35.3100	–0.4600	–1.2100		*
222.00	6698743.67	1633159.44	–211.39	RT90-RHB70	–80.28	313.94	35.8200	–0.4500	–1.2100		*
225.00	6698744.02	1633159.07	–214.34	RT90-RHB70	–80.34	314.09	36.3300	–0.4500	–1.2100		*
228.00	6698744.37	1633158.71	–217.30	RT90-RHB70	–80.37	314.20	36.8300	–0.4400	–1.2100		*
231.00	6698744.72	1633158.35	–220.26	RT90-RHB70	–80.39	314.28	37.3300	–0.4300	–1.2200		*
234.00	6698745.07	1633157.99	–223.22	RT90-RHB70	–80.39	314.19	37.8300	–0.4200	–1.2200		*
237.00	6698745.42	1633157.63	–226.18	RT90-RHB70	–80.36	314.13	38.3300	–0.4100	–1.2300		*
240.00	6698745.77	1633157.27	–229.13	RT90-RHB70	–80.34	314.15	38.8400	–0.4000	–1.2300		*
243.00	6698746.12	1633156.91	–232.09	RT90-RHB70	–80.33	314.14	39.3400	–0.3900	–1.2400		*
246.00	6698746.47	1633156.55	–235.05	RT90-RHB70	–80.33	314.06	39.8400	–0.3800	–1.2400		*
249.00	6698746.82	1633156.19	–238.01	RT90-RHB70	–80.32	314.03	40.3500	–0.3700	–1.2500		*
252.00	6698747.17	1633155.83	–240.96	RT90-RHB70	–80.31	314.04	40.8500	–0.3600	–1.2500		*
255.00	6698747.52	1633155.46	–243.92	RT90-RHB70	–80.31	314.03	41.3600	–0.3500	–1.2500		*
258.00	6698747.87	1633155.10	–246.88	RT90-RHB70	–80.31	313.96	41.8600	–0.3400	–1.2500		*
261.00	6698748.22	1633154.74	–249.83	RT90-RHB70	–80.31	313.97	42.3700	–0.3300	–1.2500		*
264.00	6698748.57	1633154.37	–252.79	RT90-RHB70	–80.30	314.10	42.8700	–0.3300	–1.2600		*
267.00	6698748.92	1633154.01	–255.75	RT90-RHB70	–80.29	314.22	43.3800	–0.3200	–1.2600		*
270.00	6698749.28	1633153.65	–258.71	RT90-RHB70	–80.28	314.31	43.8800	–0.3100	–1.2600		*
273.00	6698749.63	1633153.29	–261.66	RT90-RHB70	–80.27	314.40	44.3900	–0.3000	–1.2600		*
276.00	6698749.99	1633152.92	–264.62	RT90-RHB70	–80.27	314.51	44.9000	–0.2800	–1.2600		*
279.00	6698750.34	1633152.56	–267.58	RT90-RHB70	–80.26	314.62	45.4000	–0.2700	–1.2600		*
282.00	6698750.70	1633152.20	–270.53	RT90-RHB70	–80.26	314.71	45.9100	–0.2600	–1.2600		*
285.00	6698751.05	1633151.84	–273.49	RT90-RHB70	–80.26	314.74	46.4200	–0.2400	–1.2600		*
288.00	6698751.41	1633151.48	–276.45	RT90-RHB70	–80.25	314.73	46.9200	–0.2300	–1.2600		*

Length (m)	Northing (m)	Easting (m)	Elevation (m)	Coord System	Inclination (degrees)	Bearing (degrees)	Local A (m)	Local B (m)	Local C (m)	Extrapol Flag	QC
291.00	6698751.77	1633151.12	–279.40	RT90-RHB70	–80.24	314.81	47.4300	–0.2100	–1.2600		*
294.00	6698752.13	1633150.76	–282.36	RT90-RHB70	–80.24	314.94	47.9400	–0.2000	–1.2600		*
297.00	6698752.49	1633150.40	–285.32	RT90-RHB70	–80.25	315.02	48.4500	–0.1800	–1.2500		*
300.00	6698752.85	1633150.04	–288.27	RT90-RHB70	–80.26	315.02	48.9600	–0.1600	–1.2500		*
303.00	6698753.21	1633149.68	–291.23	RT90-RHB70	–80.26	314.94	49.4700	–0.1500	–1.2500		*
306.00	6698753.56	1633149.32	–294.19	RT90-RHB70	–80.26	314.96	49.9700	–0.1300	–1.2500		*
309.00	6698753.92	1633148.96	–297.14	RT90-RHB70	–80.25	315.08	50.4800	–0.1100	–1.2500		*
312.00	6698754.28	1633148.60	–300.10	RT90-RHB70	–80.24	315.12	50.9900	–0.1000	–1.2500		*
315.00	6698754.64	1633148.24	–303.06	RT90-RHB70	–80.24	315.11	51.5000	–0.0800	–1.2500		*
318.00	6698755.00	1633147.88	–306.01	RT90-RHB70	–80.25	315.19	52.0000	–0.0600	–1.2500		*
321.00	6698755.36	1633147.53	–308.97	RT90-RHB70	–80.25	315.30	52.5100	–0.0400	–1.2500		*
324.00	6698755.73	1633147.17	–311.93	RT90-RHB70	–80.22	315.37	53.0200	–0.0200	–1.2500		*
327.00	6698756.09	1633146.81	–314.88	RT90-RHB70	–80.17	315.38	53.5300	0.0000	–1.2500		*
330.00	6698756.45	1633146.45	–317.84	RT90-RHB70	–80.16	315.57	54.0400	0.0200	–1.2400		*
333.00	6698756.82	1633146.09	–320.79	RT90-RHB70	–80.17	315.77	54.5500	0.0400	–1.2400		*
336.00	6698757.19	1633145.73	–323.75	RT90-RHB70	–80.17	315.92	55.0600	0.0700	–1.2300		*
339.00	6698757.55	1633145.38	–326.71	RT90-RHB70	–80.18	316.09	55.5800	0.0900	–1.2300		*
342.00	6698757.92	1633145.02	–329.66	RT90-RHB70	–80.18	316.27	56.0900	0.1200	–1.2200		*
345.00	6698758.29	1633144.67	–332.62	RT90-RHB70	–80.17	316.40	56.6000	0.1500	–1.2200		*
348.00	6698758.66	1633144.32	–335.57	RT90-RHB70	–80.16	316.49	57.1100	0.1800	–1.2100		*
351.00	6698759.03	1633143.96	–338.53	RT90-RHB70	–80.15	316.61	57.6200	0.2100	–1.2100		*
354.00	6698759.41	1633143.61	–341.49	RT90-RHB70	–80.14	316.79	58.1300	0.2400	–1.2000		*
357.00	6698759.78	1633143.26	–344.44	RT90-RHB70	–80.14	316.93	58.6500	0.2700	–1.2000		*
360.00	6698760.16	1633142.91	–347.40	RT90-RHB70	–80.13	316.94	59.1600	0.3100	–1.1900		*
363.00	6698760.53	1633142.56	–350.35	RT90-RHB70	–80.10	316.92	59.6700	0.3400	–1.1900		*
366.00	6698760.91	1633142.20	–353.31	RT90-RHB70	–80.09	316.95	60.1900	0.3800	–1.1800		*
369.00	6698761.29	1633141.85	–356.26	RT90-RHB70	–80.06	317.00	60.7000	0.4100	–1.1700		*
372.00	6698761.67	1633141.50	–359.22	RT90-RHB70	–80.03	317.15	61.2200	0.4500	–1.1600		*
375.00	6698762.05	1633141.15	–362.17	RT90-RHB70	–80.01	317.31	61.7400	0.4900	–1.1500		*
378.00	6698762.43	1633140.79	–365.13	RT90-RHB70	–80.00	317.45	62.2500	0.5300	–1.1400		*
381.00	6698762.81	1633140.44	–368.08	RT90-RHB70	–80.00	317.51	62.7700	0.5700	–1.1200		*
384.00	6698763.20	1633140.09	–371.04	RT90-RHB70	–79.98	317.60	63.2900	0.6100	–1.1100		*
387.00	6698763.58	1633139.74	–373.99	RT90-RHB70	–79.97	317.67	63.8100	0.6500	–1.1000		*
390.00	6698763.97	1633139.39	–376.94	RT90-RHB70	–79.97	317.78	64.3300	0.6900	–1.0800		*
393.00	6698764.36	1633139.03	–379.90	RT90-RHB70	–79.97	317.83	64.8600	0.7300	–1.0700		*
396.00	6698764.74	1633138.68	–382.85	RT90-RHB70	–79.97	317.81	65.3800	0.7800	–1.0600		*
399.00	6698765.13	1633138.33	–385.81	RT90-RHB70	–79.96	317.82	65.9000	0.8200	–1.0400		*
402.00	6698765.52	1633137.98	–388.76	RT90-RHB70	–79.96	317.91	66.4200	0.8600	–1.0300		*
405.00	6698765.91	1633137.63	–391.72	RT90-RHB70	–79.96	317.95	66.9400	0.9100	–1.0100		*
408.00	6698766.29	1633137.28	–394.67	RT90-RHB70	–79.96	317.89	67.4600	0.9500	–1.0000		*
411.00	6698766.68	1633136.93	–397.62	RT90-RHB70	–79.95	317.88	67.9800	0.9900	–0.9900		*
414.00	6698767.07	1633136.58	–400.58	RT90-RHB70	–79.95	317.86	68.5000	1.0400	–0.9700		*
417.00	6698767.46	1633136.23	–403.53	RT90-RHB70	–79.94	317.76	69.0200	1.0800	–0.9600		*
420.00	6698767.85	1633135.88	–406.49	RT90-RHB70	–79.93	317.73	69.5500	1.1300	–0.9400		*
423.00	6698768.23	1633135.52	–409.44	RT90-RHB70	–79.93	317.78	70.0700	1.1700	–0.9200		*
426.00	6698768.62	1633135.17	–412.39	RT90-RHB70	–79.94	317.86	70.5900	1.2100	–0.9100		*
429.00	6698769.01	1633134.82	–415.35	RT90-RHB70	–79.93	317.95	71.1100	1.2600	–0.8900		*
432.00	6698769.40	1633134.47	–418.30	RT90-RHB70	–79.93	318.11	71.6400	1.3000	–0.8800		*
435.00	6698769.79	1633134.12	–421.25	RT90-RHB70	–79.91	318.27	72.1600	1.3500	–0.8600		*

Length (m)	Northing (m)	Easting (m)	Elevation (m)	Coord System	Inclination (degrees)	Bearing (degrees)	Local A (m)	Local B (m)	Local C (m)	Extrapol Flag	QC
438.00	6698770.18	1633133.77	–424.21	RT90-RHB70	–79.89	318.34	72.6800	1.3900	–0.8400		*
441.00	6698770.58	1633133.42	–427.16	RT90-RHB70	–79.84	318.35	73.2100	1.4400	–0.8300		*
444.00	6698770.97	1633133.07	–430.11	RT90-RHB70	–79.79	318.38	73.7300	1.4900	–0.8100		*
447.00	6698771.37	1633132.71	–433.07	RT90-RHB70	–79.78	318.39	74.2600	1.5400	–0.7800		*
450.00	6698771.77	1633132.36	–436.02	RT90-RHB70	–79.78	318.49	74.7900	1.5900	–0.7600		*
453.00	6698772.17	1633132.01	–438.97	RT90-RHB70	–79.77	318.60	75.3200	1.6400	–0.7400		*
456.00	6698772.57	1633131.65	–441.92	RT90-RHB70	–79.73	318.65	75.8500	1.6900	–0.7100		*
459.00	6698772.97	1633131.30	–444.88	RT90-RHB70	–79.70	318.67	76.3900	1.7400	–0.6900		*
462.00	6698773.37	1633130.95	–447.83	RT90-RHB70	–79.69	318.52	76.9200	1.8000	–0.6600		*
465.00	6698773.77	1633130.59	–450.78	RT90-RHB70	–79.68	318.31	77.4500	1.8500	–0.6300		*
468.00	6698774.17	1633130.23	–453.73	RT90-RHB70	–79.67	318.07	77.9900	1.9000	–0.6000		*
471.00	6698774.57	1633129.87	–456.68	RT90-RHB70	–79.64	317.87	78.5200	1.9400	–0.5700		*
474.00	6698774.97	1633129.51	–459.63	RT90-RHB70	–79.59	317.81	79.0600	1.9900	–0.5400		*
477.00	6698775.38	1633129.15	–462.58	RT90-RHB70	–79.54	317.86	79.6000	2.0300	–0.5100		*
480.00	6698775.78	1633128.78	–465.53	RT90-RHB70	–79.50	317.91	80.1400	2.0800	–0.4700		*
483.00	6698776.18	1633128.42	–468.48	RT90-RHB70	–79.46	317.96	80.6900	2.1300	–0.4300		*
486.00	6698776.59	1633128.05	–471.43	RT90-RHB70	–79.43	318.20	81.2400	2.1700	–0.3900		*
489.00	6698777.00	1633127.68	–474.38	RT90-RHB70	–79.41	318.19	81.7800	2.2200	–0.3500		*
492.00	6698777.41	1633127.31	–477.33	RT90-RHB70	–79.38	318.07	82.3300	2.2700	–0.3100		*
495.00	6698777.83	1633126.94	–480.28	RT90-RHB70	–79.36	318.10	82.8800	2.3200	–0.2700		*
498.00	6698778.24	1633126.57	–483.23	RT90-RHB70	–79.34	318.08	83.4400	2.3700	–0.2200		*
501.00	6698778.65	1633126.20	–486.18	RT90-RHB70	–79.33	318.00	83.9900	2.4200	–0.1700		*
504.00	6698779.06	1633125.83	–489.12	RT90-RHB70	–79.33	318.02	84.5400	2.4600	–0.1300		*
507.00	6698779.48	1633125.46	–492.07	RT90-RHB70	–79.33	318.08	85.1000	2.5100	–0.0800		*
510.00	6698779.89	1633125.09	–495.02	RT90-RHB70	–79.32	318.06	85.6500	2.5600	–0.0300		*
513.00	6698780.30	1633124.72	–497.97	RT90-RHB70	–79.30	318.01	86.2000	2.6100	0.0200		*
516.00	6698780.72	1633124.35	–500.92	RT90-RHB70	–79.28	317.91	86.7600	2.6600	0.0600		*
519.00	6698781.13	1633123.97	–503.86	RT90-RHB70	–79.26	317.77	87.3100	2.7000	0.1100		*
522.00	6698781.54	1633123.60	–506.81	RT90-RHB70	–79.24	317.70	87.8700	2.7500	0.1700		*
525.00	6698781.96	1633123.22	–509.76	RT90-RHB70	–79.22	317.67	88.4300	2.8000	0.2200		*
528.00	6698782.37	1633122.84	–512.71	RT90-RHB70	–79.20	317.61	88.9900	2.8400	0.2700		*
531.00	6698782.79	1633122.46	–515.65	RT90-RHB70	–79.17	317.53	89.5500	2.8900	0.3300		*
534.00	6698783.21	1633122.08	–518.60	RT90-RHB70	–79.14	317.47	90.1100	2.9300	0.3800		*
537.00	6698783.62	1633121.70	–521.55	RT90-RHB70	–79.11	317.35	90.6700	2.9700	0.4400		*
540.00	6698784.04	1633121.32	–524.49	RT90-RHB70	–79.08	317.18	91.2400	3.0200	0.5000		*
543.00	6698784.46	1633120.93	–527.44	RT90-RHB70	–79.04	317.04	91.8100	3.0600	0.5600		*
546.00	6698784.87	1633120.54	–530.38	RT90-RHB70	–79.01	316.92	92.3800	3.1000	0.6200		*
549.00	6698785.29	1633120.15	–533.33	RT90-RHB70	–78.98	316.80	92.9500	3.1300	0.6900		*
552.00	6698785.71	1633119.76	–536.27	RT90-RHB70	–78.96	316.67	93.5200	3.1700	0.7500		*
555.00	6698786.13	1633119.36	–539.22	RT90-RHB70	–78.93	316.59	94.0900	3.2100	0.8200		*
558.00	6698786.54	1633118.97	–542.16	RT90-RHB70	–78.91	316.57	94.6700	3.2400	0.8900		*
561.00	6698786.96	1633118.57	–545.10	RT90-RHB70	–78.89	316.54	95.2400	3.2800	0.9600		*
567.00	6698787.80	1633117.77	–550.99	RT90-RHB70	–78.86	316.45	96.4000	3.3500	1.1000		*

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