DANISH GEOTECHNICAL INSTITUTE

Hywind Offshore Wind Farm
Geotechnical Investigations 2014

Field Report
Seabed CPTUs at WTG Anchor Locations and Cable Route

GEO Project No. 36685
Statoil Project No. ST14460

Report 1.0, Rev. 2, 2014-07-09

Summary

Dudgeon Offshore Wind Ltd. (DOW) has contracted GEO to conduct a geotechnical site investigation comprising seabed Piezo-Cone Penetration Testing (CPTU) at the planned Offshore Wind Farm area at Hywind. The soil investigation shall provide information for anchoring of five floating wind turbines. The investigation shall also provide information on the soil conditions along the cable route from the wind farm area to Peterhead.

The worksite of the Hywind area is located approximately 25 km east of Peterhead, UK. The export cable route from the Hywind area to Peterhead will be 25 to 30 km long.

At the Offshore Wind Farm site a total of 15 deep push seabed CPTUs were carried out to maximum possible penetration or planned target depth. Along the cable route a total of 19 shallow seabed CPTUs and 2 additional tests (re-runs) were performed.

This Report 1.0 includes field results from the performed CPTUs.

This revision 2 of the report includes minor changes to the report text and Enclosure 1.0C.01 and 1.0E.01.

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1 INTRODUCTION

1.1 Project Participants

Dudgeon Offshore Wind Ltd. (DOW) has contracted GEO to conduct a geotechnical site investigation comprising seabed deep Piezo-Cone Penetration Testing (CPTU) at the planned Offshore Wind Farm area at Hywind. The soil investigation shall provide information for anchoring of five floating wind turbines. The investigation shall also provide information on the soil conditions along the cable route from the wind farm area to Peterhead.

A person from DOW has been offshore during the entire campaign and has acted as the Clients Representative.

1.2 Project and Scope of Work

The Hywind Offshore Wind Farm is planned as a 60 MW wind farm.

The worksite of the Hywind area is located approximately 25 km east of Peterhead, UK. The export cable route from the Hywind area to Peterhead will be 25 to 30 km long.

Water depths across the Hywind wind farm site vary between 95 and 120 m relative to LAT. The seabed shallows gradually westward towards Peterhead.

The location of the Hywind Offshore Wind Farm is shown in Figure 1.1.

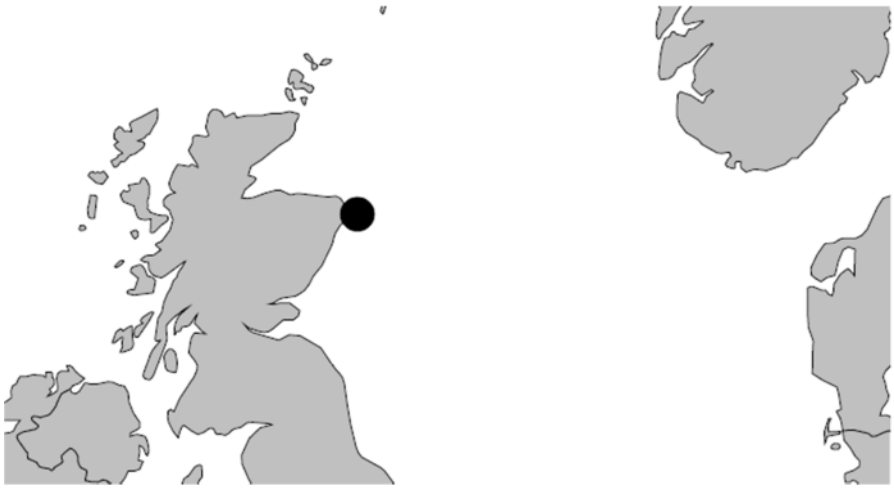

Figure 1.1 Location of Hywind Offshore Wind Farm

The project objective of this geotechnical investigation is to provide CPTU data to form the basis of a design profile for the mooring of each WTG anchor at the Hywind Offshore Wind Farm.

1.3 Geotechnical Reporting under the Contract

The geotechnical work executed under this scope of work (ST14460) is presented in the following report:

Report 1.0: Hywind Offshore Wind Farm, Geotechnical Investigations 2014, Field Report – Seabed CPTUs at WTG Anchor Locations and Cable Route

The current report, Report 1.0, includes field results from the CPTUs and a draft soil and strength interpretation for each CPTU location.

1.4 N_{kt} values used in Report 1.0

The interpretation of the c_u in Report 1.0 is based on N_{kt} values of 15-20. These N_{kt} values are only based on CPTU results and are not calibrated with laboratory tests – i.e. c_u interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

2 FIELD WORK

2.1 Field Work in General

The geotechnical offshore activities were carried out from the DP II vessel "Toisa Voyager" between 2014-03-28 and 2014-04-03. The operations were conducted on a continual 24-hour basis.

At the Offshore Wind Farm site a total of 15 deep push seabed CPTUs were carried out to maximum possible penetration or planned target depth. Along the cable route a total of 19 shallow seabed CPTUs and 2 additional tests (re-runs) were performed.

All the planned CPTUs in the wind farm area were located at the proposed anchor locations (see Enclosure 1.0A.01). The CPTUs along the cable route are presented in Enclosure 1.0A.02.

All the CPTUs from this investigation (ST14460) are listed in the summary sheets, Enclosure 1.0B.01 to 1.0B.03.

2.2 Survey Vessel – Toisa Voyager

The DP II vessel was supplied by the company Sealion Shipping Ltd.

The vessel "Toisa Voyager" has an overall length of 80.5 m and a maximum draft of 6.1 m. It is equipped with two main propulsion engines driving totally 4,800 kW and four thrusters (2 forward and 2 aft) on 610 kW.

Data for the vessel is given in Appendix 1.0.I. The vessel is depicted in Figure 2.1.

Figure 2.1 Sealion Shipping Ltd., DP II vessel "Toisa Voyager"

2.3 CPT Equipment and Procedures

2.3.1 Equipment

The seabed CPTs have been performed with GEO's 20 ton seabed rig GEOscope, see Figure 2.2. The GEOscope was placed over the stern on vessel. The overall GEOscope system

dimensions are: base plate diameter 2.4 m, height 3.4 m. GEOscope has a ballast of approximately 27 ton and provides 200 kN thrust capacity at seabed. The rig was handled by GEO's modular launch/recovery cantilever system mounted over the stern of the vessel.

A general description and technical specification for the GEOscope set-up is presented in Appendix 1.0.II.

Figure 2.2 GEOscope rig mounted over the stern of "Toisa Voyager"

2.3.2 Procedures

The CPTUs were conducted in accordance with the IRTP 1999 /1/ and ISO 119901-8 /2/. The Tip resistance, sleeve friction, pore-water pressure and inclination of the cone were recorded during each test. The cones used were of the standard Van den Berg 60-degree type with cross sectional area of 10 cm². The cone geometry, filter and sleeve diameter, joint-widths and rods were in agreement with the IRTP and ISO recommendations. On all tests a friction reducer was applied. The applied type was based on the expected soil conditions.

All cones were calibrated in accordance with the Contract Specification and GEO procedures. In total 3 CPTU cones have been used on the project. The cone calibration data are enclosed in Appendix 1.0.II.

The basic CPT thrust system is a hydraulic dual clamp system, applying continuous penetration and full control of the total thrust applied to the CPT rods. The GEO cone penetration velocity was 20 mm/sec. A hydraulic control system maintained the penetration rates in accordance with the requirements. The test data (q_c, f_s and u) and tool inclination were recorded approximately every second.

The tests were generally terminated in accordance with one of the following criteria:

- Max required penetration depth
- Total penetration resistance of 200 kN
- Maximum sleeve friction of 2.4 MPa
- Maximum tip resistance of 100 MPa
- Gradual increase of cone inclination to max. 15 deg.
- Sudden increase of inclination more than 3 deg.

- Operator stop if evaluated that further testing might damage the equipment.

In some cases one of the criteria was raised in order to increase performance at the individual test location.

System checks:
The cone was checked and approved to be fully functional in the field prior to deployment using a special field-press system, which checks the output signals from the cone tip, sleeve stress and pore pressure. The pore pressure filter stones were all saturated in glycerine prior to deployment.

The offset of each cone sensor was eliminated (zeroed) after the rig had settled on the seabed just before commencement of the test, at which time the cone tip was positioned at the reference level (0.68 m above seabed). After the test the zero values were recorded again and compared with the initial ones in order to ensure that the cone was not damaged during the test. The verification values are given in Enclosure 1.0B.02. Remarks regarding the zero values are included in section 3.1.

2.4 Navigation and Positioning

2.4.1 Datum and Coordinate System

Coordinates for all tests are given according to WGS84, UTM 30N.

2.4.2 Equipment and Procedures

Two independent GNSS systems have provided surface positioning during the project.

The primary positioning system used has been an Applanix POS MV. The secondary solution has been C-Nav system. Technical details for these equipment's can be found in Appendix 1.0.IV.

The navigation computation is executed by NaviPac software.

2.4.3 Positioning General

During positioning a navigation display showing the planned location (waypoint) and actual position for the seabed CPTU have been provided to the vessel captain/officer to enable them to navigate the vessel to the desired location.

When the vessel was in position, the GEOscope was lowered to the seabed. When the rig was landed on the seabed the actual position was fixed and a Final Positioning Report was prepared in positioning software Navipac for each test location.

The test positions determined (Northing and Easting) are given on the CPTU Logs and in the different summaries.

A HiPAP unit was lowered to the seabed during operations. The HiPAP was supplied by the vessel. This system enables the vessel to stay in the same position if both GNSS systems were out of function at the same time. Technical details for the HiPAP can be found in Appendix 1.0.IV.

2.4.4 Seabed Elevations Determined during Seabed CPT Campaign

Water depths have been monitored with a pressure transducer on GEOscope. The measured water depths have been correlated to LAT using an area specific Vorf model computed in the NaviPac system. The LAT corrected water depths were then compared with the bathymetry depths provided by the Client. The average deviation between the measured water depth and the water depths from bathymetry is 0.58 m.

On request by the Client the elevation from the bathymetry is presented on the CPTU Logs and in Summary CPTUs, Enclosure 1.0B.01.

2.4.5 Verification of positioning systems

A verification of positioning systems was made prior to the CPT campaign. The check was performed at a known location in Schiedam, Rotterdam just before transiting to site for the initial CPT work (different campaign). Documentation of the positioning check is given in Appendix 1.0.IV.

2.5 Time Log of Investigation

A summary of Daily Progress Reports is given in Enclosure 1.0B.04.

3 RESULTS

3.1 CPTU Results

The final penetration depths, coordinates, seabed levels and stop reasons for each test are listed in a summary of seabed CPTUs included as Enclosure 1.0B.01 and 1.0B.03.

The tests are presented on a CPTU plot for each test location. All tests have been presented with the standard depth scale of 1 cm = 0.5 m. The plots show the measured values q_c, f_s, u and R_f for each test, and are enclosed in Enclosure 1.0D.01.

The abbreviations used in the processing are given below:

- q_c is the measured cone resistance. q_c is shown as two curves: one corresponds to a low range (0-10 MPa) and the other to a high range scale (0-100 MPa)
- f_s is the measured sleeve friction
- u is the measured pore water pressure (relative to seabed level)
- R_f is the friction ratio. Friction ratio is the ratio between the measured sleeve friction and the measured cone resistance i.e., $R_f = f_s/q_c$

Zero Drift report for the cone is presented in Enclosure 1.0B.02. Summary of all the stops during the individual CPTUs is presented in Enclosure 1.0B.03.

Legend and definitions for the profiles are presented in Enclosure 1.0C.01.

A preliminary interpretation of soil layers and soil behaviours has been performed offshore. This is further described in section 3.

3.1.1 General Comments to CPTU tests

The majority of the tests were carried out as planned. Any specific comments to the individual tests are included on the CPTU Summary, Enclosure 1.0B.01. General comments to the tests are:

- In some tests, where a stop criterion was reached, the test was continued by a "stop and go" if a low risk for cone damage was estimated by the operator. In this case ("stop and go") the cone is withdrawn approx. 0.5 m before the penetration was continued. Generally, this procedure enabled further penetration depth with small extra time consumption.

- In some tests, the pore pressure measurements just after the test do not correspond to the hydrostatic pressure. The reason for this is assumed to be that a highly dilatant clay formation has been penetrated creating significantly negative pore water pressure during the test. This may cause cavitation inside the filter stone causing a subsequent "blocking" of the filter and erroneous measurements (sluggish response). This phenomenon is described by Lunne, T., 1997 /3/.

- The interpretation of the c_u in Report 1.0 is based on N_{kt} values of 15-20. These N_{kt} values are only based on CPTU results and are not calibrated with laboratory tests – i.e. c_u interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

- When comparing the "zero drift" readings with the ISO Standard 19901-8 it is observed that the CPT values in general could be placed in "Application Class 2" or better. However, it should be noted that a direct connection between zero drift and application class is doubtful. Typically, zero drift reflects the wide range of test conditions and cannot be isolated for the quality of the data from the penetration phase alone.
  Some tests show an excessive zero drift for the pore pressure at seabed level right after test completion, but most of the values are within the "Application Class 2" limit at deck level. Only one test (CPT-17) shows excessive pore pressure readings at deck level, which is why the pore filter after this test was changed. In addition, a few of the CPT tests show excessive zero drift for the tip resistance readings at seabed level. All tests that show zero readings excessive of the "apparent" application class 2 have been double-checked to see if the readings during the test are found to be corrupted or erroneous; hence, the quality of all tests is concluded to be acceptable, i.e. none of the performed tests are omitted. The overall test observations are summarized below in Table 3.1 and all measured values can be found in Enclosure 1.0B.02.

CPTU	Remark
ST14460-CPT-08	zero drift for pore pressure right after test. Pore pressure OK on deck.
ST14460-CPT-10	zero drift for pore pressure right after test. Pore pressure OK on deck.
ST14460-CPT-11	zero drift for pore pressure right after test. . Pore pressure OK on deck.
ST14460-CPT-13	zero drift for pore pressure right after test. Pore pressure OK on deck.
ST14460-CPT-14	zero drift for pore pressure right after test. Pore pressure OK on deck.
ST14460-CPT-16	zero drift for pore pressure right after test . Pore pressure OK on deck.
ST14460-CPT-17	zero drift for pore pressure. Filter was changed before next test.
ST14460-CPT-19	excessive tip readings after test.
ST14460-CPT-19a	excessive tip readings after test.
ST14460-CPT-111	excessive tip readings after test.
ST14460-CPT-112b	zero drift for pore pressure right after test. Pore pressure OK on deck.
ST14460-CPT-121	CPT cable broken during retrieval. No zero values registered.
ST14460-CPT-122	excessive tip readings after test.
ST14460-CPT-133	excessive tip readings after test.
ST14460-CPT-143	zero drift for pore pressure right after test. Pore pressure OK on deck.
ST14460-CPT-151_new	excessive tip readings after test.

Table 3.1 Remarks regarding the registration of zero values

4 SOIL BEHAVIOUR TYPE

In order to identify the penetrated soil layers, a preliminary interpretation of the CPTU data has been performed. The "auto-interpretation" of the soil behaviour type is based on a simple empirical model using the corrected cone resistance, q_t, and corrected friction ratio, R_{tf}. The model used is based on GEO's general experience from previous geotechnical investigations.

The model is shown in Appendix 1.0.V.

The preliminary interpretations of soil types are presented on the interpretation logs, Enclosures 1.0E.01.

A preliminary interpretation of the soil strengths is also presented on the logs. The present data have been calculated in accordance with the assumptions presented in Appendix 1.0.V. The soil unit weight of 20 kN/m^3 has been used for calculations.

5 REFERENCES

/1/ ISSMGE TC16 Ground Property Characterisation from In-Situ Testing. IRTP 1999. International Reference Test Procedure (IRTP) for the Cone Penetration Test (CPT) and the Cone Penetration Test With Pore Pressure (CPTU). Proc. XII ECSMGE Amsterdam. Balkema. pp 2195-2222. 1999

/2/ ISO. OGP DIS 19901-8. Petroleum and natural gas industries. Specific requirements for offshore structures. Part 8: Marine soil investigations. TP1 recommended DIS. July 2012

/3/ Lunne T, Robertson PK, Powell JJM. Cone Penetration Testing in Geotechnical Practice. Blackie Academic & Professional, London, 1997.

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Enclosure 1.0A.01
General Location Plan, Wind Farm Area

N

E: 235,000 m
E: 237,500 m
E: 240,000 m
E: 242,500 m
E: 245,000 m

N: 6,385,000 m
N: 6,382,500 m
N: 6,380,000 m
N: 6,377,500 m
N: 6,375,000 m

ST14460-CPT-131
ST14460-CPT-133
ST14460-CPT-121
ST14460-CPT-132
ST14460-CPT-123
ST14460-CPT-151_new
ST14460-CPT-153
ST14460-CPT-111
ST14460-CPT-122
ST14460-CPT-113
ST14460-CPT-141
ST14460-CPT-143
ST14460-CPT-152
ST14460-CPT-112b
ST14460-CPT-142

Legend

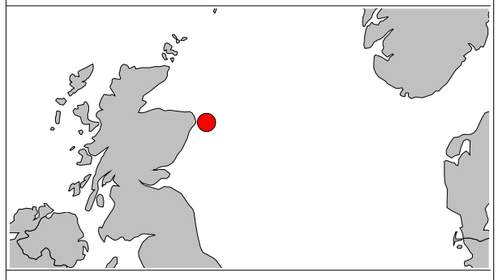
Anchor Locations
2014 Campaign

A3 Paper Size - Scale 1:50 000

0 150.000
Meters

Coordinate System:

Geodectic System :WGS84 - UTM Zone 30N
Vertical Reference :LAT



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Hywind CPT Campaign 2014

Location Plan - Wind Farm Area

Scale 1:50 000

Drawn	Date	Investigation Period
MBM	2014-04-11	March-April 2014
Interp.	Date	Vessel
		Toisa Voyager
Checked	Date	Contract No.
ABP	2014-04-11	ST14460
Approved	Date	GEO Project No.
CLB	2014-04-11	36685
Client	Report No.	Enclosure No.
Hywind Offshore Wind Limited	1.0	1.0A.01

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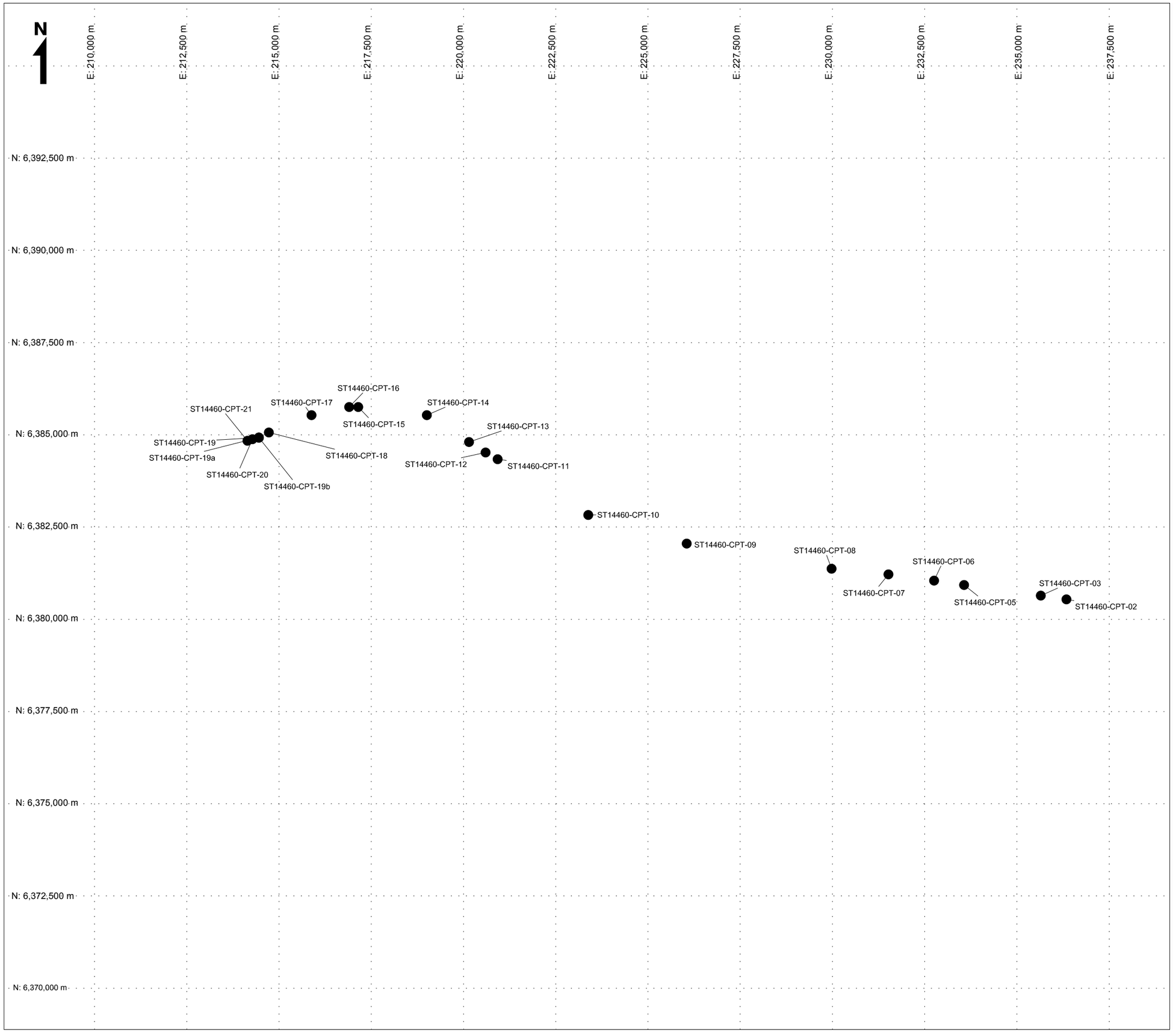
Enclosure 1.0A.02
General Location Plan, Cable Route



Legend

- Cable Route Coordinates 2014 Campaign

A3 Paper Size - Scale 1:100 000

0 — 300 000

Meters

Coordinate System:

Geodectic System :WGS84 - UTM Zone 30N
Vertical Reference :LAT

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Hywind CPT Campaign 2014

Location Plan - Cable Route

Scale 1:100 000

Drawn	Date	Investigation Period
MBM	2014-04-11	March-April 2014
Interp.	Date	Vessel
		Toisa Voyager
Checked	Date	Contract No.
ABP	2014-04-11	ST14460
Approved	Date	GEO Project No.
CLB	2014-04-11	36685
Client		Report No. / Enclosure No.
Hywind Offshore Wind Limited		1.0 / 1.0A.02

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Enclosure 1.0B.01
Summary CPTUs

Summary CPTU

Coordinates relative to WGS 84 UTM 30N
*Water depth as received from the Client, taken at the nearest available point

CPT No.	Easting (m)	Northing (m)	LAT* (m)	Pen. Depth (m)	Final Stop	Icone No.
ST14460-CPT-02	595903.4	6373125.3	-98.3	3.0	Max Depth	121113
ST14460-CPT-03	595203.6	6373165.9	-94.2	10.0	Max Depth	121113
ST14460-CPT-05	593108.7	6373269.3	-83.7	3.0	Max Depth	121113
ST14460-CPT-06	592288.1	6373312.9	-81.2	3.0	Max Depth	121113
ST14460-CPT-07	591041.9	6373373.4	-77.2	3.0	Max Depth	121113
ST14460-CPT-08	589497.1	6373388.8	-75.2	3.0	Max Depth	121113
ST14460-CPT-09	585526.3	6373724.3	-71.5	3.0	Max Depth	121113
ST14460-CPT-10	582804.7	6374258.8	-69.3	6.0	Max Depth	121113
ST14460-CPT-11	580225.4	6375546.4	-60.8	3.0	Max Depth	121113
ST14460-CPT-12	579887.2	6375700.4	-61.7	3.0	Max Depth	121113
ST14460-CPT-13	579414.6	6375942.4	-59.6	7.0	Max Depth	121113
ST14460-CPT-14	578212.3	6376567.3	-54.6	3.0	Max Depth	121113
ST14460-CPT-15	576343.4	6376621.7	-49.8	3.0	Max Depth	130711
ST14460-CPT-16	576096.5	6376600.2	-49.2	1.1	Max Depth	130711
ST14460-CPT-17	575101.2	6376289.0	-44.6	2.0	Max Depth	130711
ST14460-CPT-18	573990.7	6375721.9	-28.5	1.6	Max Thrust	121113
ST14460-CPT-19	573734.6	6375559.5	-25.4	0.3	Max Incl.	130711
ST14460-CPT-19a	573735.1	6375561.0	-25.4	0.3	Max Thrust	130711
ST14460-CPT-19b	573732.6	6375556.9	-25.4	0.4	Max Tip/Incl.	121113
ST14460-CPT-20	573563.8	6375499.6	-21.2	1.9	Max Depth	121113
ST14460-CPT-21	573435.7	6375447.8	-18.1	2.4	Max Depth	130711
ST14460-CPT-111	599506.9	6373078.0	-112.0	22.1	Max Depth	130711
ST14460-CPT-112b	599732.9	6371830.1	-114.0	21.4	Max Thrust	130711
ST14460-CPT-113	600845.2	6372685.7	-117.0	21.2	Max Thrust	130711
ST14460-CPT-121	598345.3	6373747.8	-106.0	22.8	Max Depth	130711
ST14460-CPT-122	598525.8	6372519.3	-108.0	22.6	Max Depth	130810
ST14460-CPT-123	599548.5	6373343.3	-111.0	21.0	Max Depth	130711
ST14460-CPT-131	597047.0	6374478.2	-100.0	20.0	Max Depth	130711
ST14460-CPT-132	597347.0	6373118.2	-104.0	23.5	Max Depth	121113
ST14460-CPT-133	598349.7	6374087.6	-106.0	23.3	Max Depth	130810
ST14460-CPT-141	598112.3	6372212.9	-106.0	23.0	Max Depth	130711
ST14460-CPT-142	598785.2	6371019.4	-111.0	22.2	Max Thrust	130810
ST14460-CPT-143	599466.6	6372221.9	-113.0	21.6	Max Thrust	130711
ST14460-CPT-151_new	596901.0	6372897.1	-102.0	25.0	Max Depth	130711
ST14460-CPT-152	597598.8	6371689.1	-105.0	19.8	Max Incl.	130711
ST14460-CPT-153	598290.3	6372946.0	-107.0	22.4	Max Depth	130711

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Enclosure 1.0B.02
Summary Zero Drift

Summary Zero Drift

		Before test at the deck				After the test at the deck				Zero drift				Before the test at the refer-ence level				After the test at the refer-ence level				Zero drift			
		Tip	Sleeve	Pore	Incl.	Tip	Sleeve	Pore	Incl.	Tip	Sleeve	Pore	Incl.	Tip	Sleeve	Pore	Incl.	Tip	Sleeve	Pore	Incl.	Tip	Sleeve	Pore	Incl.
CPT No.	Icone	[MPa]	[MPa]	[MPa]	[°]	[MPa]	[MPa]	[MPa]	[°]	[MPa]	[MPa]	[MPa]	[°]	[MPa]	[MPa]	[MPa]	[°]	[MPa]	[MPa]	[MPa]	[°]	[MPa]	[MPa]	[MPa]	[°]
ST14460-CPT-02	121113	-0.238	0.014	0.000	1.921	-0.316	0.015	0.002	1.030	0.078	0.001	0.002	0.891	0.738	0.000	0.996	0.300	0.730	0.000	0.995	0.361	0.008	0.000	0.001	0.061
ST14460-CPT-03	121113	-0.295	0.015	0.003	0.583	-0.281	0.014	0.002	1.360	0.014	0.001	0.000	0.777	0.788	-0.001	0.960	0.000	0.799	-0.001	0.960	0.141	0.011	0.000	0.000	0.141
ST14460-CPT-05	121113	-0.271	0.013	-0.003	2.119	-0.284	0.014	0.003	3.276	0.013	0.001	0.005	1.157	0.679	0.003	0.877	0.854	0.700	0.001	0.874	0.608	0.021	0.002	0.002	0.246
ST14460-CPT-06	121113	-0.270	0.014	-0.001	0.447	-0.349	0.015	0.002	0.806	0.079	0.001	0.003	0.359	0.644	0.001	0.834	0.539	0.652	0.001	0.834	3.672	0.008	0.000	0.000	3.133
ST14460-CPT-07	121113	-0.297	0.014	0.003	1.942	-0.283	0.014	0.003	1.924	0.015	0.000	0.000	0.018	0.669	0.000	0.804	0.200	0.679	0.000	0.799	0.300	0.009	0.000	0.004	0.100
ST14460-CPT-08	121113	-0.283	0.014	-0.004	4.205	-0.302	0.015	0.001	1.044	0.019	0.001	0.005	3.161	0.612	0.001	0.779	0.500	0.625	0.000	0.296	0.583	0.013	0.001	0.483	0.083
ST14460-CPT-09	121113	-0.281	0.014	-0.002	0.412	-0.269	0.014	0.003	1.273	0.012	0.000	0.005	0.861	0.570	0.001	0.729	0.894	0.595	0.001	0.726	0.640	0.025	0.000	0.002	0.254
ST14460-CPT-10	121113	-0.345	0.016	0.003	0.671	-0.305	0.014	0.003	0.400	0.040	0.002	0.000	0.271	0.684	-0.001	0.711	0.985	0.647	-0.002	0.021	0.633	0.038	0.000	0.690	0.352
ST14460-CPT-11	121113	-0.340	0.015	0.002	1.700	-0.306	0.015	0.002	3.590	0.034	0.001	0.000	1.890	0.578	-0.001	0.641	0.800	0.583	-0.001	-0.090	0.539	0.005	0.000	0.731	0.262
ST14460-CPT-12	121113	-0.325	0.018	0.000	0.800	-0.336	0.015	0.002	1.552	0.011	0.003	0.002	0.752	0.549	-0.001	0.650	0.583	0.585	-0.004	0.645	0.600	0.036	0.003	0.005	0.017
ST14460-CPT-13	121113	-0.281	0.014	-0.002	2.693	-0.335	0.016	0.002	2.000	0.054	0.002	0.004	0.693	0.474	0.006	0.631	2.062	0.514	0.000	0.567	0.600	0.040	0.007	0.063	1.462
ST14460-CPT-14	121113	-0.361	0.018	0.003	0.224	-0.314	0.014	0.003	1.118	0.047	0.004	0.000	0.894	0.563	-0.003	0.580	0.906	0.540	-0.003	0.014	0.825	0.023	0.000	0.566	0.081
ST14460-CPT-15	130711	0.240	0.012	-0.006	4.272	0.250	0.010	0.004	2.759	0.010	0.001	0.010	1.513	0.354	0.001	0.541	0.316	0.410	-0.001	0.538	0.316	0.056	0.002	0.003	0.000
ST14460-CPT-16	130711	0.271	0.011	-0.007	1.703	0.248	0.010	0.004	3.829	0.023	0.001	0.011	2.126	0.389	-0.001	0.540	1.030	0.377	-0.001	-0.004	0.707	0.012	0.000	0.543	0.323
ST14460-CPT-17	130711	0.253	0.011	0.004	2.335	0.191	0.011	-0.049	1.100	0.062	0.000	0.053	1.235	0.333	0.000	0.470	0.583	0.327	0.000	-0.080	0.762	0.006	0.000	0.550	0.179
ST14460-CPT-18	121113	-0.290	0.018	-0.002	1.487	-0.365	0.016	0.003	1.613	0.075	0.002	0.005	0.126	0.244	0.001	0.284	0.781	0.223	-0.003	0.283	2.419	0.021	0.005	0.001	1.638
ST14460-CPT-19	130711	0.122	0.011	0.003	1.030	0.274	0.005	0.003	3.384	0.153	0.006	0.001	2.354	0.179	0.000	0.253	0.200	0.351	0.000	0.250	0.316	0.172	0.000	0.003	0.116
ST14460-CPT-19a	130711	0.122	0.011	0.003	1.030	0.274	0.005	0.003	3.384	0.153	0.006	0.001	2.354	0.179	0.000	0.253	0.200	0.292	-0.006	0.247	2.555	0.113	0.007	0.005	2.355
ST14460-CPT-19b	121113	-0.326	0.014	0.003	3.300	-0.276	0.014	0.003	0.640	0.051	0.000	0.000	2.660	0.292	0.000	0.255	1.204	0.289	0.000	0.255	1.649	0.003	0.000	0.000	0.445
ST14460-CPT-20	121113	-0.371	0.015	0.003	1.118	-0.327	0.014	0.003	2.802	0.044	0.001	0.000	1.684	0.328	-0.001	0.228	0.283	0.289	-0.001	0.225	0.412	0.039	0.000	0.003	0.130
ST14460-CPT-21	130711	0.192	0.012	-0.008	1.709	0.111	0.010	0.003	0.600	0.081	0.001	0.011	1.109	0.101	-0.001	0.195	0.361	0.057	-0.001	0.192	0.500	0.045	0.001	0.004	0.139
ST14460-CPT-111	130711	0.183	0.009	0.005	0.781	0.306	0.009	0.005	0.539	0.124	0.000	0.000	0.243	0.821	0.001	1.130	0.300	0.975	0.000	1.120	0.707	0.154	0.001	0.010	0.407
ST14460-CPT-112b	130711	0.151	0.009	0.001	0.640	0.075	0.008	0.006	1.300	0.076	0.001	0.006	0.660	0.856	0.001	1.191	0.640	0.825	-0.001	0.977	2.884	0.031	0.003	0.214	2.244
ST14460-CPT-113	130711	0.102	0.010	-0.003	1.253	0.178	0.009	0.005	0.671	0.076	0.001	0.008	0.582	0.892	0.000	1.205	0.200	0.973	-0.001	1.193	0.141	0.081	0.001	0.012	0.059
ST14460-CPT-121	130711	0.241	0.011	0.001	1.030	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0.764	0.002	1.086	0.300	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
ST14460-CPT-122	130810	-1.059	-0.049	-0.004	0.943	-1.176	-0.053	-0.005	2.702	0.117	0.004	0.002	1.759	0.861	-0.002	1.091	1.897	0.715	-0.004	1.083	1.342	0.146	0.002	0.008	0.556
ST14460-CPT-123	130711	0.183	0.009	0.005	0.781	0.306	0.009	0.005	0.539	0.124	0.000	0.000	0.243	0.946	0.000	1.126	0.671	0.965	0.000	1.122	0.671	0.019	0.000	0.005	0.000
ST14460-CPT-131	130711	0.088	0.008	-0.002	2.400	0.107	0.008	0.006	2.062	0.019	0.001	0.008	0.338	0.755	0.003	1.048	1.404	0.813	0.001	1.033	1.005	0.058	0.002	0.014	0.399
ST14460-CPT-132	121113	-0.286	0.014	-0.001	1.360	-0.308	0.015	0.003	0.400	0.022	0.001	0.004	0.960	0.812	0.002	1.057	0.539	0.834	0.000	1.050	0.141	0.022	0.002	0.007	0.397
ST14460-CPT-133	130810	-1.177	-0.051	-0.006	1.769	-0.943	-0.054	-0.006	1.709	0.234	0.003	0.000	0.060	0.778	0.003	1.080	1.273	1.057	-0.002	1.082	1.140	0.279	0.005	0.001	0.133
ST14460-CPT-141	130711	0.201	0.010	0.003	1.664	0.220	0.010	0.006	3.353	0.019	0.000	0.003	1.688	0.824	-0.001	1.109	0.949	0.846	-0.001	1.097	0.894	0.022	0.000	0.012	0.054
ST14460-CPT-142	130810	-1.023	-0.040	-0.004	1.400	-1.061	-0.048	-0.004	1.772	0.038	0.008	0.000	0.372	0.833	0.004	1.138	1.030	0.871	-0.009	1.124	1.030	0.038	0.013	0.014	0.000
ST14460-CPT-143	130711	0.276	0.010	-0.005	0.600	0.210	0.010	0.006	0.608	0.065	0.000	0.010	0.008	0.817	0.000	1.168	0.721	0.810	-0.001	0.001	1.887	0.008	0.001	1.167	1.166
ST14460-CPT-151_new	130711	0.108	0.008	0.001	1.703	0.159	0.008	0.006	0.539	0.051	0.000	0.005	1.164	0.733	0.003	1.038	0.500	0.857	-0.001	1.023	0.100	0.124	0.004	0.015	0.400
ST14460-CPT-152	130711	0.144	0.010	-0.002	1.726	0.156	0.008	0.006	0.922	0.011	0.002	0.008	0.804	0.773	0.001	1.084	0.300	0.845	-0.001	1.081	0.447	0.073	0.003	0.003	0.147
ST14460-CPT-153	130711	0.228	0.010	-0.005	2.474	0.241	0.009	0.005	3.400	0.013	0.000	0.010	0.926	0.801	0.000	1.095	0.300	0.817	0.000	1.078	0.400	0.016	0.000	0.017	0.100

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Enclosure 1.0B.03
Summary CPTU Stops

Summary CPTU stops

CPTU No.	Pen. Depth	Stop Reason
ST14460-CPT-02	0.95	Operator Stop
	3.00	Max Depth
ST14460-CPT-03	-0.68	Max Incl. Dev.
	3.44	Operator Stop
	4.32	Operator Stop
	10.00	Max Depth
ST14460-CPT-05	-0.68	Max Incl. Dev.
	-0.29	Max Incl. Dev.
	-0.04	Max Incl. Dev.
	0.65	Operator Stop
	3.00	Max Depth
ST14460-CPT-06	3.00	Max Depth
ST14460-CPT-07	-0.68	Max Incl. Dev.
	-0.67	Max Incl. Dev.
	0.44	Operator Stop
	3.00	Max Depth
ST14460-CPT-08	-0.68	Max Incl. Dev.
	-0.44	Max Incl. Dev.
	0.74	Operator Stop
	2.31	Operator Stop
	3.00	Max Depth
ST14460-CPT-09	-0.68	Max Incl. Dev.
	-0.67	Max Incl. Dev.
	-0.27	Max Incl. Dev.
	0.60	Operator Stop
	3.01	Max Depth
ST14460-CPT-10	0.87	Operator Stop
	6.00	Max Depth
ST14460-CPT-11	-0.69	Max Incl. Dev.
	-0.68	Max Incl. Dev.
	0.97	Operator Stop
	3.00	Max Depth
ST14460-CPT-12	-0.71	Max Incl. Dev.
	3.00	Max Depth
ST14460-CPT-13	-0.66	Max Incl. Dev.
	7.00	Max Depth
ST14460-CPT-14	-0.68	Max Incl. Dev.
	3.00	Max Depth
ST14460-CPT-15	0.78	Max Thrust
	3.00	Max Depth

CPTU No.	Pen. Depth	Stop Reason
ST14460-CPT-16	-0.28	Max Incl. Dev.
	-0.27	Max Incl. Dev.
	1.00	Max Depth
ST14460-CPT-17	1.01	Max Thrust
	1.96	Max Depth
ST14460-CPT-18	-0.70	Max Incl. Dev.
	-0.68	Max Incl. Dev.
	-0.08	Max Incl. Dev.
	0.02	Max Incl. Dev.
	1.11	Max Thrust
	1.61	Max Thrust
ST14460-CPT-19	0.15	Max Thrust
	0.21	Max Incl. Dev.
ST14460-CPT-19a	0.33	Max Thrust
ST14460-CPT-19b	0.34	Max Incl. Dev.
	0.34	Operator Stop
	0.37	Operator Stop
ST14460-CPT-20	1.00	Max Depth
	1.92	Quick Stop
ST14460-CPT-21	2.01	Max Depth
	2.43	Operator Stop
ST14460-CPT-111	20.48	Operator Stop
	22.15	Operator Stop
ST14460-CPT-112b	-0.68	Max Incl. Dev.
	19.50	Operator Stop
	21.40	Max Thrust
ST14460-CPT-113	7.68	Operator Stop
	21.18	Max Thrust
ST14460-CPT-121	6.12	Operator Stop
	22.83	Operator Stop
ST14460-CPT-122	21.31	Operator Stop
	22.59	Operator Stop
ST14460-CPT-123	-0.68	Max Incl. Dev.
	1.87	Operator Stop
	21.01	Operator Stop
ST14460-CPT-131	19.39	Operator Stop
	20.00	Max Depth

CPTU No.	Pen. Depth	Stop Reason
ST14460-CPT-132	-0.68	Max Incl. Dev.
	0.59	Operator Stop
	19.74	Operator Stop
	23.54	Operator Stop
ST14460-CPT-133	20.00	Max Depth
	23.25	Operator Stop
ST14460-CPT-141	22.99	Operator Stop

CPTU No.	Pen. Depth	Stop Reason
ST14460-CPT-142	19.54	Operator Stop
	22.22	Max Thrust
ST14460-CPT-143	21.57	Max Thrust
ST14460-CPT-151	-0.62	Max Incl. Dev.
	25.00	Max Depth
ST14460-CPT-152	19.82	Max Incl.
ST14460-CPT-153	22.44	Operator Stop

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Enclosure 1.0B.04
Summary Daily Progress Report

Summary – Daily Progress Reports

Date	Activity
2014-03-28	Transit to Hywind site. WOW.
2014-03-29	WOW.
2014-03-30	Completed CPT at CPT-142, CPT-122 and CPT-133. WOW. Completed CPT at CPT-131, CPT-151 and CPT-152.
2014-03-31	Completed CPT at CPT-112b, CPT-113, CPT-111, CPT-123, CPT-143, CPT-141 and CPT-153. WOW.
2014-04-01	Completed CPT at CPT-121. WOW. Completed CPT at CPT-16, CPT-15, CPT-17, CPT-21, CPT-19, CPT-19a and CPT-18. GEO maintenance.
2014-04-02	GEO maintenance. Completed CPT at CPT-14, CPT-12, CPT-10, CPT-132, CPT-03, CPT-05, CPT-07, CPT-08 and CPT-09. WOW. Completed CPT at CPT-02.
2014-04-03	Completed CPT at CPT-06, CPT-11, CPT-13, CPT-20 and CPT-19b. Transit to Peter-head.

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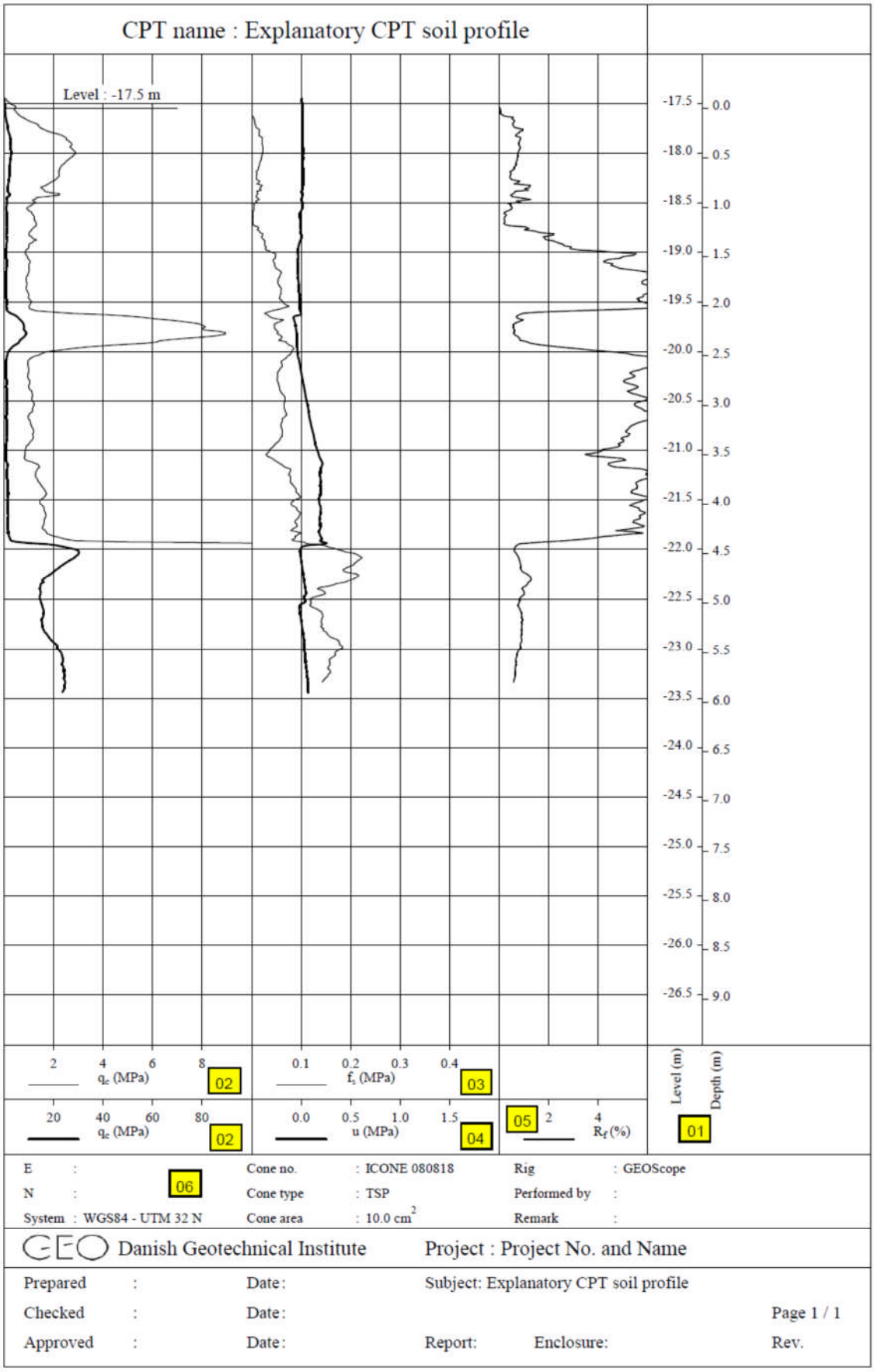
Enclosure 1.0C.01
Legend and Definitions CPTU


CPT name : Explanatory CPT soil profile
Level : -17.5 m
-17.5 0.0
-18.0 0.5
-18.5 1.0
-19.0 1.5
-19.5 2.0
-20.0 2.5
-20.5 3.0
-21.0 3.5
-21.5 4.0
-22.0 4.5
-22.5 5.0
-23.0 5.5
-23.5 6.0
-24.0 6.5
-24.5 7.0
-25.0 7.5
-25.5 8.0
-26.0 8.5
-26.5 9.0
2 4 6 8 qc (MPa) 02
20 40 60 80 qc (MPa) 02
0.1 0.2 0.3 0.4 fs (MPa) 03
0.0 0.5 1.0 1.5 u (MPa) 04
05 2 4 Rf (%)
Level (m) Depth (m) 01
E :
N :
06
System : WGS84 - UTM 32 N
Cone no. : ICONE 080818
Cone type : TSP
Cone area : 10.0 cm2
Rig : GEOScope
Performed by :
Remark :
Danish Geotechnical Institute
Project : Project No. and Name
Prepared : Date:
Checked : Date:
Approved : Date:
Subject: Explanatory CPT soil profile
Report: Enclosure:
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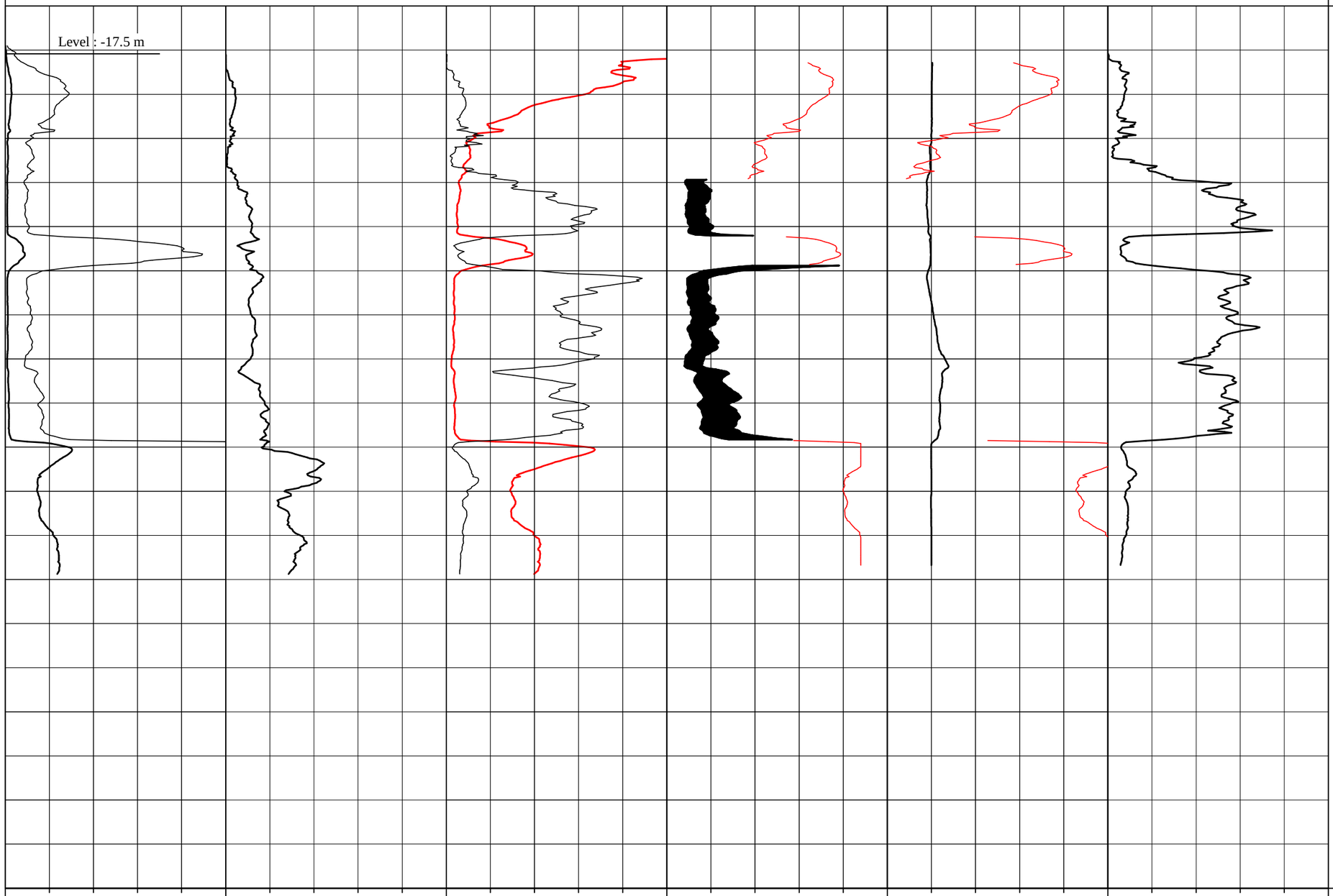
Rev.

Cone Penetration Tests

01	Depth:	Depth refers to the penetration depth below start of test level. The depth is not corrected for tool inclination. Depth refers to cone tip
01	Level:	Level to penetration depth
02	q_c:	Tip resistance in two scales, 0 – 10 MPa and 0 – 100 MPa
03	f_s:	Sleeve friction in scale 0 – 0.5 MPa
04	u:	Pore water pressure relative to level at start of test in scale -0.5 – 2.0 MPa
05	R_f:	Friction ratio in scale 0 – 9 %
06	Other test information	
E and N:	Test location (E: Easting and N: Northing)	
Date:	Date of CPT testing	
Cone no:	Number of cone used in test	
Cone type:	Type of Cone – TSP. Tip resistance, Sleeve friction and Pore water pressure are measured in agreement with the ISOPT1 recommendations	
Cone area:	10.0 cm^2 in agreement with the ISOPT1 recommendations	
Rig:	Name of rig – SCOPE2008 / GEORIIS (DTH)	
Performed by:	Initial of test operator	
Remarks:	Remarks to test (If any)	

CPT name : Explanatory CPT soil profile



Level (m)	Depth (m)
-17.5	0.0
-18.0	0.5
-18.5	1.0
-19.0	1.5
-19.5	2.0
-20.0	2.5
-20.5	3.0
-21.0	3.5
-21.5	4.0
-22.0	4.5
-22.5	5.0
-23.0	5.5
-23.5	6.0
-24.0	6.5
-24.5	7.0
-25.0	7.5
-25.5	8.0
-26.0	8.5
-26.5	9.0

Soil (Engineer)
SAND
CLAY
SAND
CLAY
SAND

2 4 6 8 q_t (MPa)	11	0.1 0.2 0.3 0.4 f_t (MPa)		200 400 600 800 Q_t (-)	13	25 30 35 40 φ' (°)	15	20 40 60 80 D_r (%)	17	2 4 6 8 R_{ft} (%)	19
20 40 60 80 q_t (MPa)	11		12	2 4 6 8 F_r (%)	14	100 200 300 400 c_u (kPa)	16	0.0 0.5 1.0 1.5 B_q (-)	18		

Level (m) 10 | Depth (m)

E :
N : 21
System : WGS84 - UTM 32 N

Cone no. : ICONE 080818
Cone type : TSP
Cone area : 10.0 cm^2

Rig : GEOScope
Performed by :
Remark :

GEO Danish Geotechnical Institute

Project : Project No. and Name

Prepared : Date :
Checked : Date :
Approved : Date :

Subject: Explanatory CPT soil profile

Report Enclosure: Page 1 / 1 Rev.

Perceptor - 1.5.10.97

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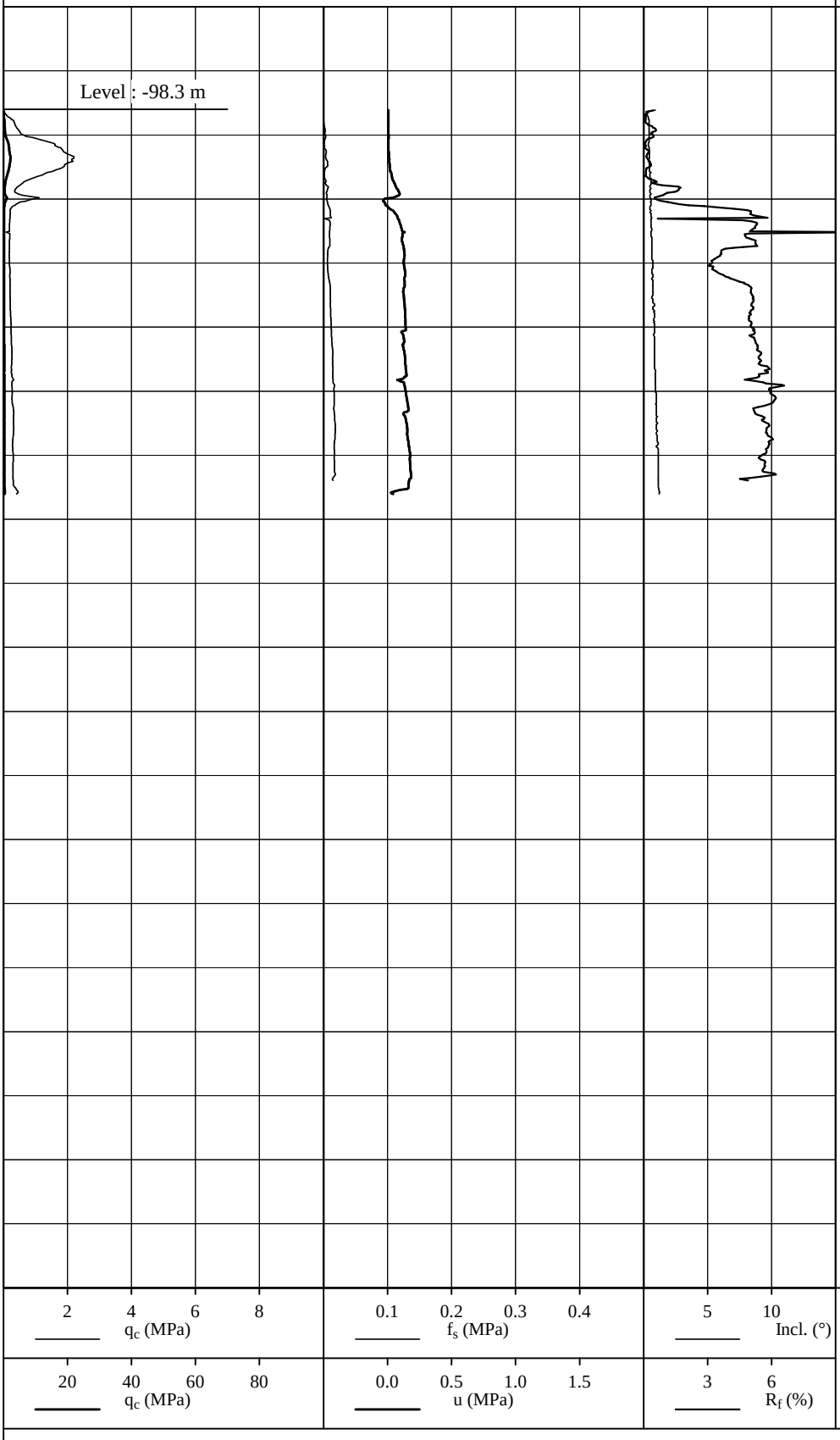
Cone Penetration Tests

10	Depth:	Depth refers to the penetration depth below start of test level. The depth is not corrected for tool inclination.
10	Level:	Level to penetration depth
11	q_t:	Corrected tip resistance in two scales, 0 – 10 MPa and 0 – 100 MPa
12	f_t:	Corrected sleeve friction in scale 0 – 0.5 MPa
13	Q_t:	Normalized cone restistance in scale 0 - 200
14	F_r:	Normalized sleeve friction in scale 0 – 10 %
15	φ:	Angle of internal friction in scale 10 - 60°
16	c_u:	Undrained shear strength in scale 0 – 500 kPa, Nkt = 15-20 The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests – i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.
17	D_r:	Relative density in scale 0 – 150 %
18	B_q:	Pore pressure ratio in scale –0.5 – 2.0
19	R_{ft}:	Corrected friction ratio in scale 0 – 10 %
20		Main soil description interpreted from CPT results
21	Other test information:	
E and N:		Test location (E: Easting and N: Northing)
Date:		Date of CPT testing
Cone no.:		Number of cone
Cone type:		Type of Cone – TSP. Tip resistance, Sleeve friction and Pore water pressure are measured in agreement with the ISOPT1 recommendations
Cone area:		10 cm^2 in agreement with the ISOPT1 recommendations
Rig:		Name of rig – SCOPE2008
Performed by:		Initials of test operator
Remarks:		Remarks to test (if any)

DANISH GEOTECHNICAL INSTITUTE

Enclosure 1.0D.01
CPT Profiles with q_c, f_s, u and R_f

CPT name : ST14460-CPT-02



E	: 595903.4	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373125.3	Cone type	: TSP	Performed by	: ALJ/2014-04-02 22:52:19
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

GEO Danish Geotechnical Institute — Project : 36685 Hywind

Prepared	: ABP	Date: 2014-04-04	Subject: Original CPTU Data	
Checked	: KNM	Date: 2014-04-04		Page 1 / 1
Approved	: CLB	Date: 2014-04-04	Report 1.0 Enclosure: ST14460-CPT-02	Rev.

Perceptor - 1.5.10.124

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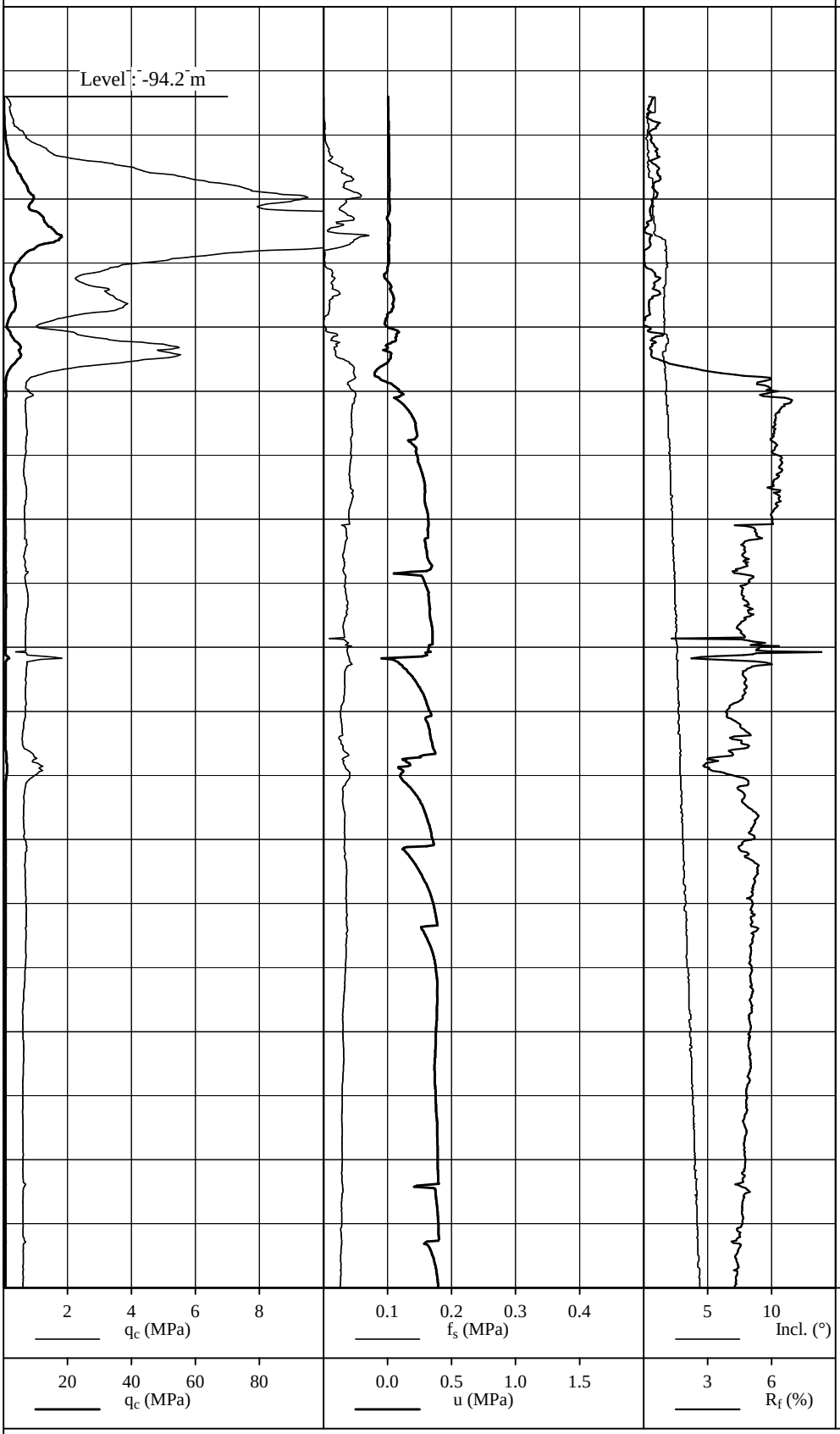
CPT name : ST14460-CPT-03



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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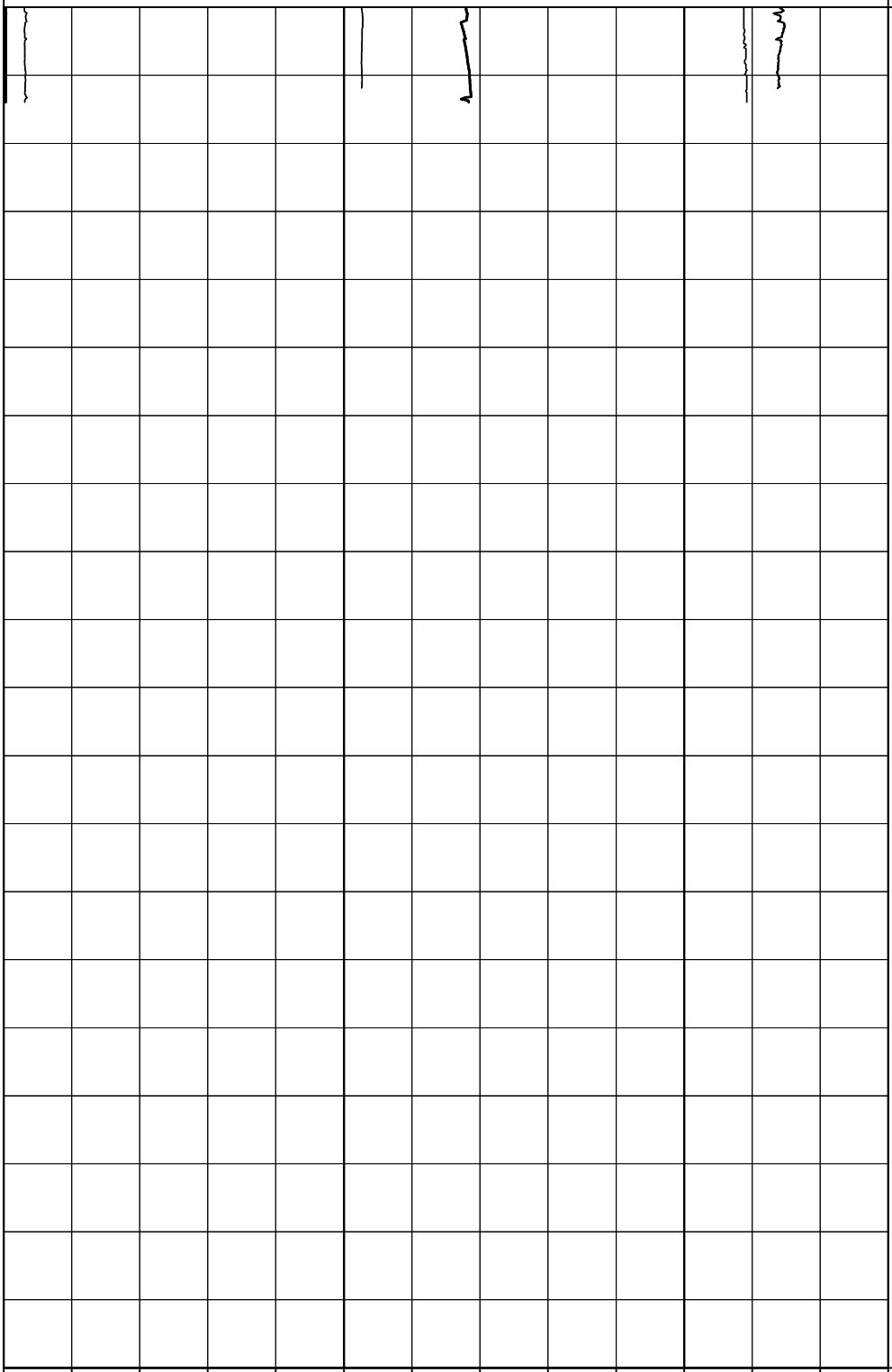
CPT name : ST14460-CPT-03



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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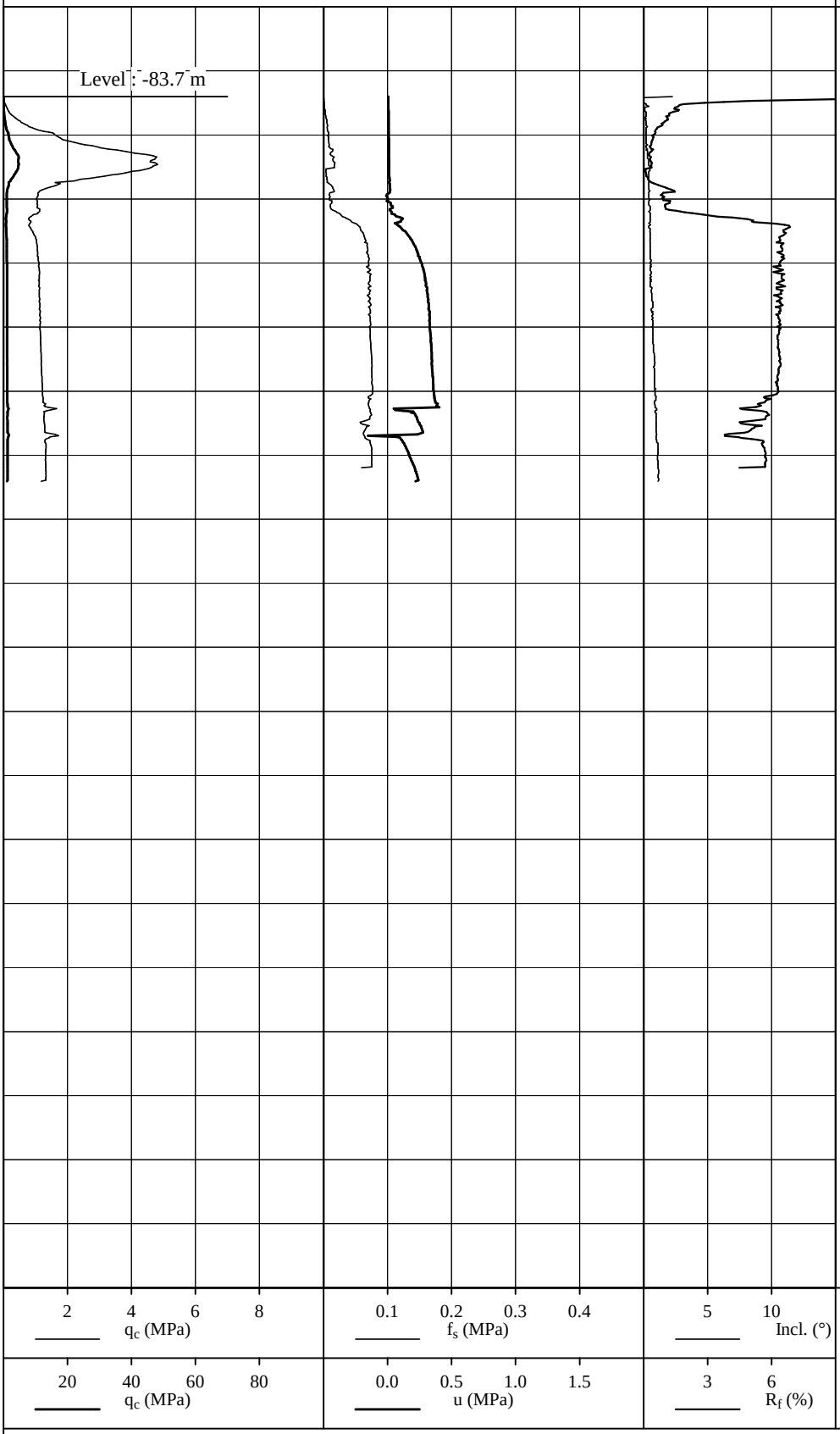
CPT name : ST14460-CPT-05



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N	: 6373269.3	Cone type	: TSP	Performed by	: ALJ/2014-04-02 15:21:12
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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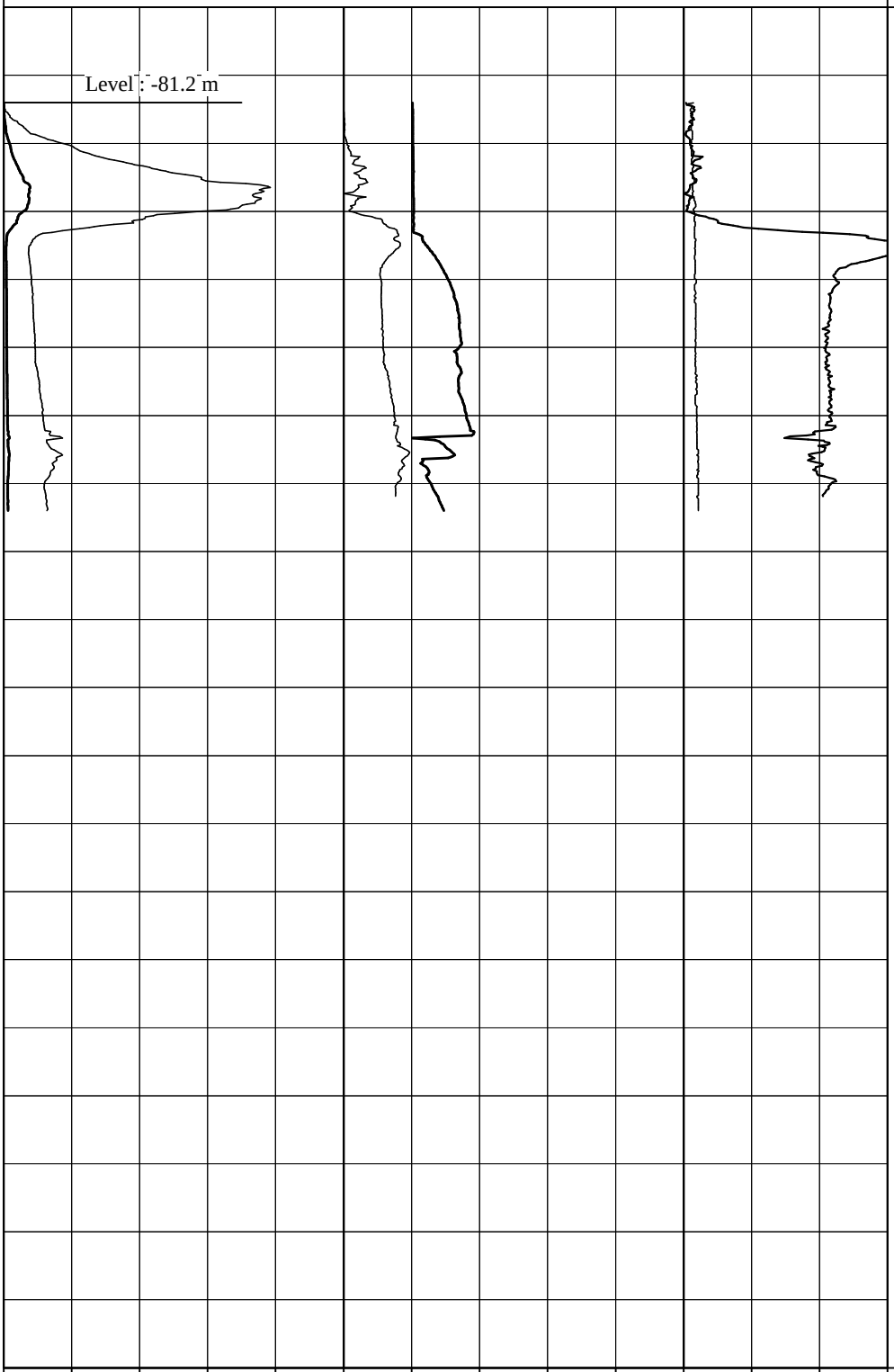
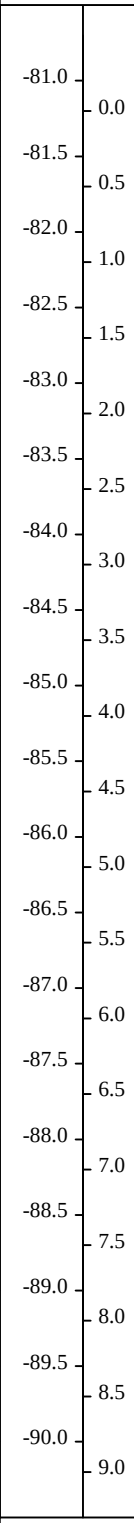
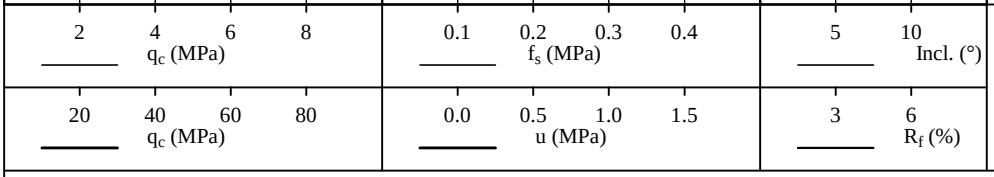
CPT name : ST14460-CPT-06







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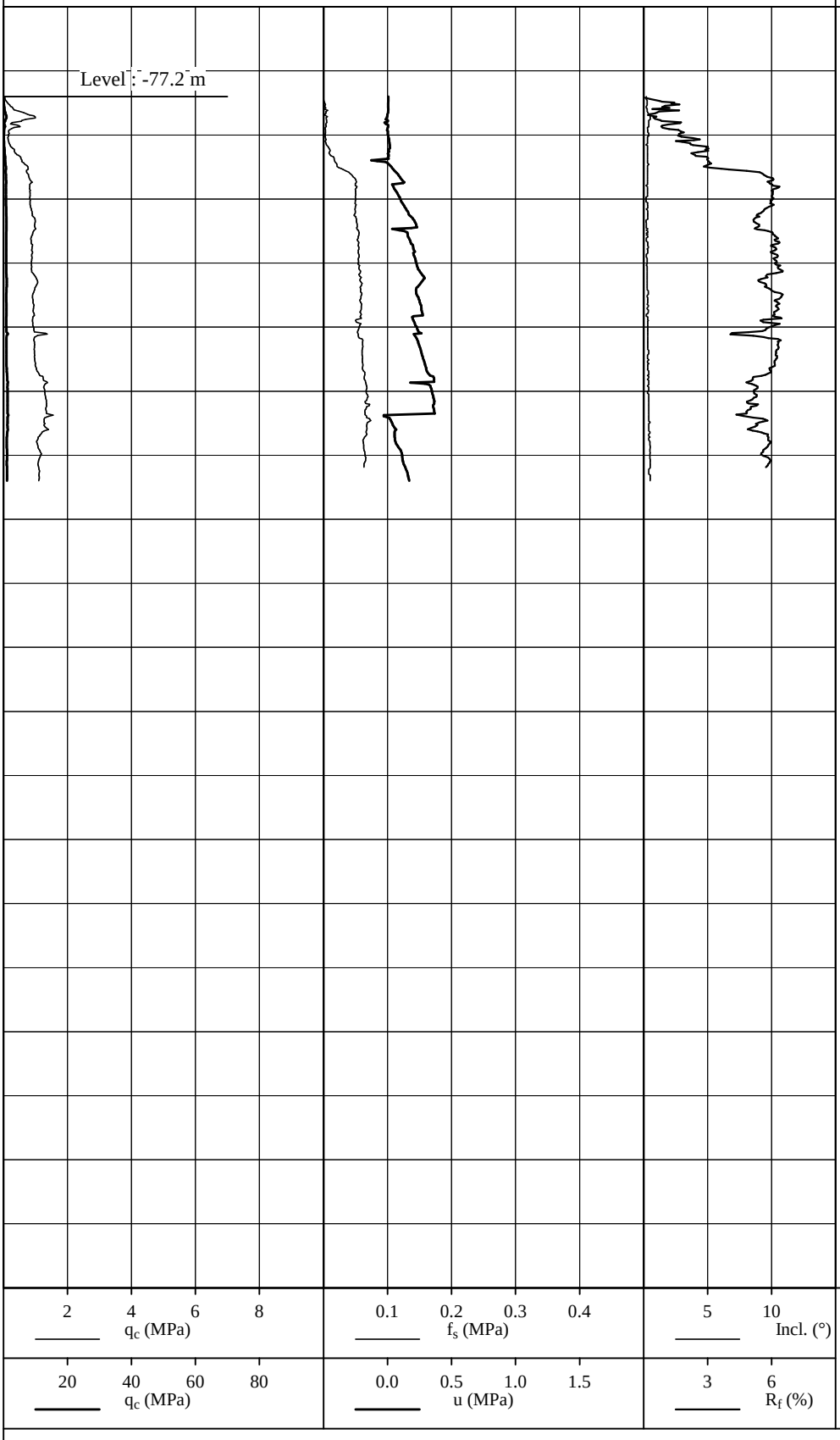
CPT name : ST14460-CPT-07



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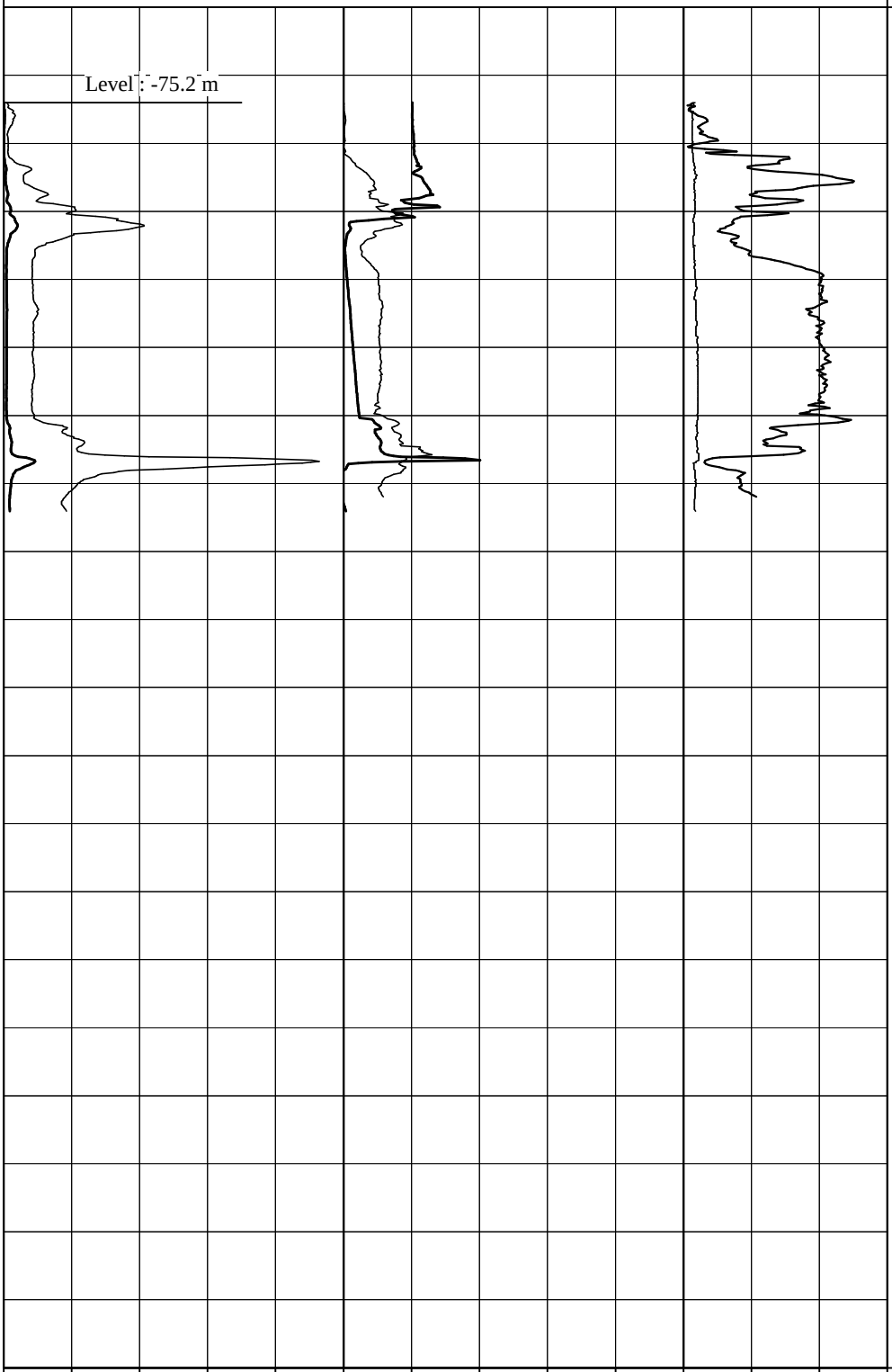
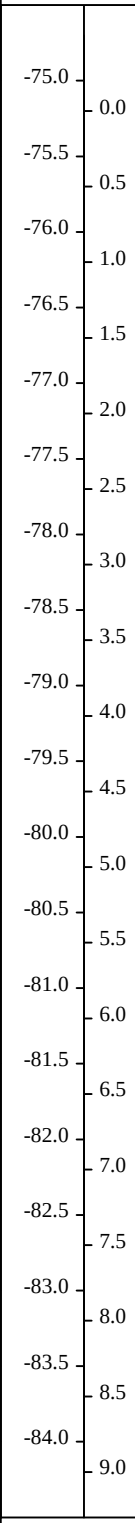
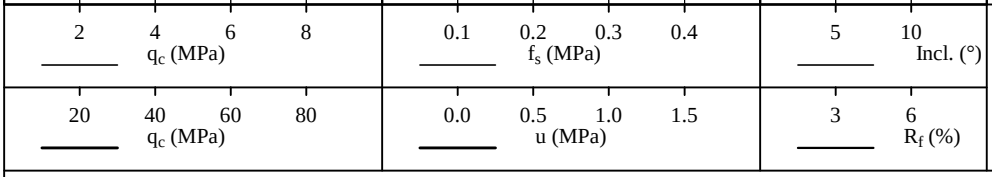
CPT name : ST14460-CPT-08







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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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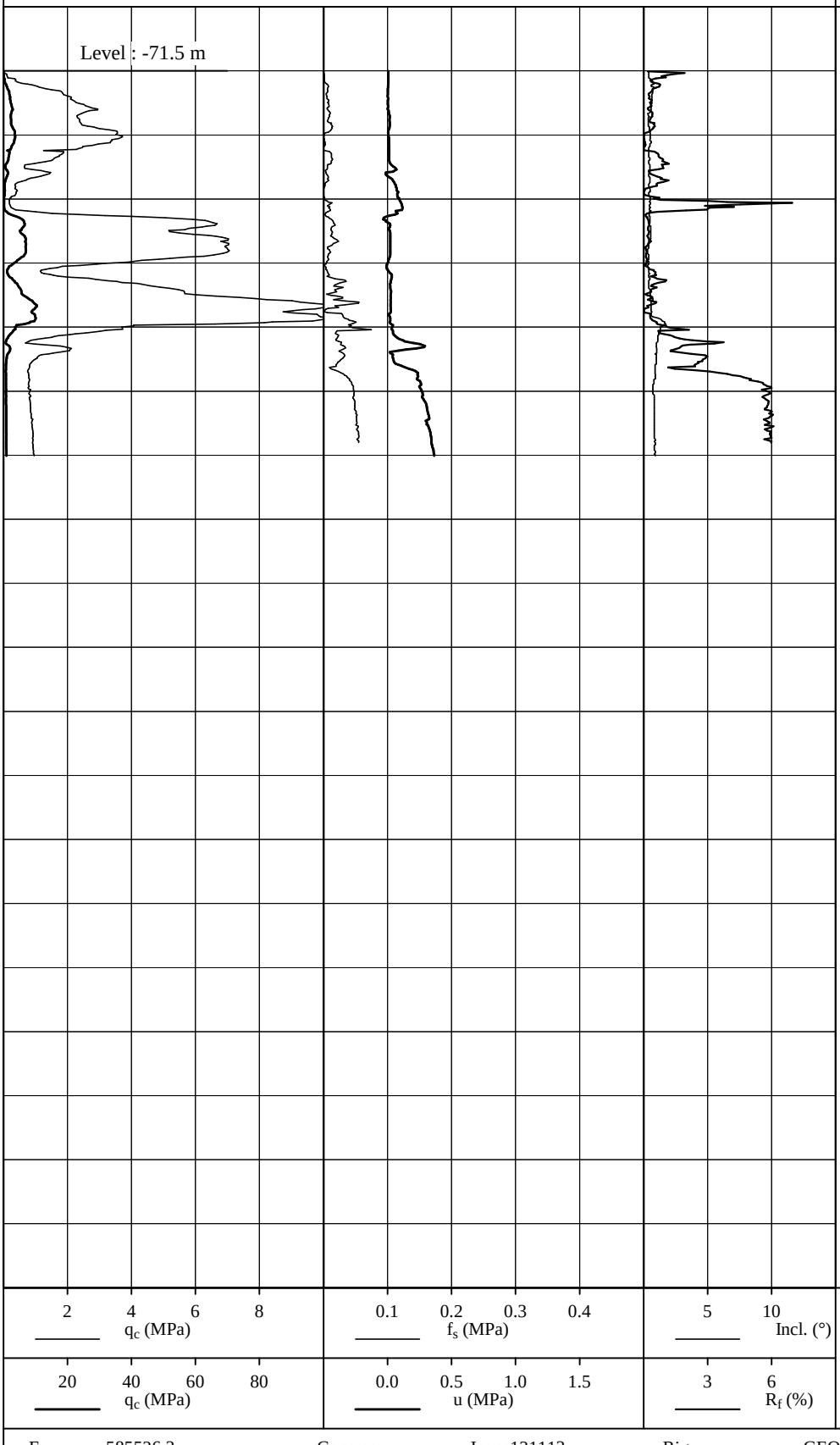
CPT name : ST14460-CPT-09



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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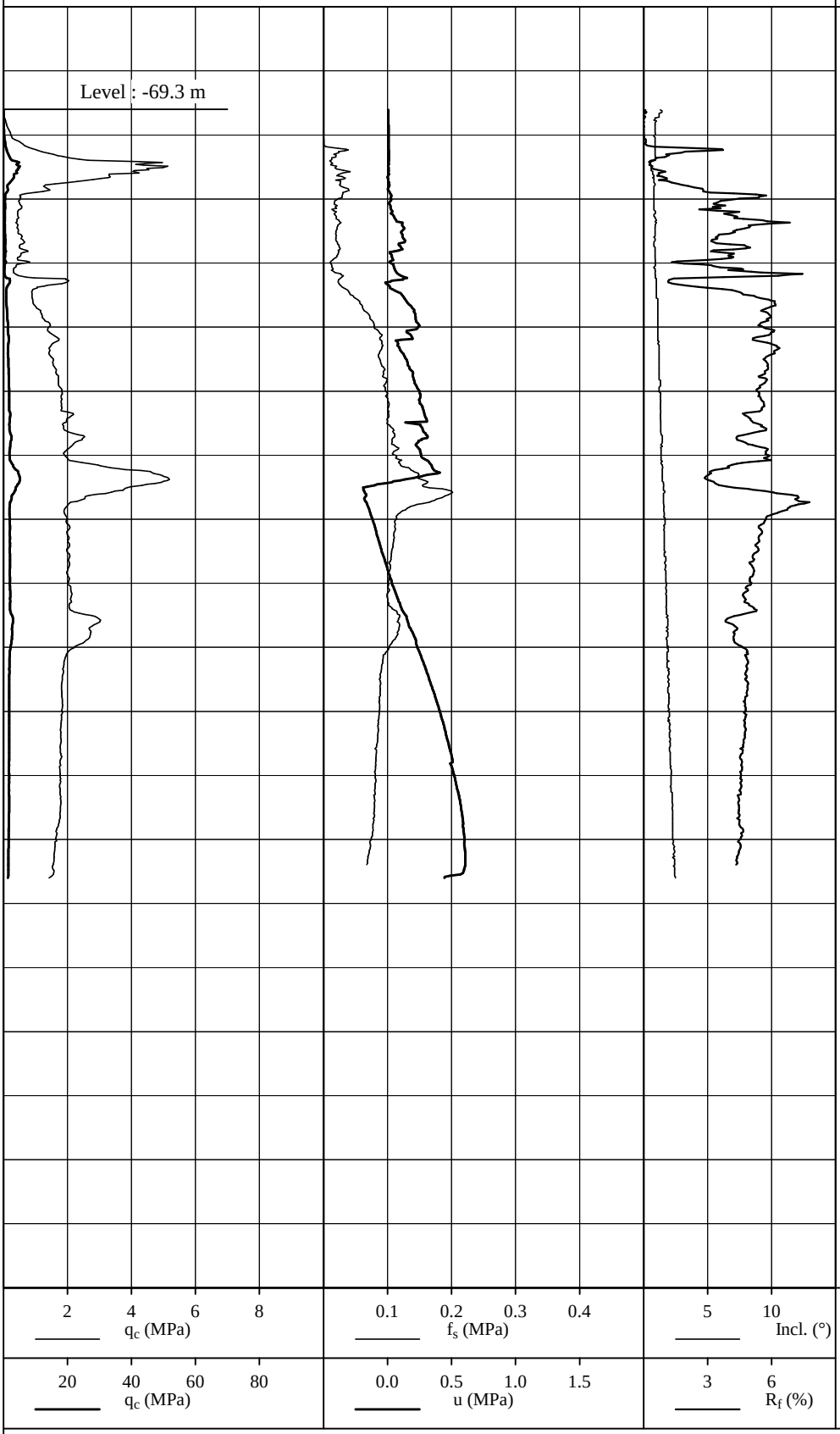
CPT name : ST14460-CPT-10



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N	: 6374258.8	Cone type	: TSP	Performed by	: JPM/2014-04-02 06:28:56
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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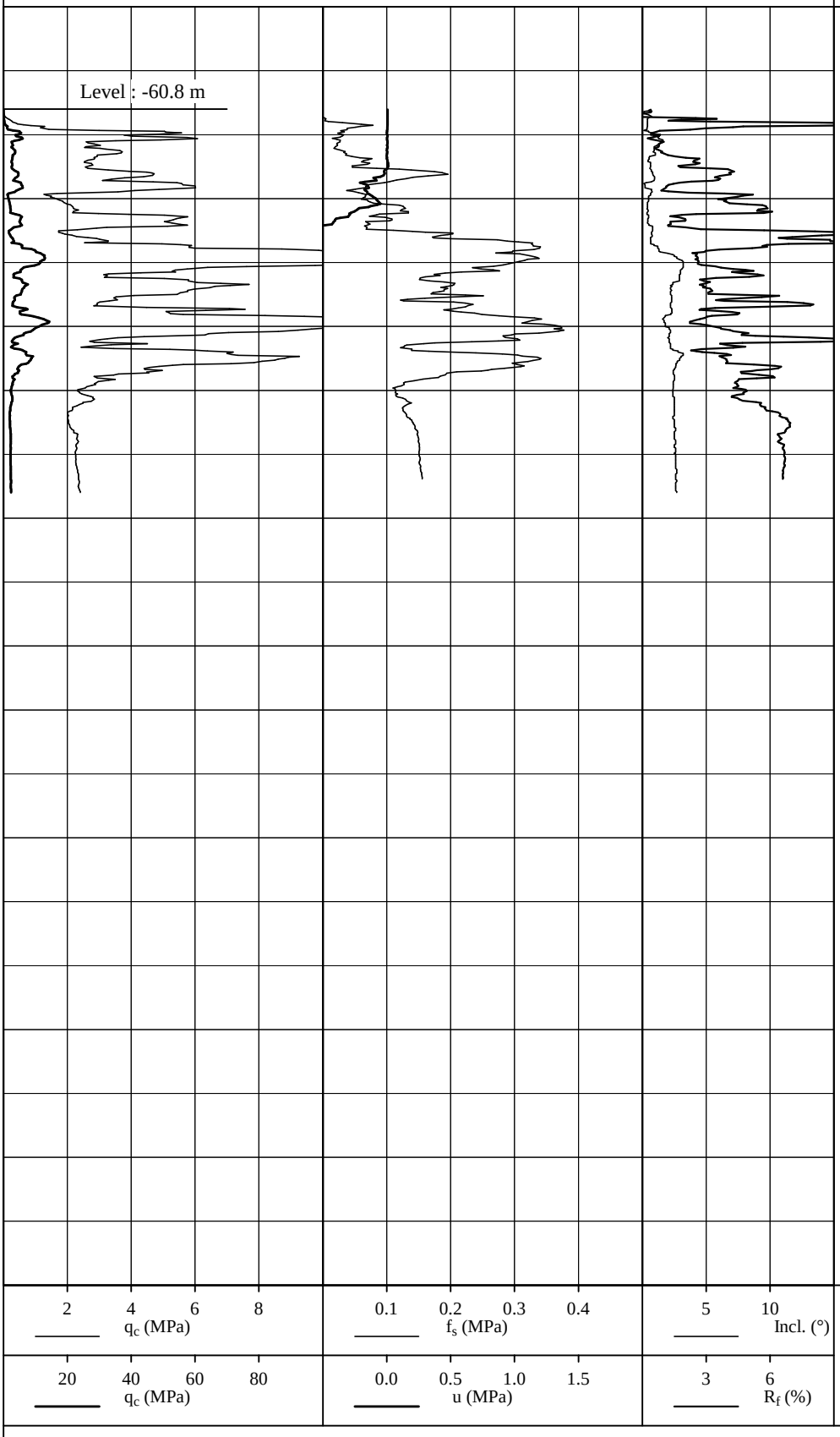
CPT name : ST14460-CPT-11



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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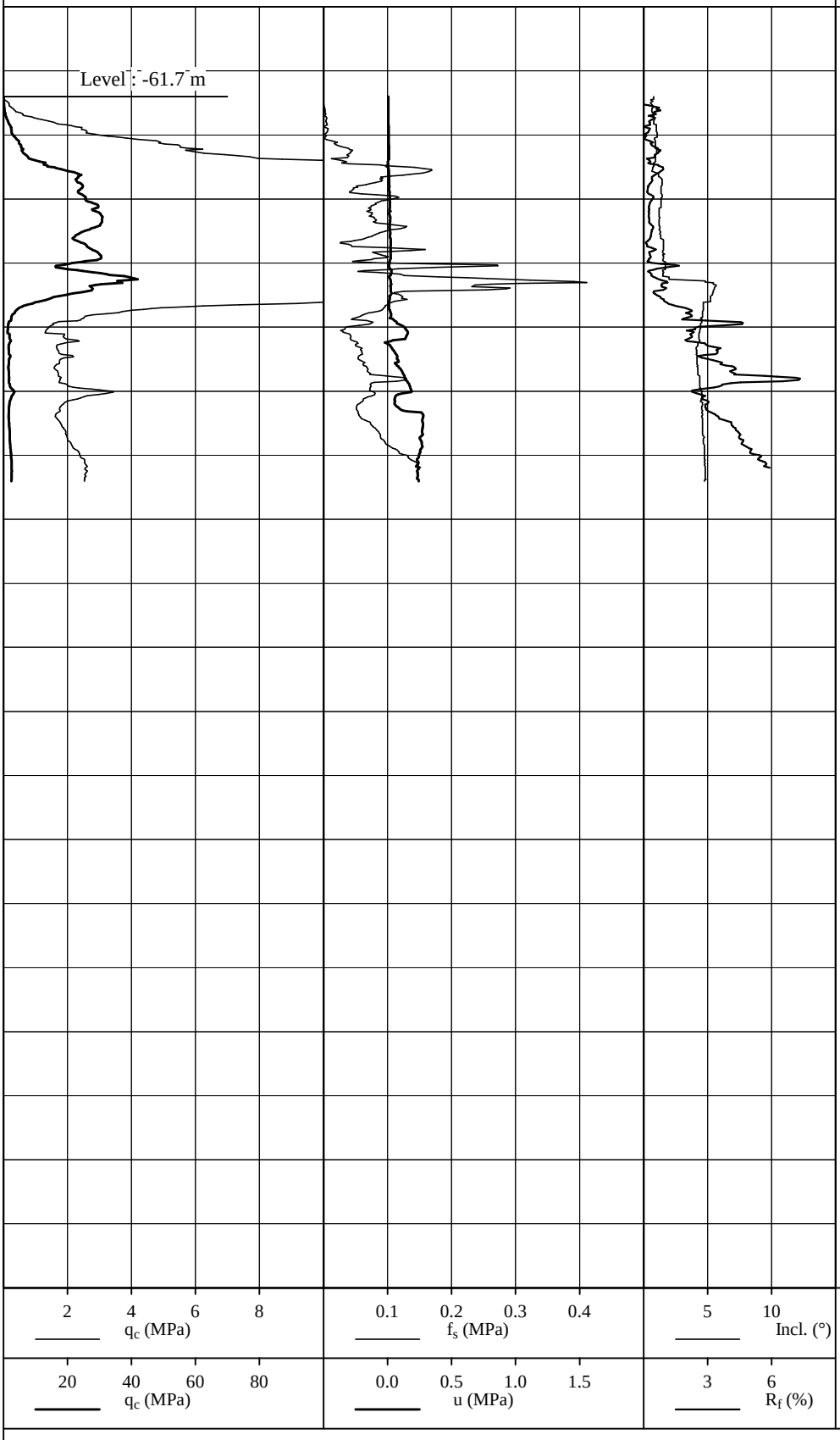
CPT name : ST14460-CPT-12



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N	: 6375700.4	Cone type	: TSP	Performed by	: JPM/2014-04-02 04:38:47
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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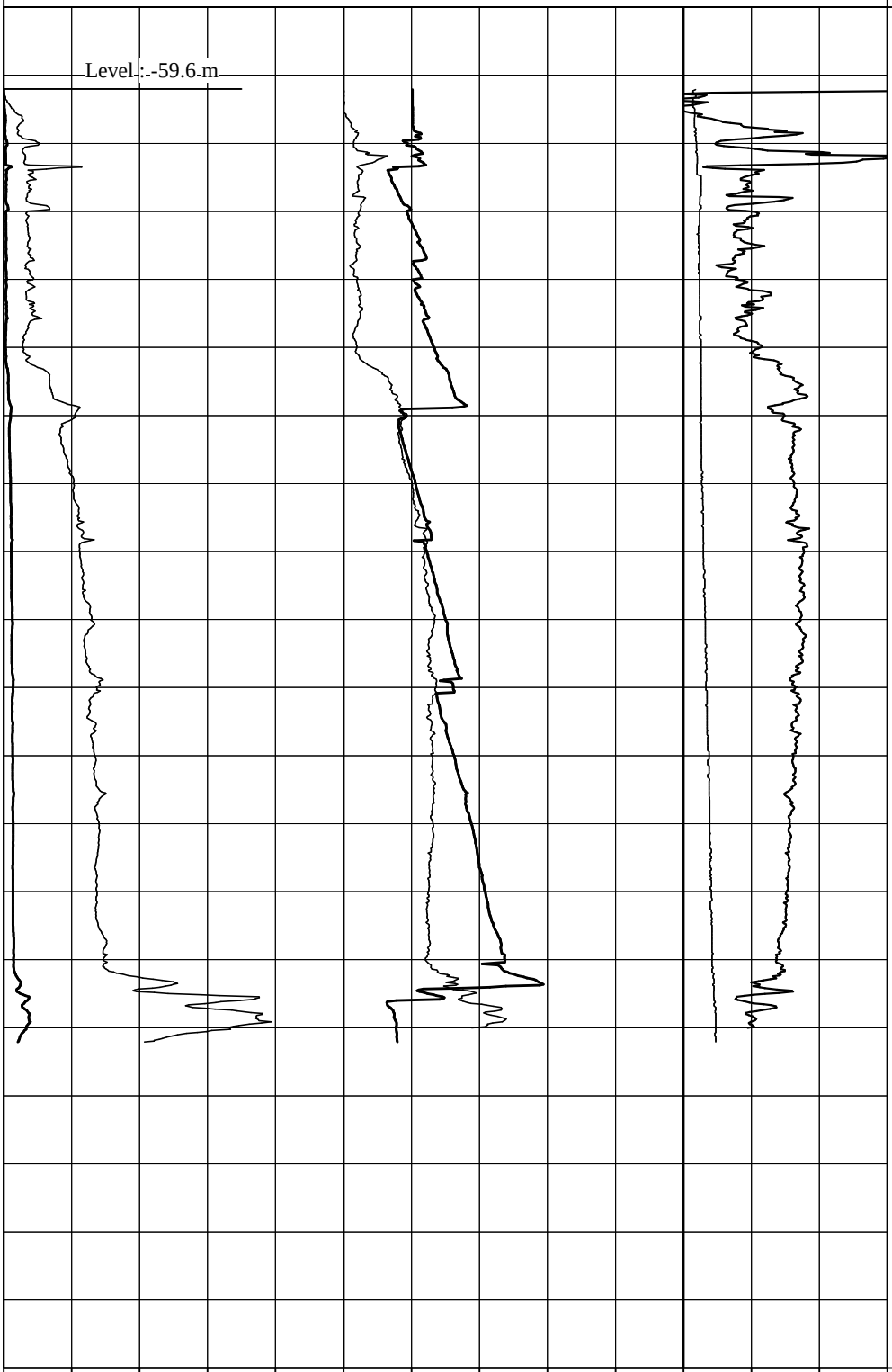
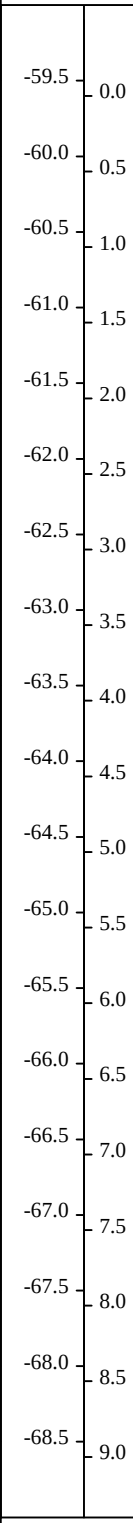
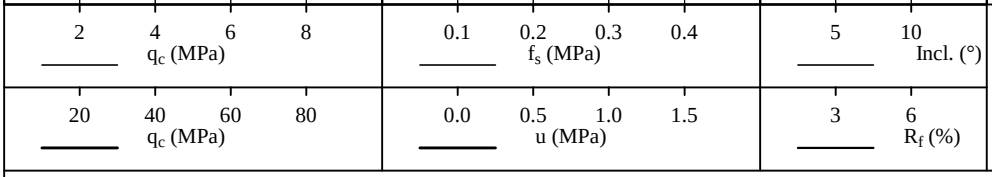
CPT name : ST14460-CPT-13







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N	: 6375942.4	Cone type	: TSP	Performed by	: JPM/2014-04-03 04:42:31
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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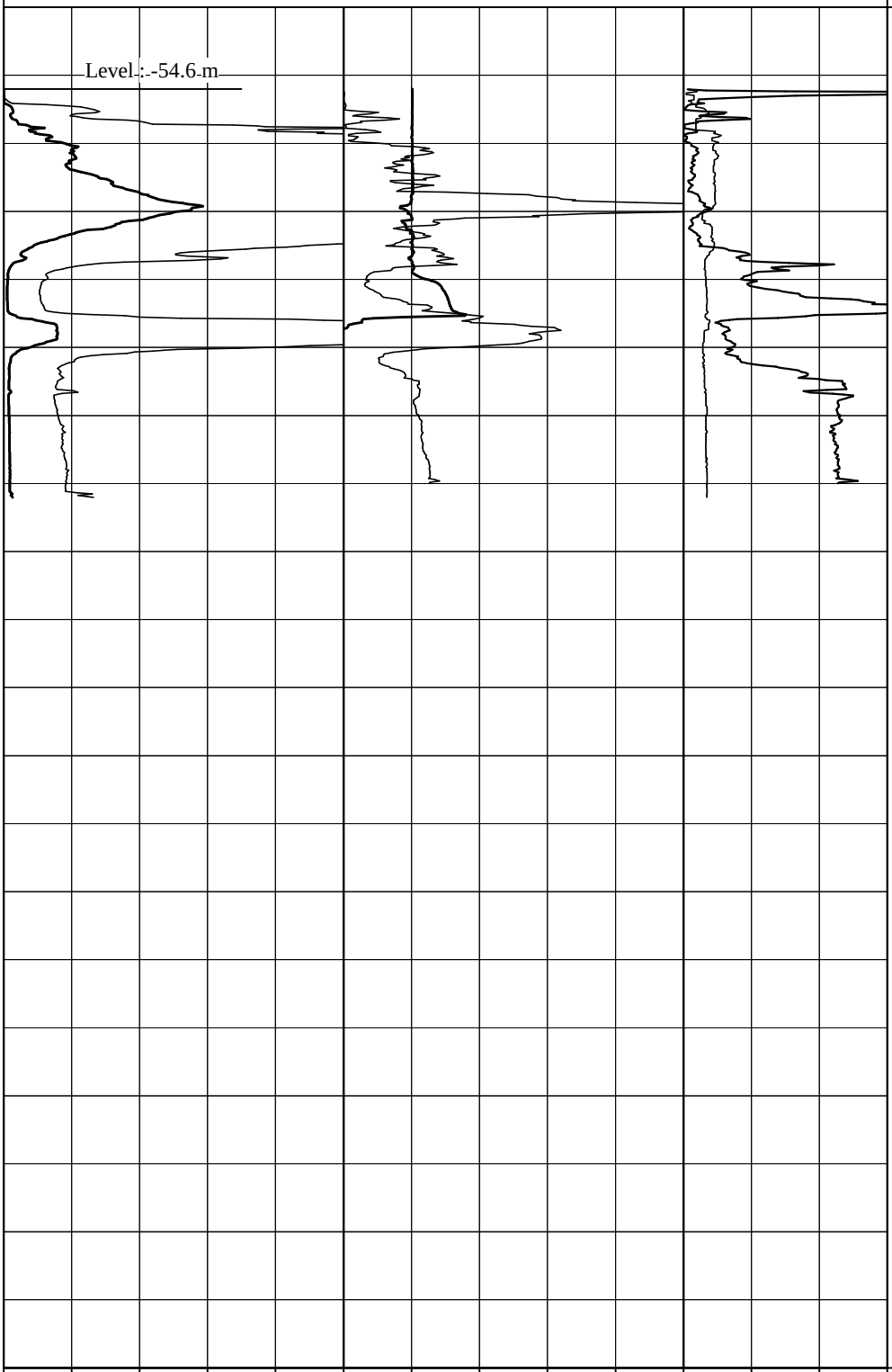
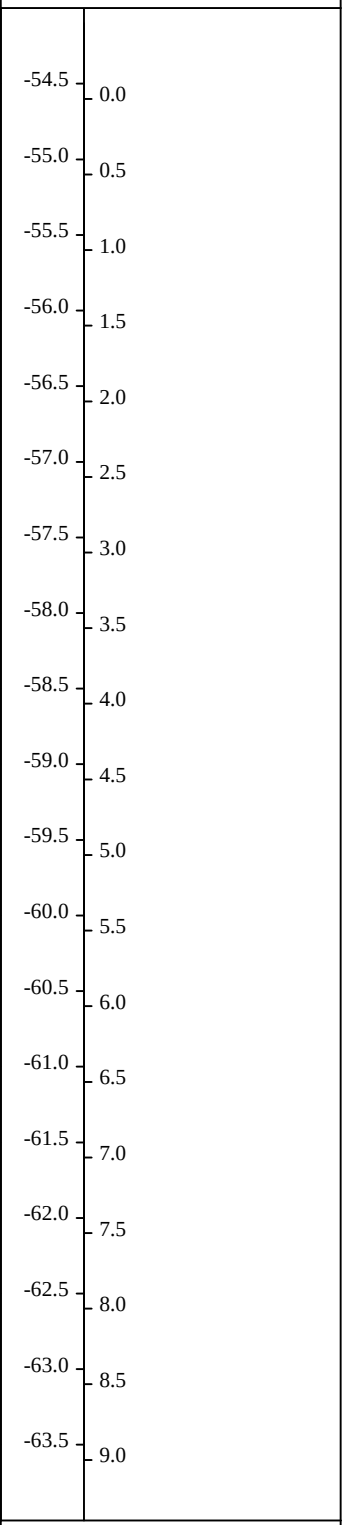
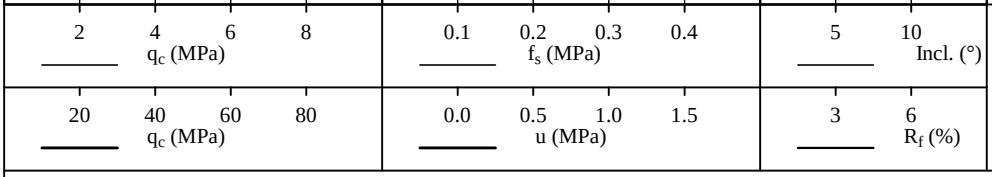
CPT name : ST14460-CPT-14







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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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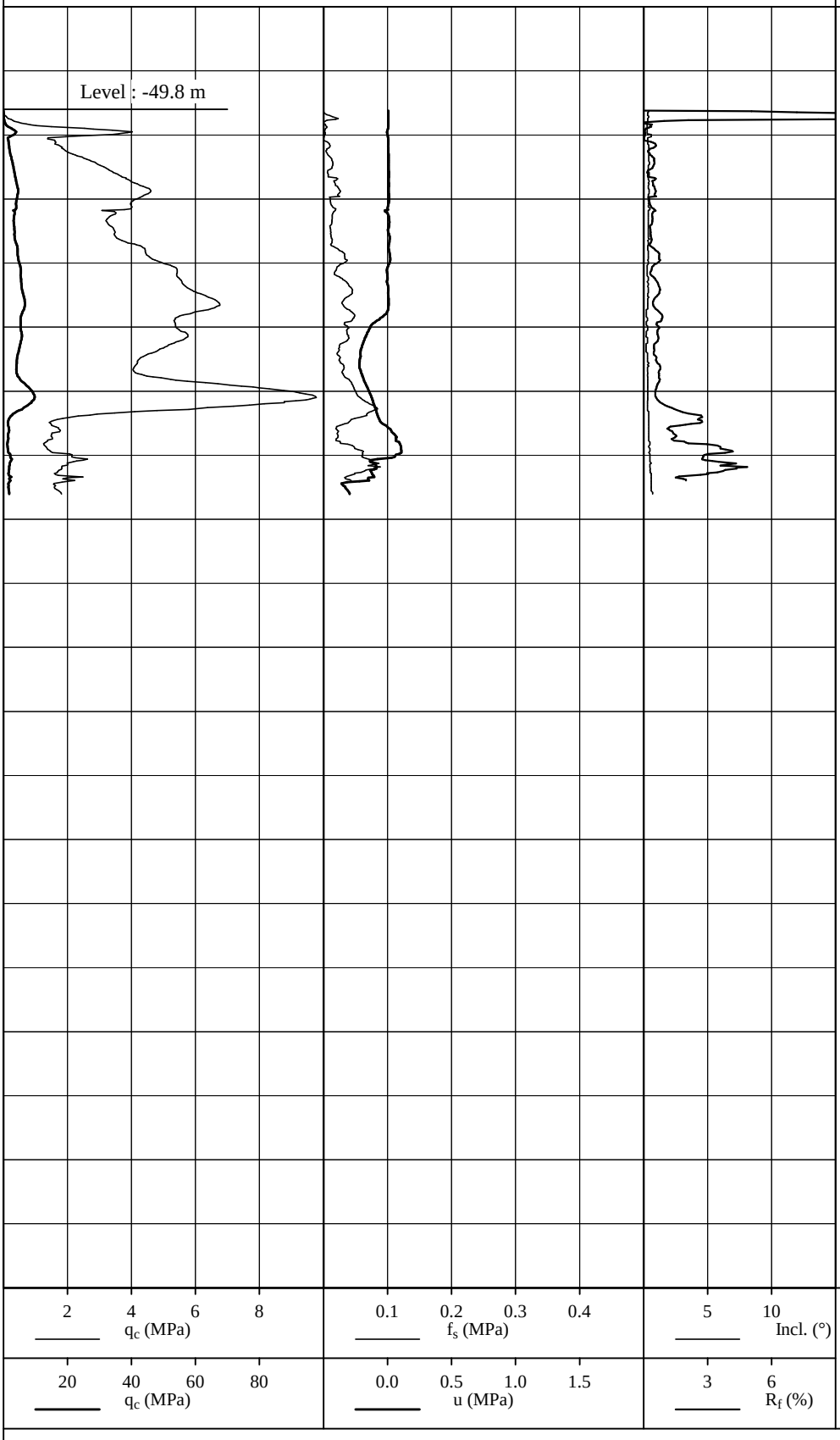
CPT name : ST14460-CPT-15



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N	: 6376621.7	Cone type	: TSP	Performed by	: ALJ/2014-04-01 16:10:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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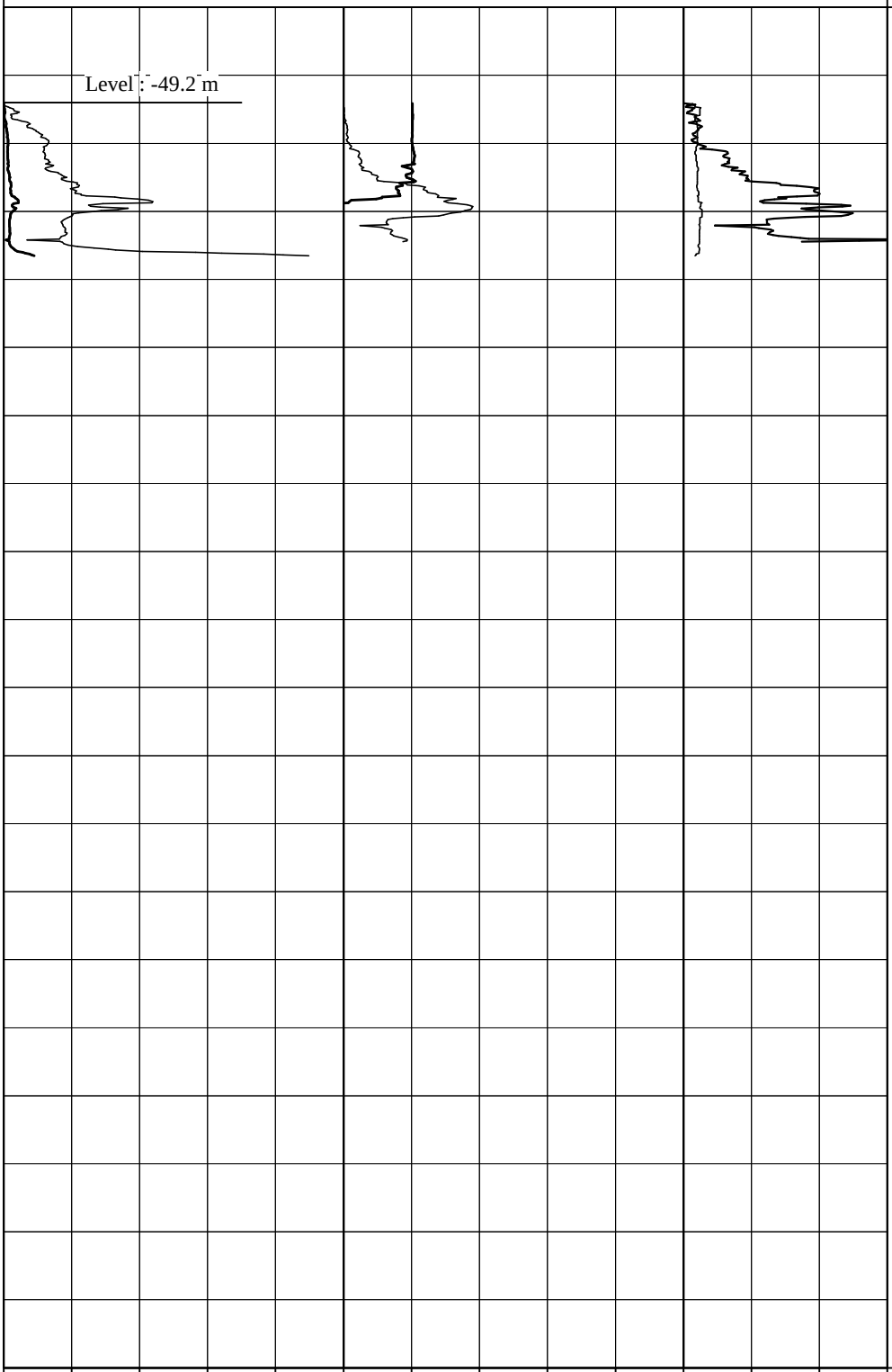
CPT name : ST14460-CPT-16



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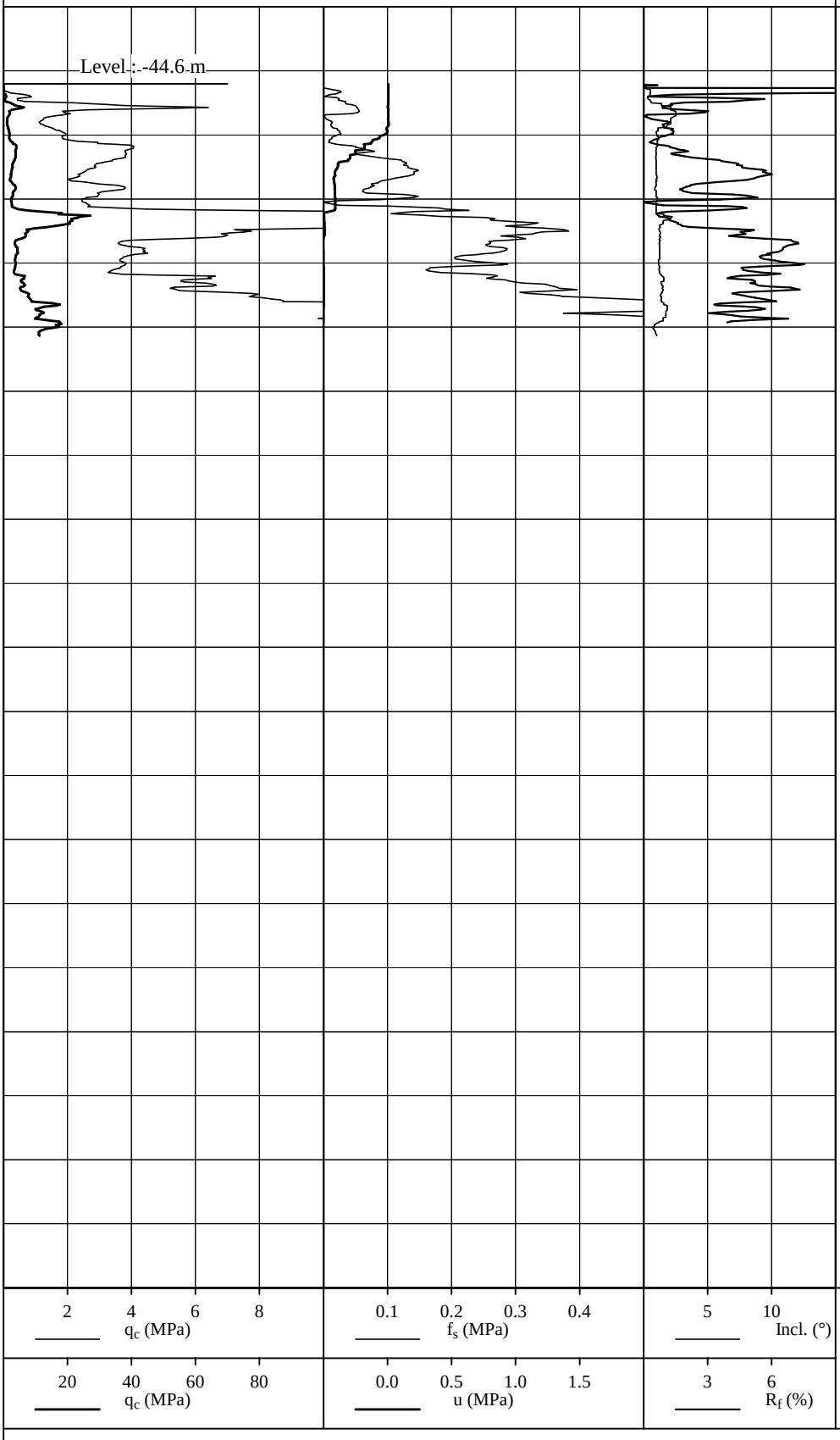
CPT name : ST14460-CPT-17



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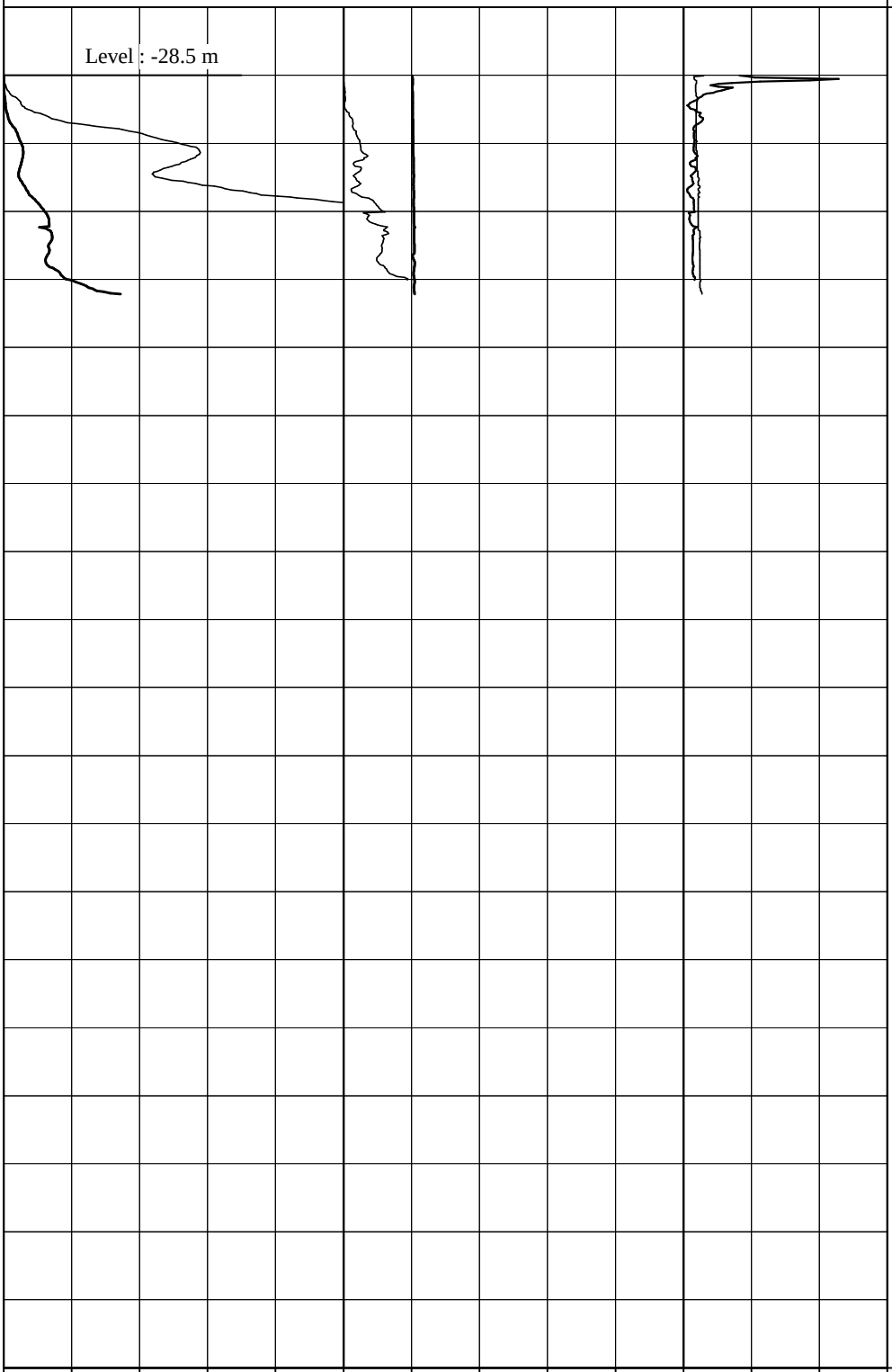
CPT name : ST14460-CPT-18



E	: 573990.7	Cone no.	: Icone121113	Rig	: GEOScope
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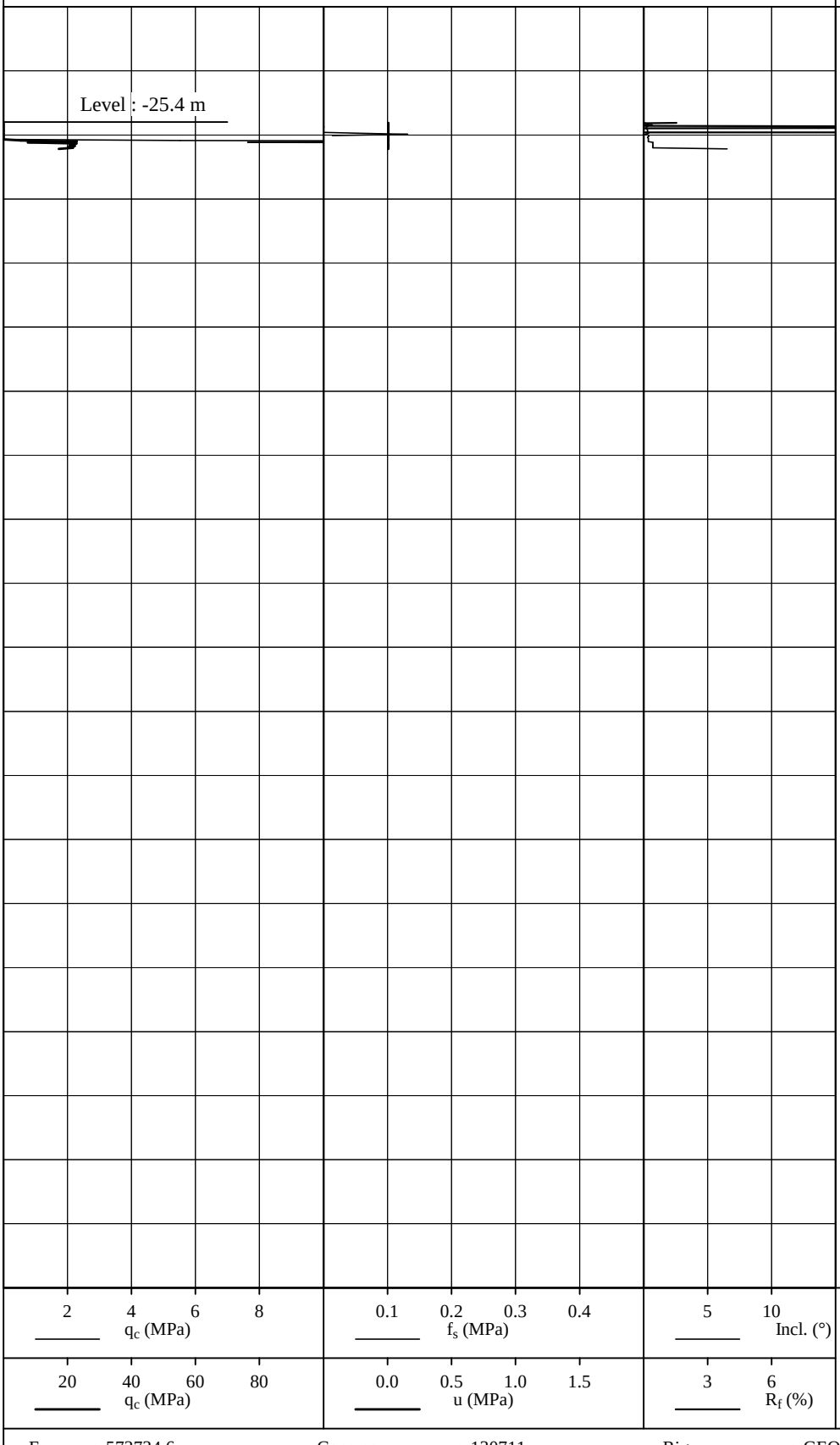
CPT name : ST14460-CPT-19



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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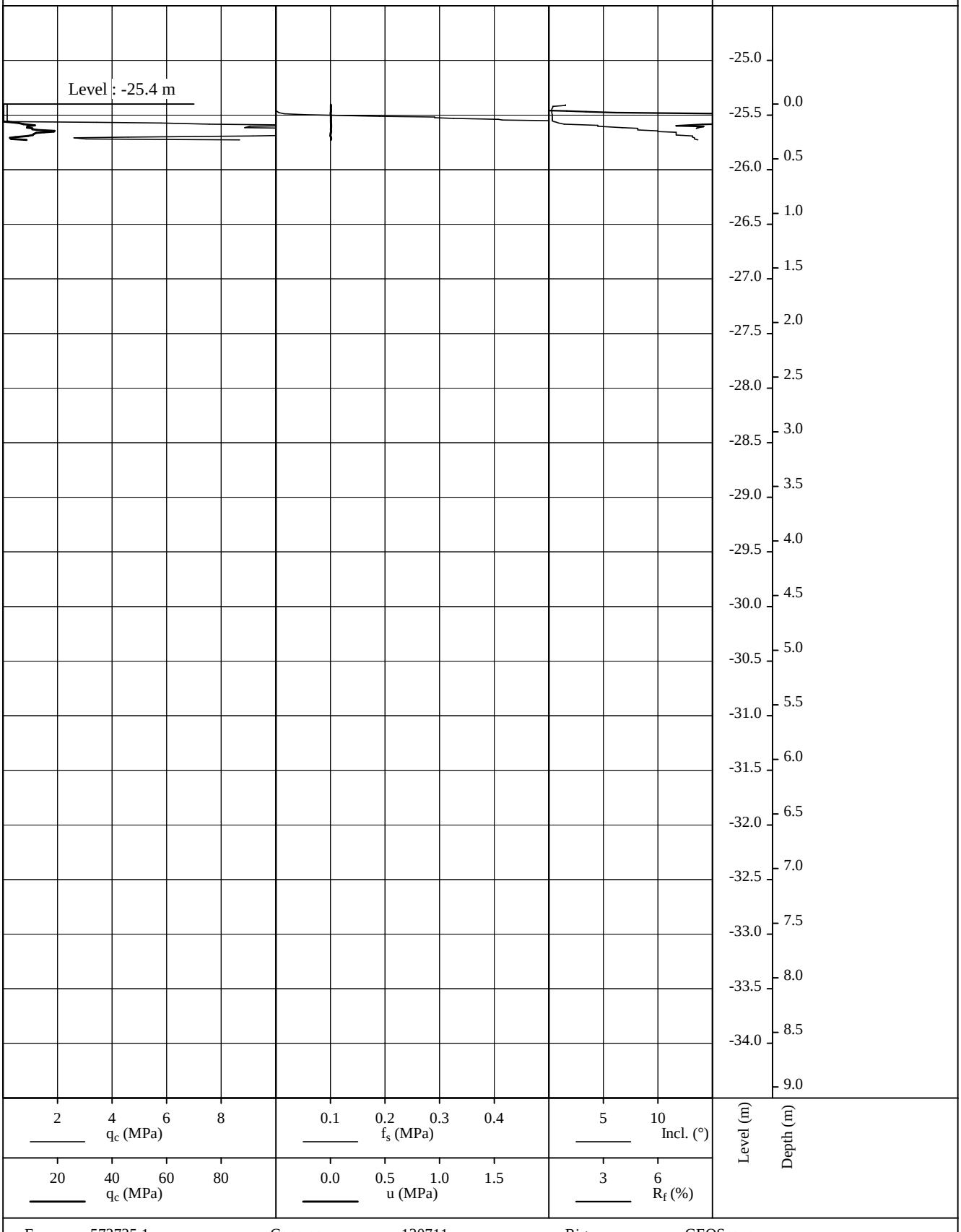
CPT name : ST14460-CPT-19a



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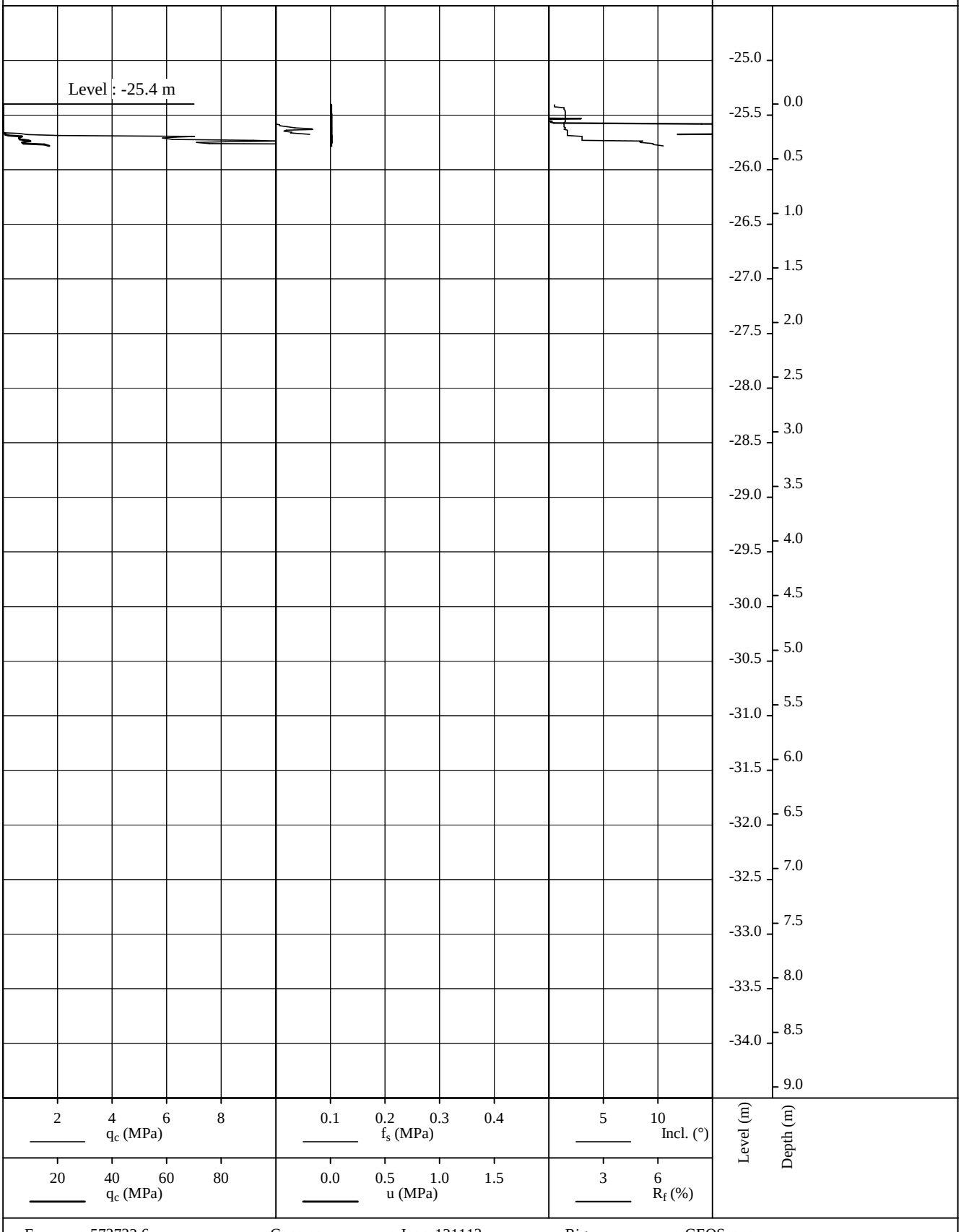
CPT name : ST14460-CPT-19b



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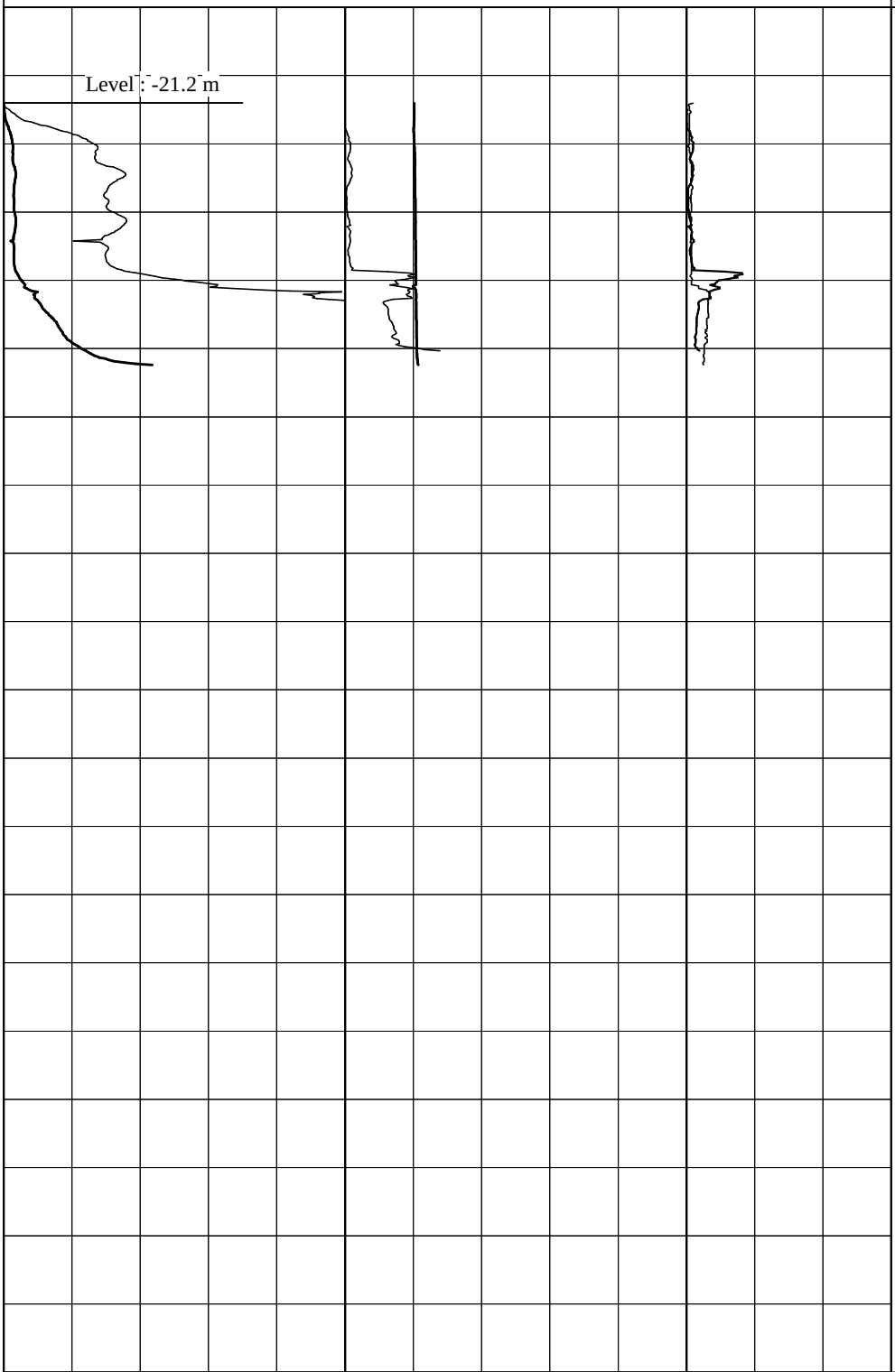
CPT name : ST14460-CPT-20



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N	: 6375499.6	Cone type	: TSP	Performed by	: JPM/2014-04-03 06:41:34
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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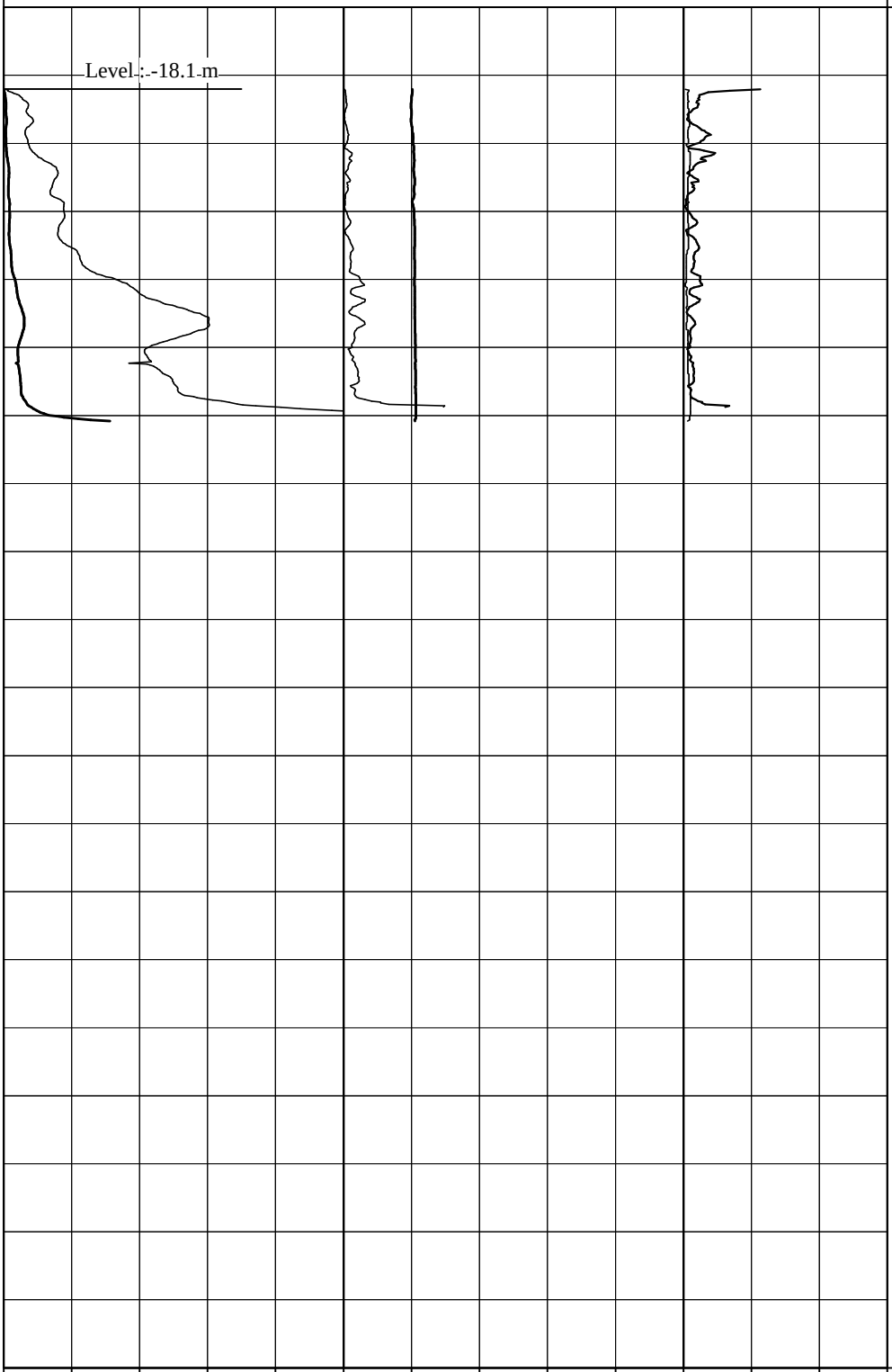
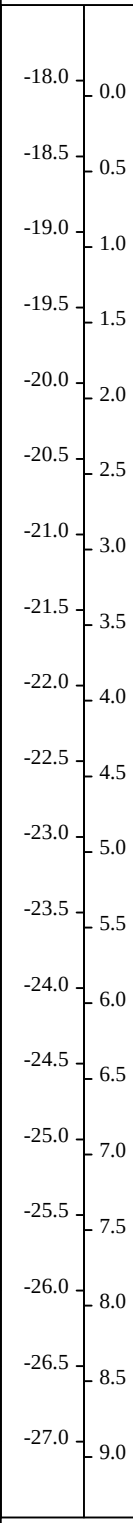
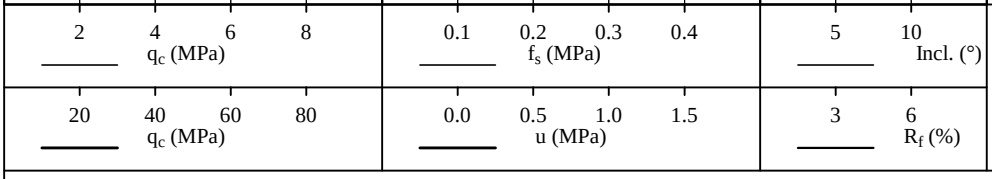
Printed 2014-04-08 09:47:03

CPT name : ST14460-CPT-21







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N	: 6375447.8	Cone type	: TSP	Performed by	: ALJ/2014-04-01 19:09:04
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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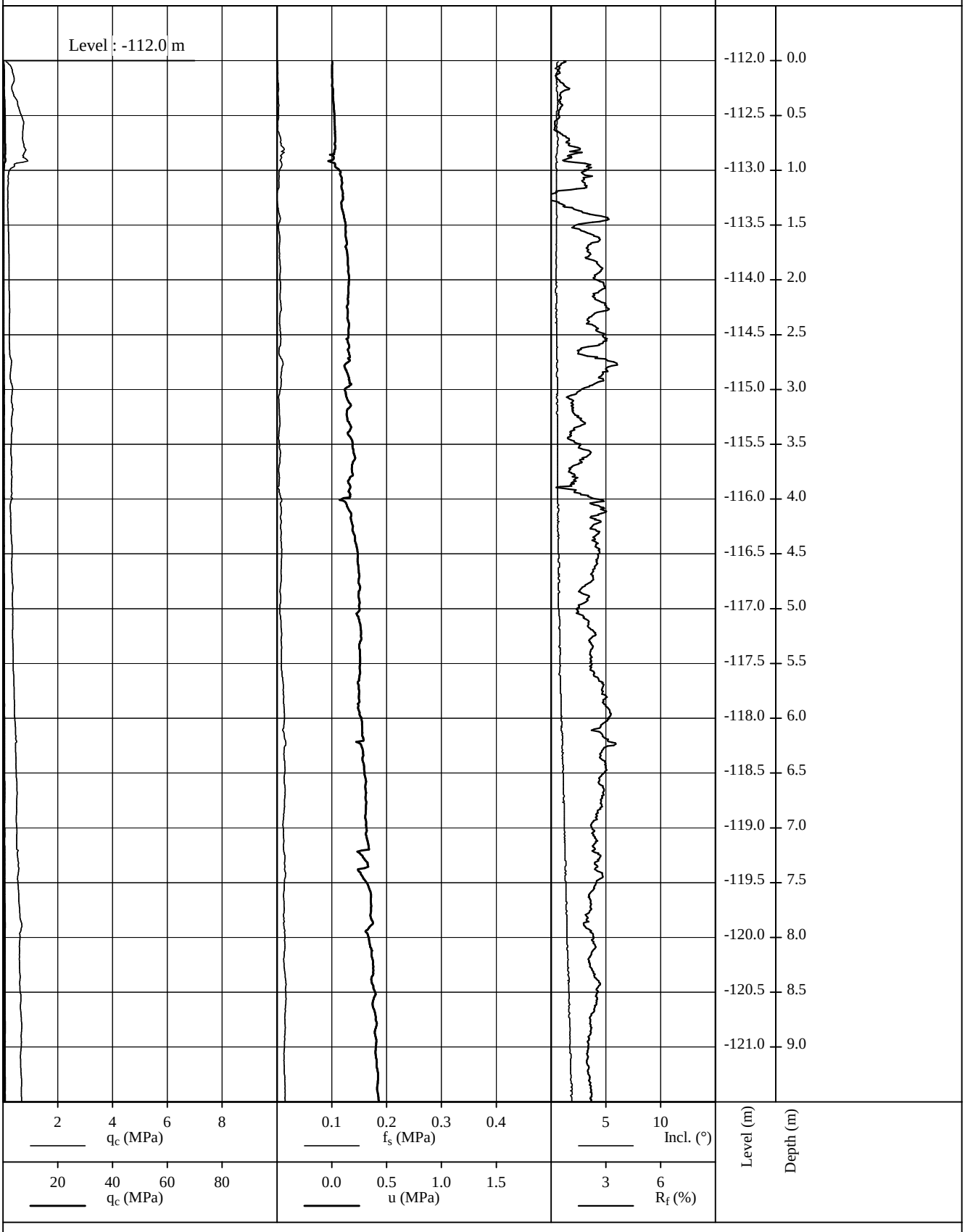
Printed 2014-04-08 11:02:30

CPT name : ST14460-CPT-111



E	: 599506.9	Cone no.	: 130711	Rig	: GEOScope
N	: 6373078.0	Cone type	: TSP	Performed by	: JPM/2014-03-31 07:08:01
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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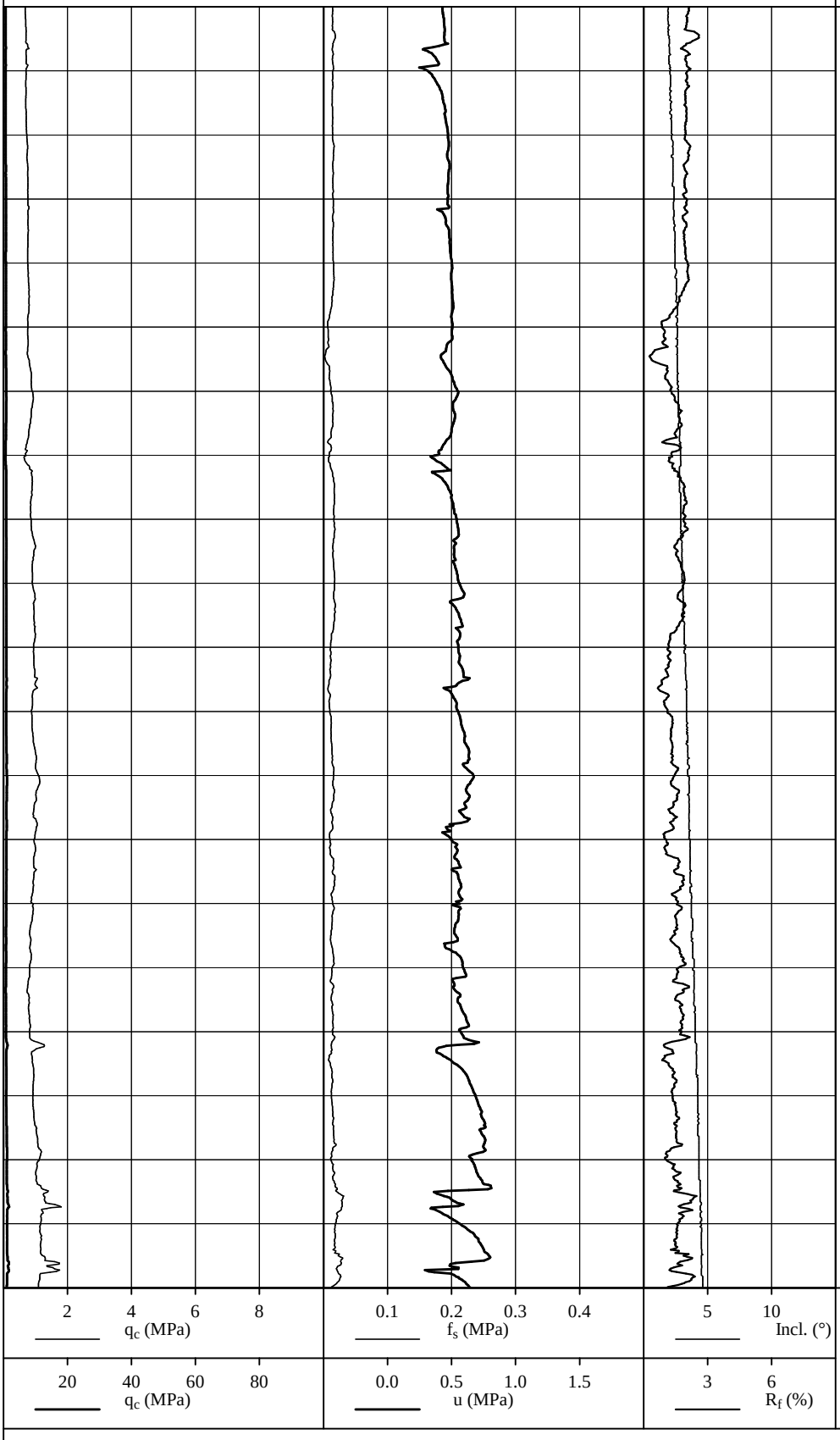

E	: 599506.9	Cone no.	: 130711	Rig	: GEOScope
N	: 6373078.0	Cone type	: TSP	Performed by	: JPM/2014-03-31 07:08:01
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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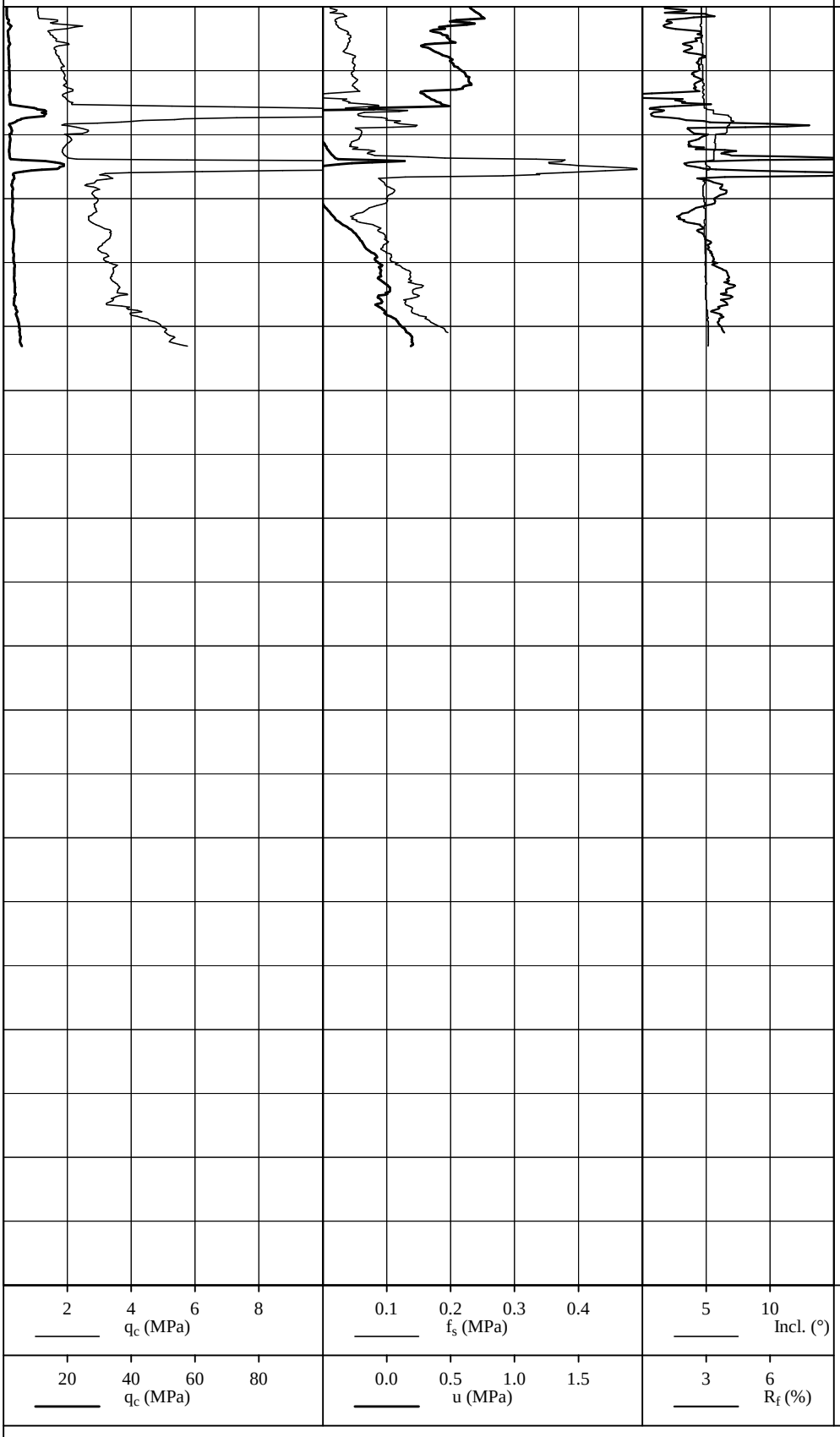
CPT name : ST14460-CPT-111



E	: 599506.9	Cone no.	: 130711	Rig	: GEOScope
N	: 6373078.0	Cone type	: TSP	Performed by	: JPM/2014-03-31 07:08:01
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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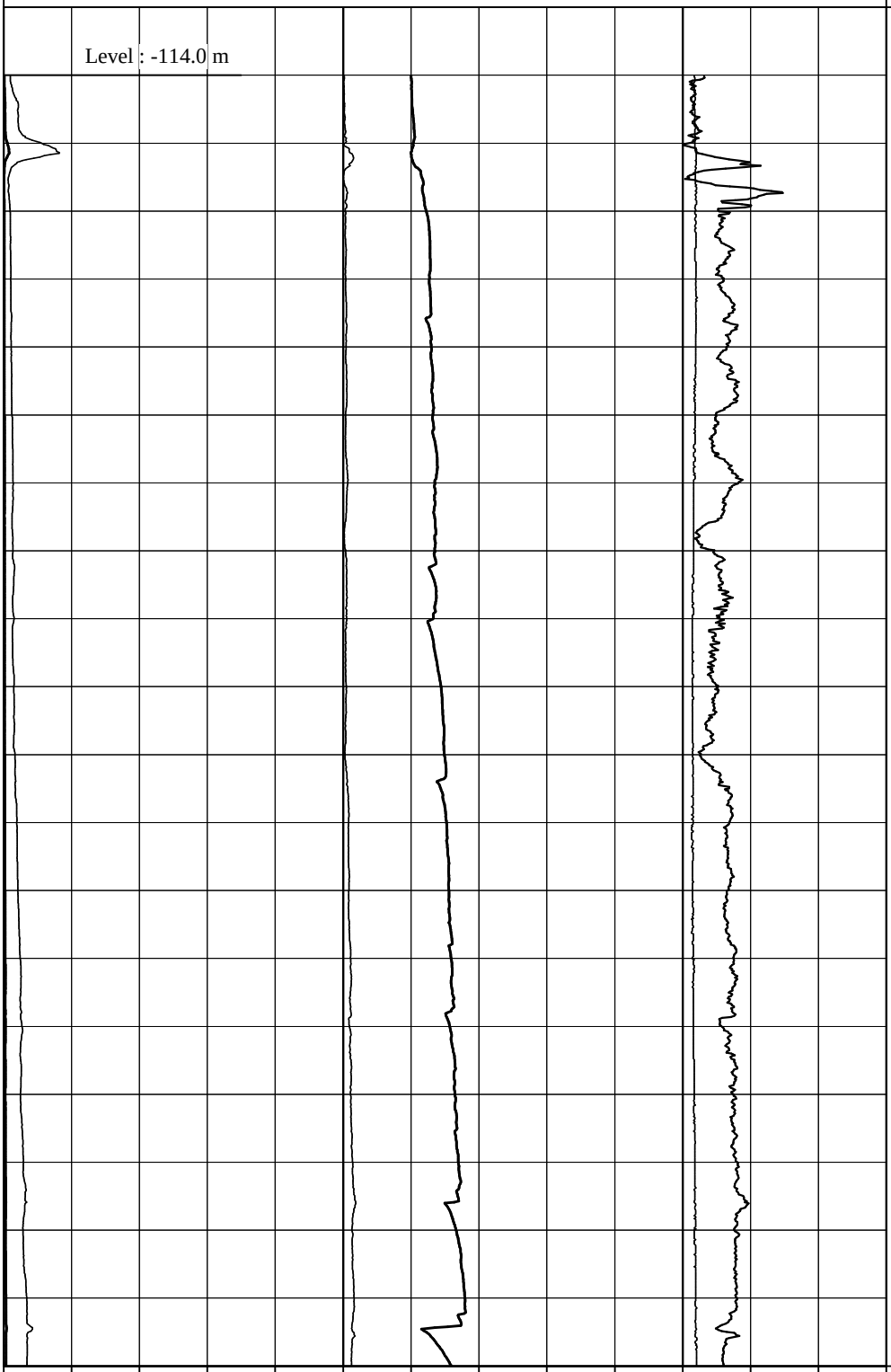
Printed 2014-04-08 09:45:42

CPT name : ST14460-CPT-112b



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N	: 6371830.1	Cone type	: TSP	Performed by	: JPM/2014-03-31 02:12:37
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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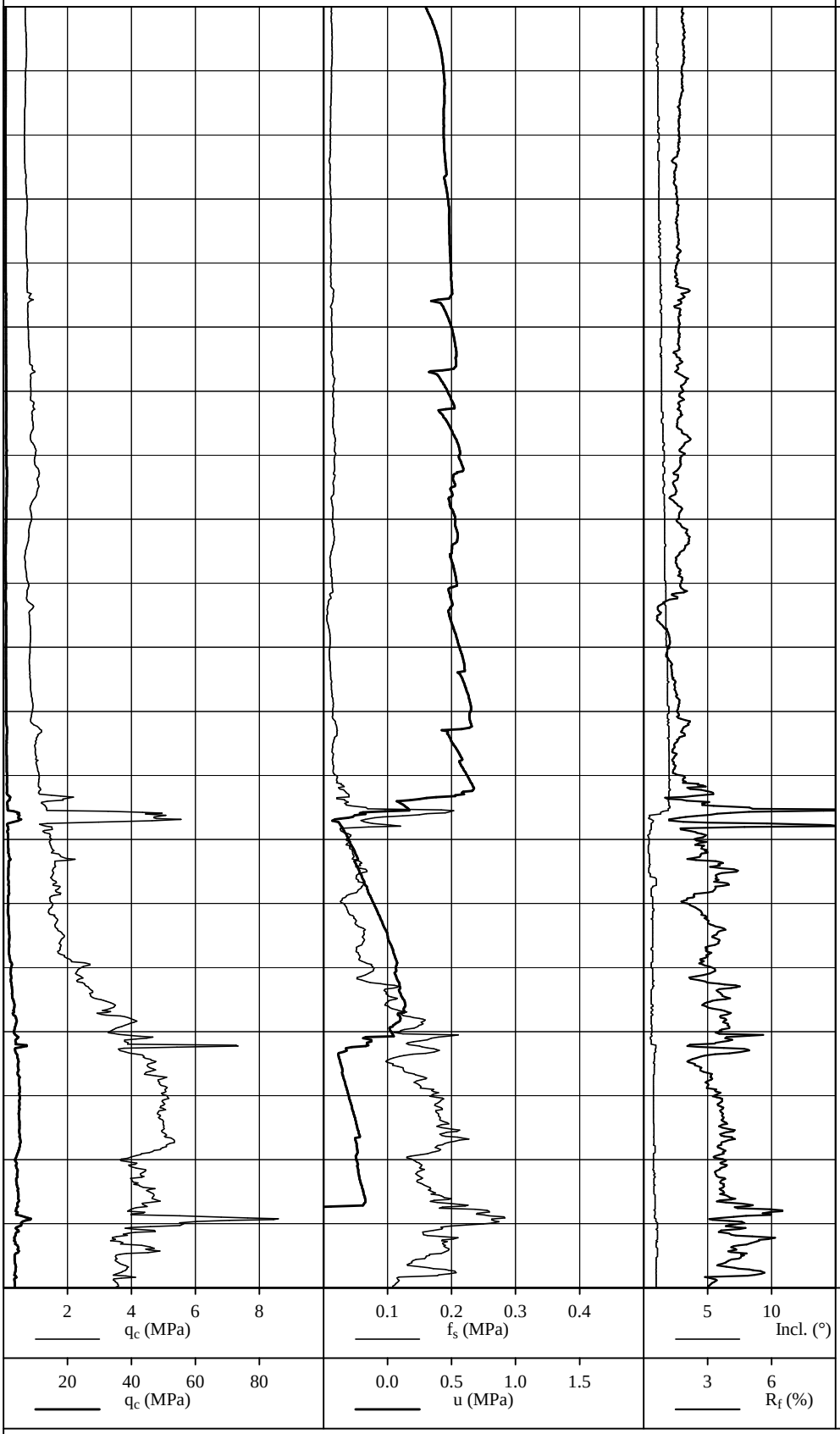
Printed 2014-04-08 09:45:45

CPT name : ST14460-CPT-112b



E	: 599733.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6371830.1	Cone type	: TSP	Performed by	: JPM/2014-03-31 02:12:37
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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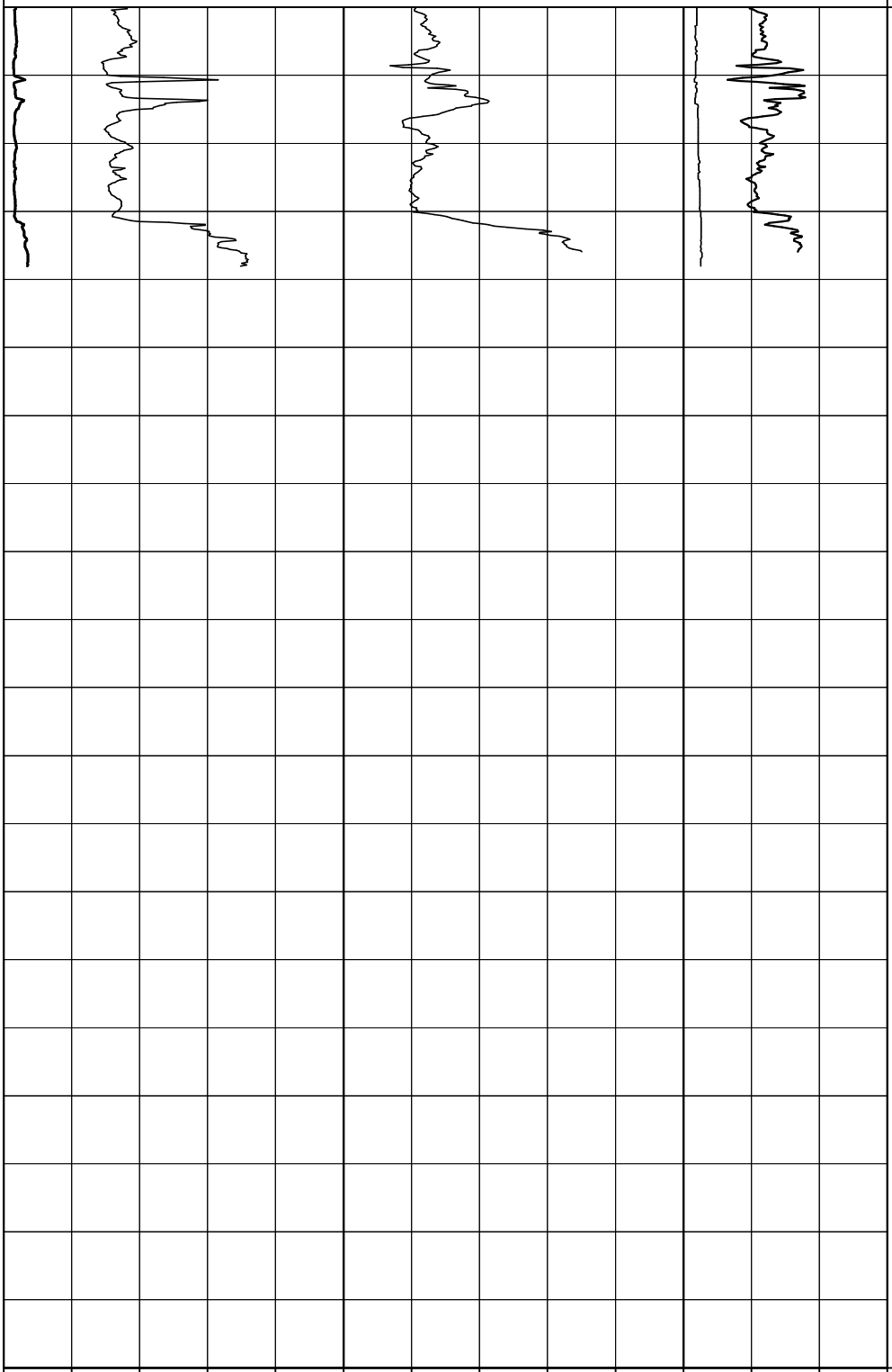
CPT name : ST14460-CPT-112b



E	: 599733.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6371830.1	Cone type	: TSP	Performed by	: JPM/2014-03-31 02:12:37
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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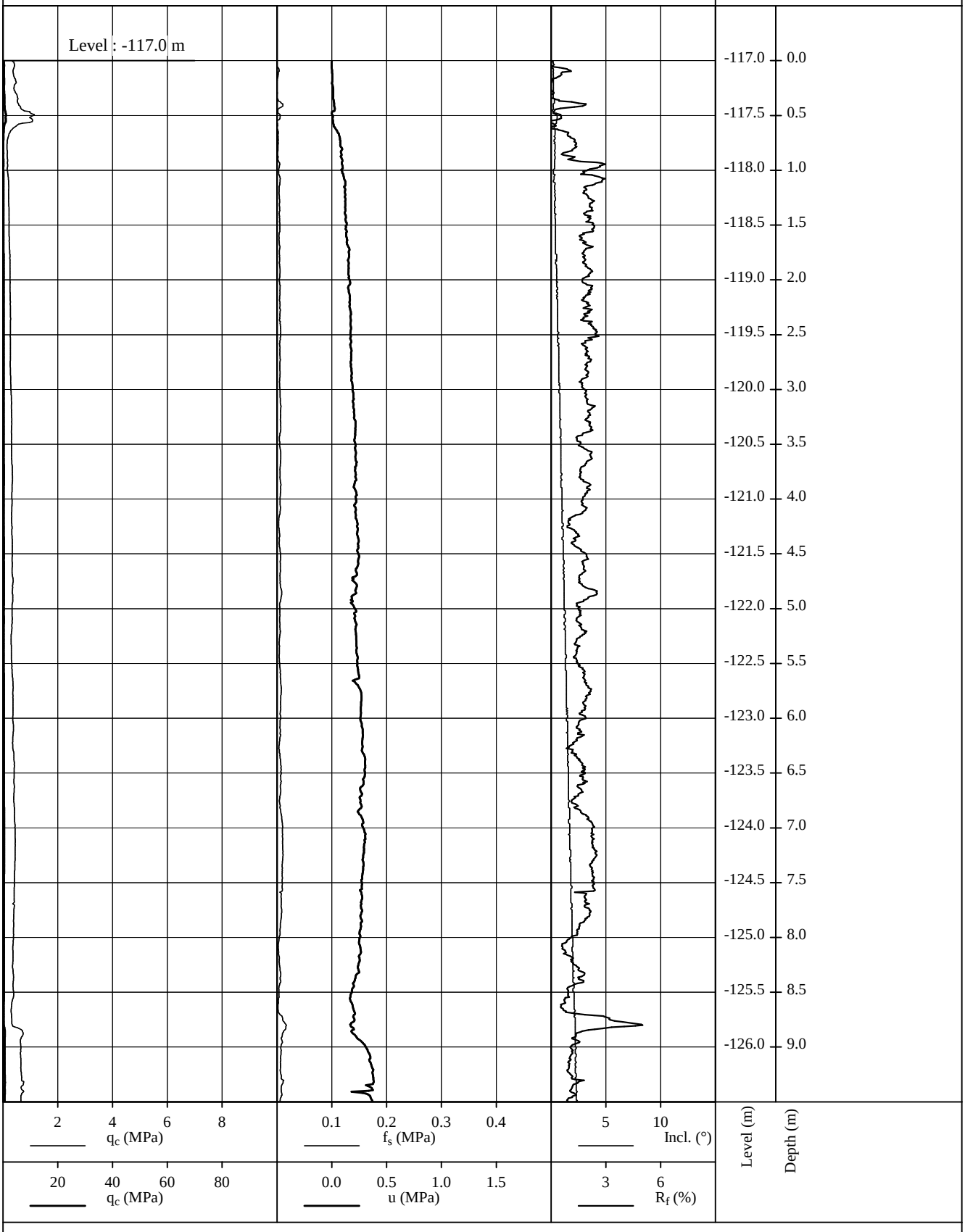
CPT name : ST14460-CPT-113



E	: 600845.2	Cone no.	: 130711	Rig	: GEOScope
N	: 6372685.7	Cone type	: TSP	Performed by	: JPM/2014-03-31 04:48:14
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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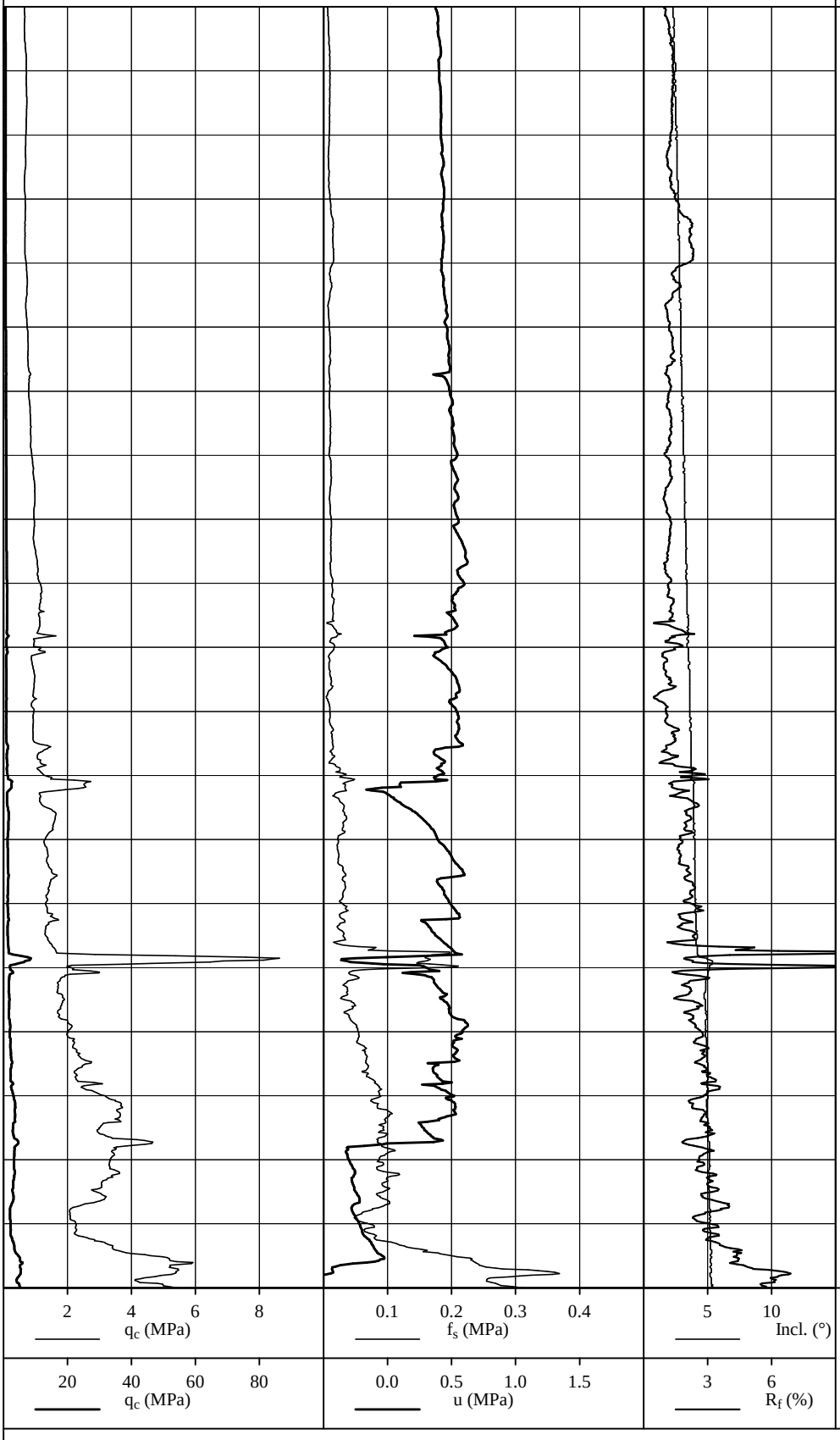
CPT name : ST14460-CPT-113



E	: 600845.2	Cone no.	: 130711	Rig	: GEOScope
N	: 6372685.7	Cone type	: TSP	Performed by	: JPM/2014-03-31 04:48:14
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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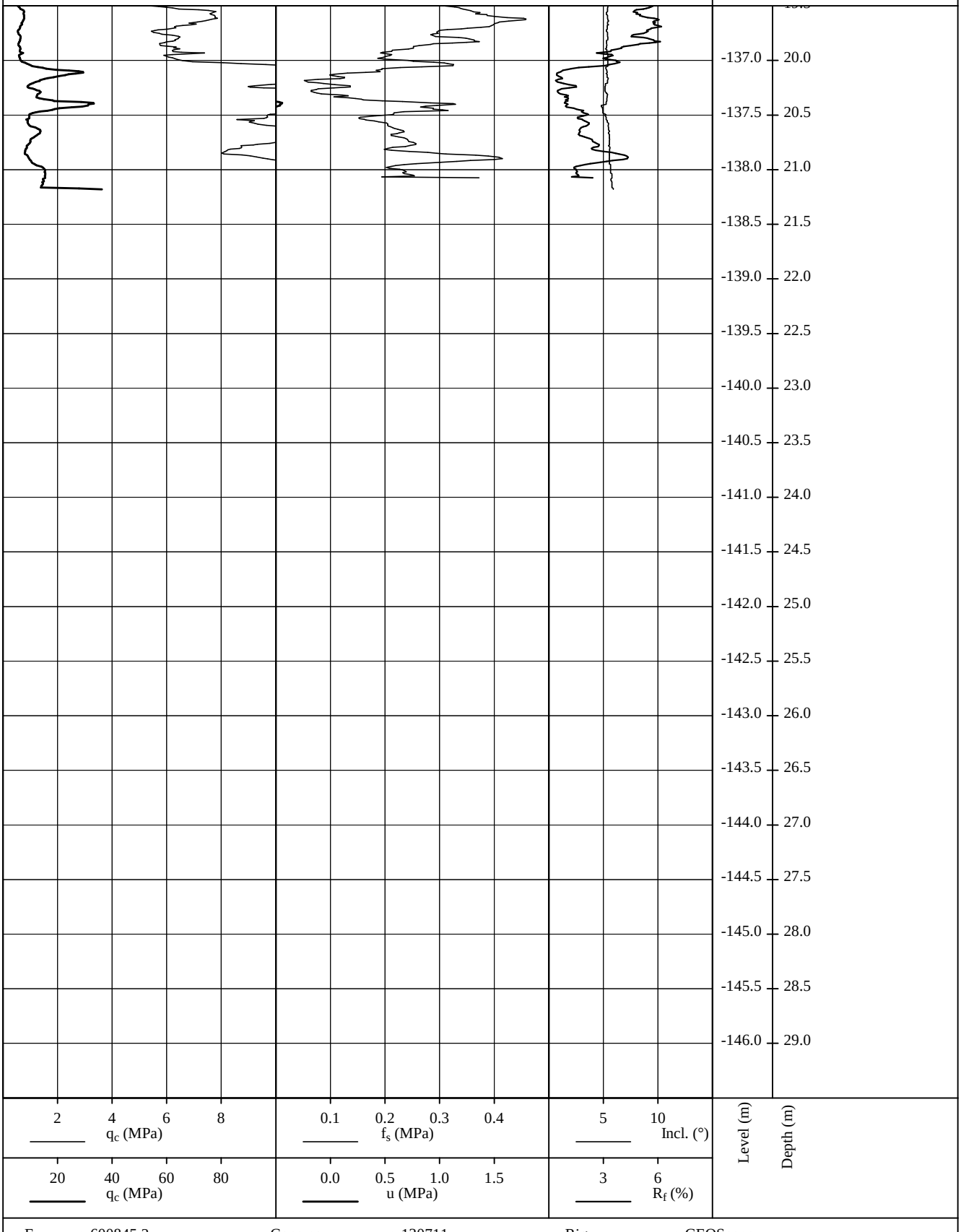
CPT name : ST14460-CPT-113



E	: 600845.2	Cone no.	: 130711	Rig	: GEOScope
N	: 6372685.7	Cone type	: TSP	Performed by	: JPM/2014-03-31 04:48:14
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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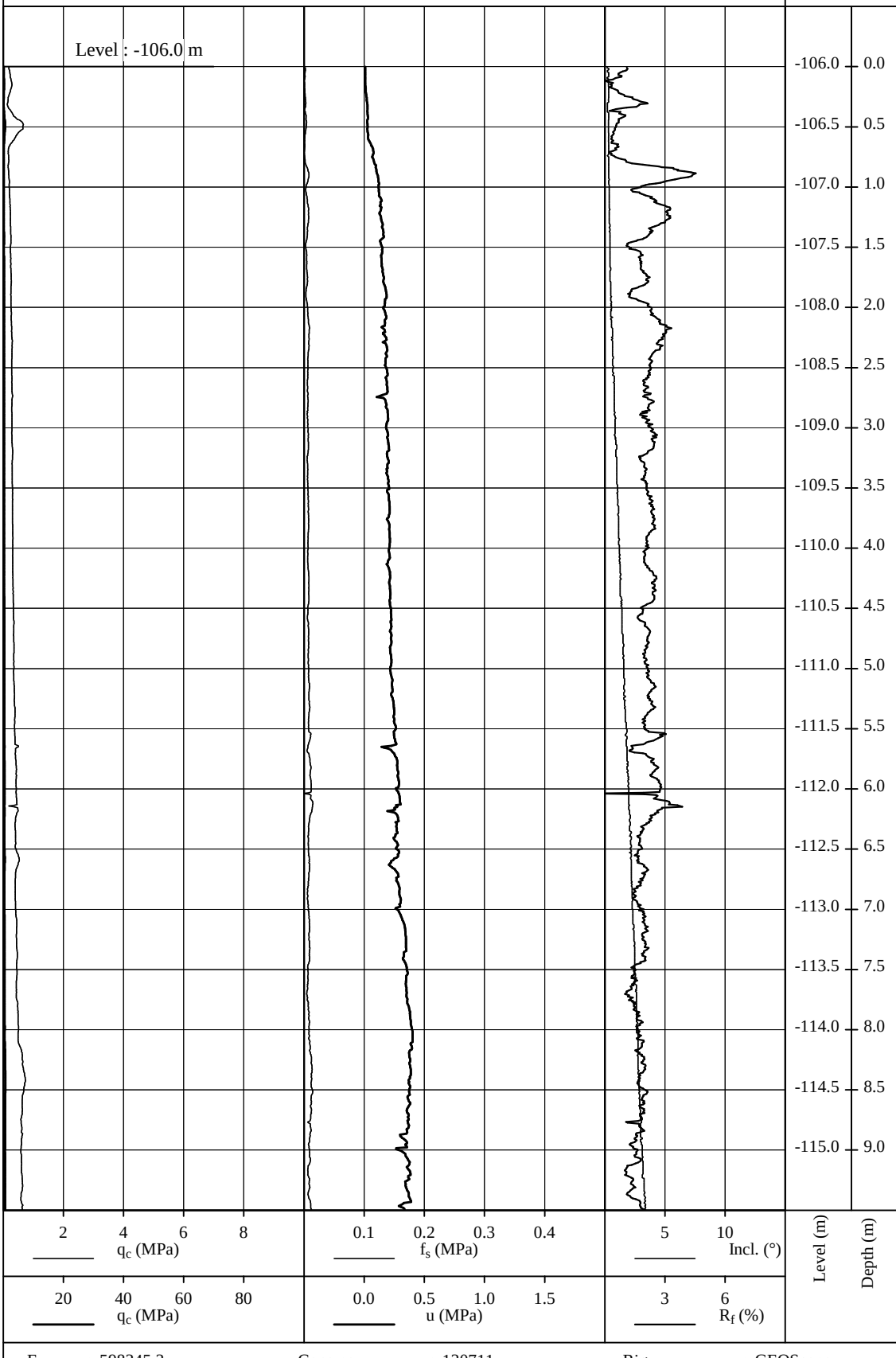
CPT name : ST14460-CPT-121



E	: 598345.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6373747.8	Cone type	: TSP	Performed by	: ALJ/2014-03-31 22:41:56
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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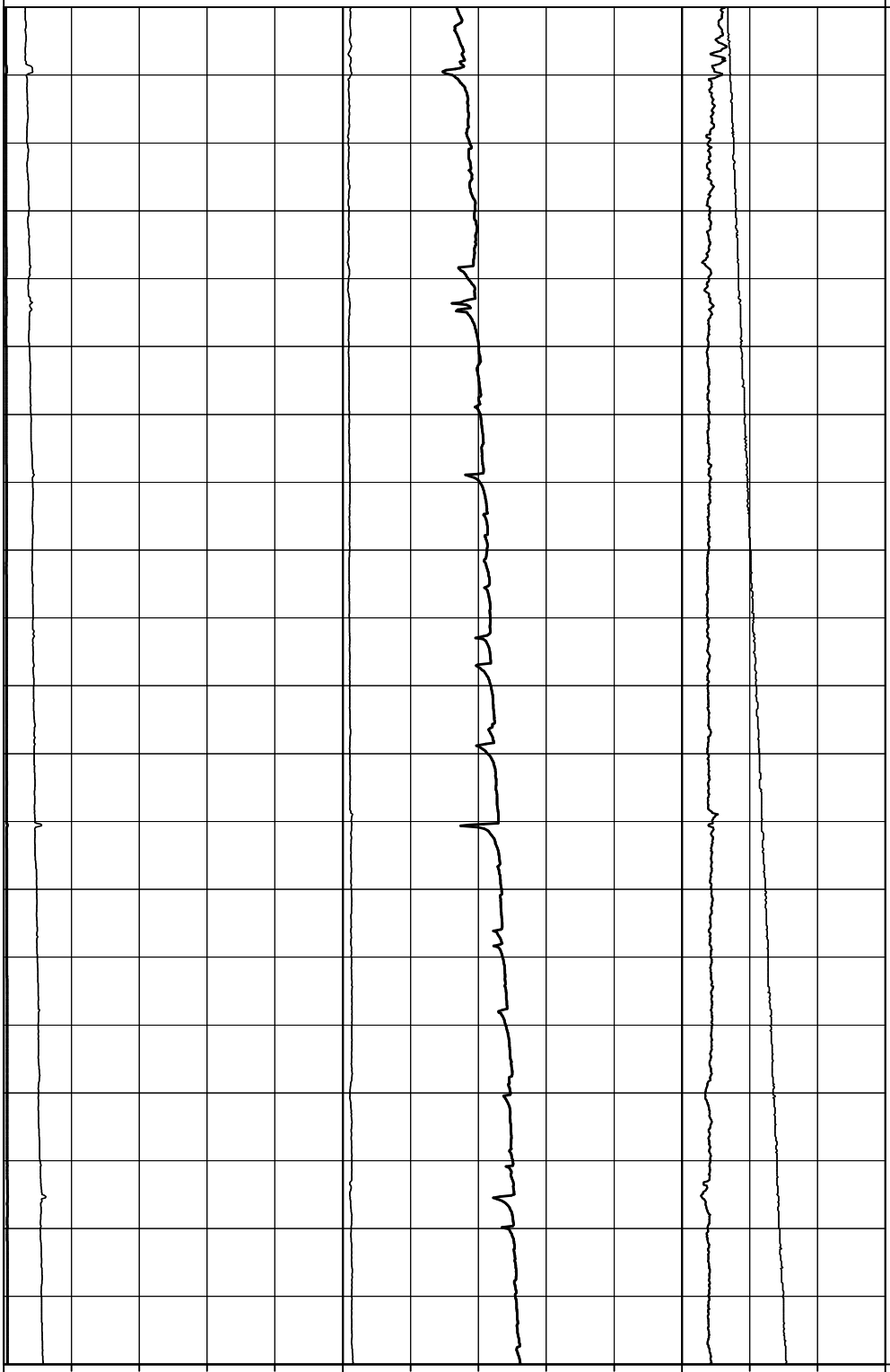
CPT name : ST14460-CPT-121



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N	: 6373747.8	Cone type	: TSP	Performed by	: ALJ/2014-03-31 22:41:56
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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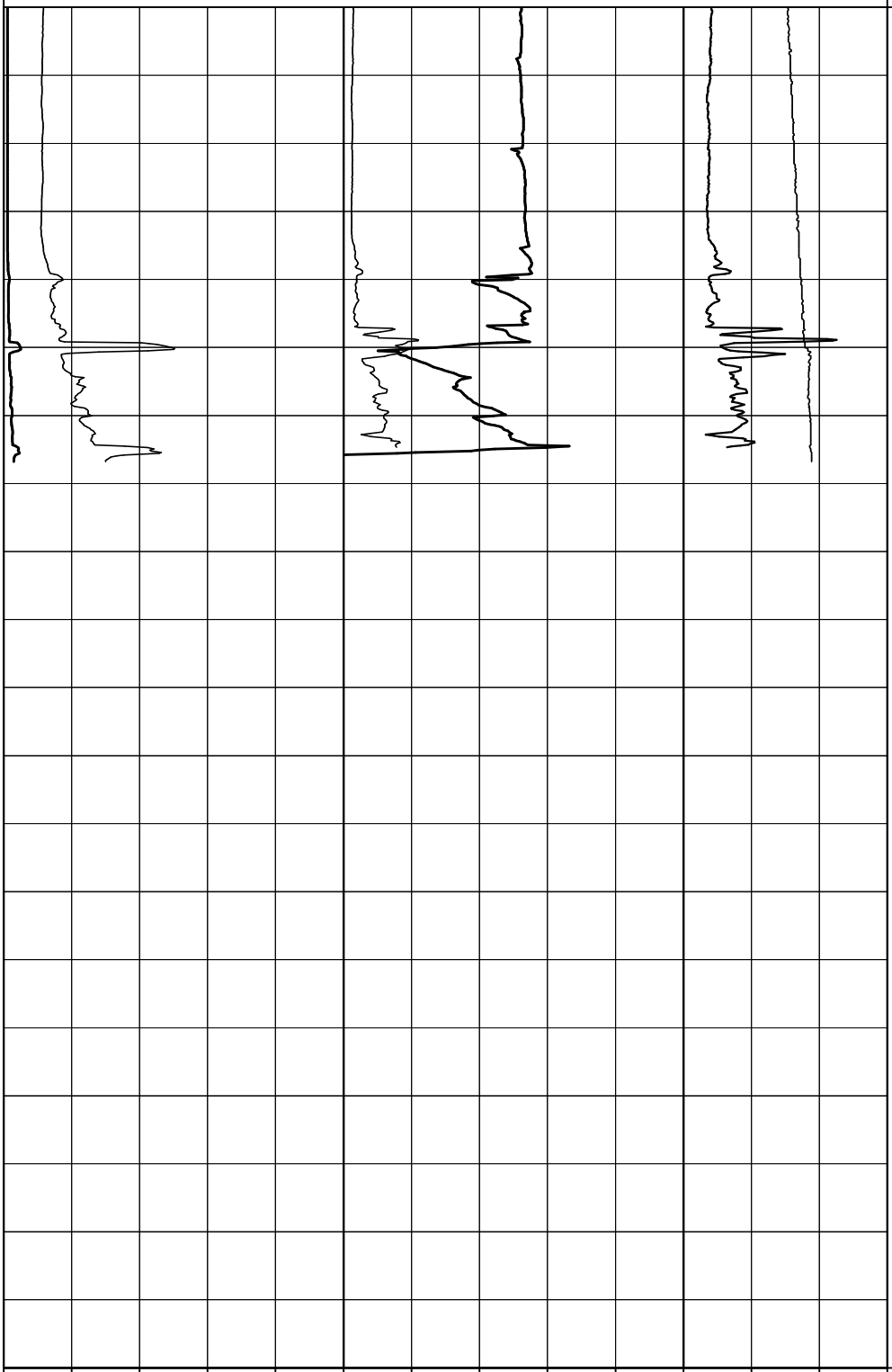
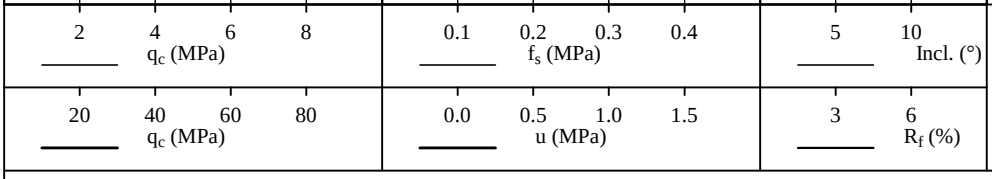
CPT name : ST14460-CPT-121





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N	: 6373747.8	Cone type	: TSP	Performed by	: ALJ/2014-03-31 22:41:56
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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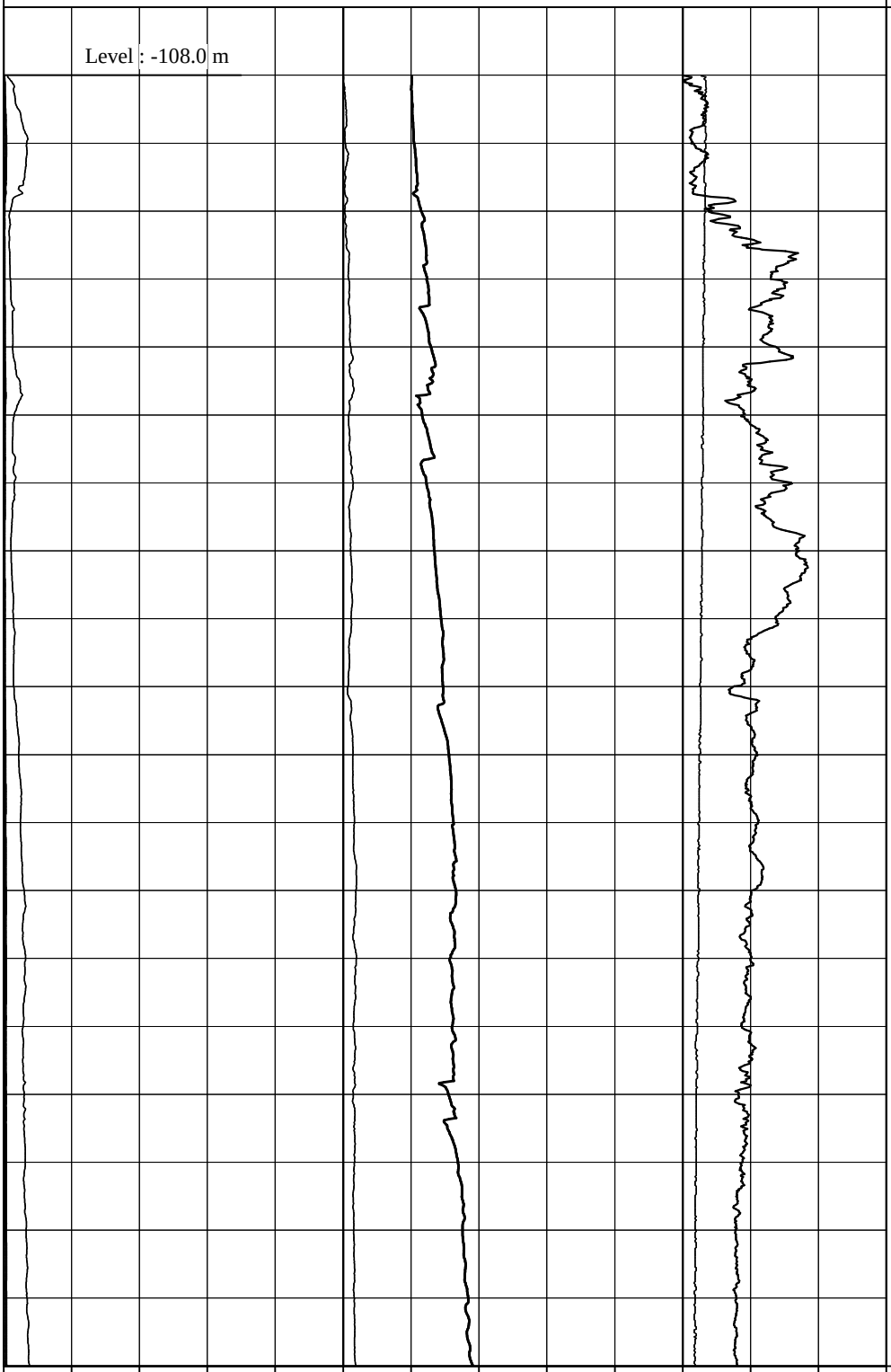
CPT name : ST14460-CPT-122



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N	: 6372519.3	Cone type	: TSP	Performed by	: JPM/2014-03-30 06:47:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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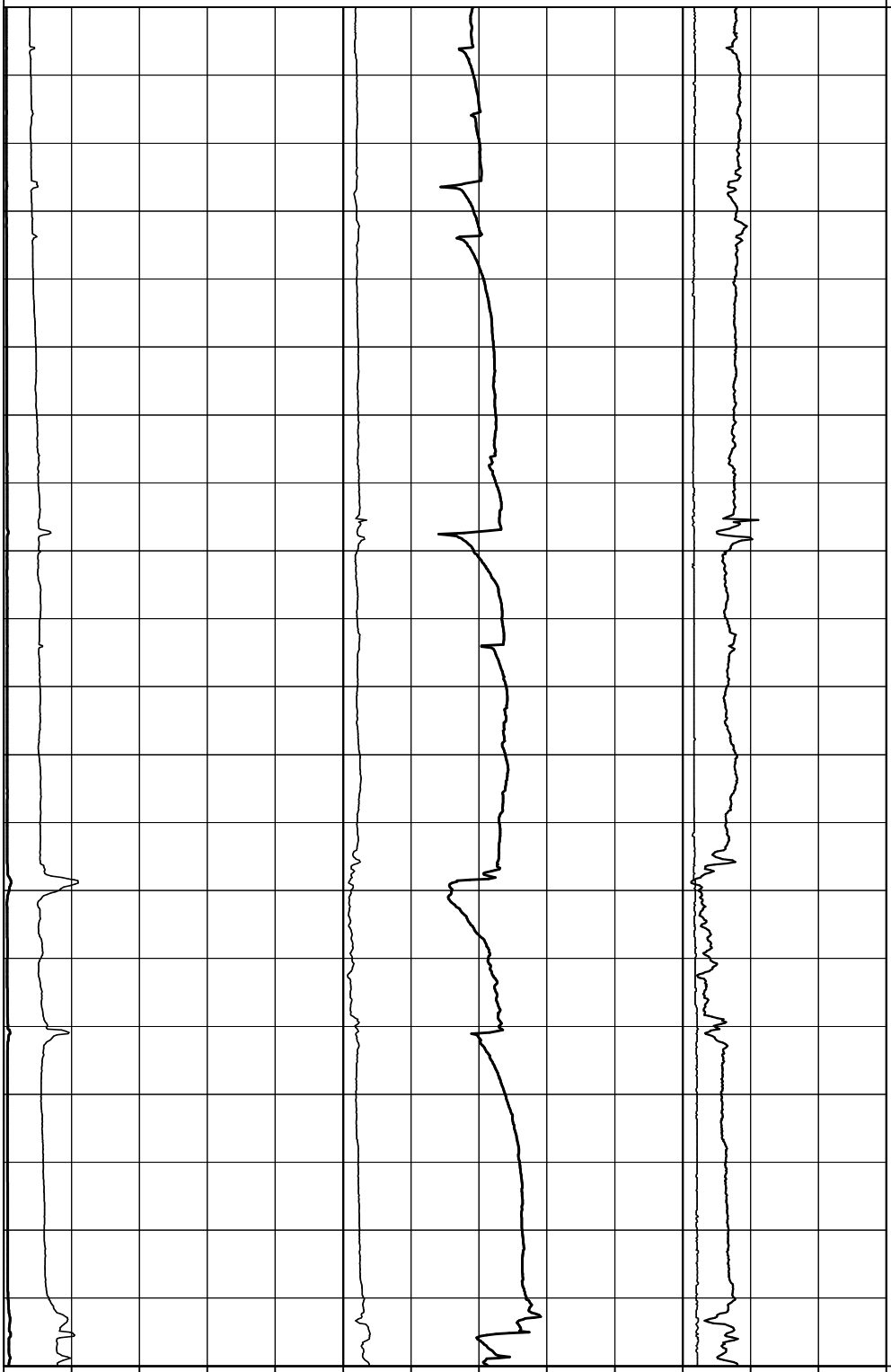
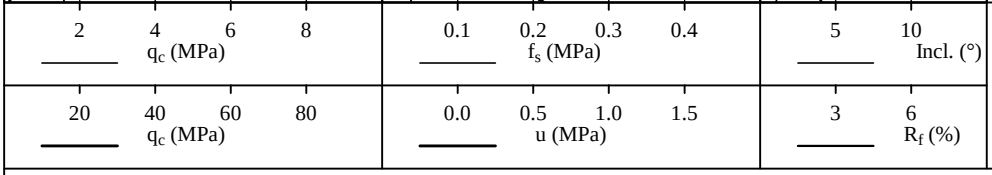
Printed 2014-04-08 09:46:00

CPT name : ST14460-CPT-122





E	: 598525.8	Cone no.	: 130810	Rig	: GEOScope
N	: 6372519.3	Cone type	: TSP	Performed by	: JPM/2014-03-30 06:47:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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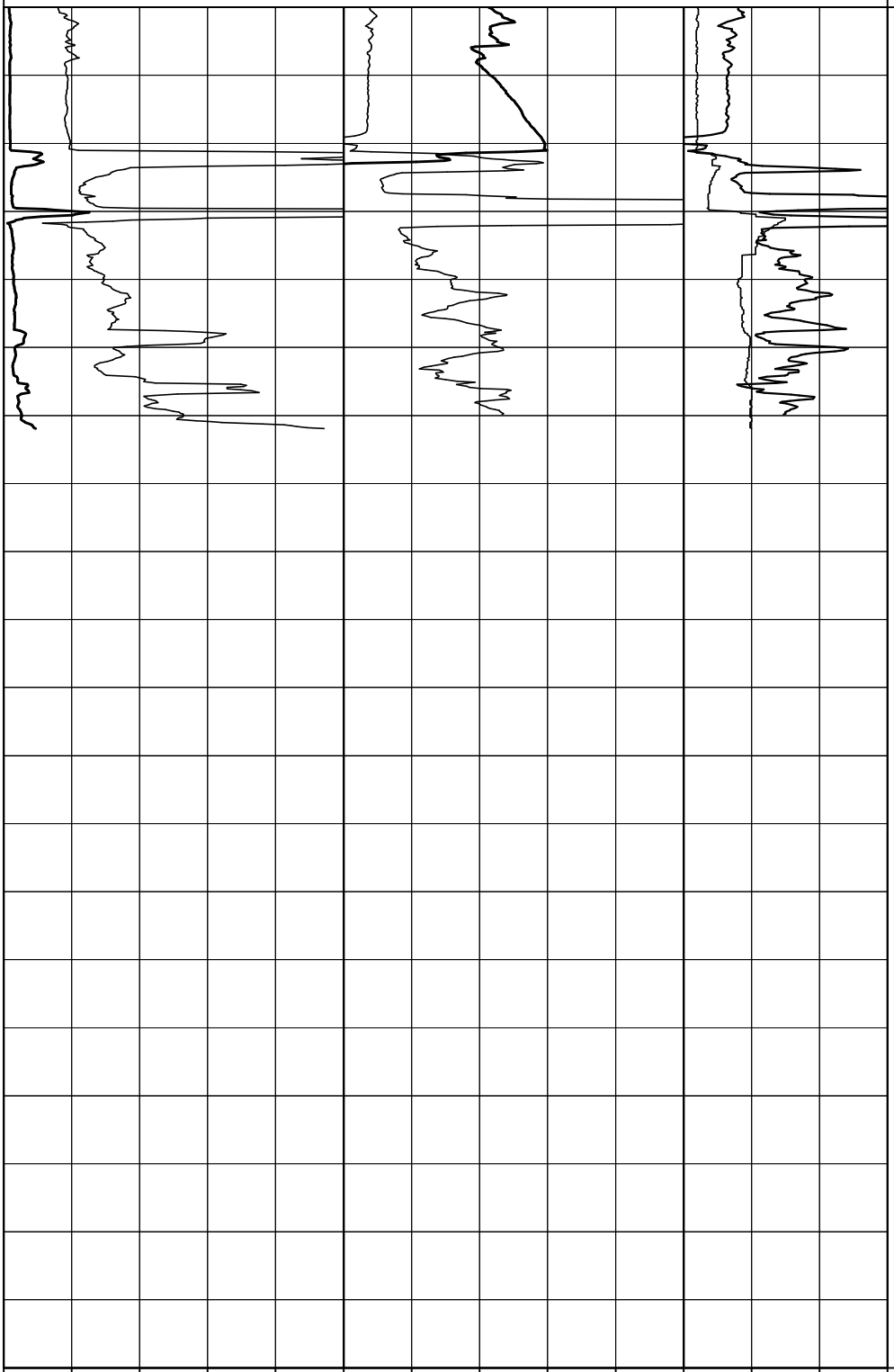
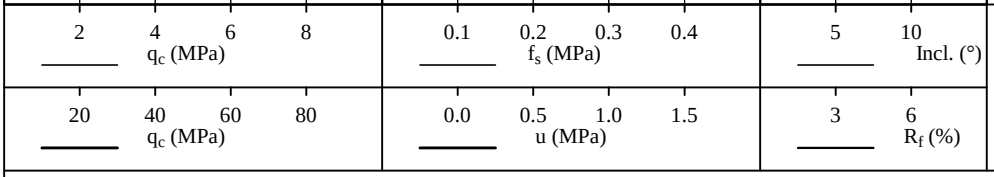
Printed 2014-04-08 09:46:01

CPT name : ST14460-CPT-122





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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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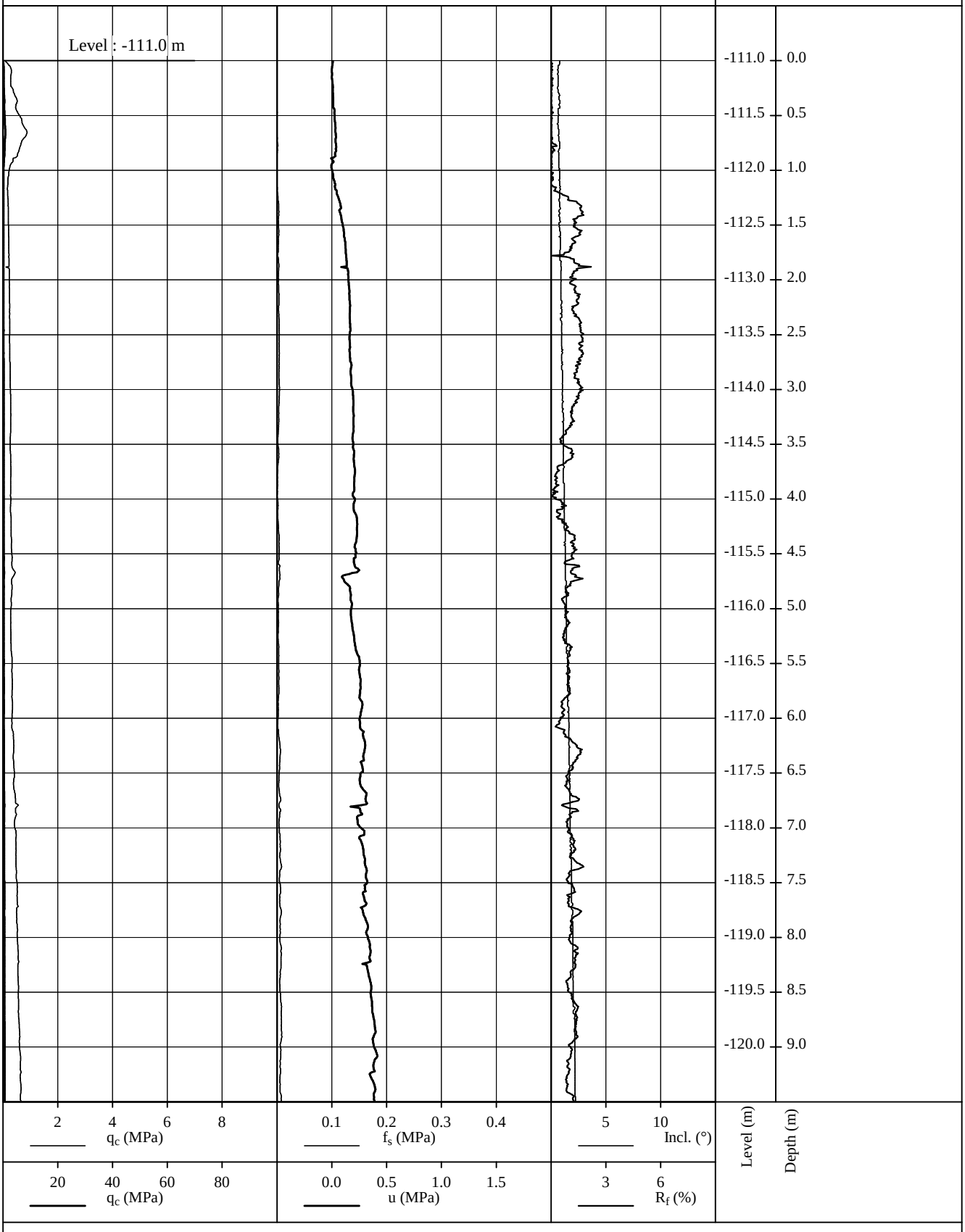
CPT name : ST14460-CPT-123



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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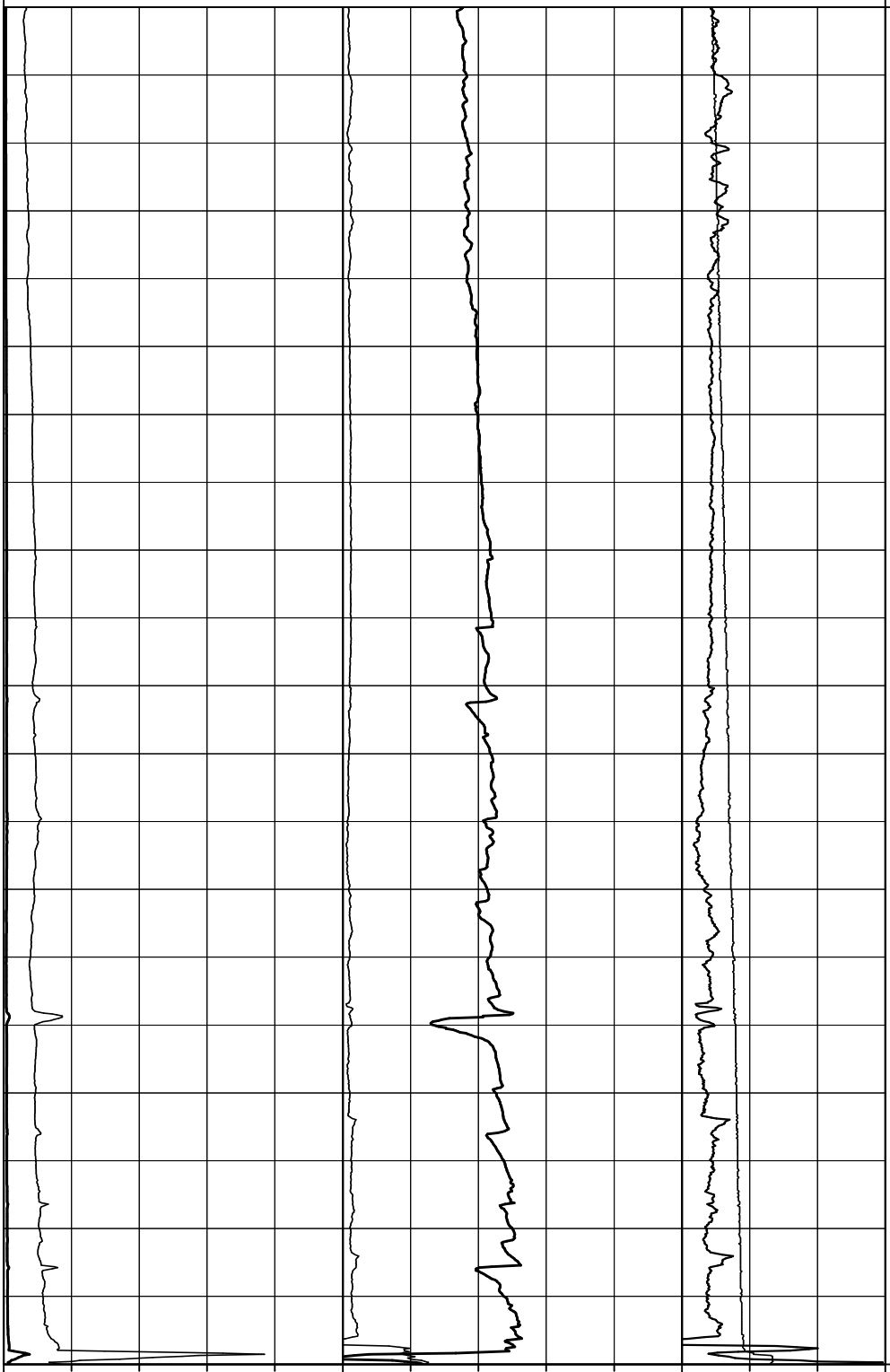
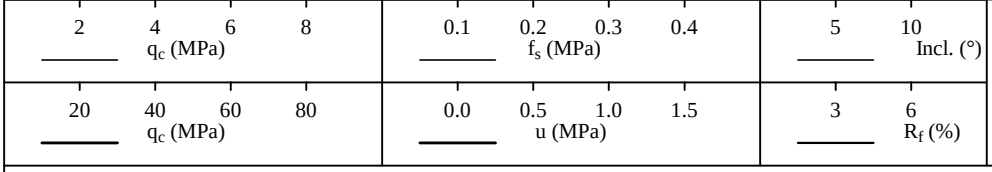
Printed 2014-04-08 09:46:04

CPT name : ST14460-CPT-123





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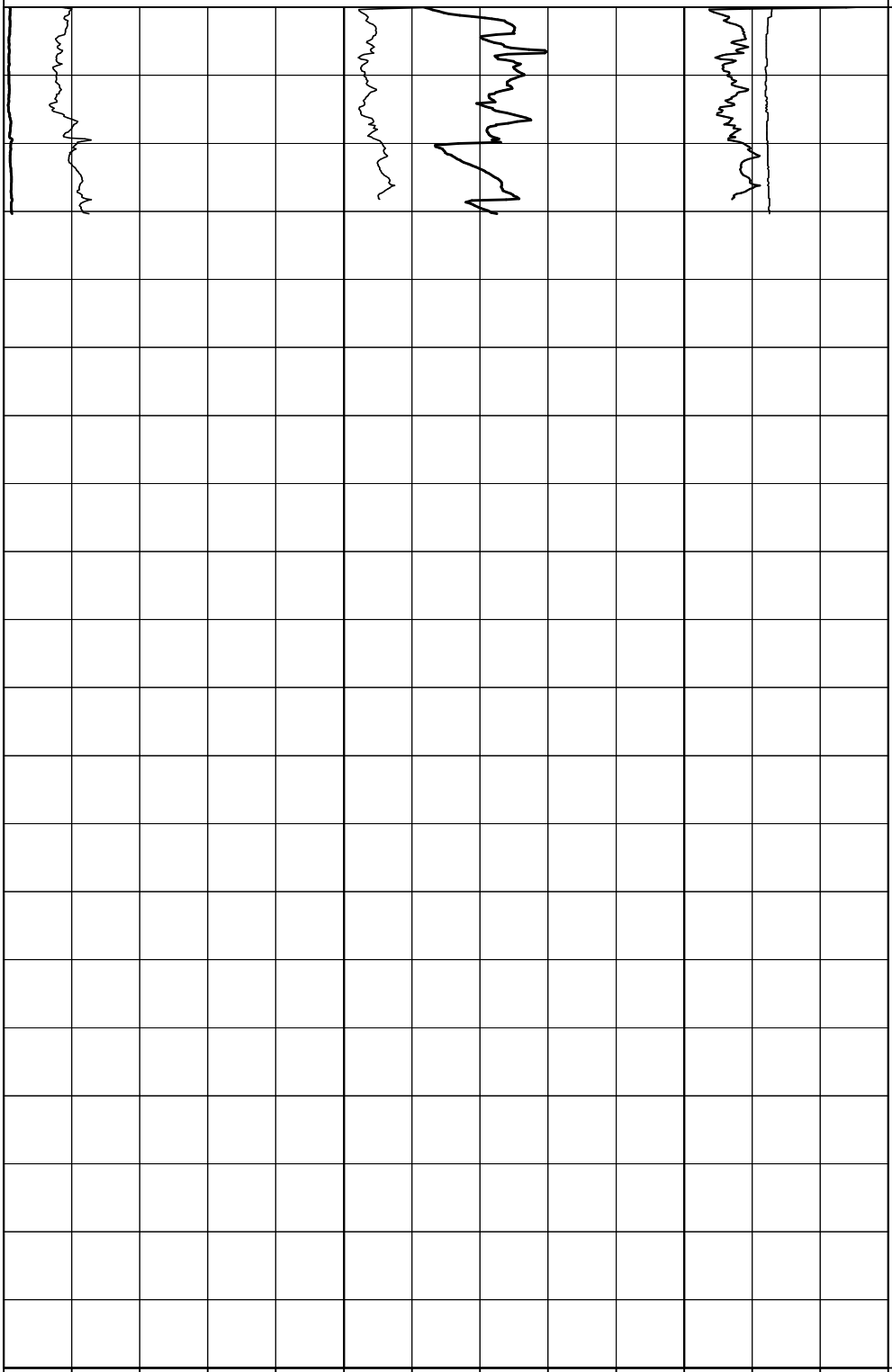
CPT name : ST14460-CPT-123



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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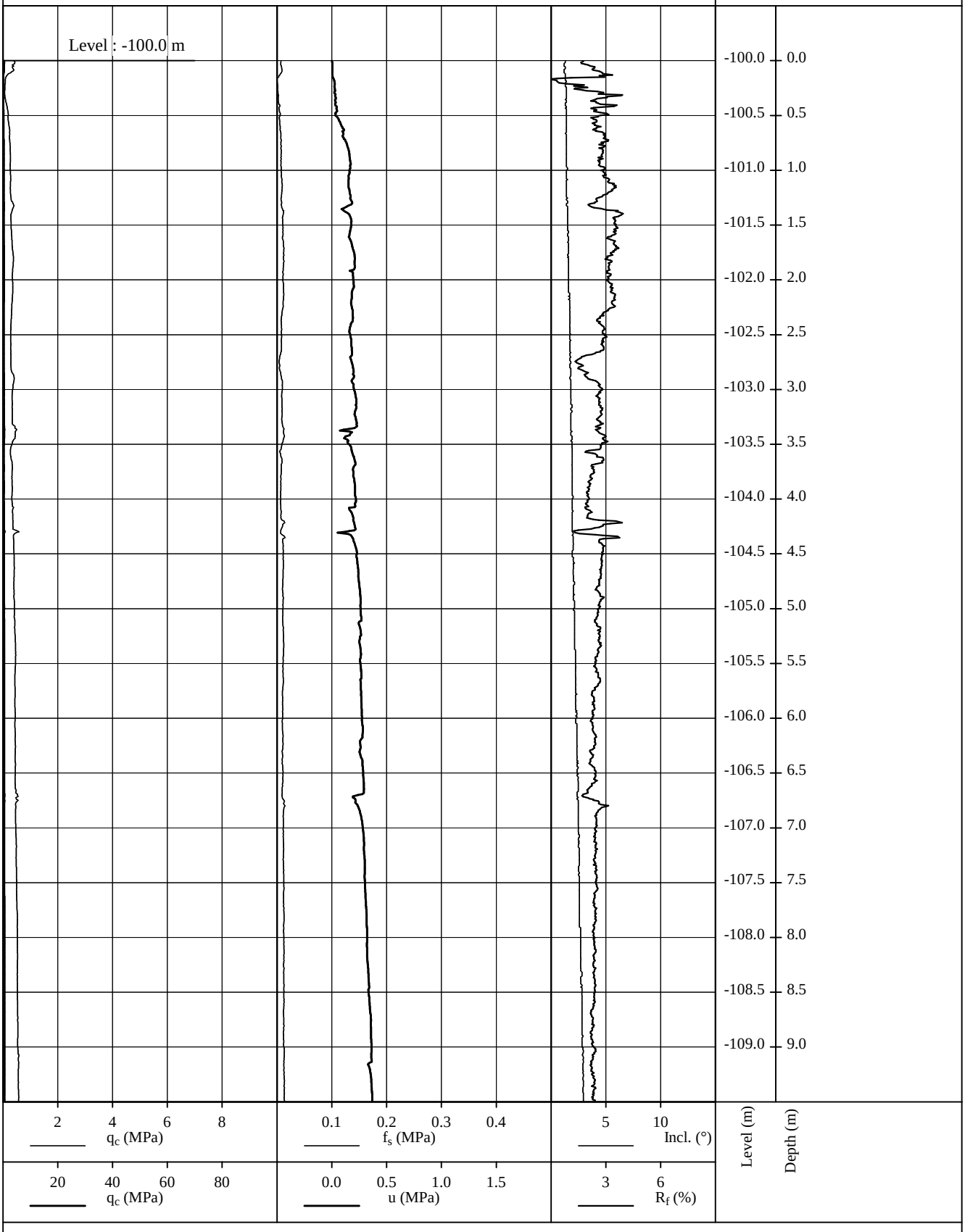
Printed 2014-04-08 09:46:07

CPT name : ST14460-CPT-131



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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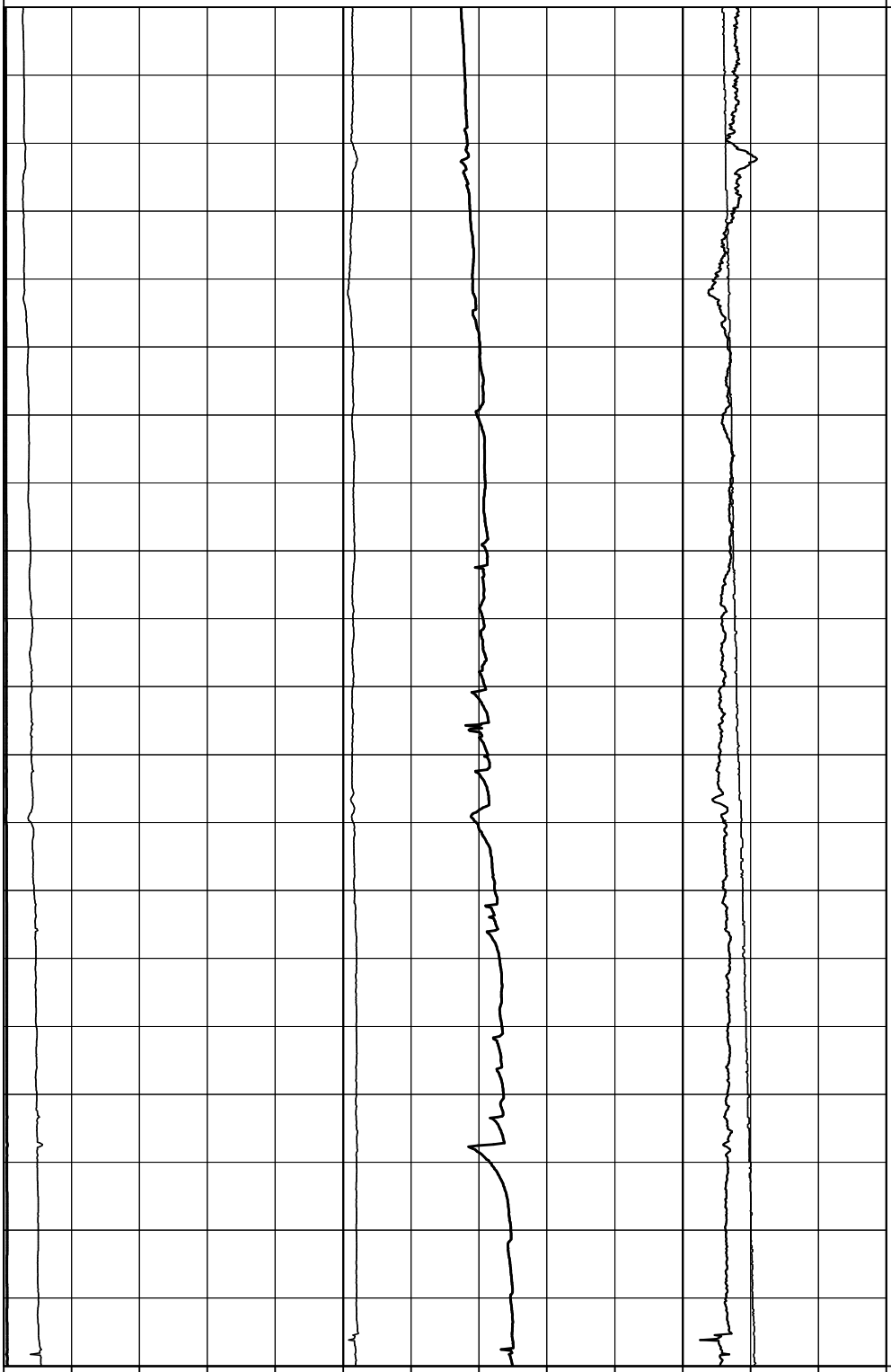
Approved	: CLB	Date: 2014-04-03	Report 1.0 Enclosure: ST14460-CPT-131	Rev.

CPT name : ST14460-CPT-131



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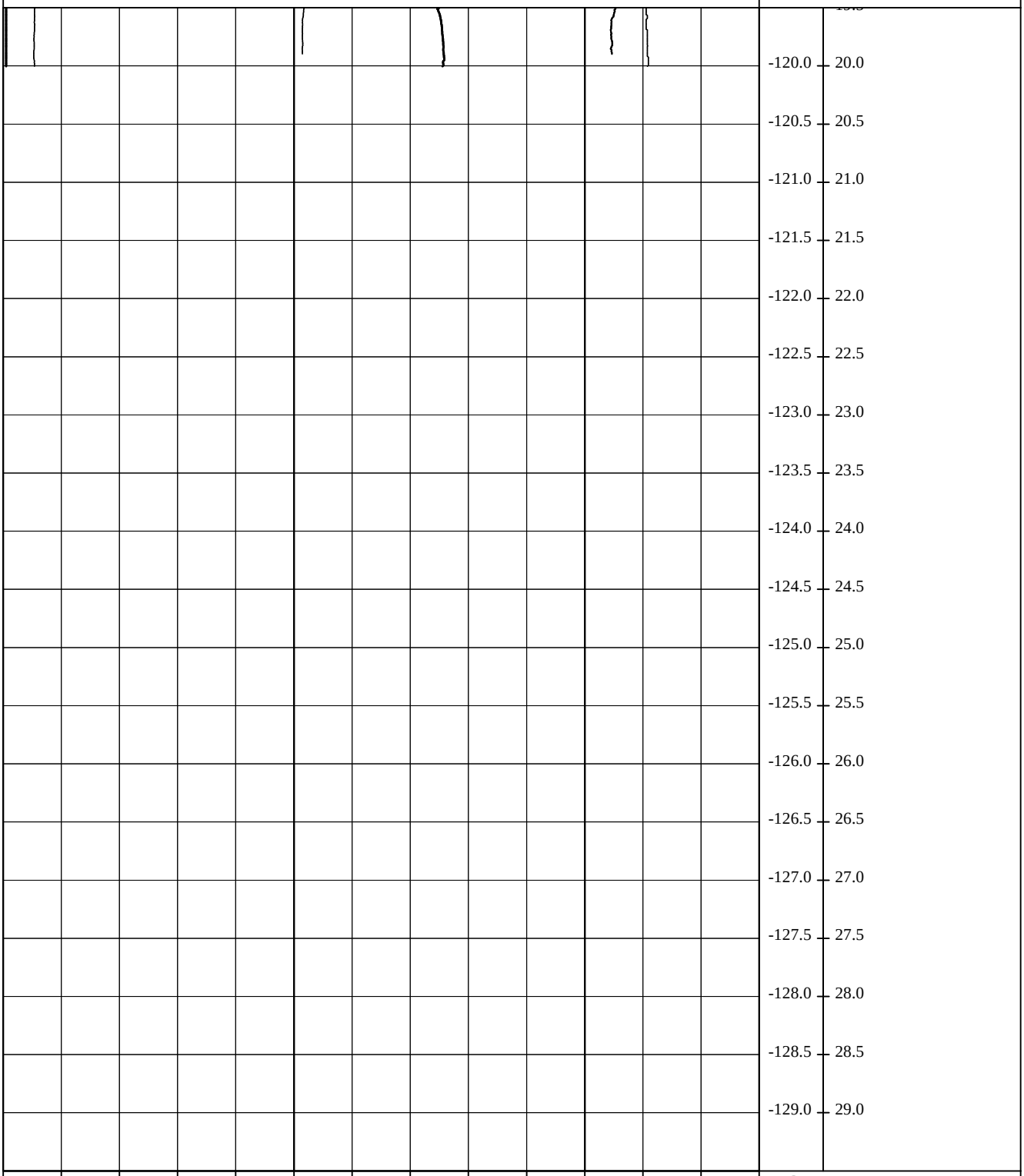
CPT name : ST14460-CPT-131



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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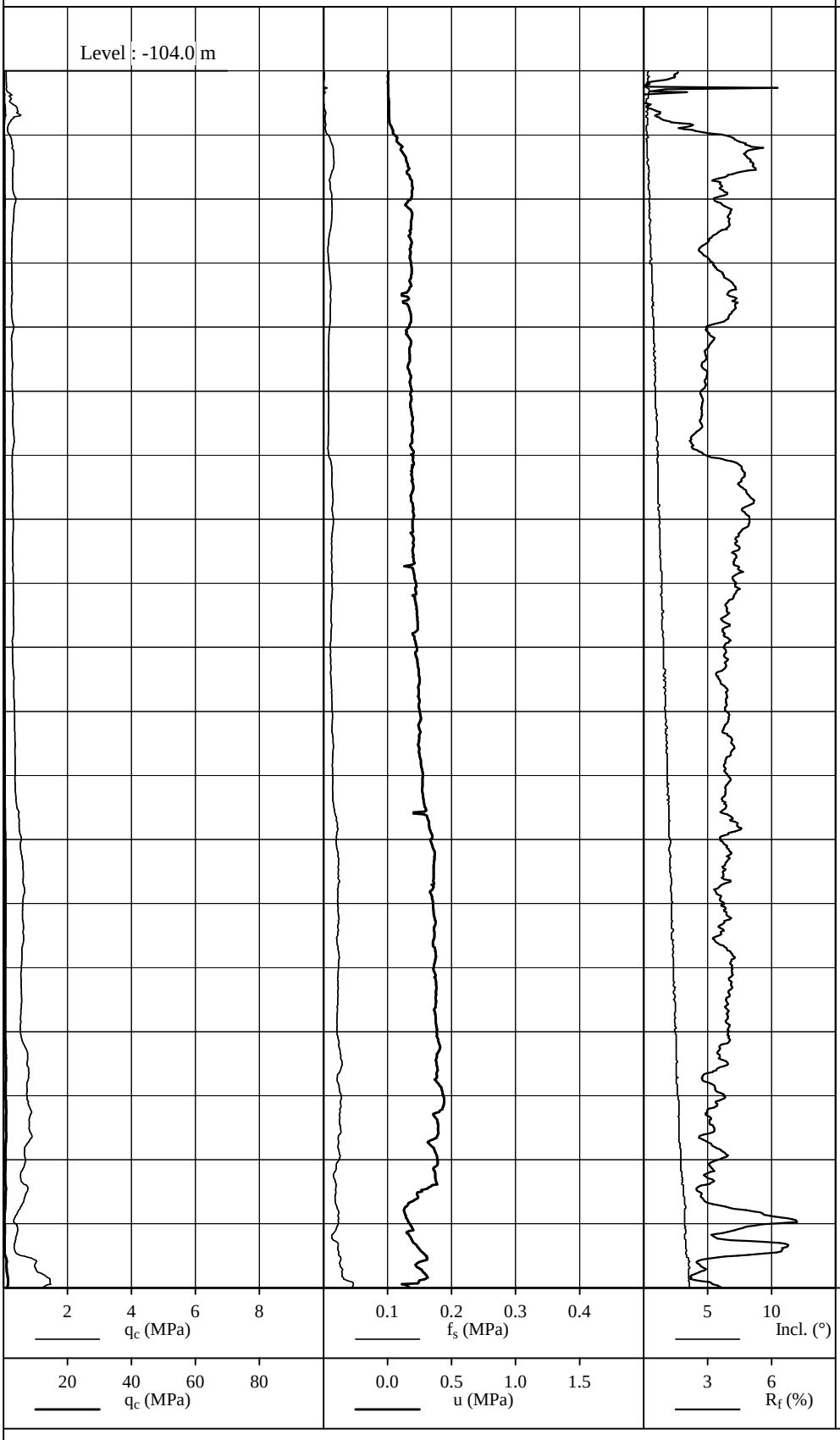
CPT name : ST14460-CPT-132



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Prepared	: ABP	Date: 2014-04-04	Subject: Original CPTU Data	
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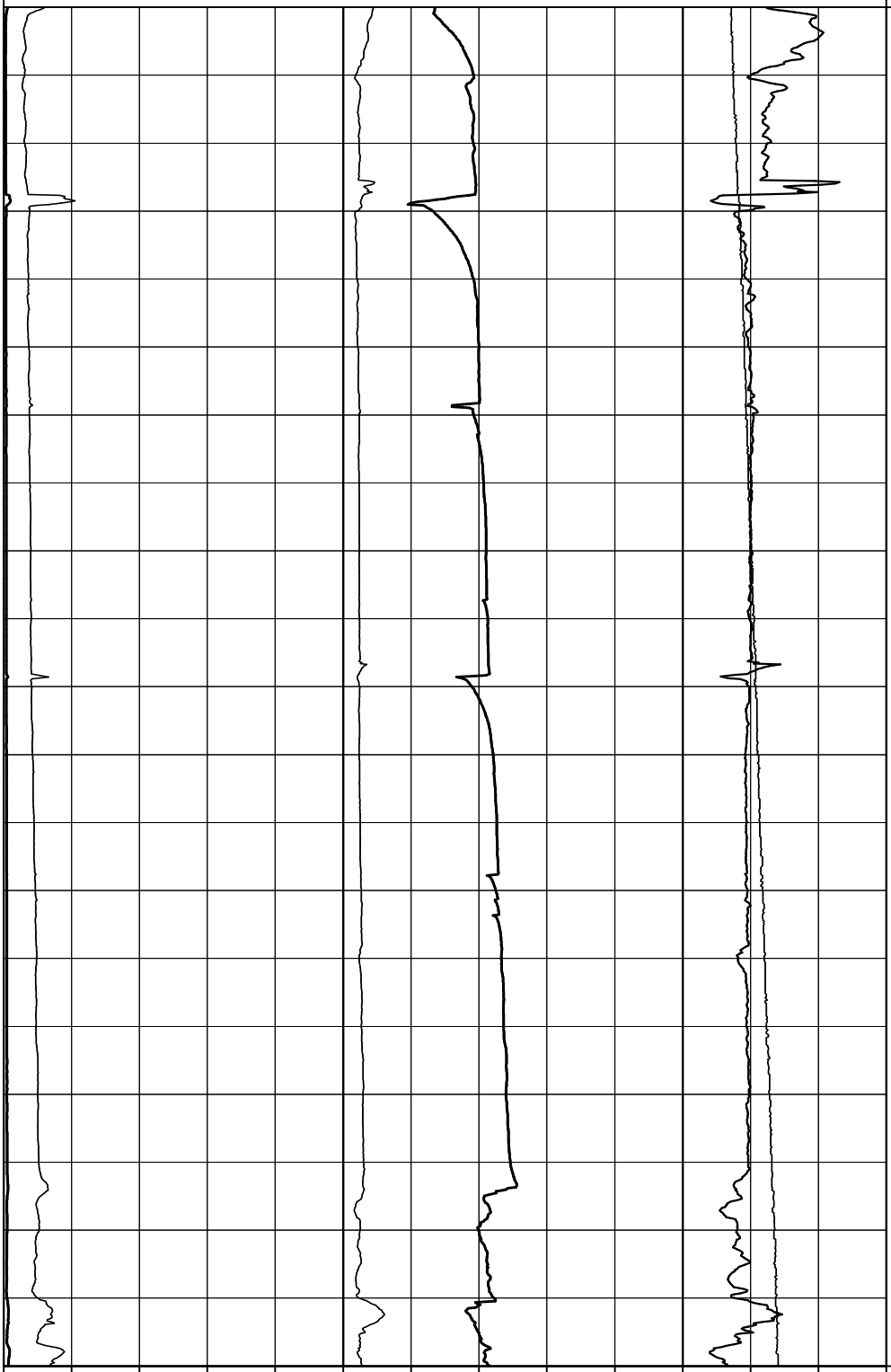
Printed 2014-04-08 09:46:15

CPT name : ST14460-CPT-132



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Prepared	: ABP	Date: 2014-04-04	Subject: Original CPTU Data	
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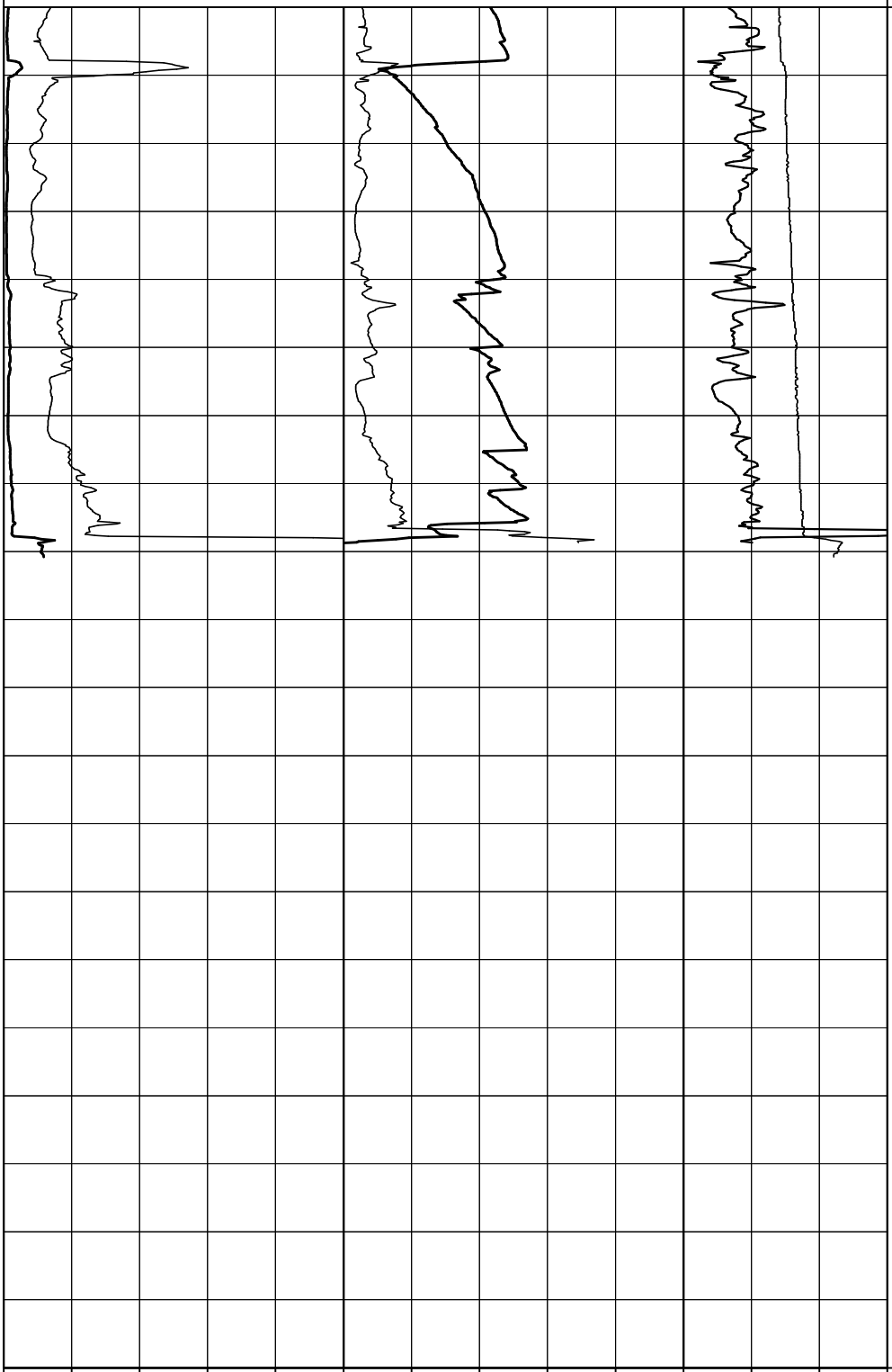
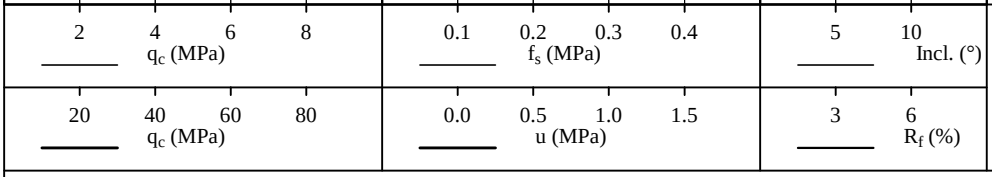
CPT name : ST14460-CPT-132





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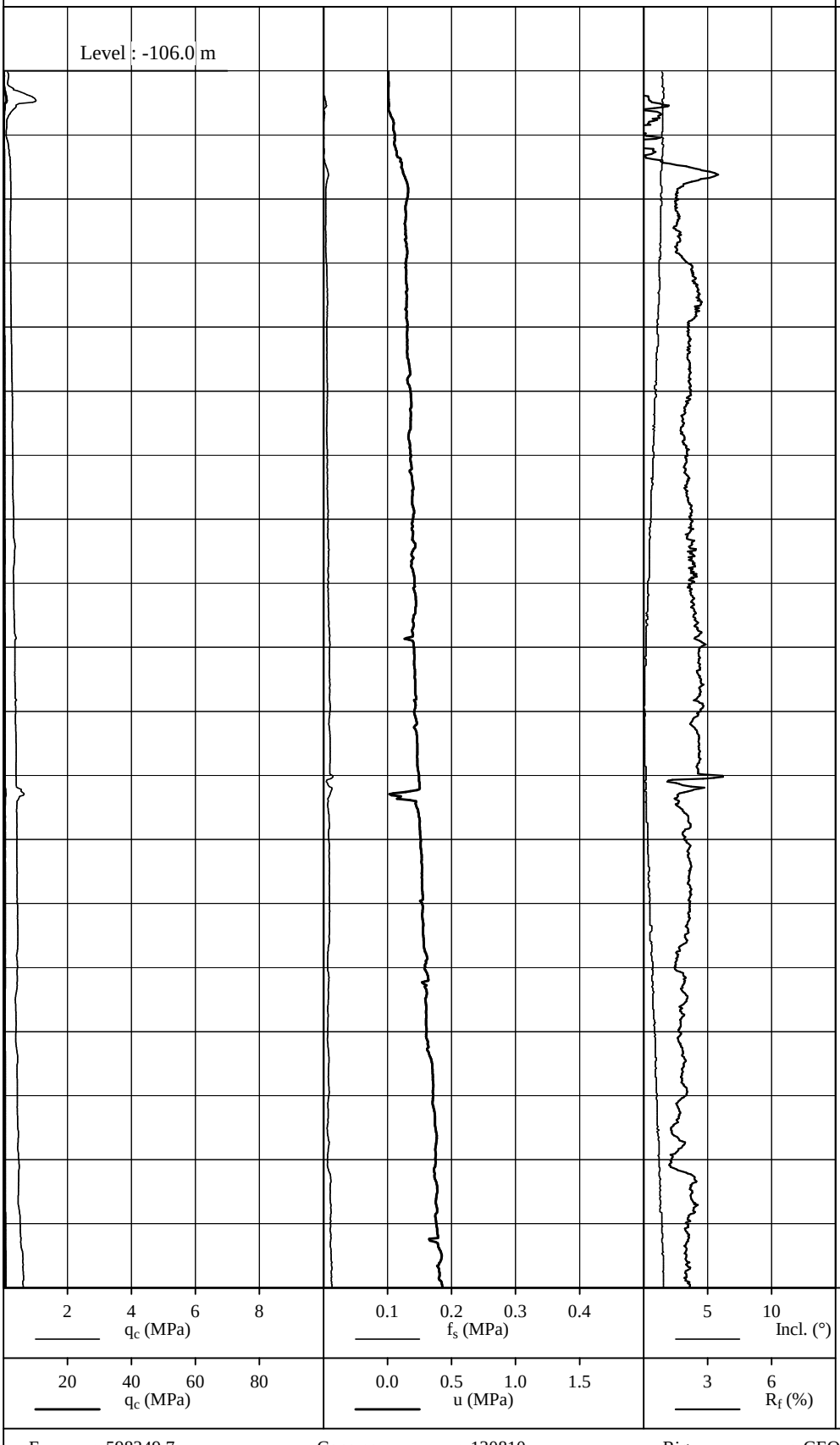
CPT name : ST14460-CPT-133



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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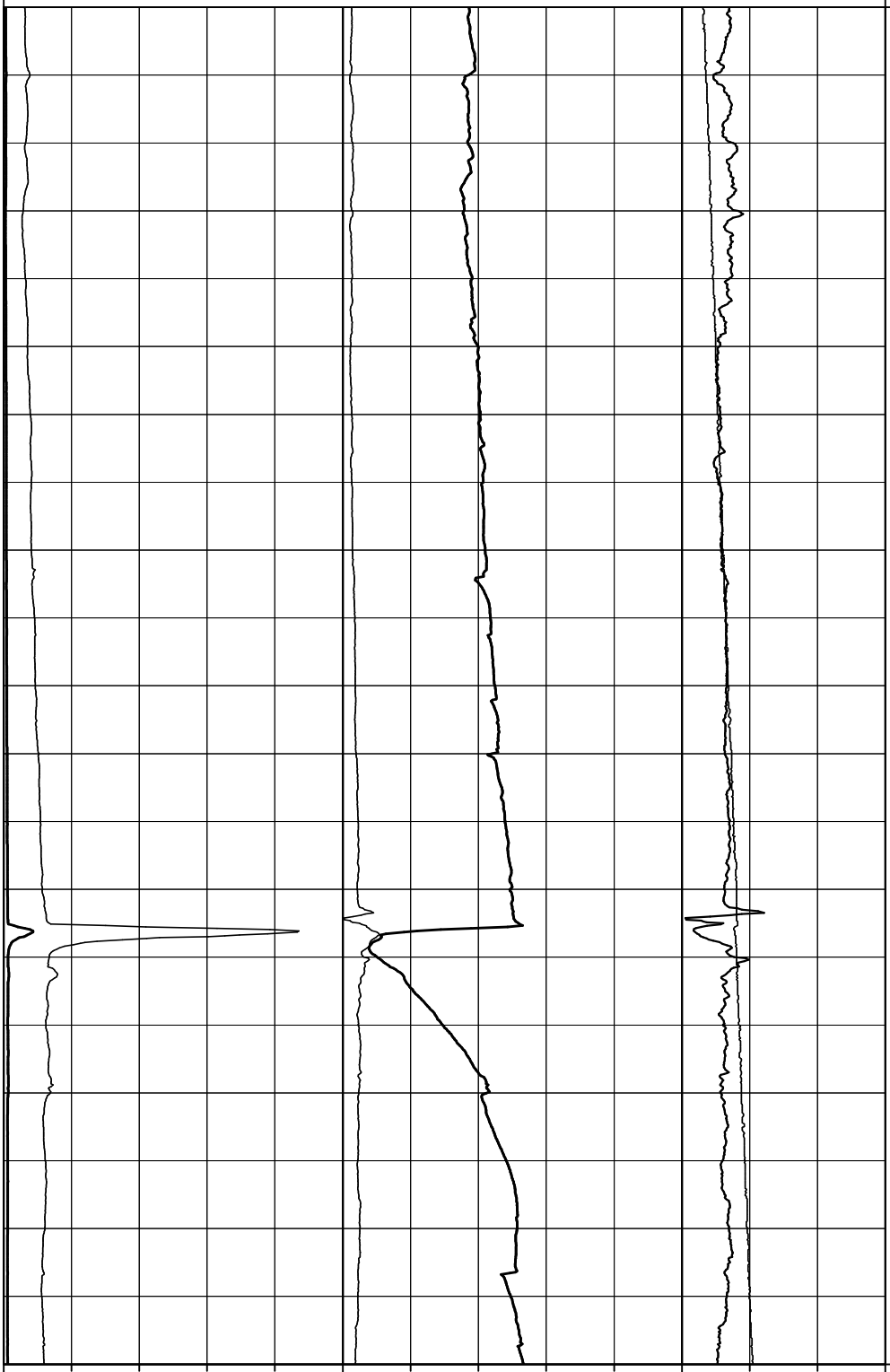
CPT name : ST14460-CPT-133



E	: 598349.7	Cone no.	: 130810	Rig	: GEOScope
N	: 6374087.6	Cone type	: TSP	Performed by	: JPM/2014-03-30 09:34:09
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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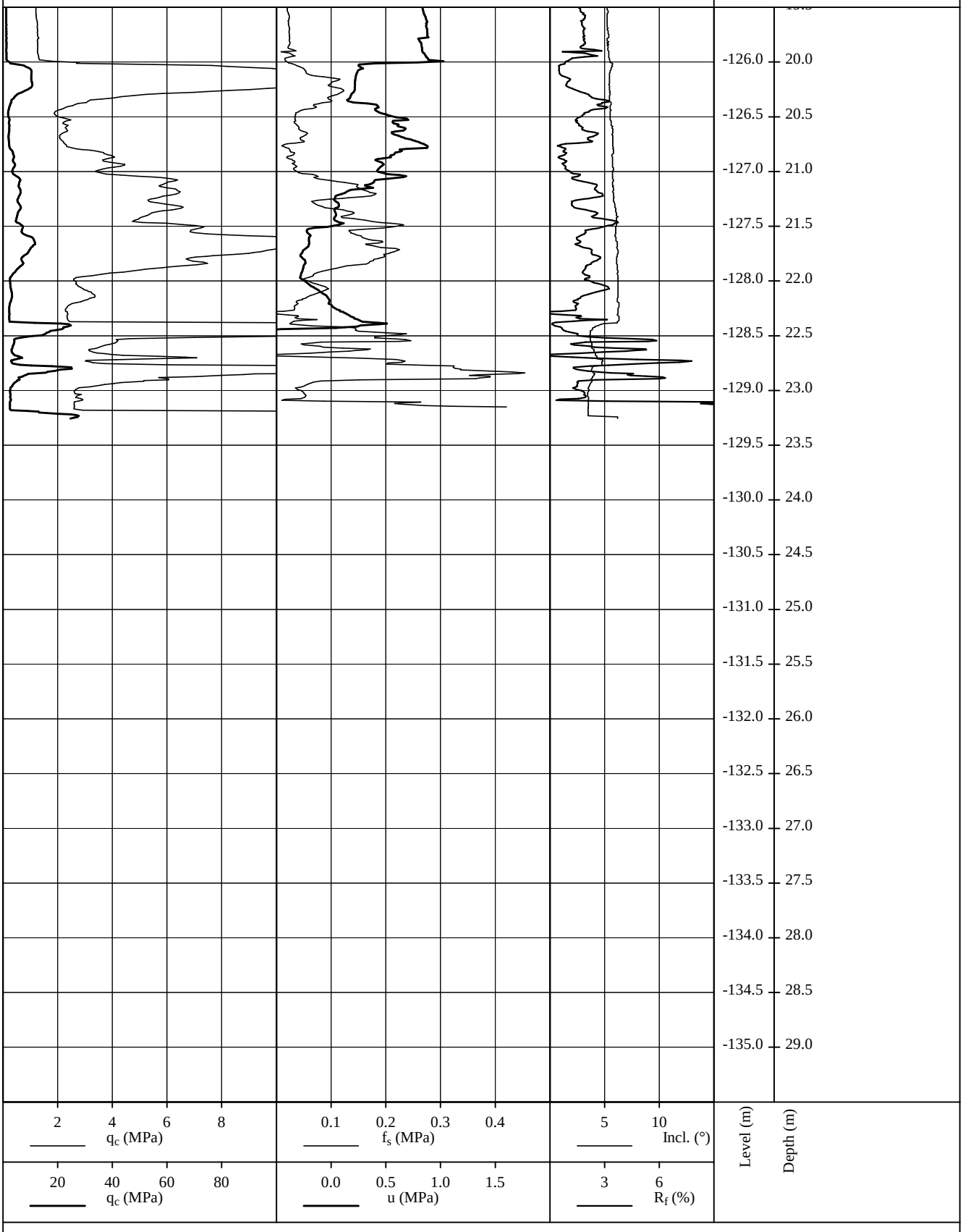
CPT name : ST14460-CPT-133



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N	: 6374087.6	Cone type	: TSP	Performed by	: JPM/2014-03-30 09:34:09
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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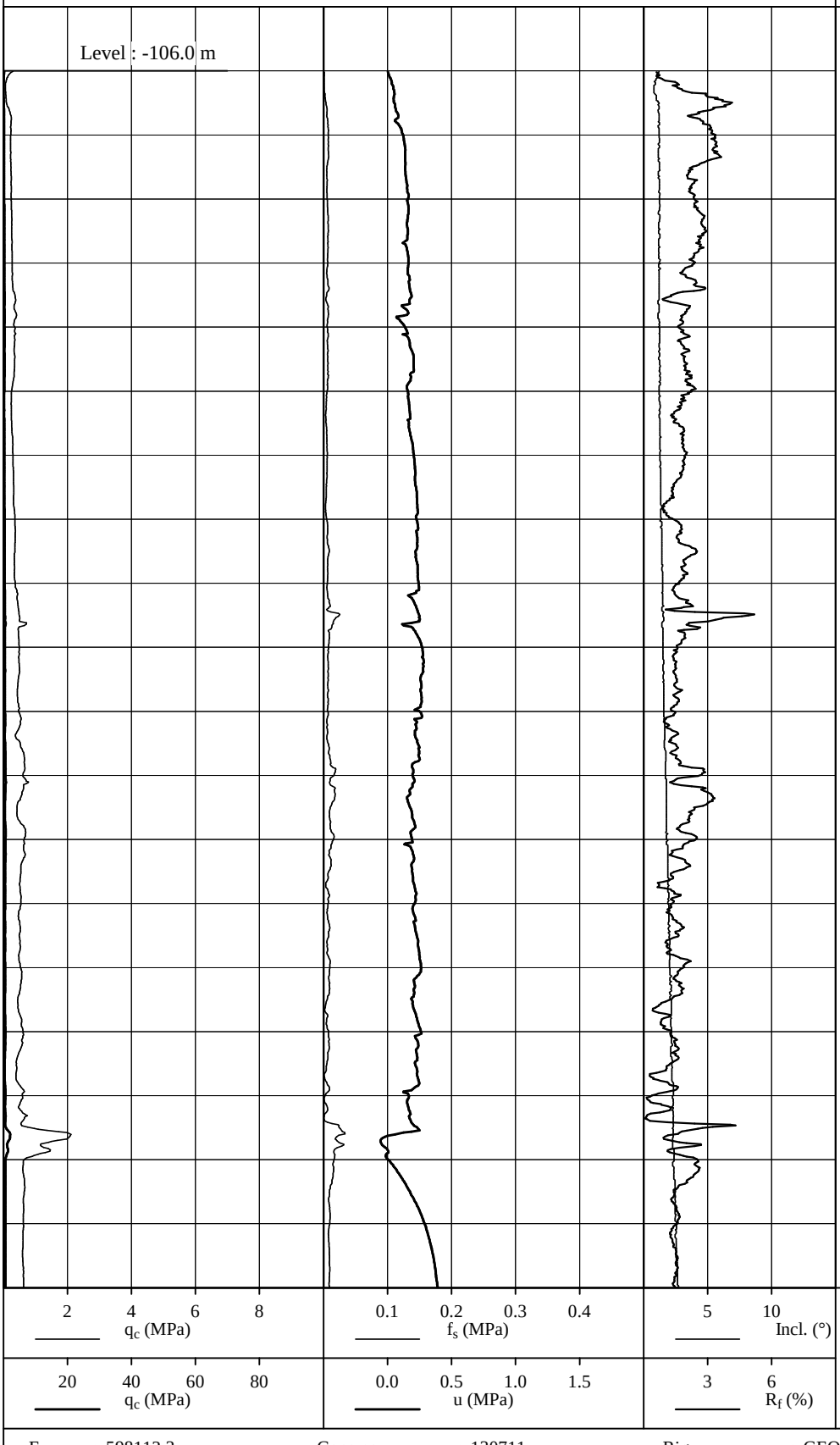
CPT name : ST14460-CPT-141



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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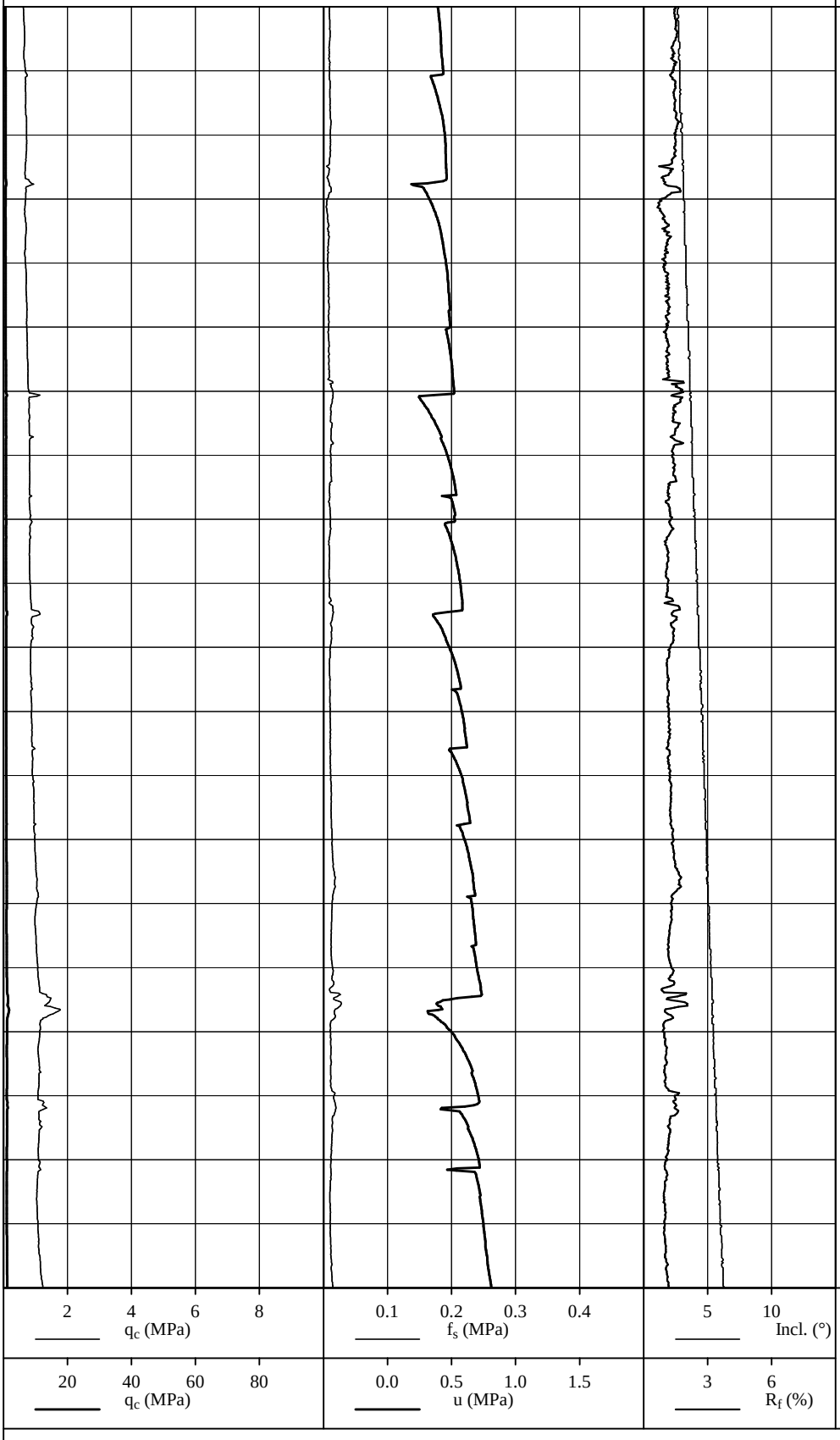
Printed 2014-04-08 09:46:25

CPT name : ST14460-CPT-141



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N	: 6372212.9	Cone type	: TSP	Performed by	: ALJ/2014-03-31 15:57:25
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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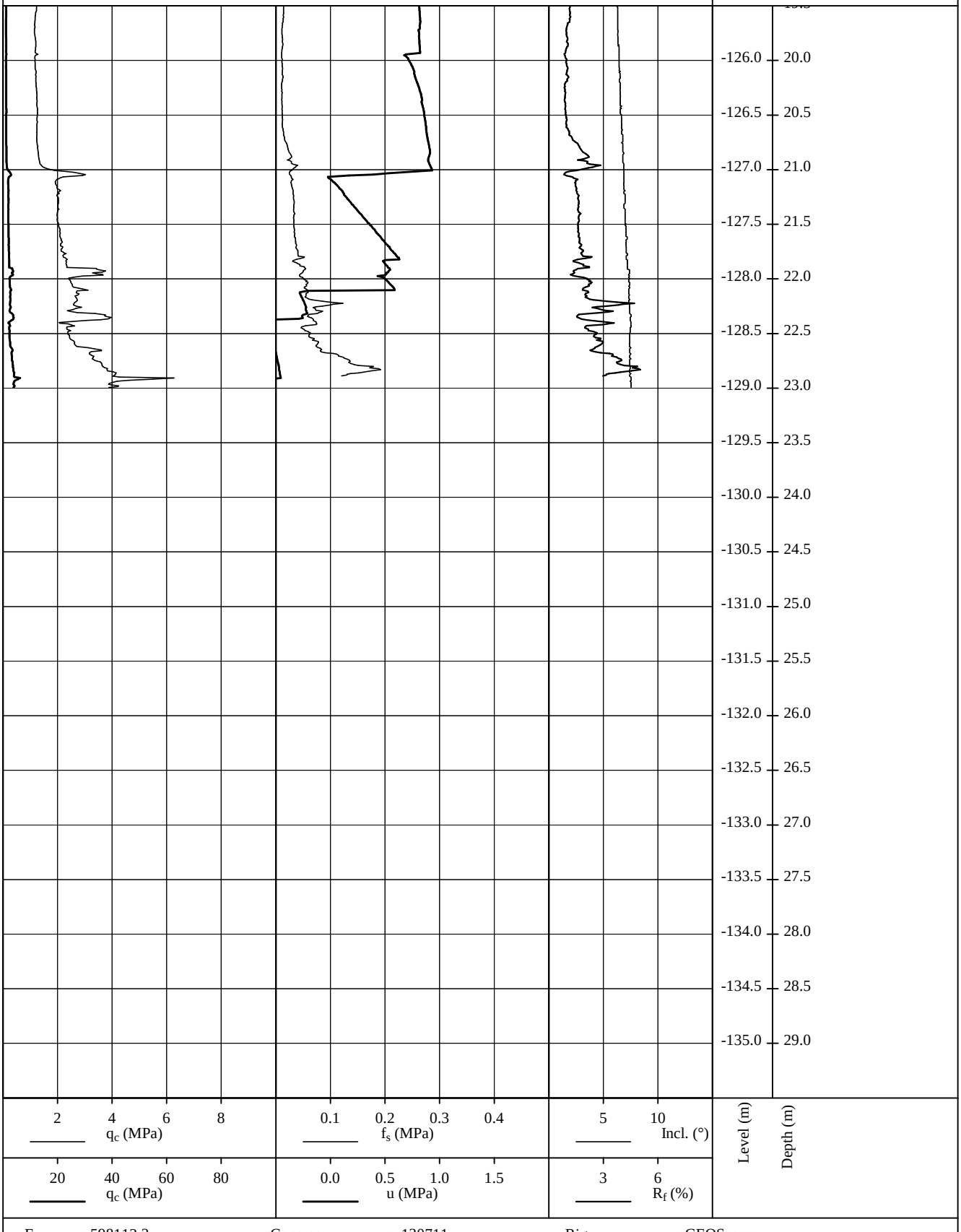
CPT name : ST14460-CPT-141



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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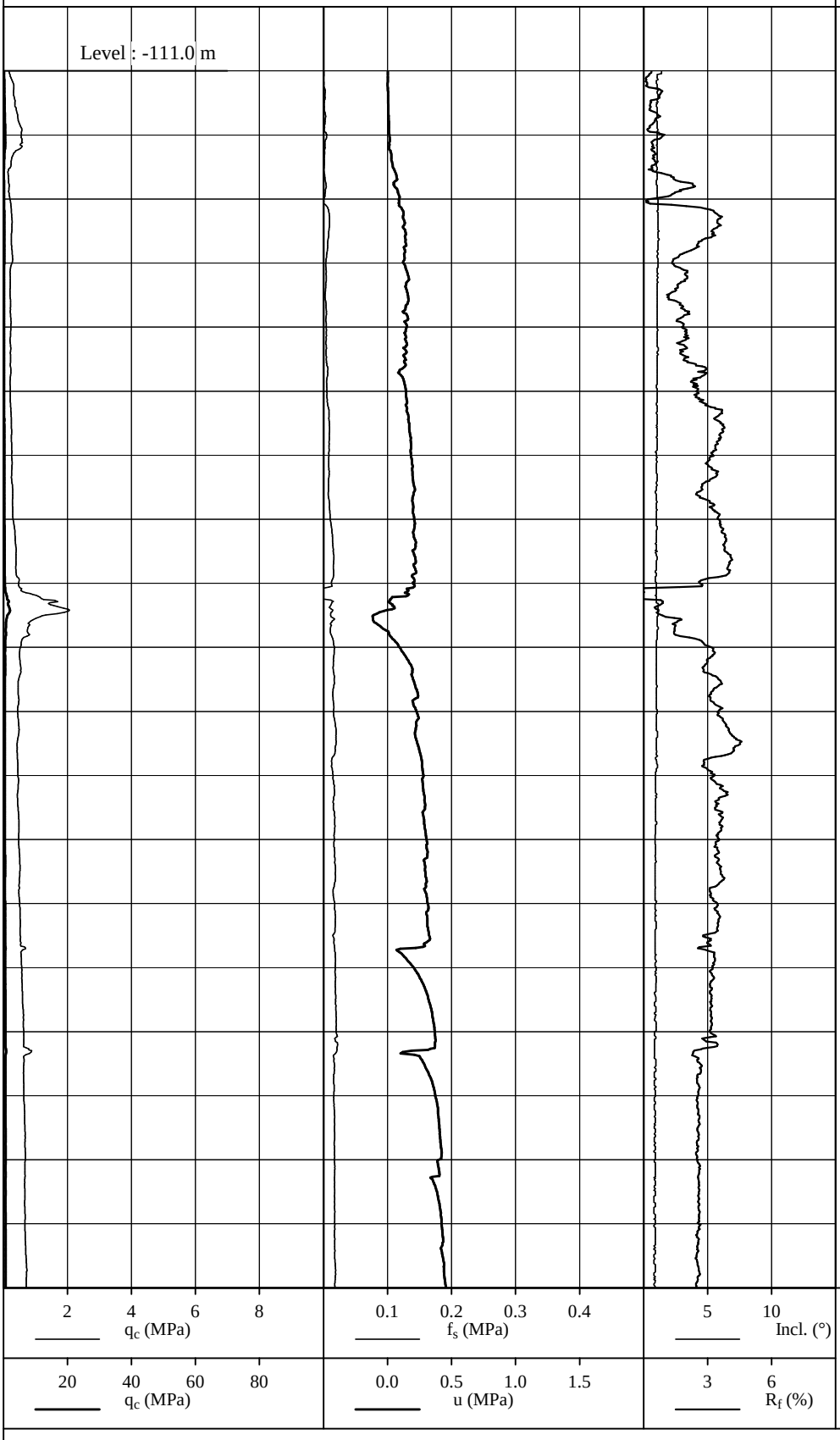
Printed 2014-04-08 09:46:28

CPT name : ST14460-CPT-142



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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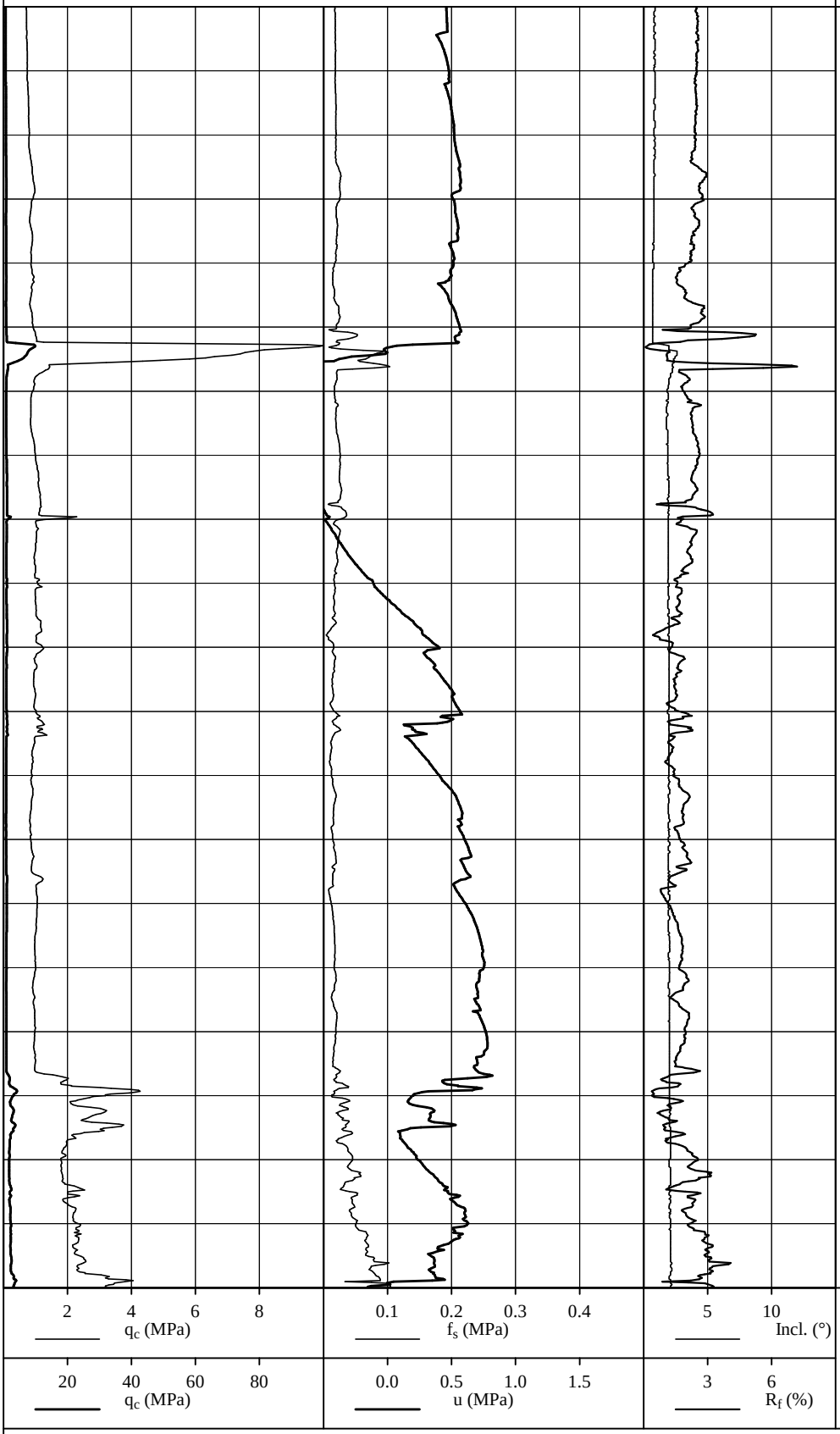
CPT name : ST14460-CPT-142



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N	: 6371019.4	Cone type	: TSP	Performed by	: JPM/2014-03-30 03:55:17
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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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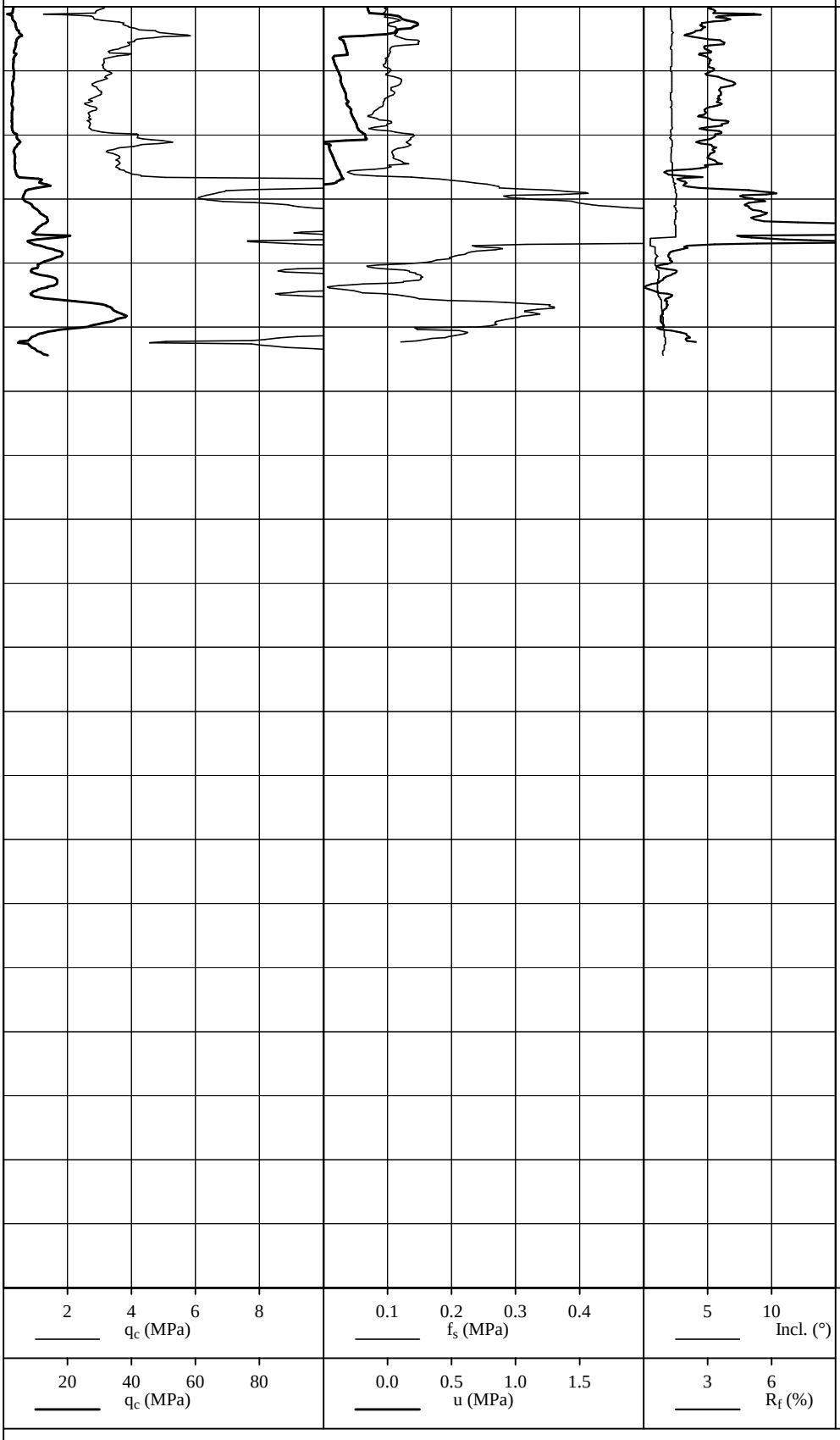
CPT name : ST14460-CPT-142



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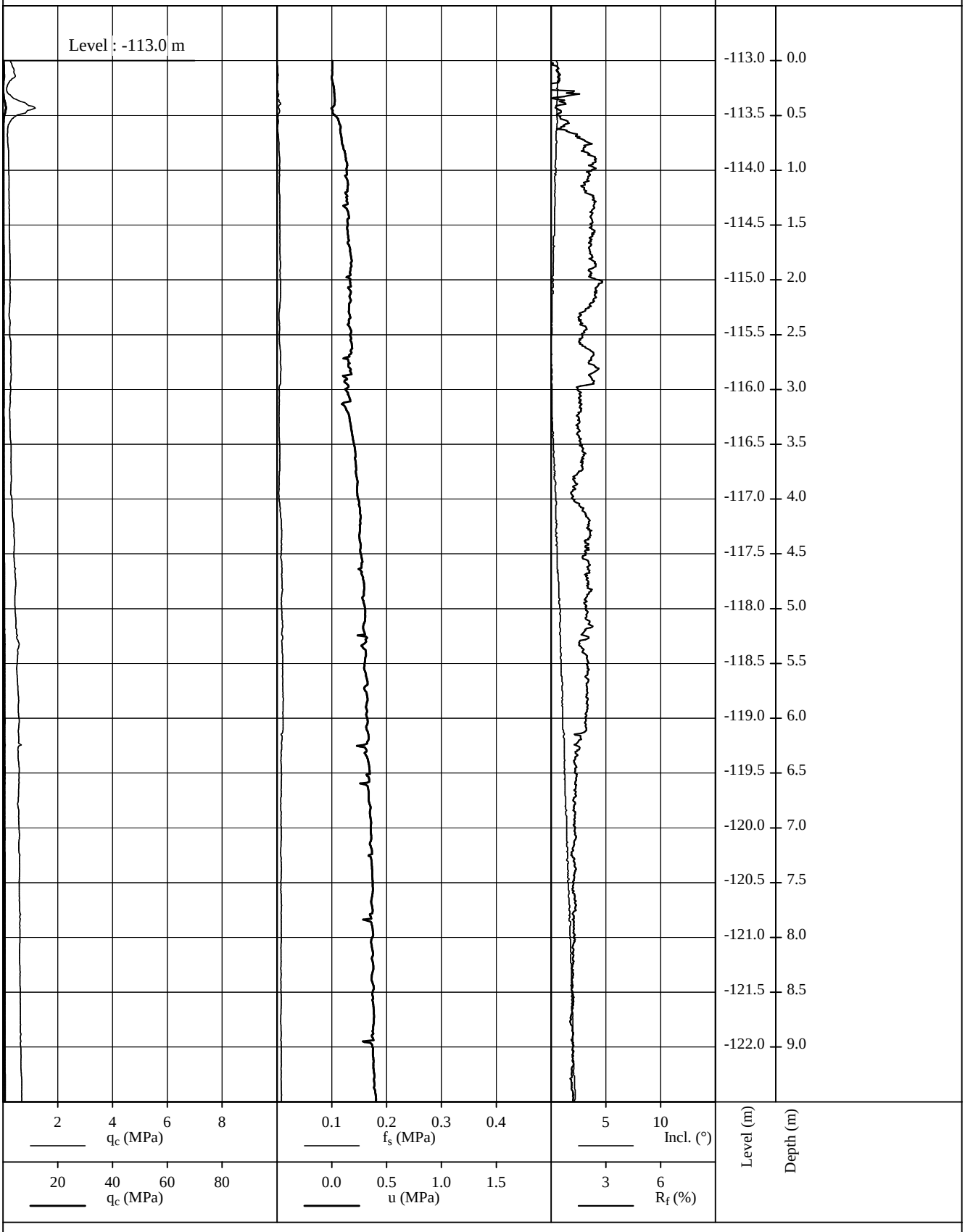
Printed 2014-04-08 09:46:32

CPT name : ST14460-CPT-143



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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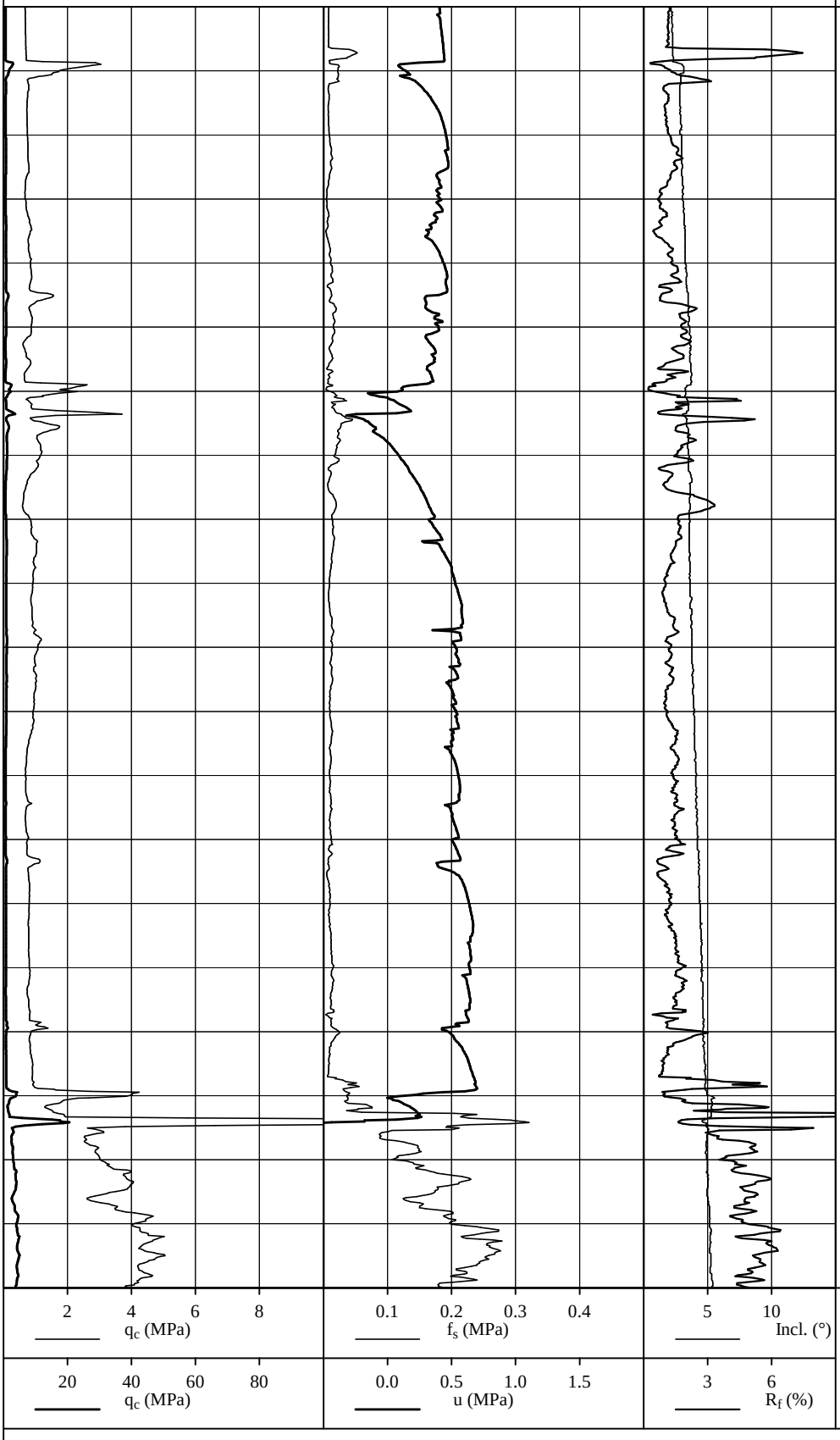
Printed 2014-04-08 09:46:34

CPT name : ST14460-CPT-143



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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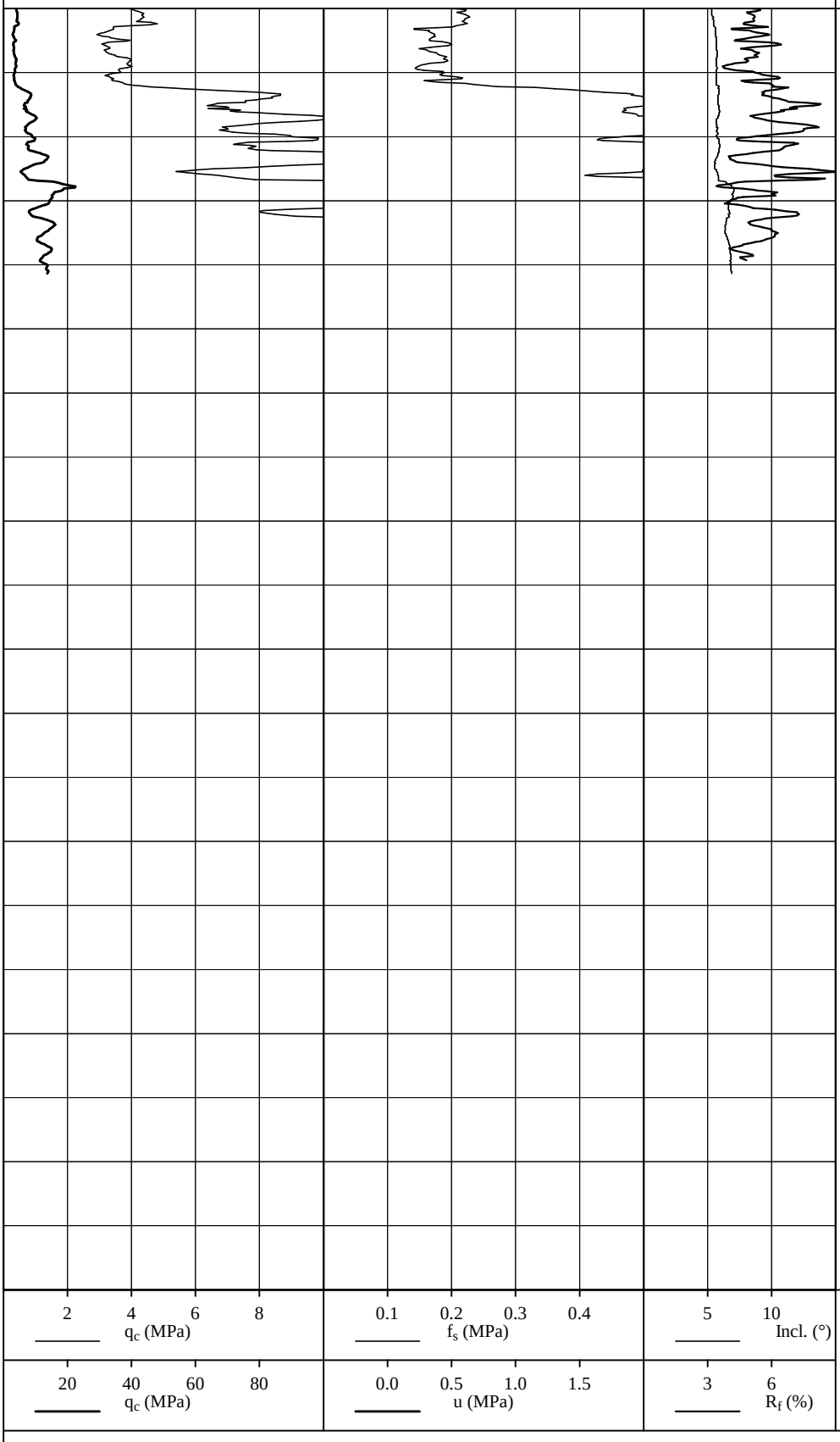
Printed 2014-04-08 09:46:36

CPT name : ST14460-CPT-143



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Negative Pore Pressure Observed

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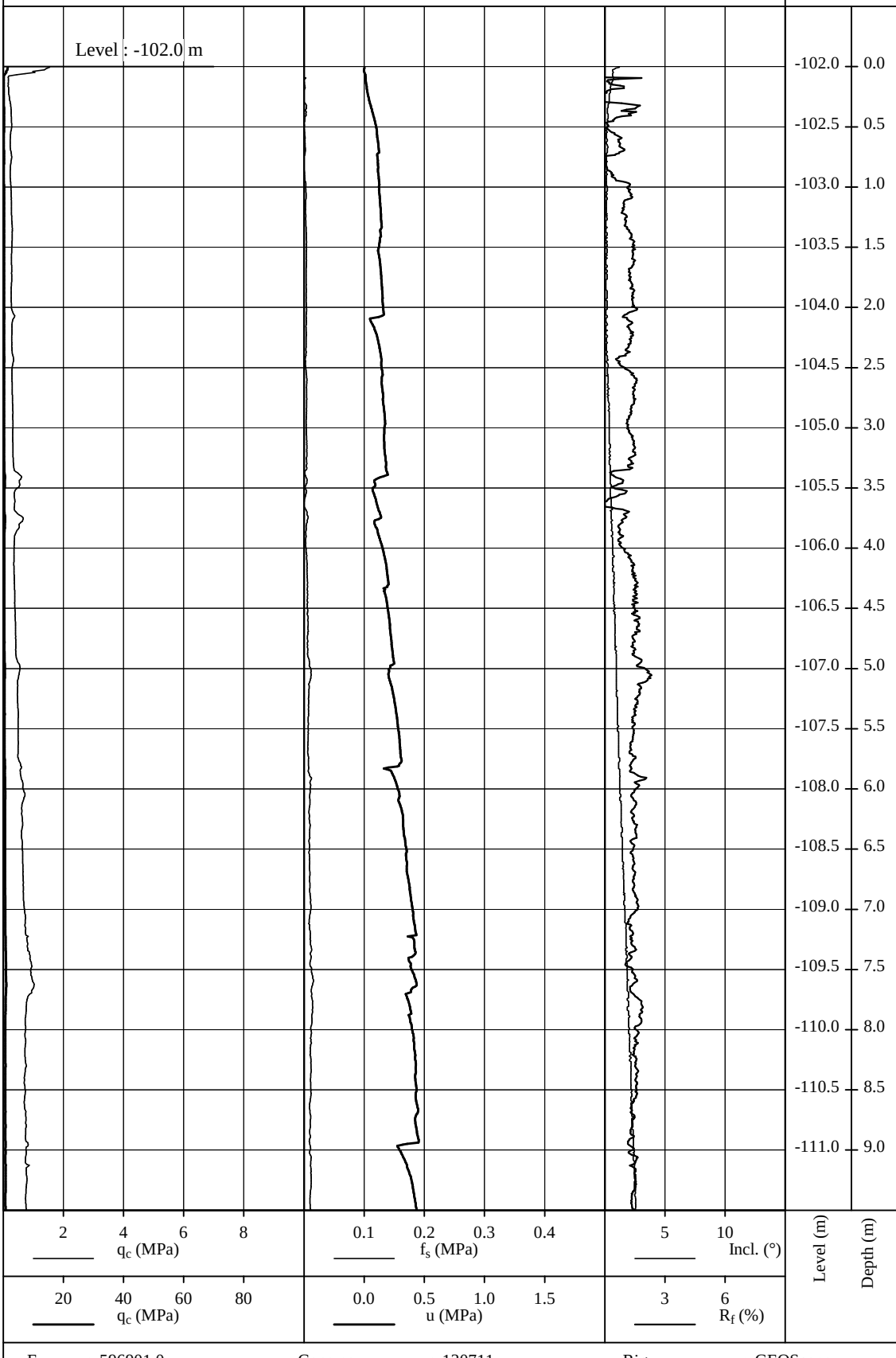
Printed 2014-04-08 09:46:37

CPT name : ST14460-CPT-151



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N	: 6372897.1	Cone type	: TSP	Performed by	: ALJ/2014-03-30 19:48:26
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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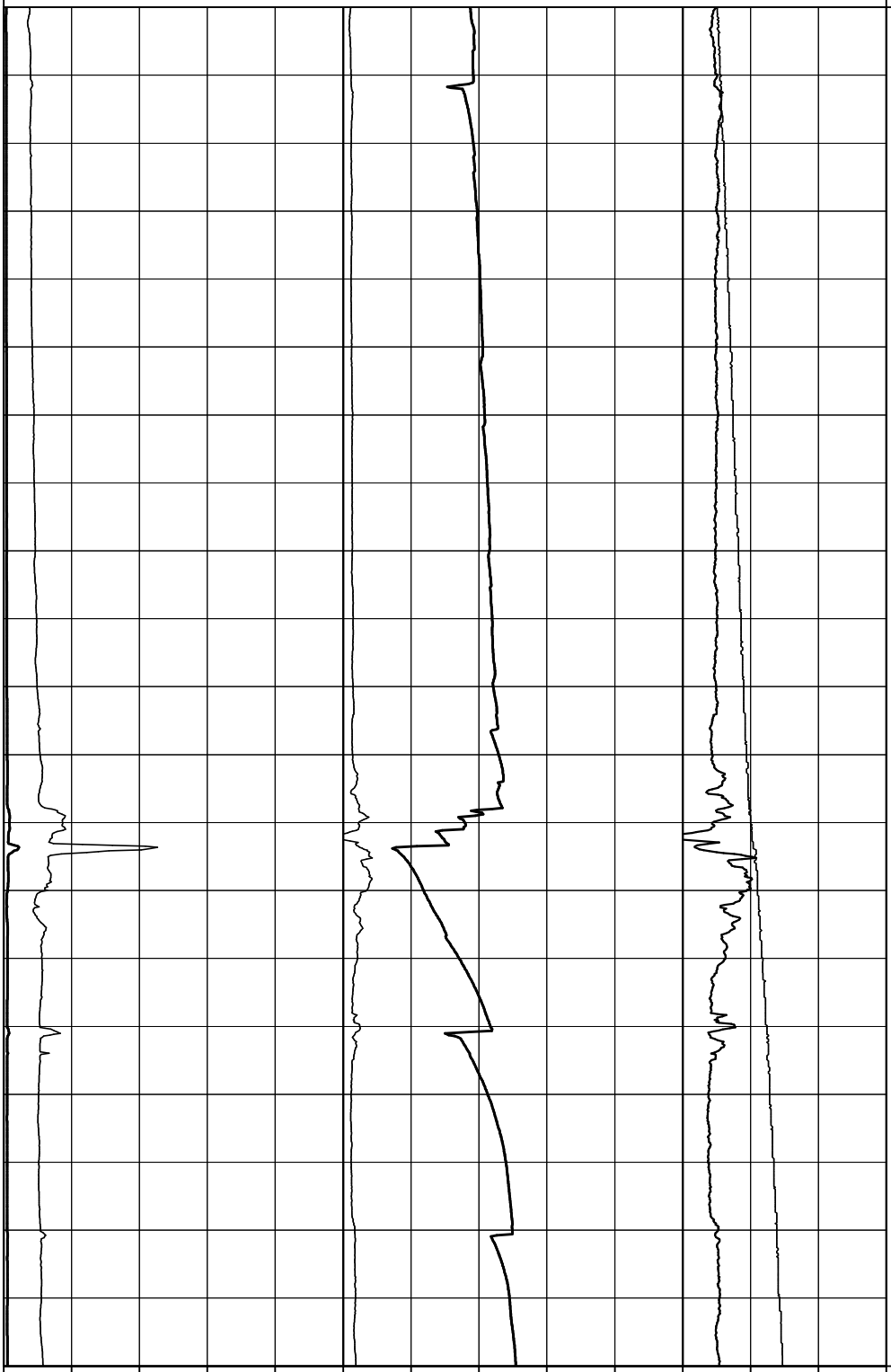
CPT name : ST14460-CPT-151



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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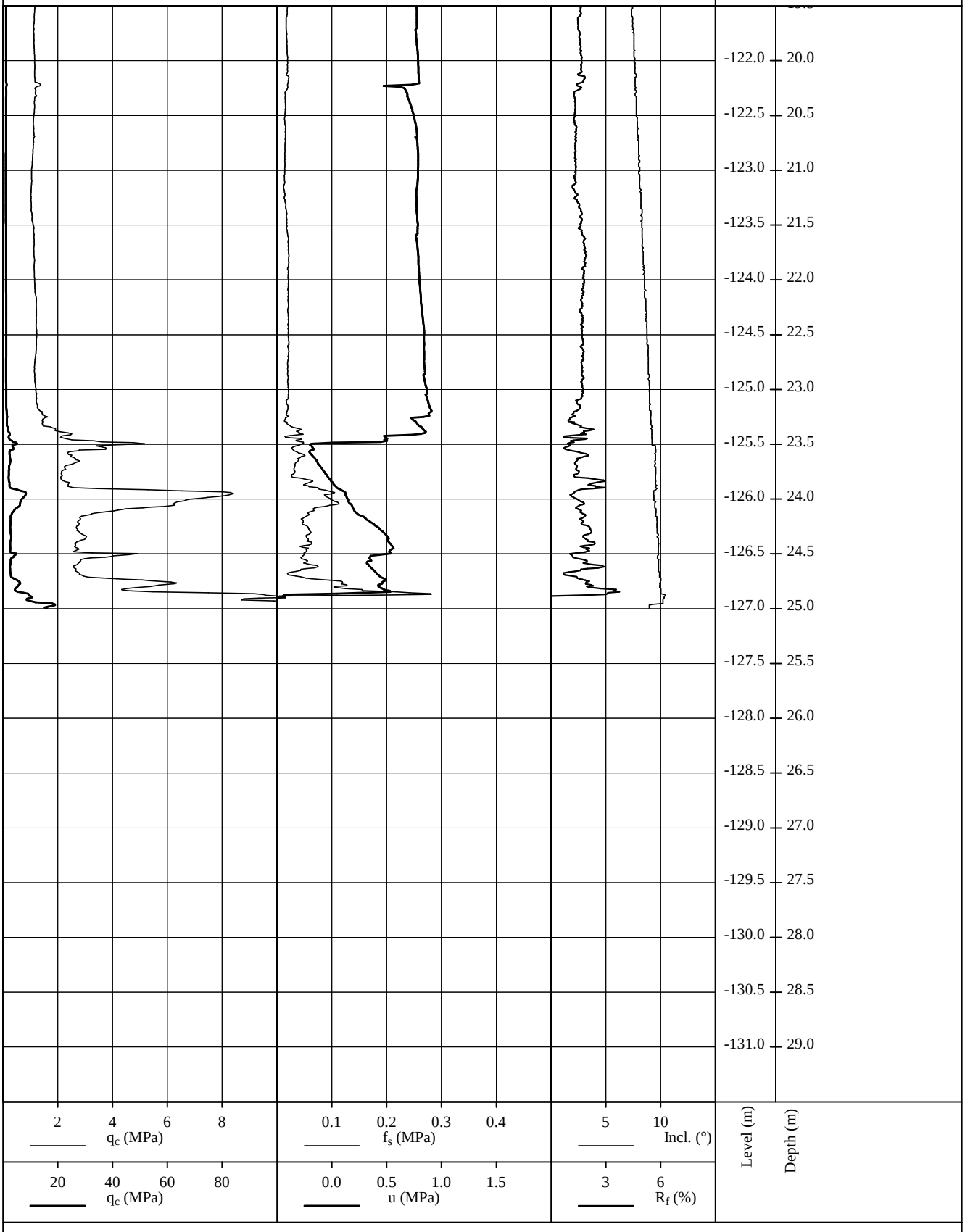
CPT name : ST14460-CPT-151



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
Checked	: KNM	Date: 2014-04-03		Page 3 / 3
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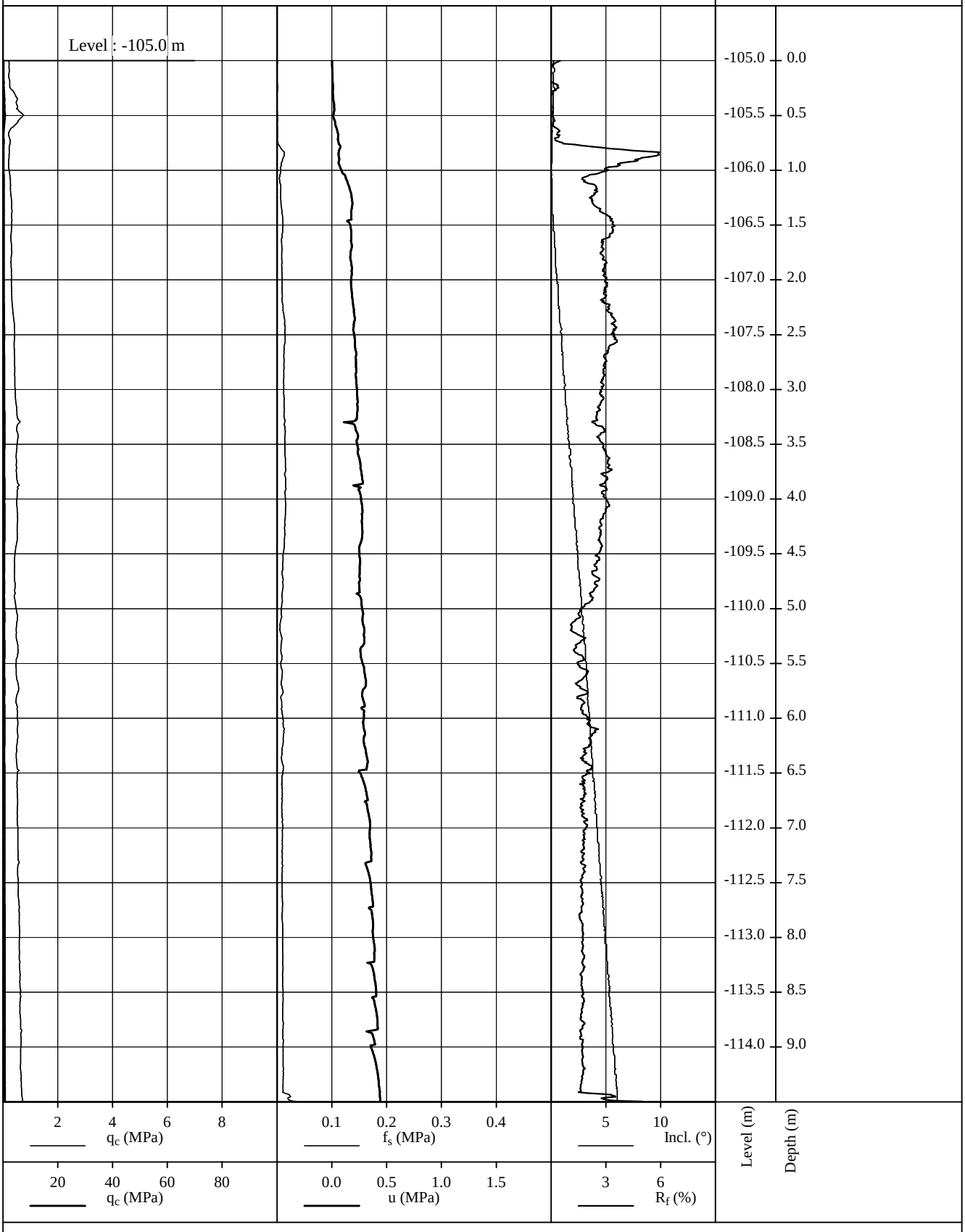
Printed 2014-04-08 09:46:43

CPT name : ST14460-CPT-152



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System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
Checked	: KNM	Date: 2014-04-03		Page 1 / 3
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Perceptor - 1.5.10.124

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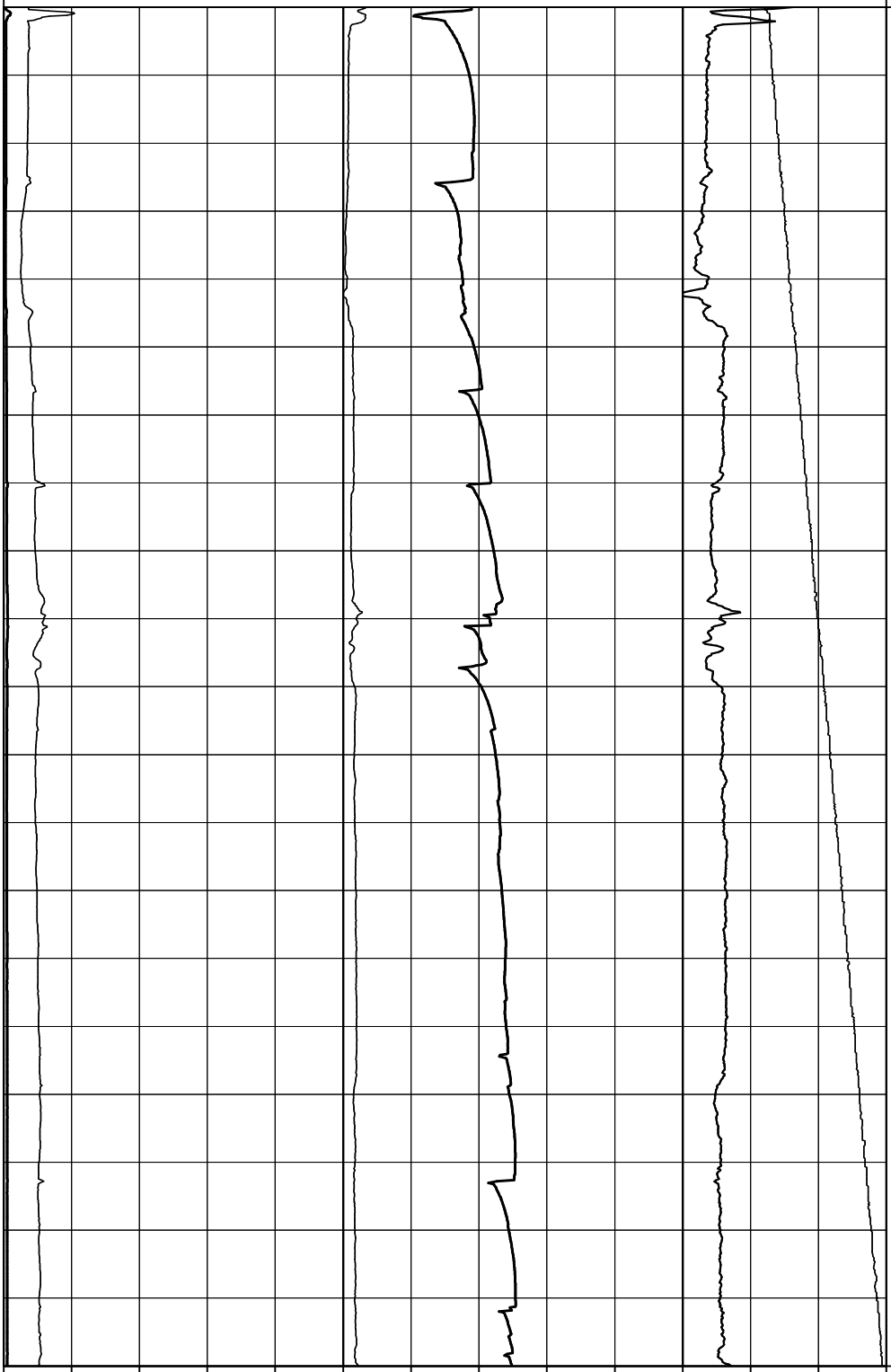
CPT name : ST14460-CPT-152



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Prepared	: ABP	Date: 2014-04-03	Subject: Original CPTU Data	
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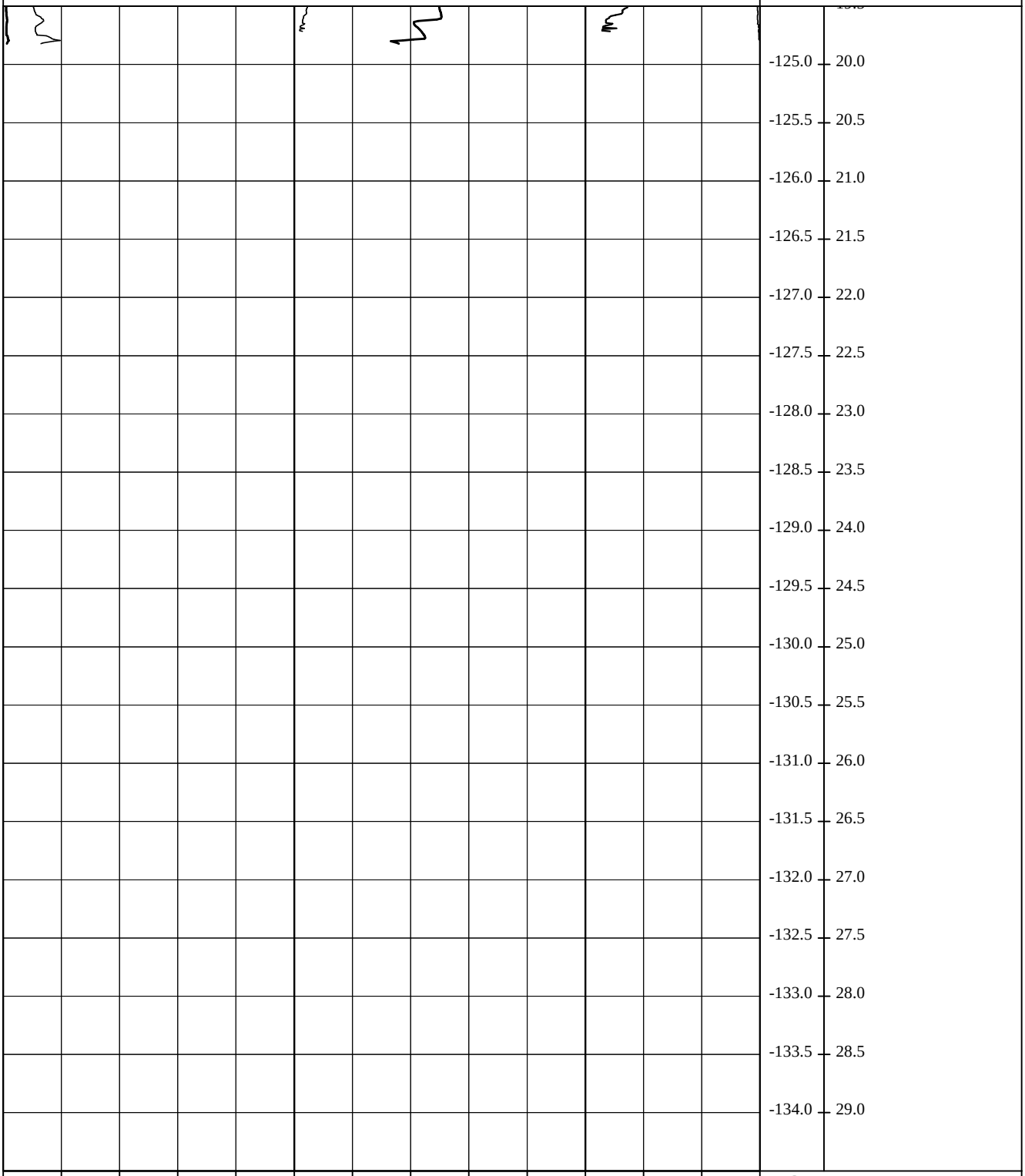
CPT name : ST14460-CPT-152



E	: 597598.8	Cone no.	: 130711	Rig	: GEOScope
N	: 6371689.0	Cone type	: TSP	Performed by	: ALJ/2014-03-30 22:25:24
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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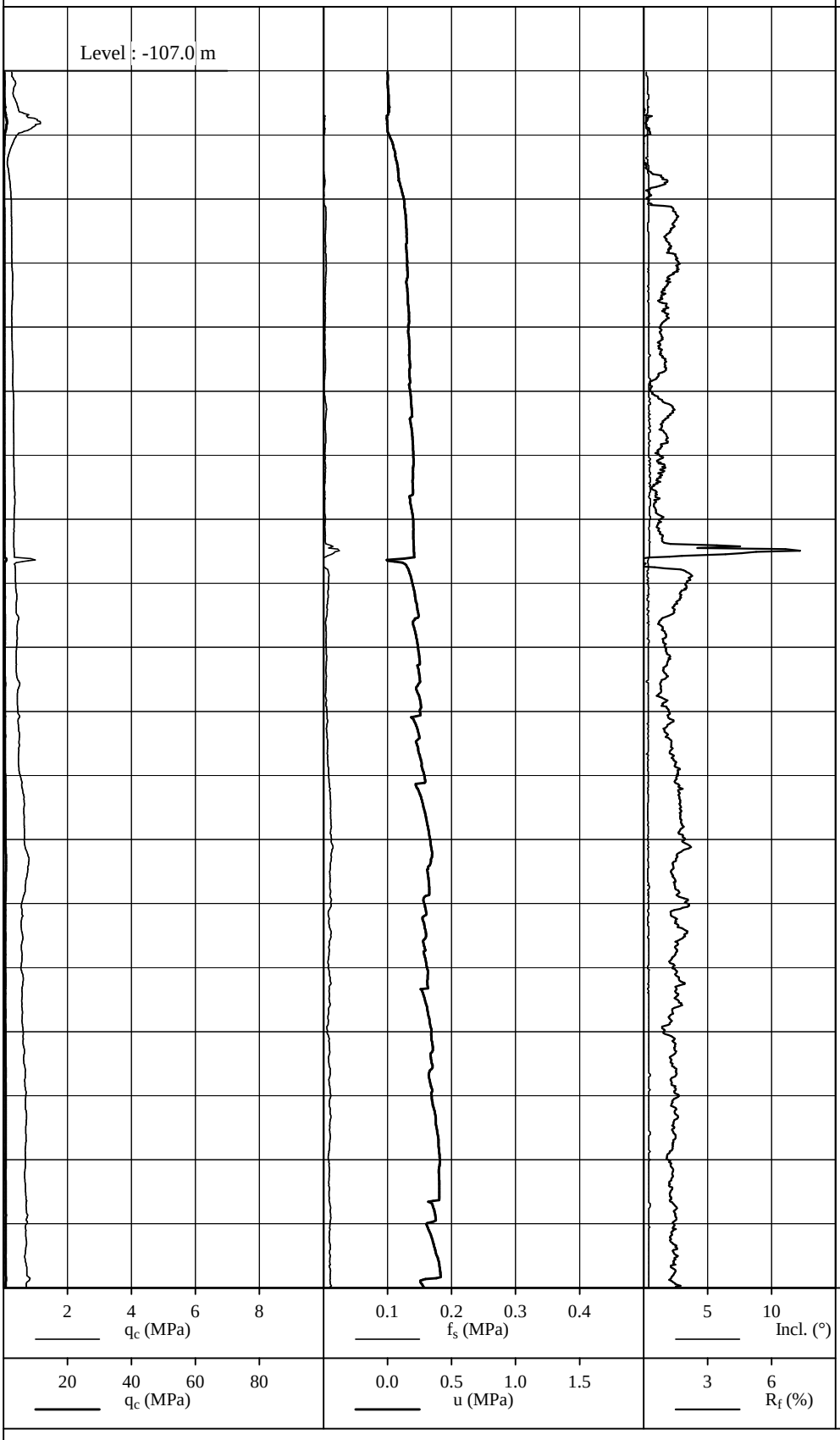
Perceptor - 1.5.10.124

Printed 2014-04-08 09:46:47

CPT name : ST14460-CPT-153



E	: 598290.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6372946.0	Cone type	: TSP	Performed by	: ALJ/2014-03-31 18:37:29
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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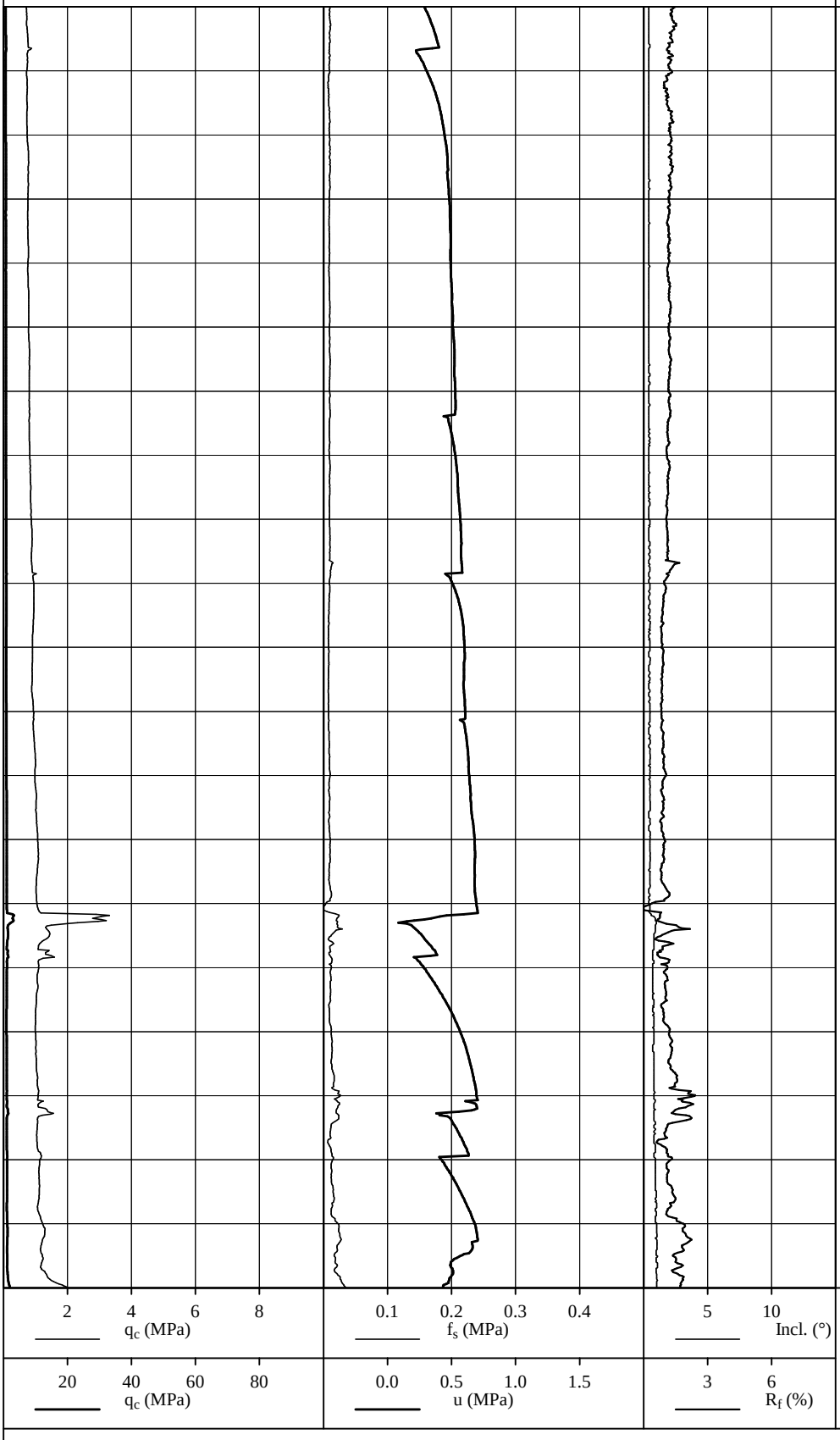
Printed 2014-04-08 09:46:49

CPT name : ST14460-CPT-153



E	: 598290.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6372946.0	Cone type	: TSP	Performed by	: ALJ/2014-03-31 18:37:29
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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CPT name : ST14460-CPT-153

Level (m)	Depth (m)
-127.0	20.0
-127.5	20.5
-128.0	21.0
-128.5	21.5
-129.0	22.0
-129.5	22.5
-130.0	23.0
-130.5	23.5
-131.0	24.0
-131.5	24.5
-132.0	25.0
-132.5	25.5
-133.0	26.0
-133.5	26.5
-134.0	27.0
-134.5	27.5
-135.0	28.0
-135.5	28.5
-136.0	29.0

q_c (MPa)	f_s (MPa)	Incl. (°)
2 4 6 8	0.1 0.2 0.3 0.4	5 10
20 40 60 80	0.0 0.5 1.0 1.5	3 6
q_c (MPa)	u (MPa)	R_f (%)

E	: 598290.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6372946.0	Cone type	: TSP	Performed by	: ALJ/2014-03-31 18:37:29
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	:

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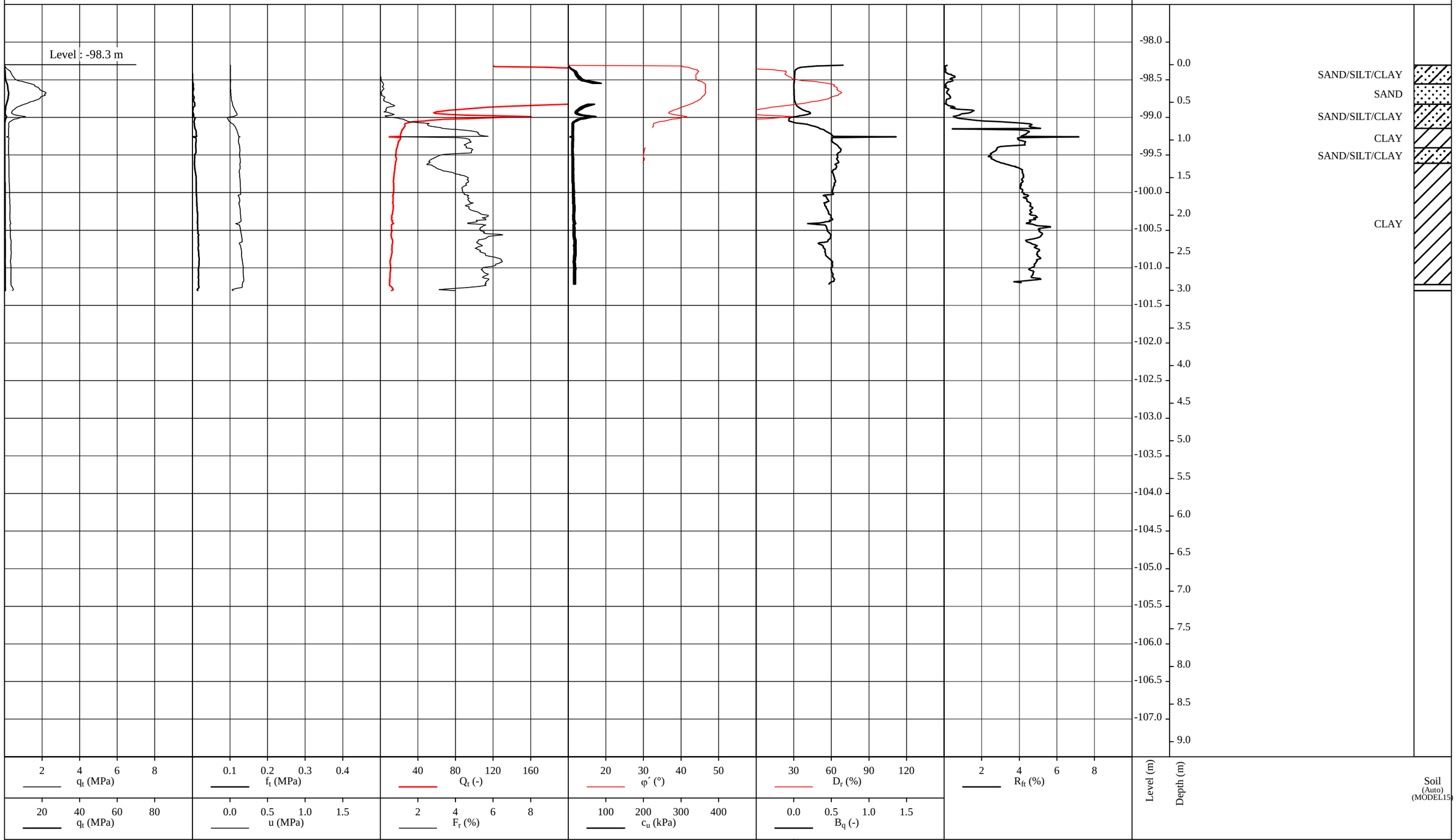
DANISH GEOTECHNICAL INSTITUTE

Enclosure 1.0E.01
CPT Profiles with soil behaviours

CPT name : ST14460-CPT-02



The interpretation of the c_u in Report 1.0 is based on N_{kt} values of 15-20. These N_{kt} values are only based on CPTU results and are not calibrated with laboratory tests i.e. c_u interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 595903.4	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373125.3	Cone type	: TSP	Performed by	: ALJ/2014-04-02 22:52:19
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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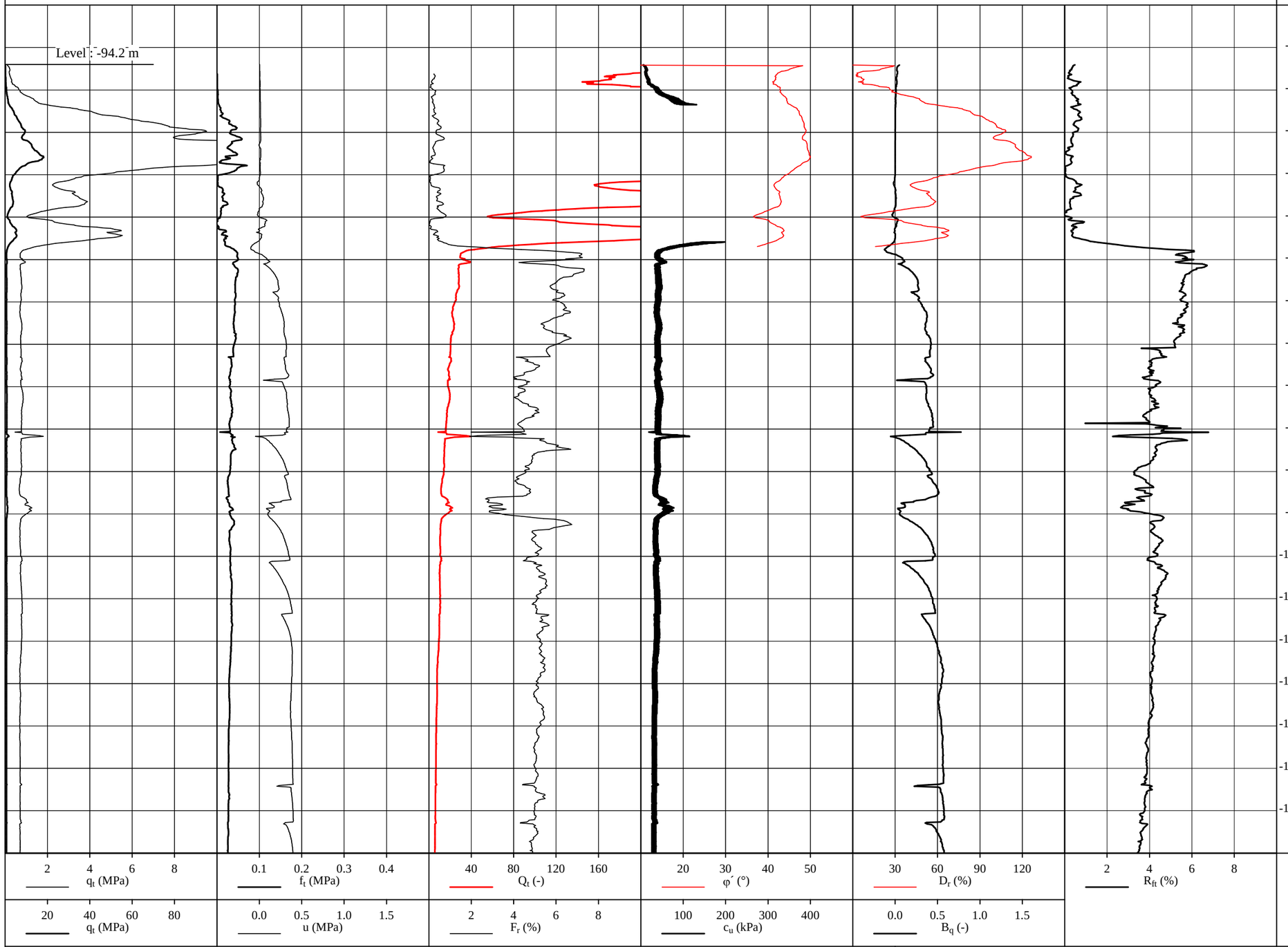
Printed 2014-05-06 09:22:10

CPT name : ST14460-CPT-03



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 595203.6	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373165.9	Cone type	: TSP	Performed by	: ALJ/2014-04-02 12:08:20
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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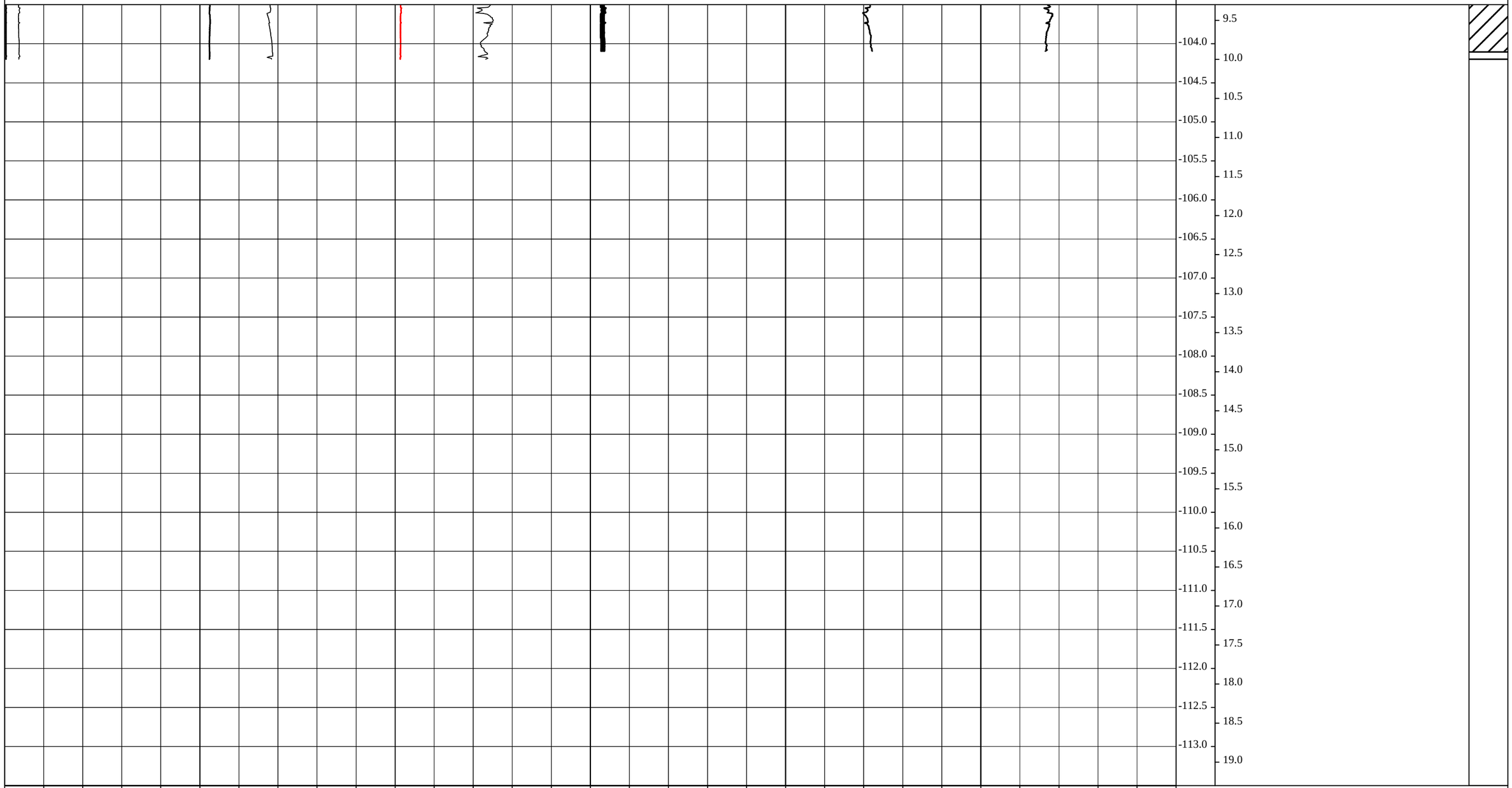
Printed 2014-05-06 09:23:47

CPT name : ST14460-CPT-03



2 4 6 8 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

40 80 120 160 Q_t (-)

20 30 40 50 φ' (°)

30 60 90 120 D_r (%)

2 4 6 8 R_{ft} (%)

Level (m)

Depth (m)

Soil
(Auto)
(MODEL15)

20 40 60 80 q_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

2 4 6 8 F_r (%)

100 200 300 400 c_u (kPa)

0.0 0.5 1.0 1.5 B_q (-)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 595203.6	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373165.9	Cone type	: TSP	Performed by	: ALJ/2014-04-02 12:08:20
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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CPT name : ST14460-CPT-05

Level : -83.7 m

Level (m)	Depth (m)
-83.5	0.0
-84.0	0.5
-84.5	1.0
-85.0	1.5
-85.5	2.0
-86.0	2.5
-86.5	3.0
-87.0	3.5
-87.5	4.0
-88.0	4.5
-88.5	5.0
-89.0	5.5
-89.5	6.0
-90.0	6.5
-90.5	7.0
-91.0	7.5
-91.5	8.0
-92.0	8.5
-92.5	9.0

Soil (Auto) (MODEL15)

SAND/SILT/CLAY

SAND

SAND/SILT/CLAY

CLAY

2 4 6 8 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

40 80 120 160 Q_t (-)

20 30 40 50 φ' (°)

30 60 90 120 D_r (%)

2 4 6 8 R_{ft} (%)

20 40 60 80 q_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

2 4 6 8 F_r (%)

100 200 300 400 c_u (kPa)

0.0 0.5 1.0 1.5 B_q (-)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 593108.7	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373269.3	Cone type	: TSP	Performed by	: ALJ/2014-04-02 15:21:12
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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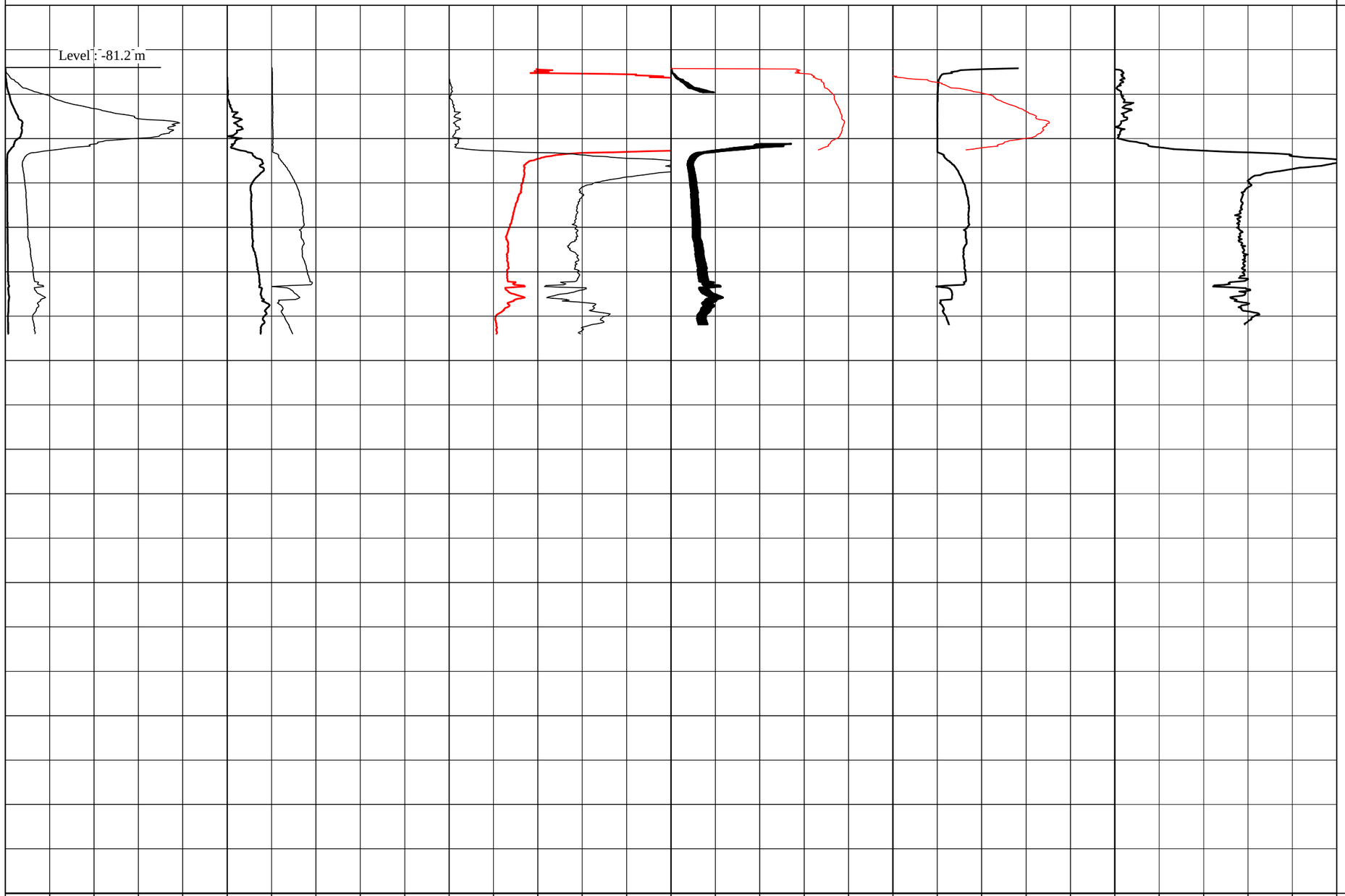
Printed 2014-05-06 09:25:02

CPT name : ST14460-CPT-06



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 592288.1	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373312.9	Cone type	: TSP	Performed by	: JPM/2014-04-03 00:49:26
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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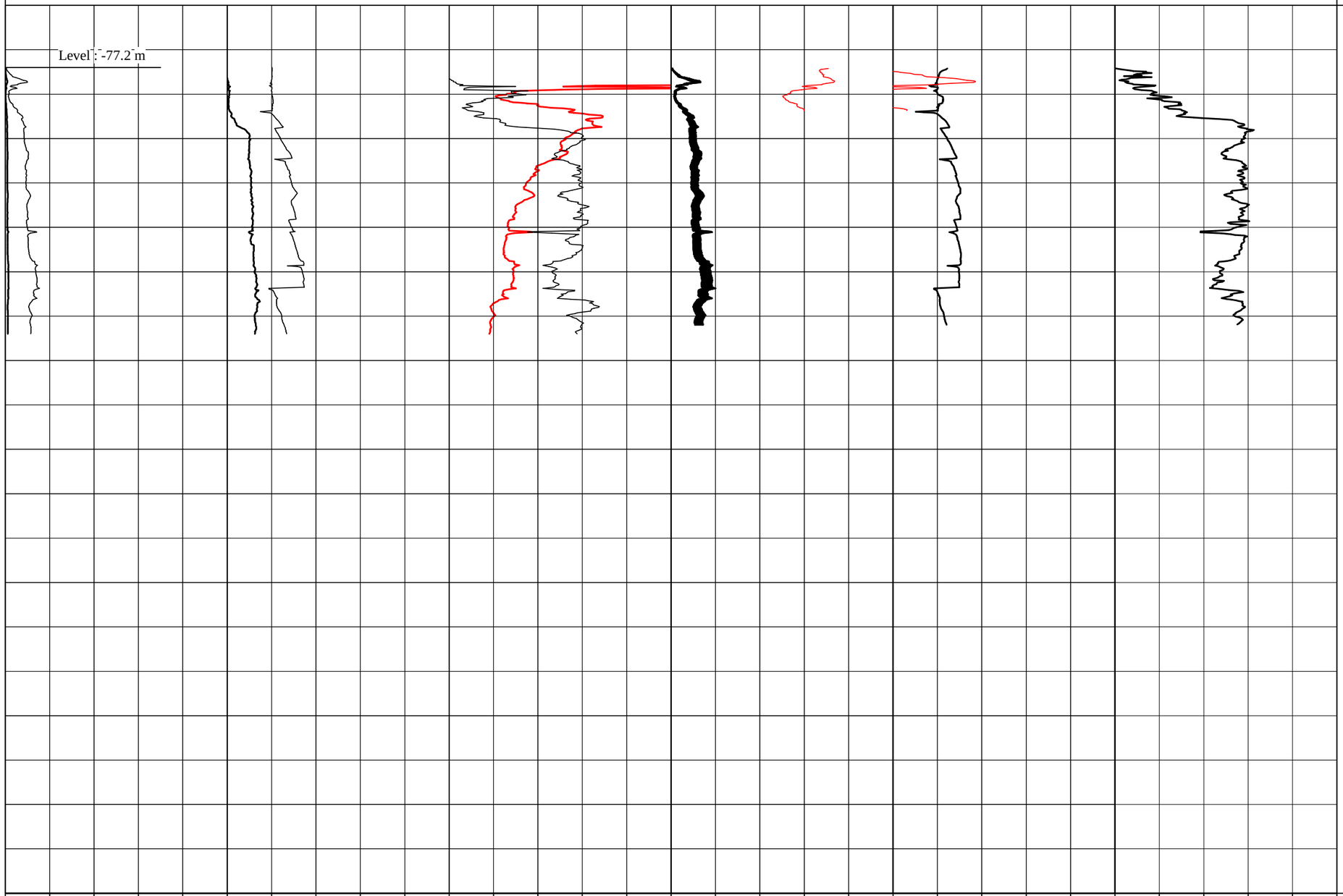
Perceptor - 1.5.10.127

Printed 2014-05-06 09:25:50

CPT name : ST14460-CPT-07



2 4 6 8 q_t (MPa)

20 40 60 80 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

40 80 120 160 Q_t (-)

2 4 6 8 F_r (%)

20 30 40 50 φ' (°)

100 200 300 400 c_u (kPa)

30 60 90 120 D_r (%)

0.0 0.5 1.0 1.5 B_q (-)

2 4 6 8 R_{ft} (%)

Level (m)

Depth (m)

Soil
(Auto)
(MODEL15)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 591041.9	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373373.4	Cone type	: TSP	Performed by	: ALJ/2014-04-02 16:55:43
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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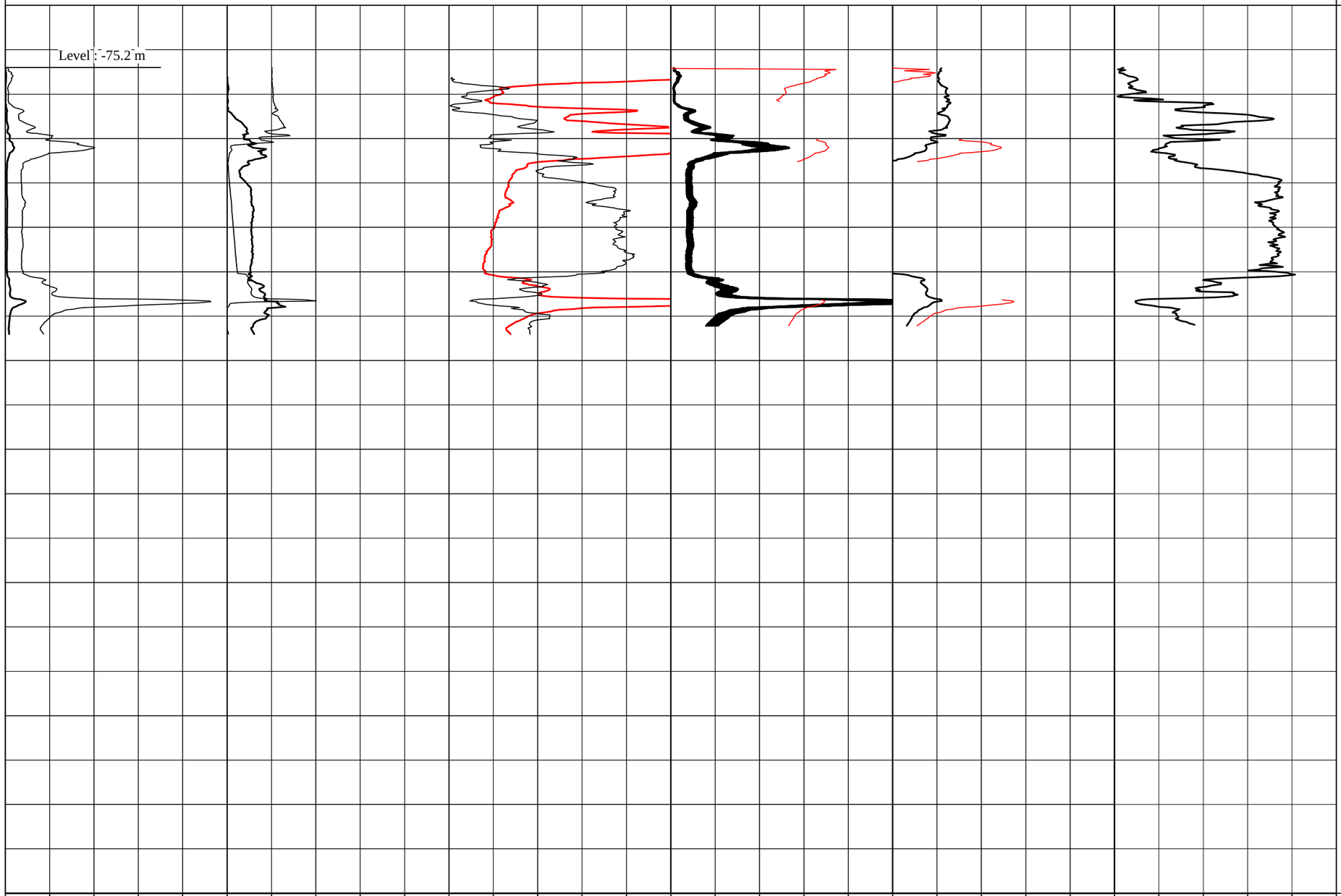
Perceptor - 1.5.10.127

Printed 2014-05-06 09:26:29

CPT name : ST14460-CPT-08



2 4 6 8 q_t (MPa)

20 40 60 80 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

40 80 120 160 Q_t (-)

2 4 6 8 F_r (%)

20 30 40 50 φ' (°)

100 200 300 400 c_u (kPa)

30 60 90 120 D_r (%)

0.0 0.5 1.0 1.5 B_q (-)

2 4 6 8 R_{ft} (%)

Level (m)

Depth (m)

Soil
(Auto)
(MODEL15)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 589497.1	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373388.8	Cone type	: TSP	Performed by	: ALJ/2014-04-02 18:22:51
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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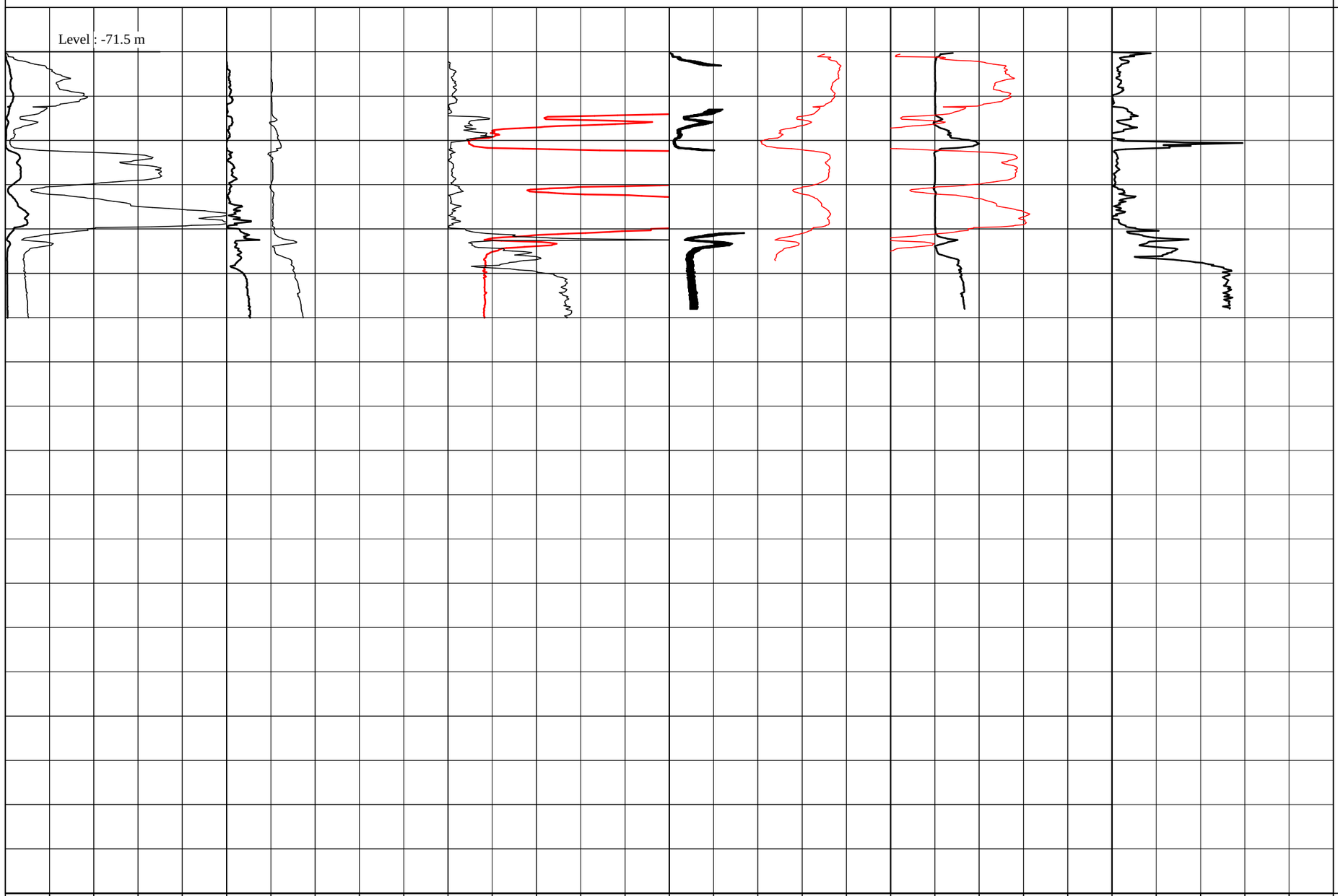
Printed 2014-05-06 09:27:08

CPT name : ST14460-CPT-09



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 585526.3	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373724.3	Cone type	: TSP	Performed by	: ALJ/2014-04-02 19:54:21
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Perceptor - 1.5.10.127

CPT name : ST14460-CPT-10

Level : -69.3 m

Level (m)	Depth (m)
-69.0	0.0
-69.5	0.5
-70.0	1.0
-70.5	1.5
-71.0	2.0
-71.5	2.5
-72.0	3.0
-72.5	3.5
-73.0	4.0
-73.5	4.5
-74.0	5.0
-74.5	5.5
-75.0	6.0
-75.5	6.5
-76.0	7.0
-76.5	7.5
-77.0	8.0
-77.5	8.5
-78.0	9.0

Soil (Auto) (MODEL15)

SAND/SILT/CLAY

SAND

CLAY

2 4 6 8 q_t (MPa)

20 40 60 80 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

40 80 120 160 Q_t (-)

2 4 6 8 F_r (%)

20 30 40 50 φ' (°)

100 200 300 400 c_u (kPa)

30 60 90 120 D_r (%)

0.0 0.5 1.0 1.5 B_q (-)

2 4 6 8 R_{ft} (%)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 582804.7	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6374258.8	Cone type	: TSP	Performed by	: JPM/2014-04-02 06:28:56
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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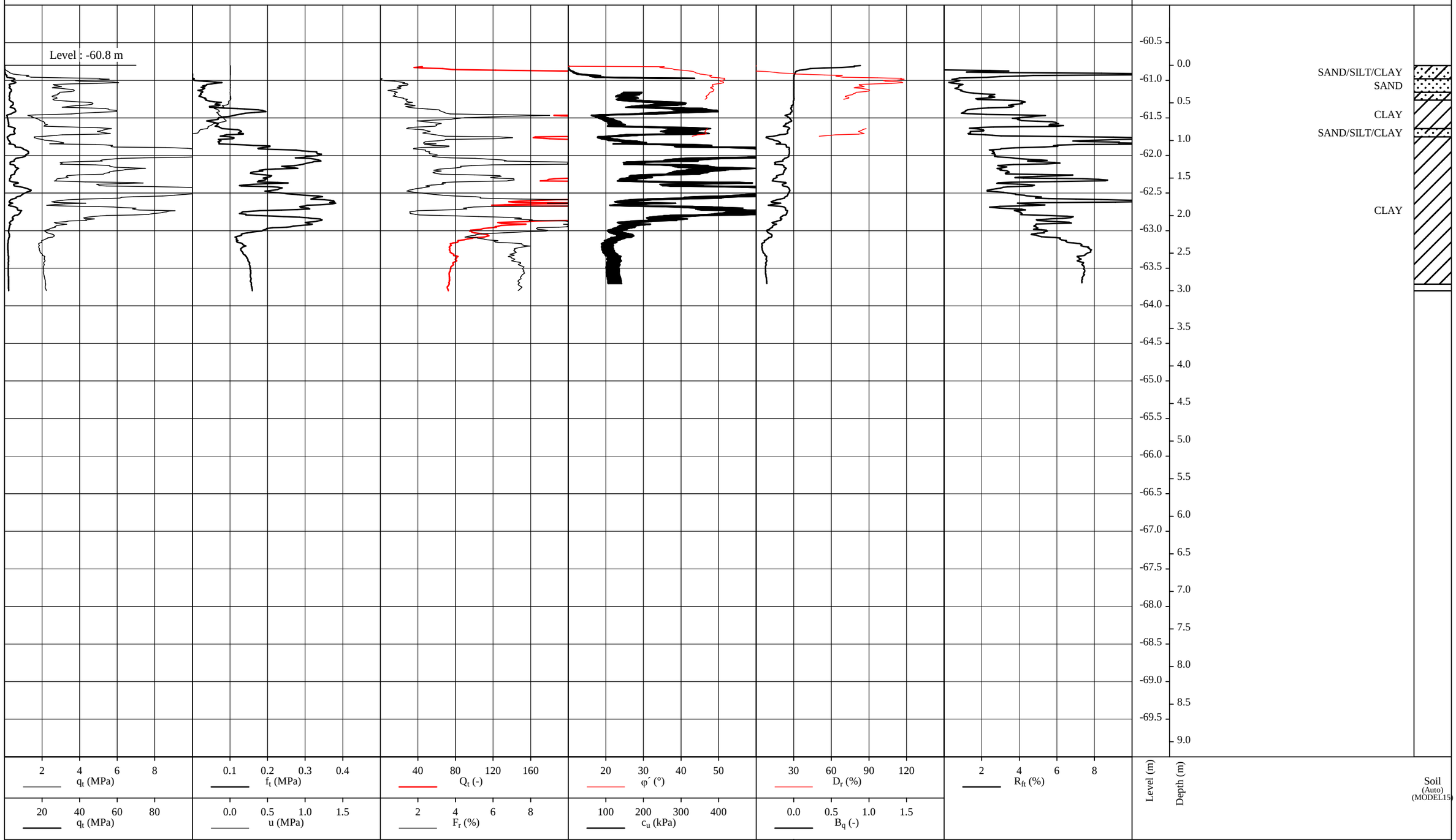
Perceptor - 1.5.10.127

Printed 2014-05-06 09:28:31

CPT name : ST14460-CPT-11



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 580225.4	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6375546.4	Cone type	: TSP	Performed by	: JPM/2014-04-03 03:15:04
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Printed 2014-05-06 09:29:13

CPT name : ST14460-CPT-12

Level : -61.7 m

-61.5 -62.0 -62.5 -63.0 -63.5 -64.0 -64.5 -65.0 -65.5 -66.0 -66.5 -67.0 -67.5 -68.0 -68.5 -69.0 -69.5 -70.0 -70.5

Level (m)

0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0

Depth (m)

SAND/SILT/CLAY
SAND
SAND/SILT/CLAY
CLAY
SAND/SILT/CLAY
CLAY

Soil
(Auto)
(MODEL15)

2 4 6 8 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

40 80 120 160 Q_t (-)

20 30 40 50 φ' (°)

30 60 90 120 D_r (%)

2 4 6 8 R_{ft} (%)

20 40 60 80 q_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

2 4 6 8 F_r (%)

100 200 300 400 c_u (kPa)

0.0 0.5 1.0 1.5 B_q (-)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 579887.2	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6375700.4	Cone type	: TSP	Performed by	: JPM/2014-04-02 04:38:47
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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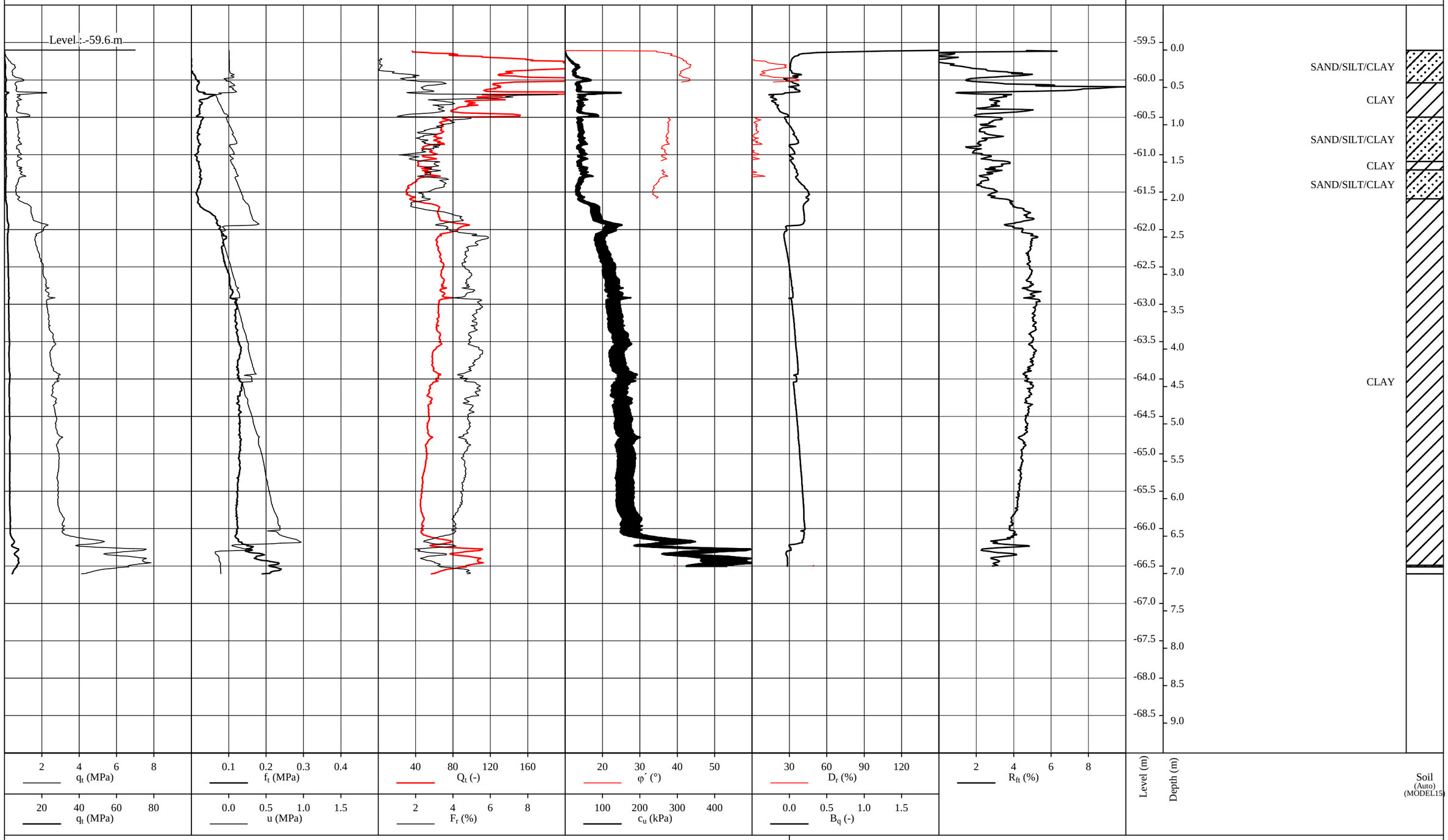
Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-12

Perceptor - 1.5.10.127

Printed 2014-05-06 09:29:57

CPT name : ST14460-CPT-13



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 579414.6	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6375942.4	Cone type	: TSP	Performed by	: JPM/2014-04-03 04:42:31
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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CPT name : ST14460-CPT-14

Level : -54.6 m

Level (m)	Depth (m)
-54.5	0.0
-55.0	0.5
-55.5	1.0
-56.0	1.5
-56.5	2.0
-57.0	2.5
-57.5	3.0
-58.0	3.5
-58.5	4.0
-59.0	4.5
-59.5	5.0
-60.0	5.5
-60.5	6.0
-61.0	6.5
-61.5	7.0
-62.0	7.5
-62.5	8.0
-63.0	8.5
-63.5	9.0

Soil (Auto) (MODEL15)

- SAND/SILT/CLAY
- SAND
- SAND/SILT/CLAY
- CLAY
- SAND
- CLAY

2 4 6 8 q_t (MPa)	0.1 0.2 0.3 0.4 f_t (MPa)	40 80 120 160 Q_t (-)	20 30 40 50 φ' (°)	30 60 90 120 D_r (%)	2 4 6 8 R_{ft} (%)
20 40 60 80 q_t (MPa)	0.0 0.5 1.0 1.5 u (MPa)	2 4 6 8 F_r (%)	100 200 300 400 c_u (kPa)	0.0 0.5 1.0 1.5 B_q (-)	

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 578212.3	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6376567.3	Cone type	: TSP	Performed by	: JPM/2014-04-02 03:15:48
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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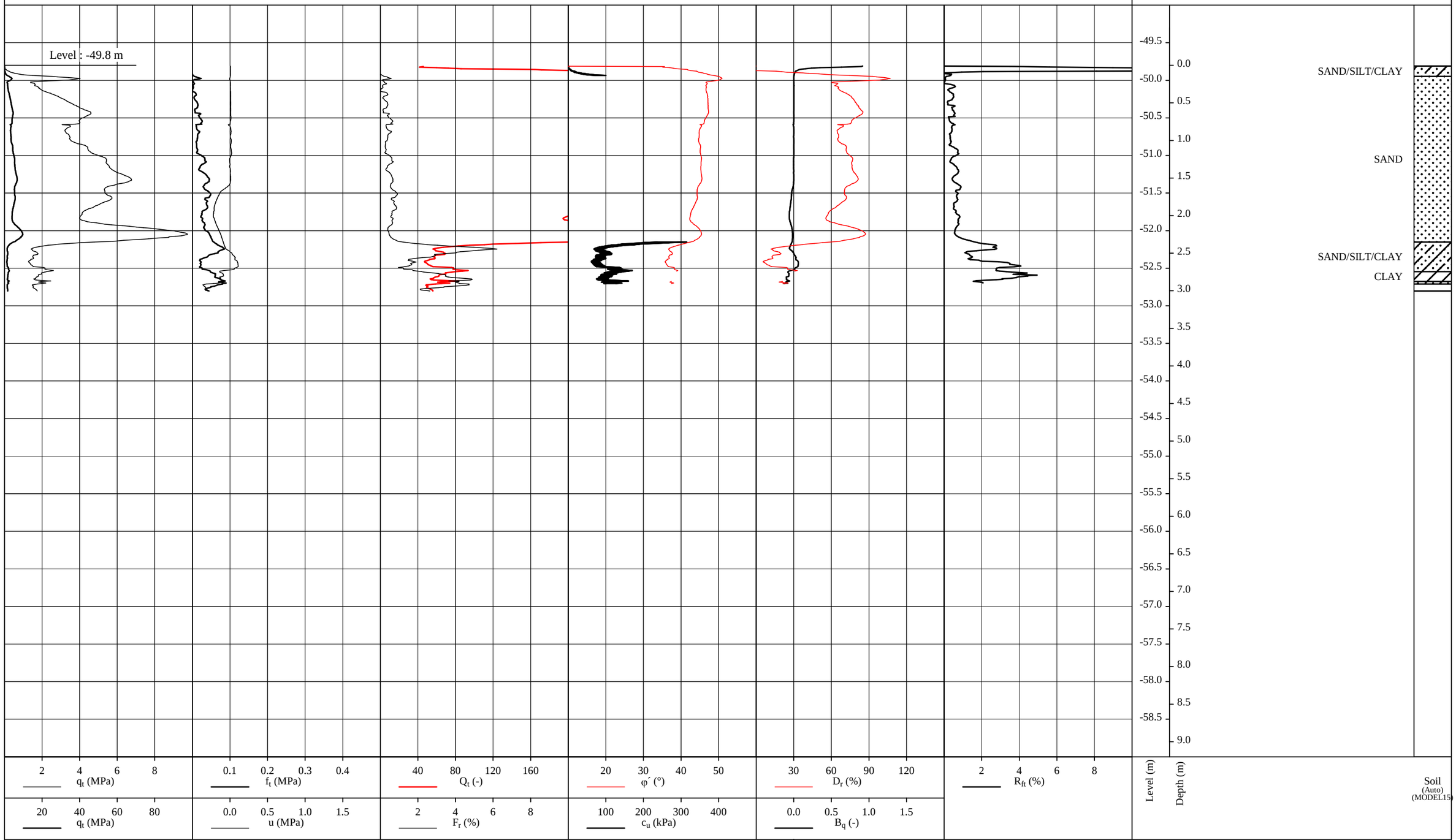
Perceptor - 1.5.10.127

CPT name : ST14460-CPT-15



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 576343.4	Cone no.	: 130711	Rig	: GEOScope
N	: 6376621.7	Cone type	: TSP	Performed by	: ALJ/2014-04-01 16:10:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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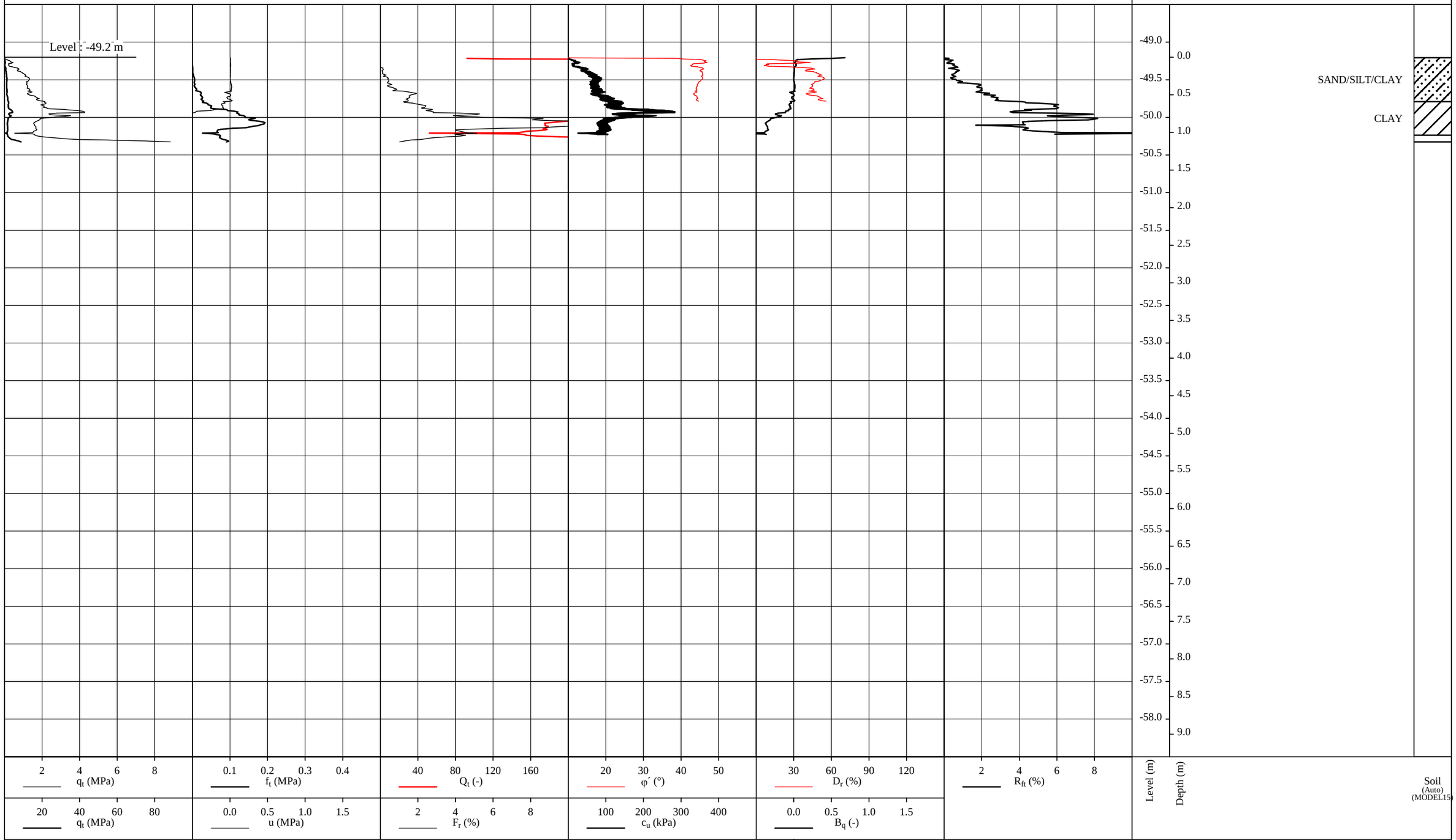
CPT name : ST14460-CPT-16



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 576096.5	Cone no.	: 130711	Rig	: GEOScope
N	: 6376600.2	Cone type	: TSP	Performed by	: ALJ/2014-04-01 15:00:41
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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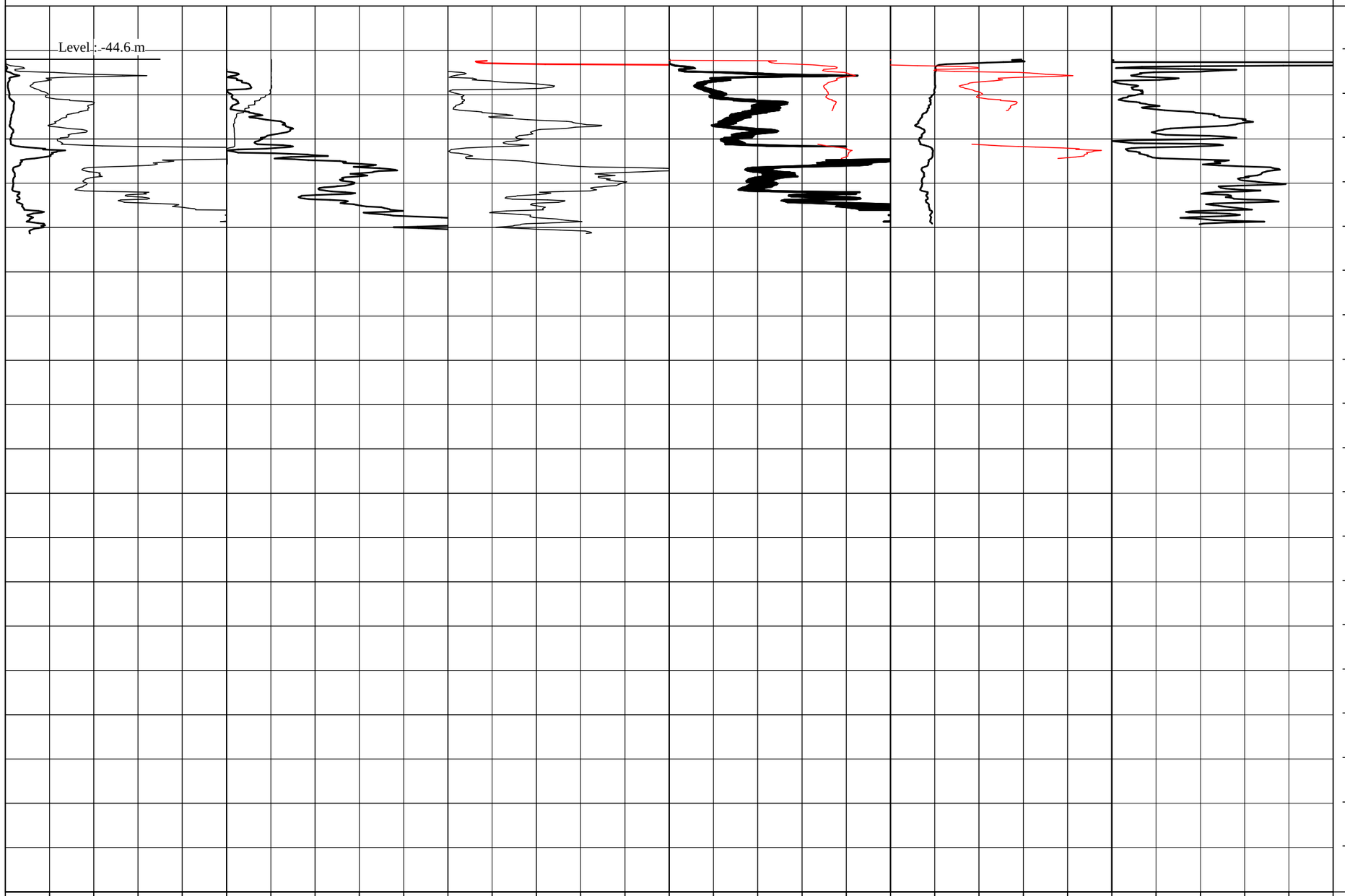
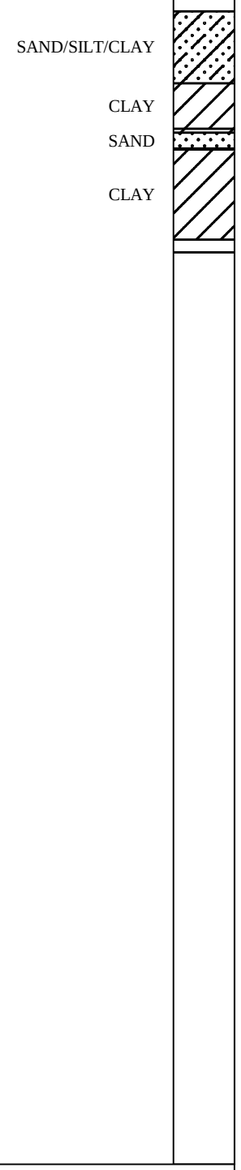
Perceptor - 1.5.10.127

Printed 2014-05-06 09:32:41

CPT name : ST14460-CPT-17

Level : -44.6 m





2 4 6 8 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

40 80 120 160 Q_t (-)

20 30 40 50 φ´ (°)

30 60 90 120 D_r (%)

2 4 6 8 R_{ft} (%)

Level (m)

Depth (m)

Soil (Auto) (MODEL15)

20 40 60 80 q_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

2 4 6 8 F_r (%)

100 200 300 400 c_u (kPa)

0.0 0.5 1.0 1.5 B_q (-)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 575101.2	Cone no.	: 130711	Rig	: GEOScope
N	: 6376289.0	Cone type	: TSP	Performed by	: ALJ/2014-04-01 17:22:34
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Perceptor - 1.5.10.127

CPT name : ST14460-CPT-18

Level : -28.5 m

Level (m)	Depth (m)
-28.5	0.0
-29.0	0.5
-29.5	1.0
-30.0	1.5
-30.5	2.0
-31.0	2.5
-31.5	3.0
-32.0	3.5
-32.5	4.0
-33.0	4.5
-33.5	5.0
-34.0	5.5
-34.5	6.0
-35.0	6.5
-35.5	7.0
-36.0	7.5
-36.5	8.0
-37.0	8.5
-37.5	9.0

Soil (Auto) (MODEL15)

SAND/SILT/CLAY

SAND

2 4 6 8 q_t (MPa)

20 40 60 80 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

40 80 120 160 Q_t (-)

2 4 6 8 F_r (%)

20 30 40 50 φ' (°)

100 200 300 400 c_u (kPa)

30 60 90 120 D_r (%)

0.0 0.5 1.0 1.5 B_q (-)

2 4 6 8 R_{ft} (%)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 573990.7	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6375721.9	Cone type	: TSP	Performed by	: ALJ/2014-04-01 21:35:11
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Perceptor - 1.5.10.127

CPT name : ST14460-CPT-19

Level : -25.4 m

SAND/SILT/CLAY

Level (m)	Depth (m)
-25.0	0.0
-25.5	0.5
-26.0	1.0
-26.5	1.5
-27.0	2.0
-27.5	2.5
-28.0	3.0
-28.5	3.5
-29.0	4.0
-29.5	4.5
-30.0	5.0
-30.5	5.5
-31.0	6.0
-31.5	6.5
-32.0	7.0
-32.5	7.5
-33.0	8.0
-33.5	8.5
-34.0	9.0

2 4 6 8 q_t (MPa)	0.1 0.2 0.3 0.4 f_t (MPa)	40 80 120 160 Q_t (-)	20 30 40 50 φ' (°)	30 60 90 120 D_r (%)	2 4 6 8 R_{ft} (%)	Soil (Auto) (MODEL15)
20 40 60 80 q_t (MPa)	0.0 0.5 1.0 1.5 u (MPa)	2 4 6 8 F_r (%)	100 200 300 400 c_u (kPa)	0.0 0.5 1.0 1.5 B_q (-)		

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 573734.6	Cone no.	: 130711	Rig	: GEOScope
N	: 6375559.5	Cone type	: TSP	Performed by	: ALJ/2014-04-01 20:04:31
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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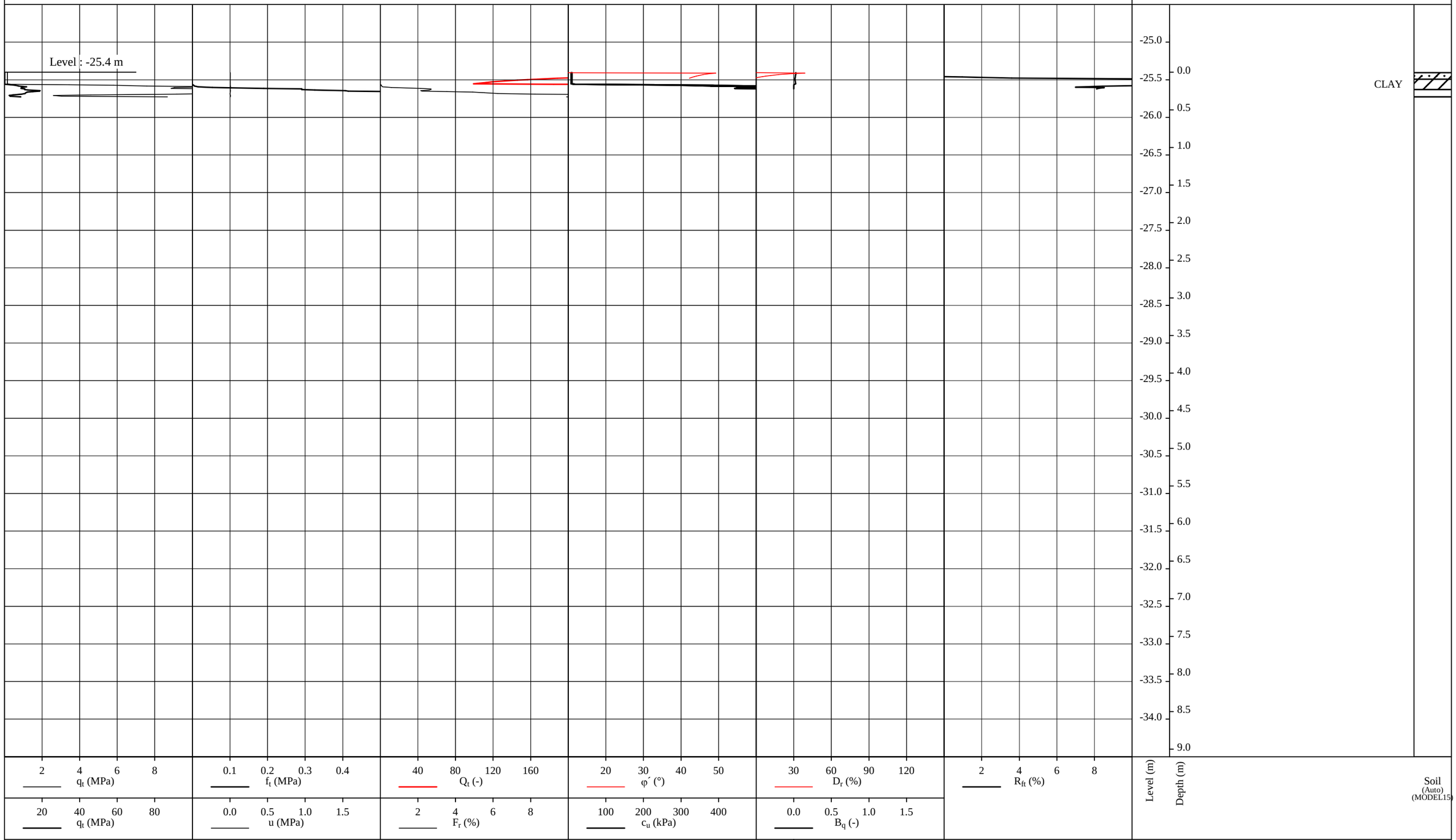
CPT name : ST14460-CPT-19a



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 573735.1	Cone no.	: 130711	Rig	: GEOScope
N	: 6375561.0	Cone type	: TSP	Performed by	: ALJ/2014-04-01 20:04:31
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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CPT name : ST14460-CPT-19b

Level : -25.4 m

SAND/SILT/CLAY

Level (m)	Depth (m)
-25.0	0.0
-25.5	0.5
-26.0	1.0
-26.5	1.5
-27.0	2.0
-27.5	2.5
-28.0	3.0
-28.5	3.5
-29.0	4.0
-29.5	4.5
-30.0	5.0
-30.5	5.5
-31.0	6.0
-31.5	6.5
-32.0	7.0
-32.5	7.5
-33.0	8.0
-33.5	8.5
-34.0	9.0

2 4 6 8 q_t (MPa)	0.1 0.2 0.3 0.4 f_t (MPa)	40 80 120 160 Q_t (-)	20 30 40 50 φ' (°)	30 60 90 120 D_r (%)	2 4 6 8 R_{ft} (%)	Soil (Auto) (MODEL15)
20 40 60 80 q_t (MPa)	0.0 0.5 1.0 1.5 u (MPa)	2 4 6 8 F_r (%)	100 200 300 400 c_u (kPa)	0.0 0.5 1.0 1.5 B_q (-)		

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 573732.6	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6375556.9	Cone type	: TSP	Performed by	: JPM/2014-04-03 08:13:05
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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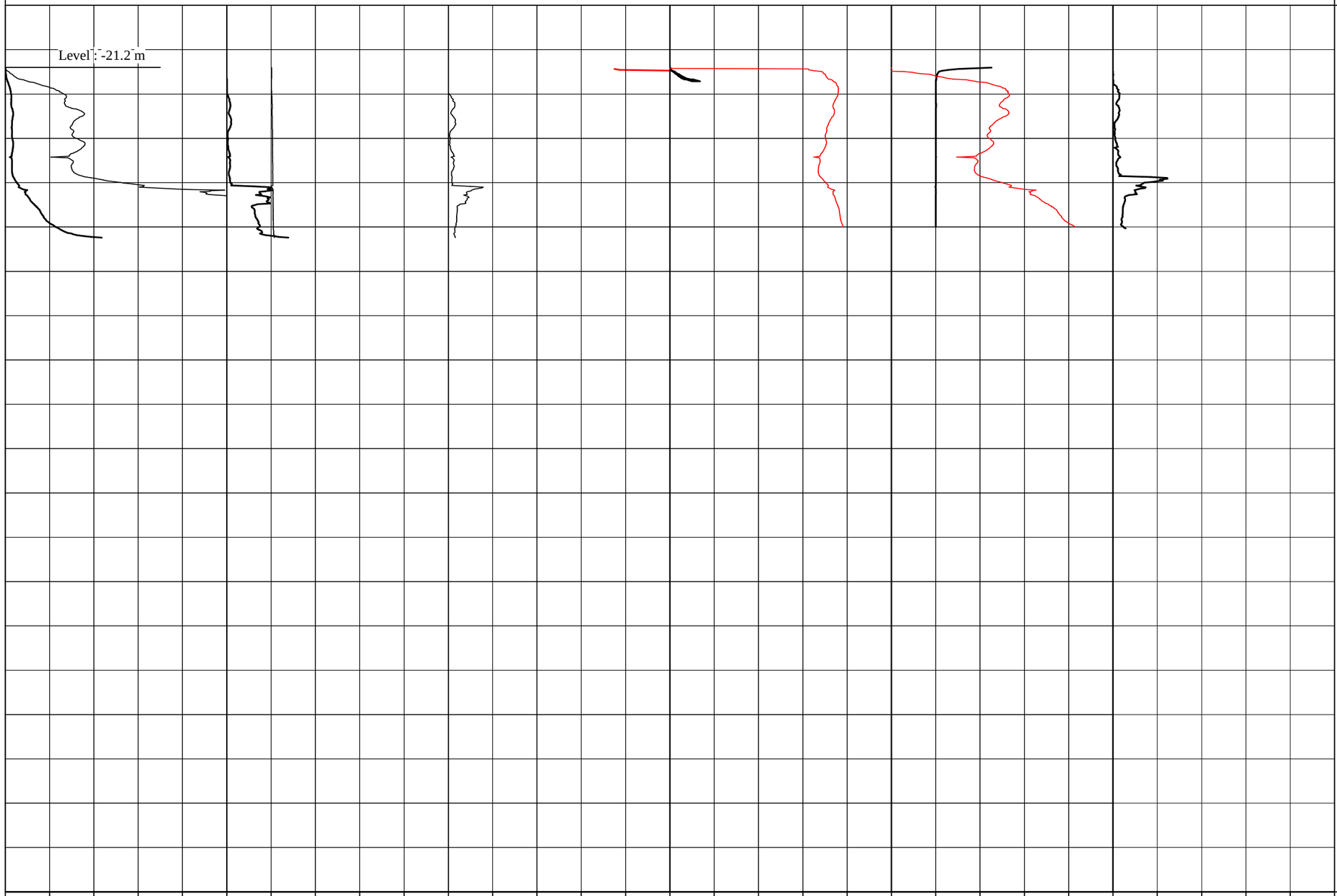
CPT name : ST14460-CPT-20



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 573563.8	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6375499.6	Cone type	: TSP	Performed by	: JPM/2014-04-03 06:41:34
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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CPT name : ST14460-CPT-21

Level : -18.1 m

Level (m)	Depth (m)
-18.0	0.0
-18.5	0.5
-19.0	1.0
-19.5	1.5
-20.0	2.0
-20.5	2.5
-21.0	3.0
-21.5	3.5
-22.0	4.0
-22.5	4.5
-23.0	5.0
-23.5	5.5
-24.0	6.0
-24.5	6.5
-25.0	7.0
-25.5	7.5
-26.0	8.0
-26.5	8.5
-27.0	9.0

Soil (Auto) (MODEL15)

SAND/SILT/CLAY

SAND

2 4 6 8 q_t (MPa)	0.1 0.2 0.3 0.4 f_t (MPa)	40 80 120 160 Q_t (-)	20 30 40 50 φ' (°)	30 60 90 120 D_r (%)	2 4 6 8 R_{ft} (%)
20 40 60 80 q_t (MPa)	0.0 0.5 1.0 1.5 u (MPa)	2 4 6 8 F_r (%)	100 200 300 400 c_u (kPa)	0.0 0.5 1.0 1.5 B_q (-)	

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 573435.7	Cone no.	: 130711	Rig	: GEOScope
N	: 6375447.8	Cone type	: TSP	Performed by	: ALJ/2014-04-01 19:09:04
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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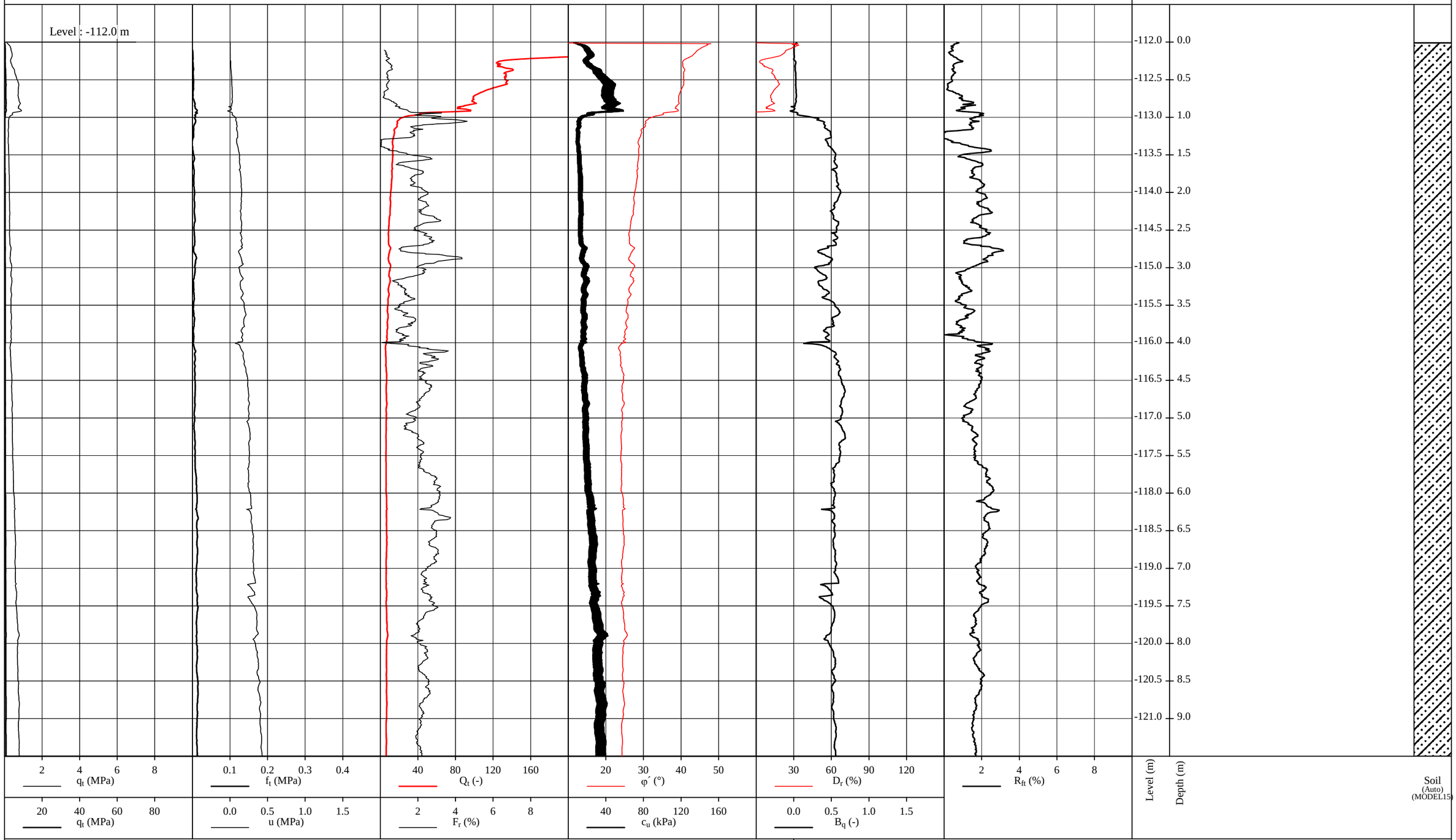
CPT name : ST14460-CPT-111

Level : -112.0 m



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599506.9	Cone no.	: 130711	Rig	: GEOScope
N	: 6373078.0	Cone type	: TSP	Performed by	: JPM/2014-03-31 07:08:01
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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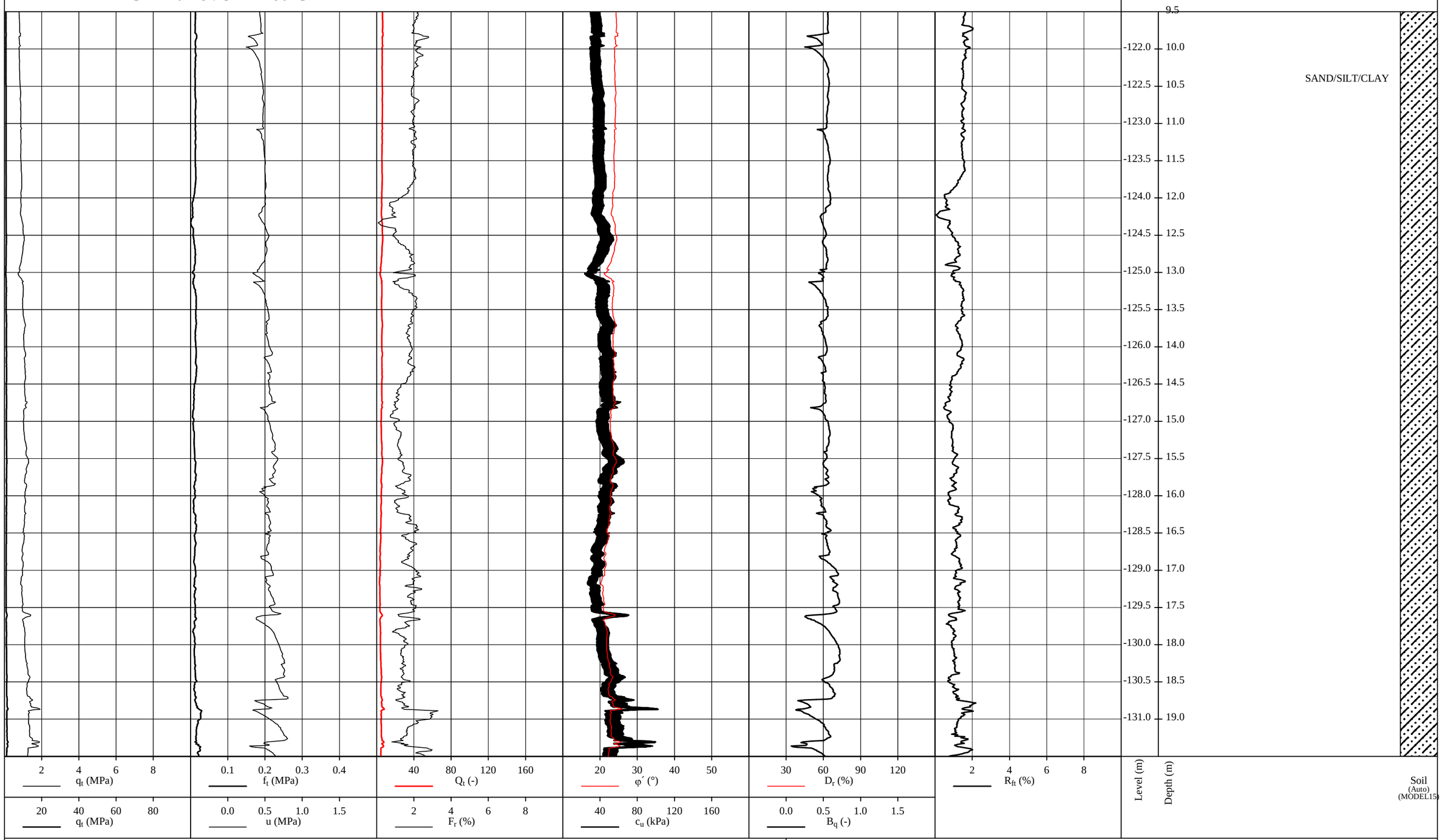
CPT name : ST14460-CPT-111



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599506.9	Cone no.	: 130711	Rig	: GEOScope
N	: 6373078.0	Cone type	: TSP	Performed by	: JPM/2014-03-31 07:08:01
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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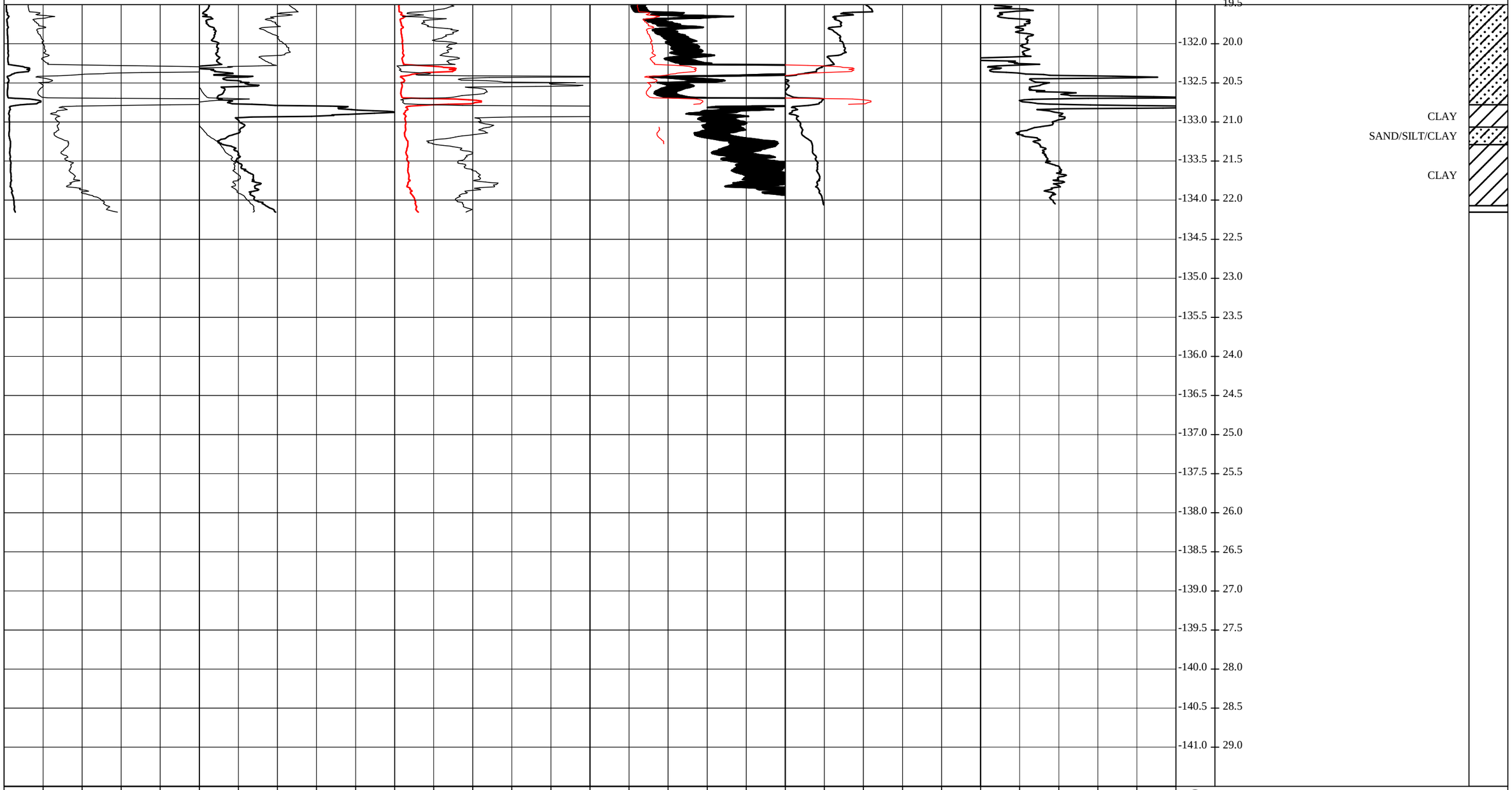
CPT name : ST14460-CPT-111



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599506.9	Cone no.	: 130711	Rig	: GEOScope
N	: 6373078.0	Cone type	: TSP	Performed by	: JPM/2014-03-31 07:08:01
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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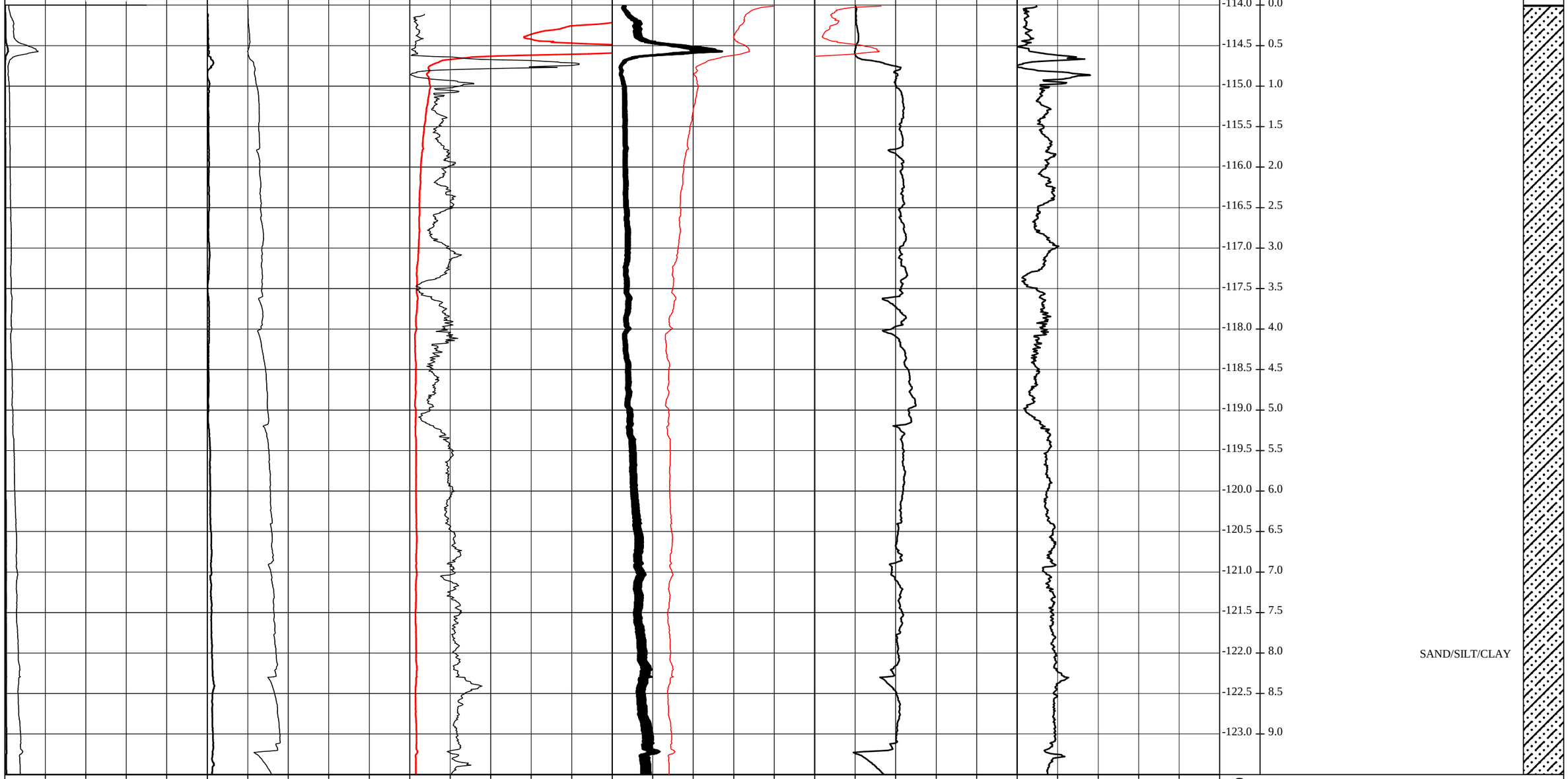
CPT name : ST14460-CPT-112b

Level : -114.0 m



2 4 6 8 q_t (MPa)

20 40 60 80 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

40 80 120 160 Q_t (-)

2 4 6 8 F_r (%)

20 30 40 50 φ´ (°)

40 80 120 160 c_u (kPa)

30 60 90 120 D_r (%)

0.0 0.5 1.0 1.5 B_q (-)

2 4 6 8 R_{ft} (%)

Level (m)

Depth (m)

Soil
(Auto)
(MODEL15)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599733.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6371830.1	Cone type	: TSP	Performed by	: JPM/2014-03-31 02:12:37
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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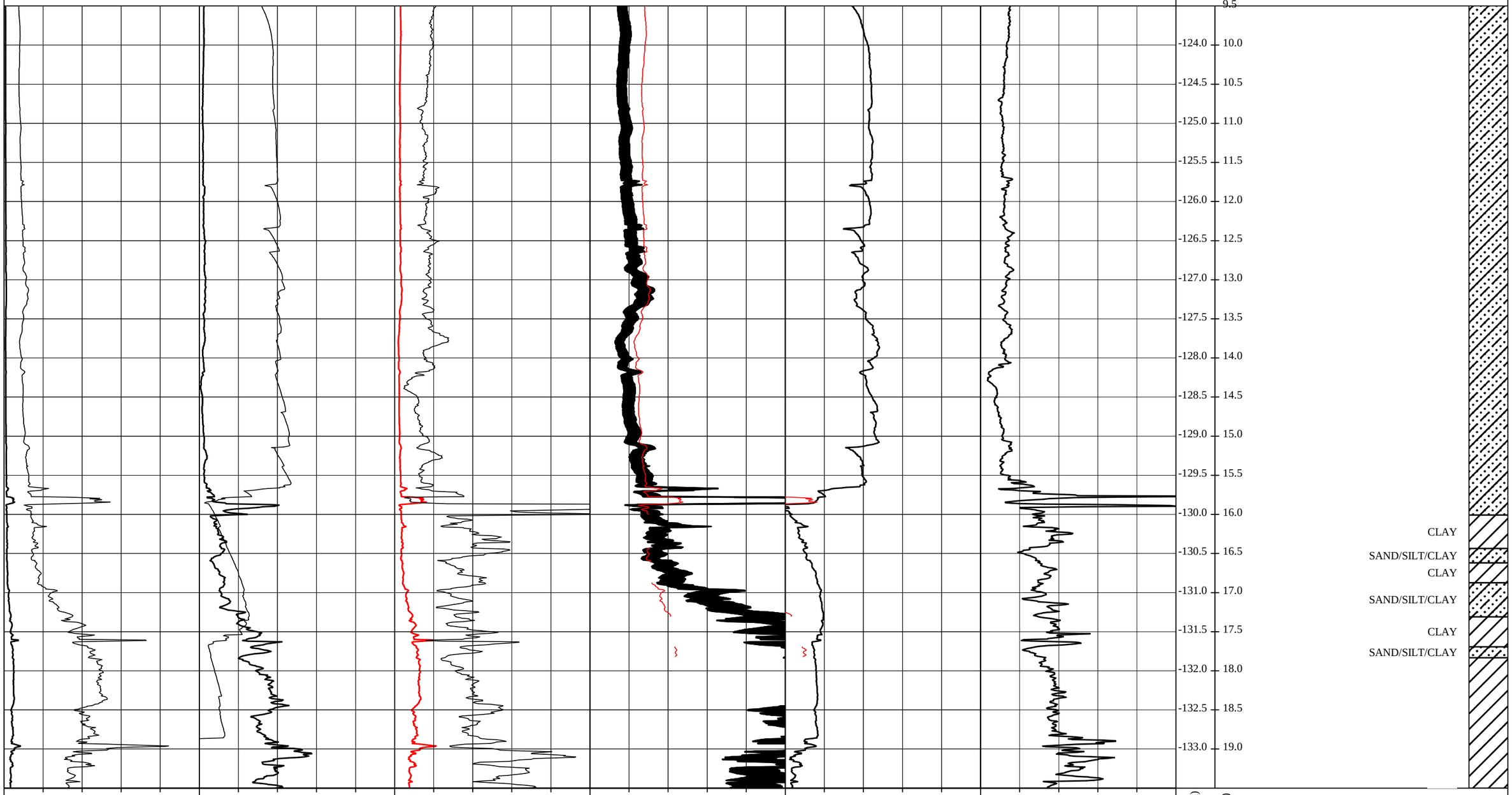
Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-112b

CPT name : ST14460-CPT-112b



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599733.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6371830.1	Cone type	: TSP	Performed by	: JPM/2014-03-31 02:12:37
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

GEO Danish Geotechnical Institute — Project : 36685 Hywind

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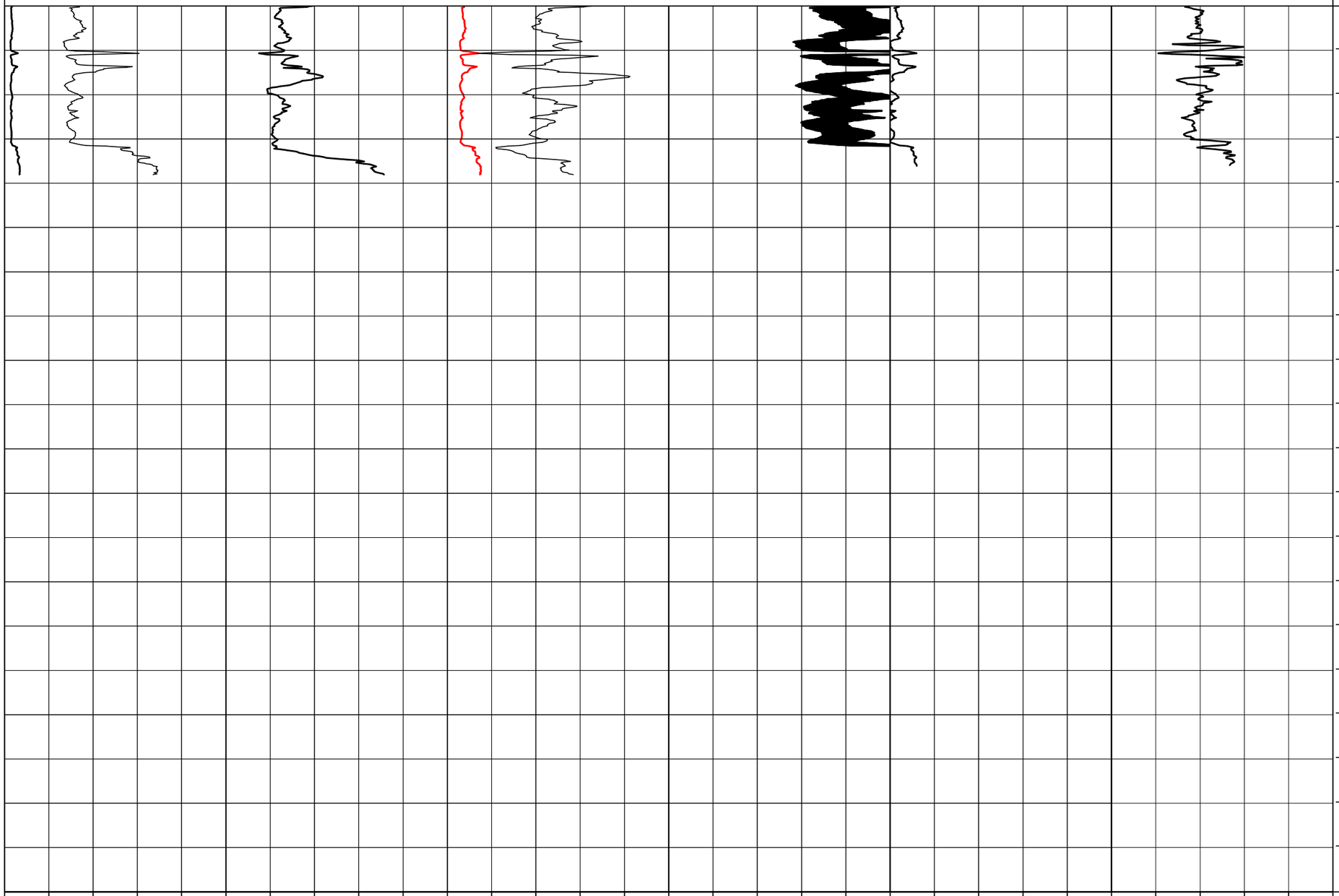
Printed 2014-05-06 09:39:45

CPT name : ST14460-CPT-112b



Level (m)	Depth (m)
	19.5
-134.0	20.0
-134.5	20.5
-135.0	21.0
-135.5	21.5
-136.0	22.0
-136.5	22.5
-137.0	23.0
-137.5	23.5
-138.0	24.0
-138.5	24.5
-139.0	25.0
-139.5	25.5
-140.0	26.0
-140.5	26.5
-141.0	27.0
-141.5	27.5
-142.0	28.0
-142.5	28.5
-143.0	29.0

Soil (Auto) (MODEL15)

CLAY

2 4 6 8 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

40 80 120 160 Q_t (-)

20 30 40 50 φ' (°)

30 60 90 120 D_r (%)

2 4 6 8 R_{ft} (%)

20 40 60 80 q_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

2 4 6 8 F_r (%)

40 80 120 160 c_u (kPa)

0.0 0.5 1.0 1.5 B_q (-)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599733.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6371830.1	Cone type	: TSP	Performed by	: JPM/2014-03-31 02:12:37
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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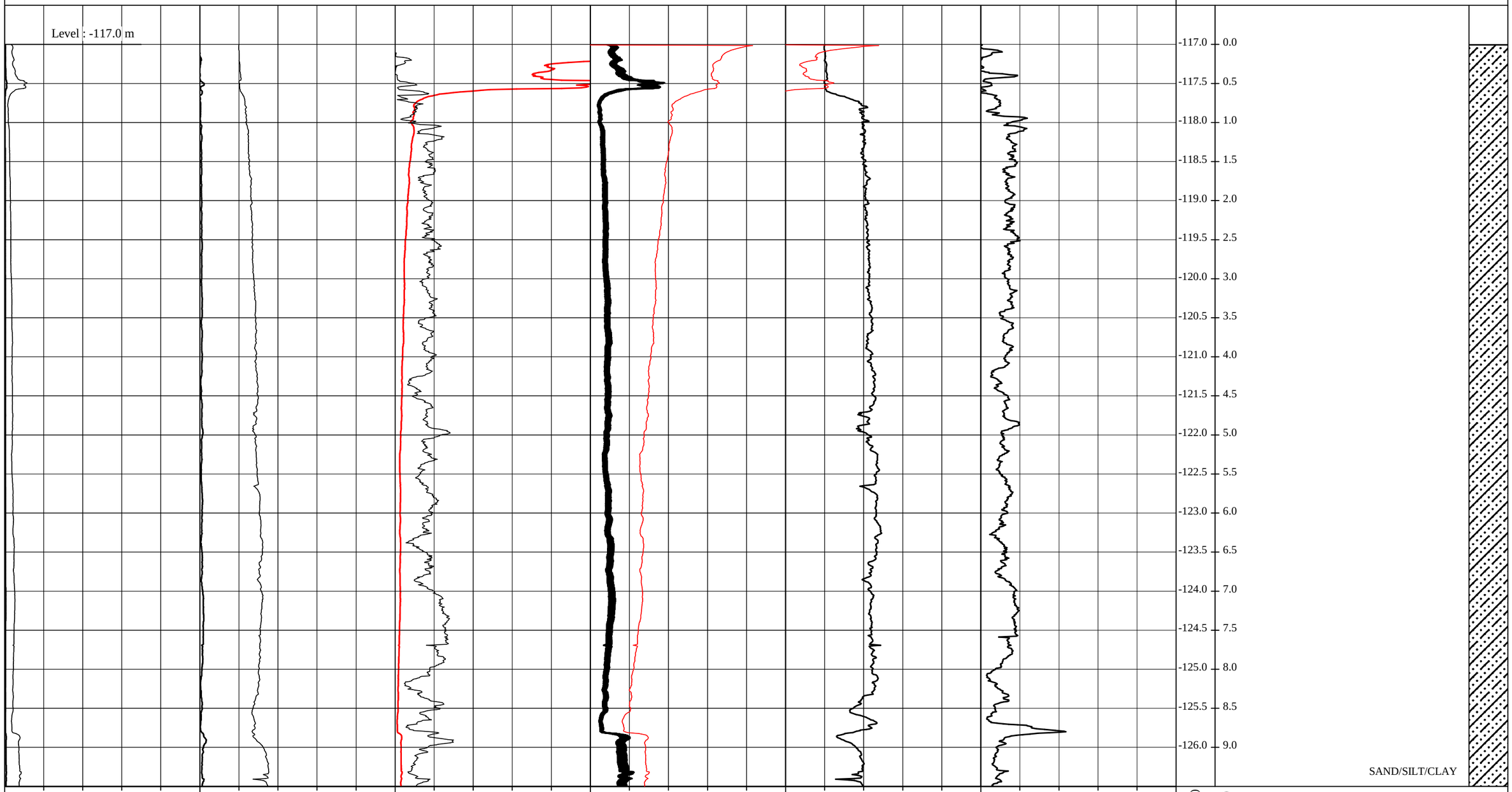
Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-112b

CPT name : ST14460-CPT-113



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 600845.2	Cone no.	: 130711	Rig	: GEOScope
N	: 6372685.7	Cone type	: TSP	Performed by	: JPM/2014-03-31 04:48:14
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

GEO Danish Geotechnical Institute — Project : 36685 Hywind

Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles
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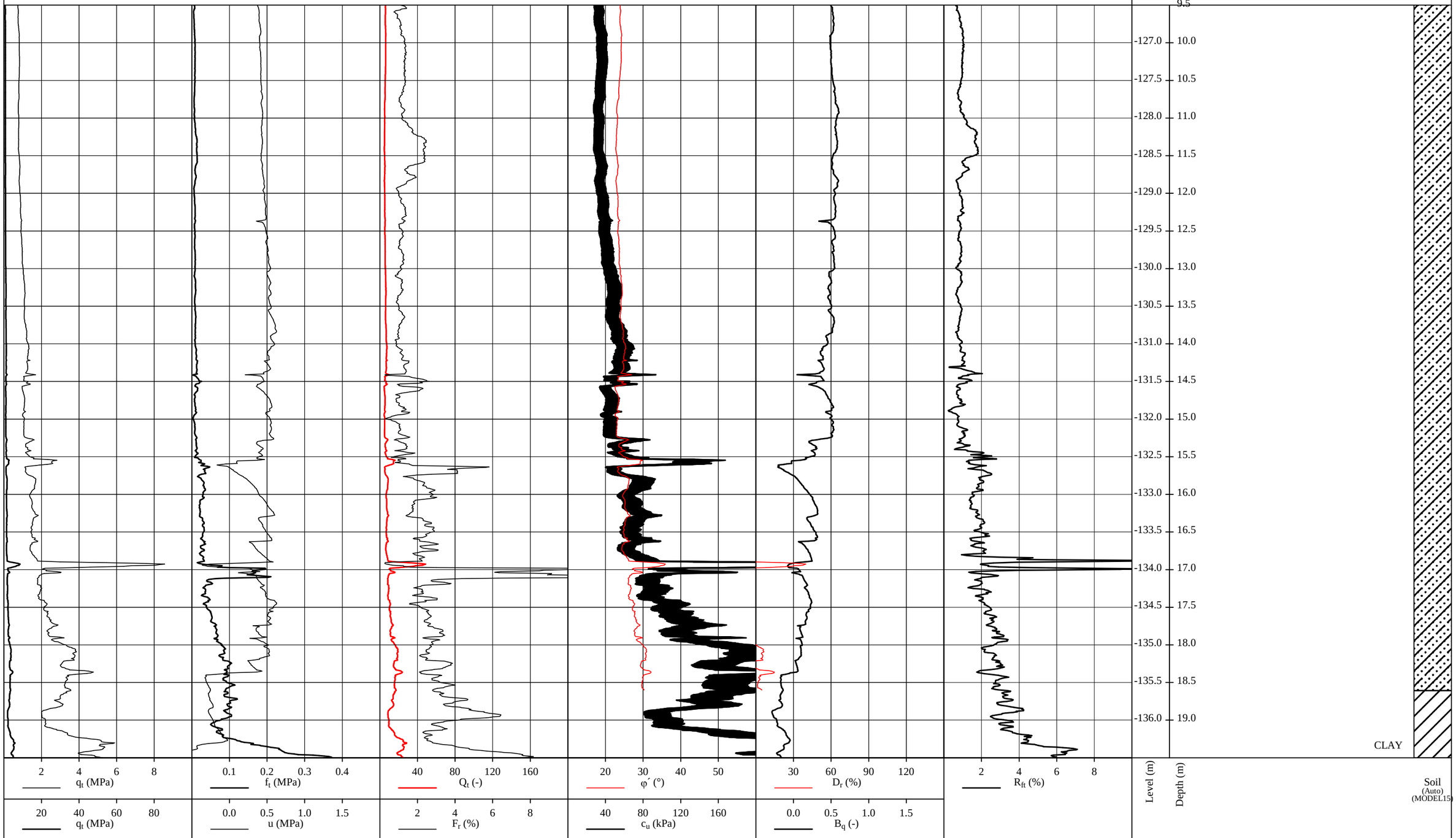
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-113

Perceptor - 1.5.10.127

Printed 2014-05-06 09:40:34

CPT name : ST14460-CPT-113



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 600845.2	Cone no.	: 130711	Rig	: GEOScope
N	: 6372685.7	Cone type	: TSP	Performed by	: JPM/2014-03-31 04:48:14
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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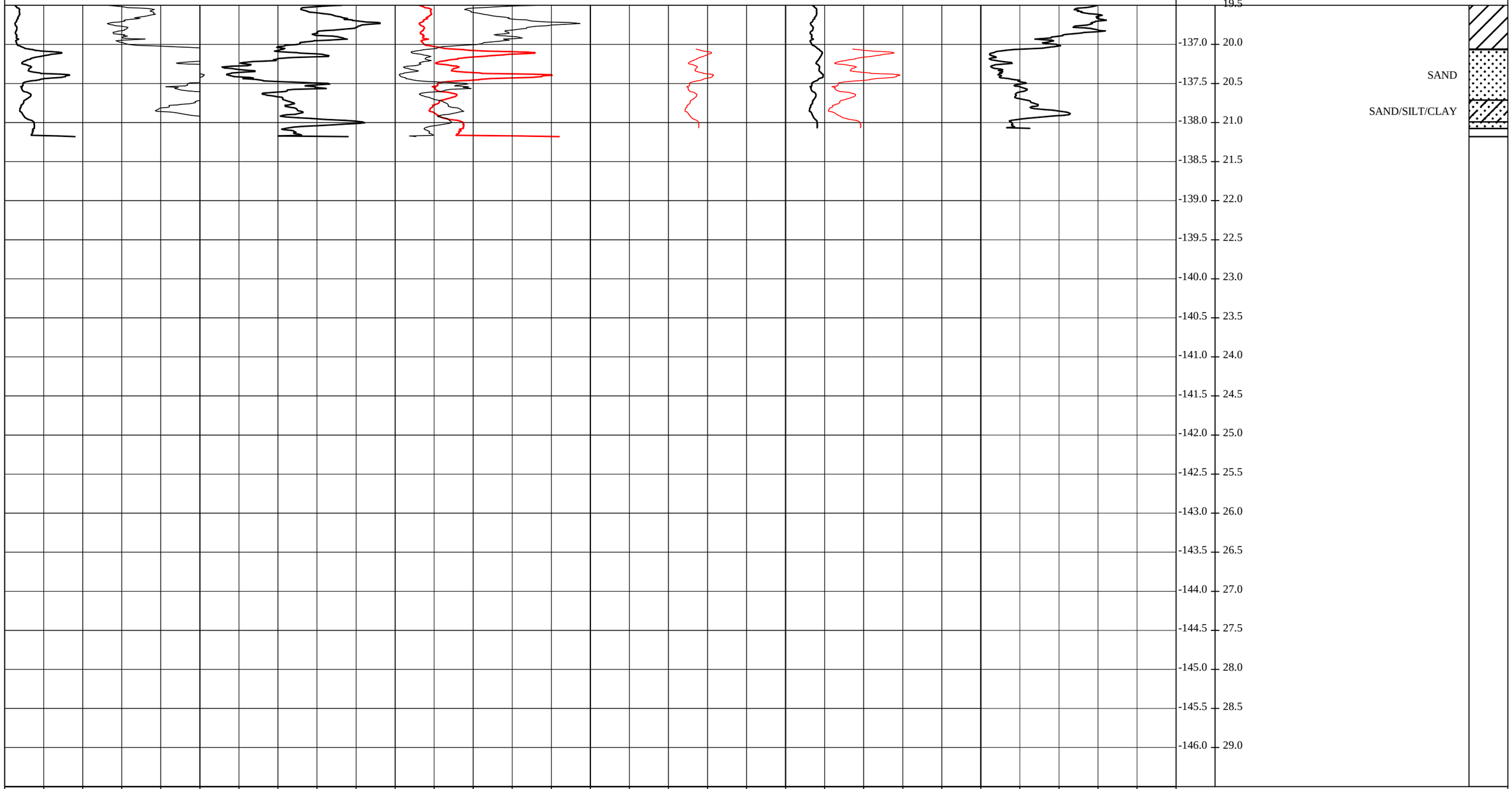
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-113

Printed 2014-05-06 09:40:39

CPT name : ST14460-CPT-113



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E	: 600845.2	Cone no.	: 130711	Rig	: GEOScope
N	: 6372685.7	Cone type	: TSP	Performed by	: JPM/2014-03-31 04:48:14
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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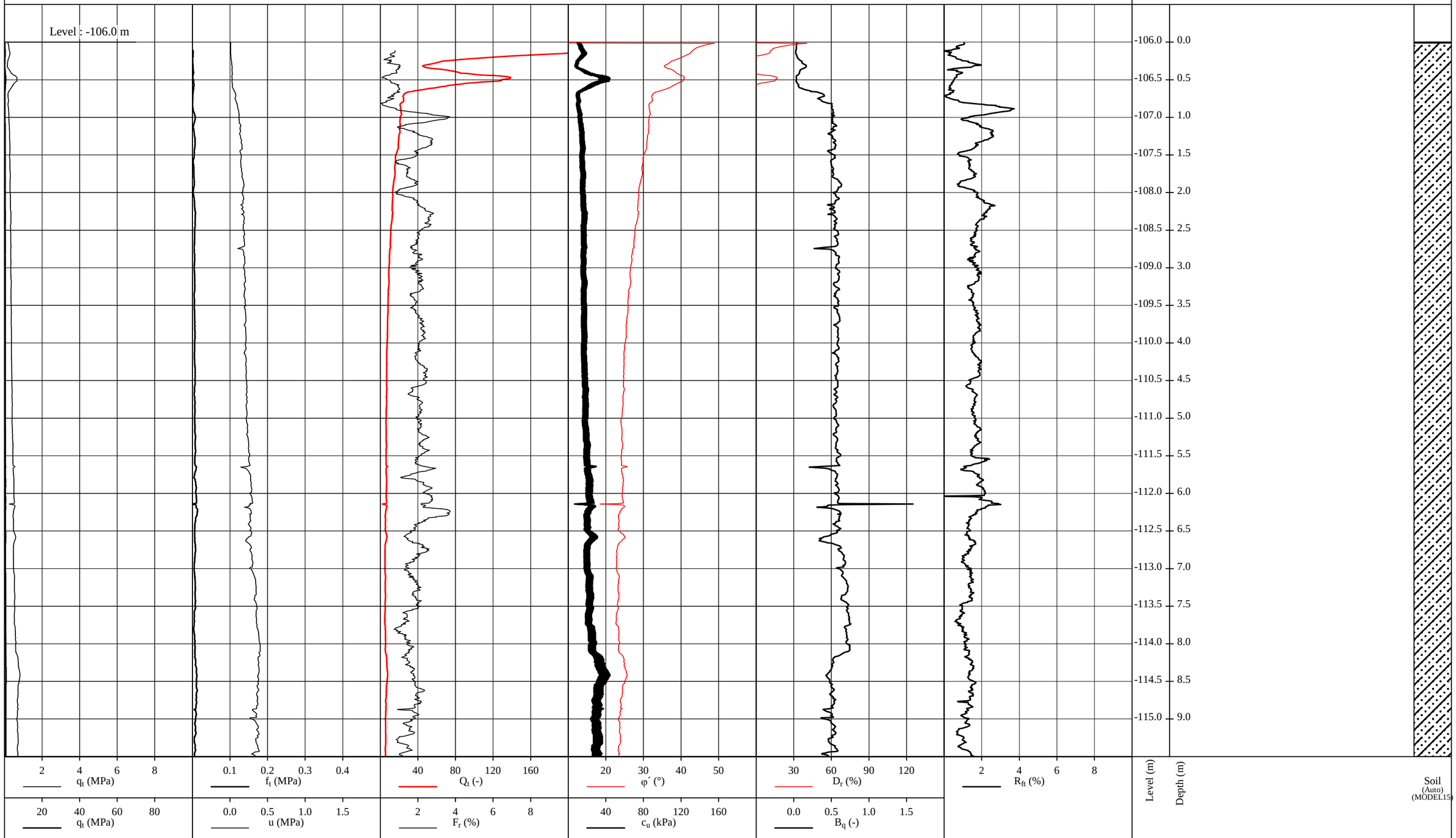
Printed 2014-05-06 09:40:44

CPT name : ST14460-CPT-121

Level : -106.0 m



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598345.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6373747.8	Cone type	: TSP	Performed by	: ALJ/2014-03-31 22:41:56
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles	
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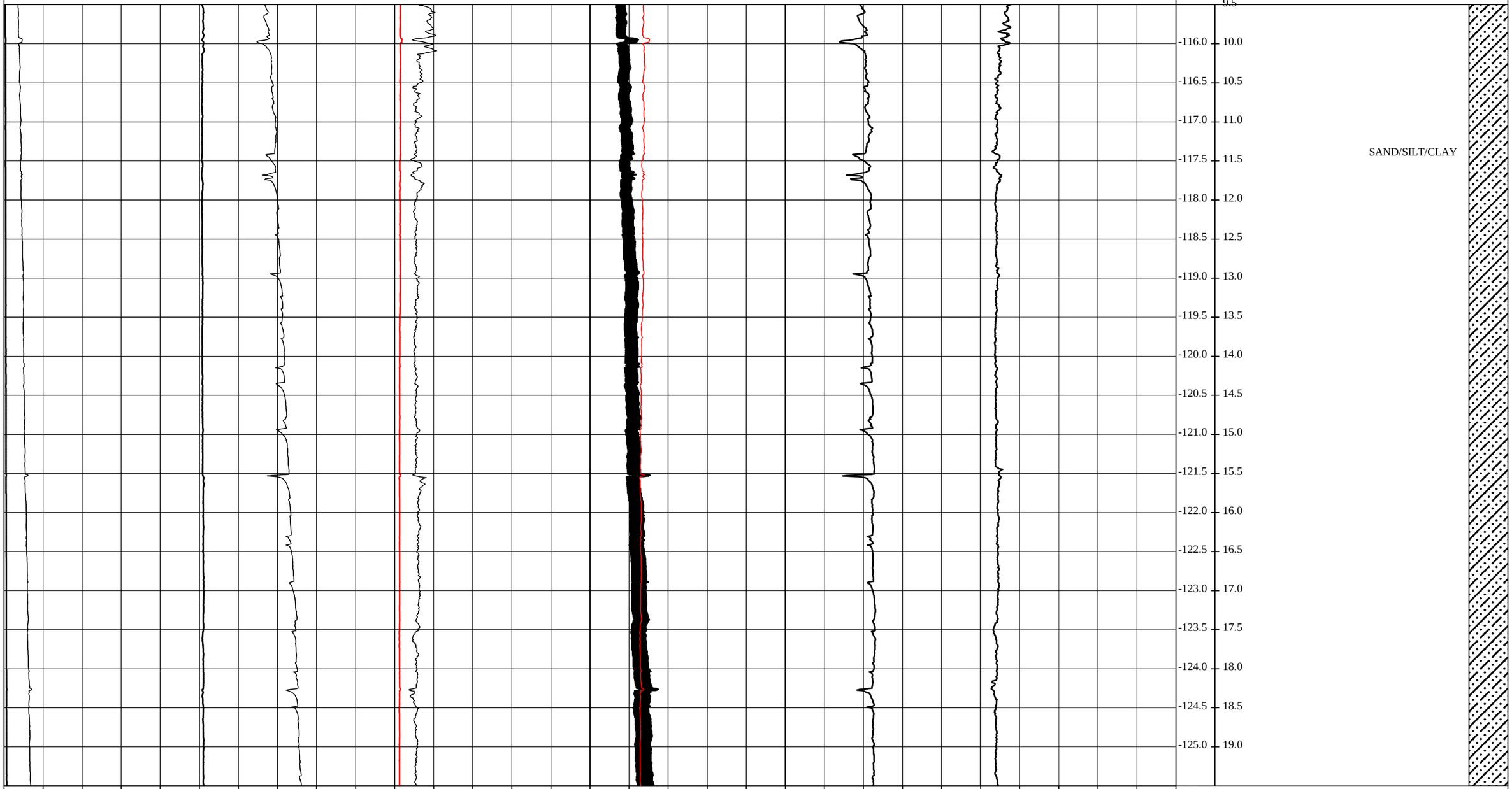
Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-121

CPT name : ST14460-CPT-121



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E	: 598345.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6373747.8	Cone type	: TSP	Performed by	: ALJ/2014-03-31 22:41:56
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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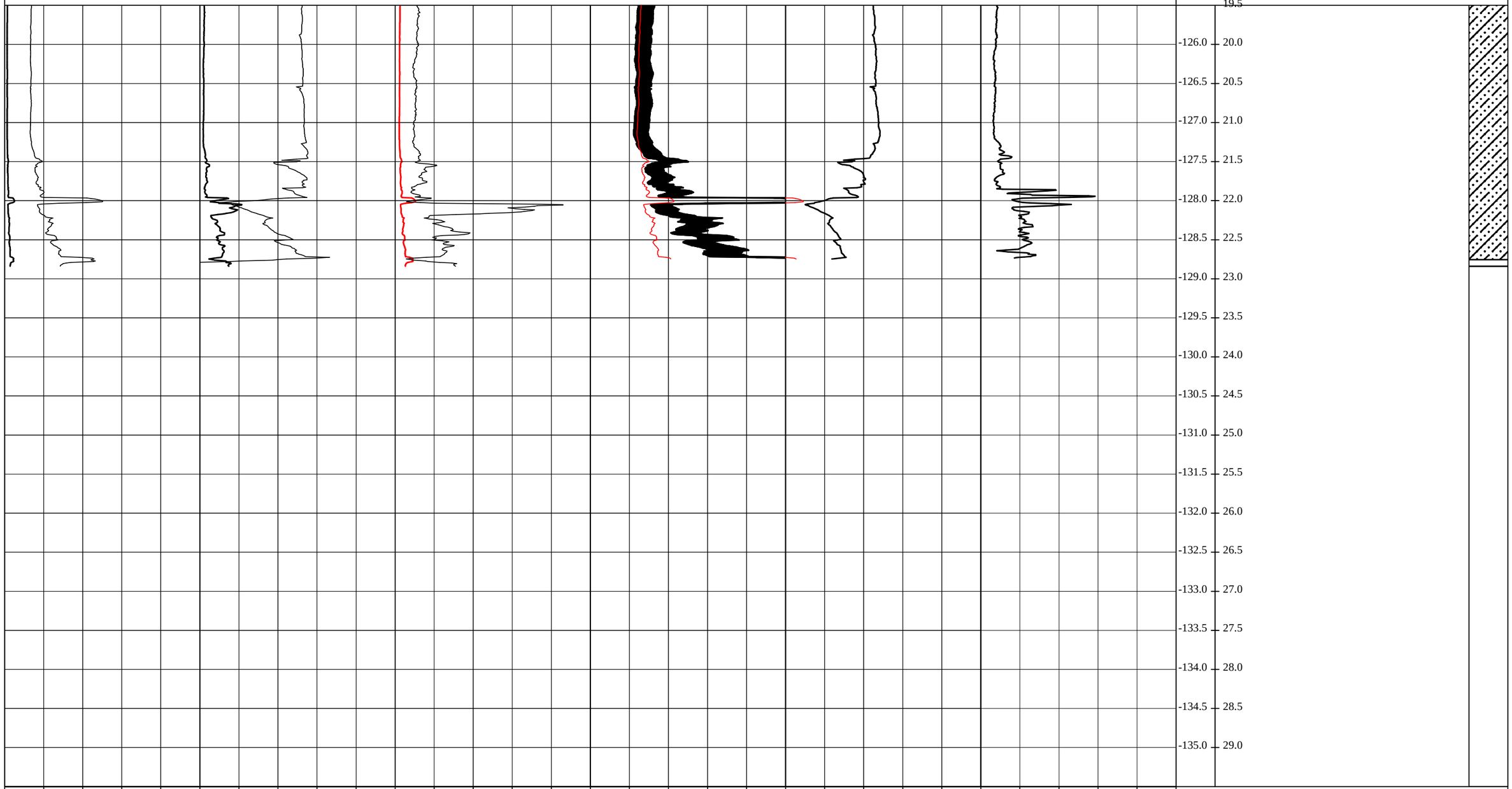
Approved	: CLB	Date : 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-121

CPT name : ST14460-CPT-121



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E	: 598345.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6373747.8	Cone type	: TSP	Performed by	: ALJ/2014-03-31 22:41:56
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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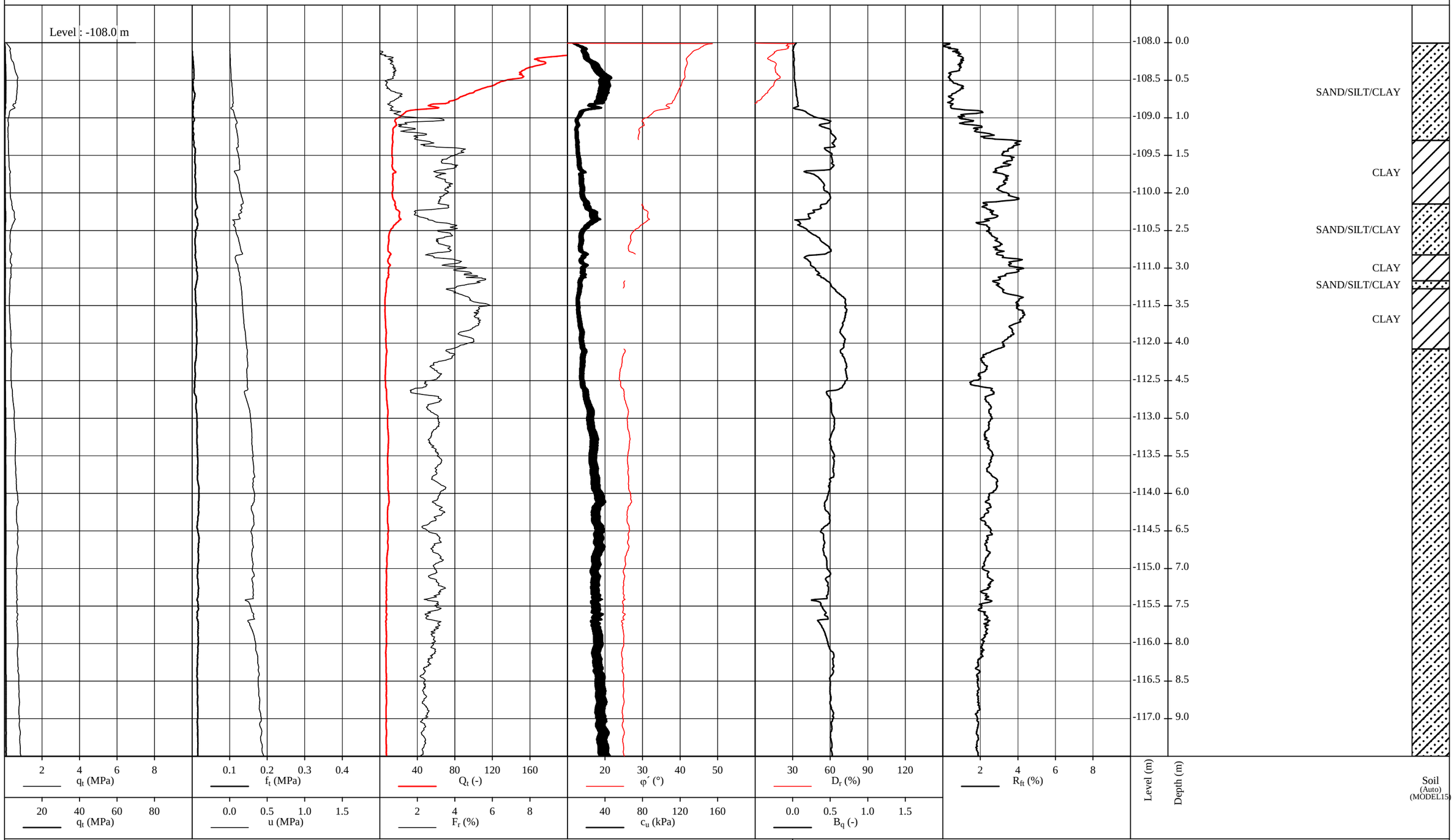
CPT name : ST14460-CPT-122



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E	: 598525.8	Cone no.	: 130810	Rig	: GEOScope
N	: 6372519.3	Cone type	: TSP	Performed by	: JPM/2014-03-30 06:47:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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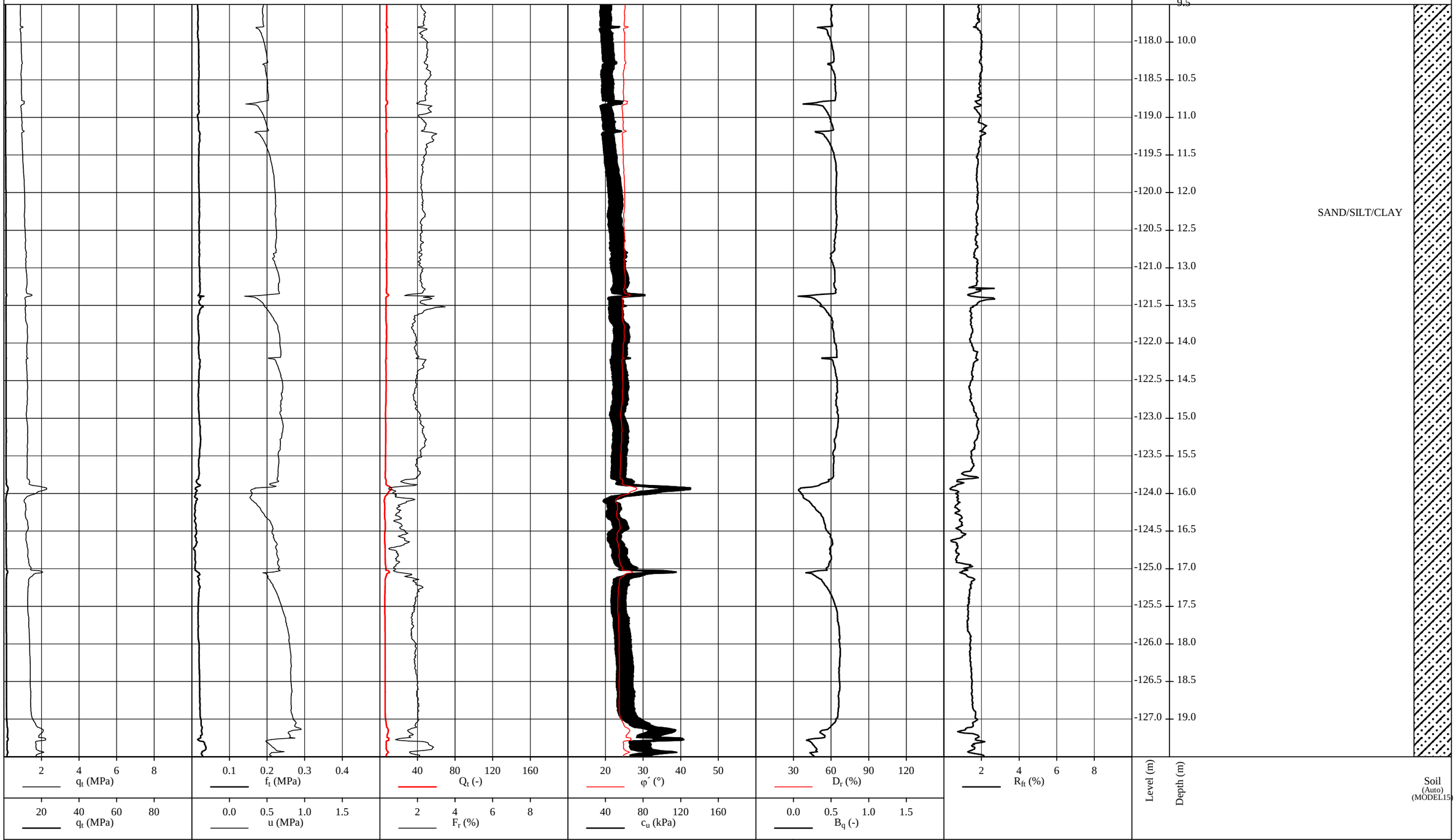
Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-122

Printed 2014-05-06 09:42:15

CPT name : ST14460-CPT-122



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598525.8	Cone no.	: 130810	Rig	: GEOScope
N	: 6372519.3	Cone type	: TSP	Performed by	: JPM/2014-03-30 06:47:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

Danish Geotechnical Institute — Project : 36685 Hywind

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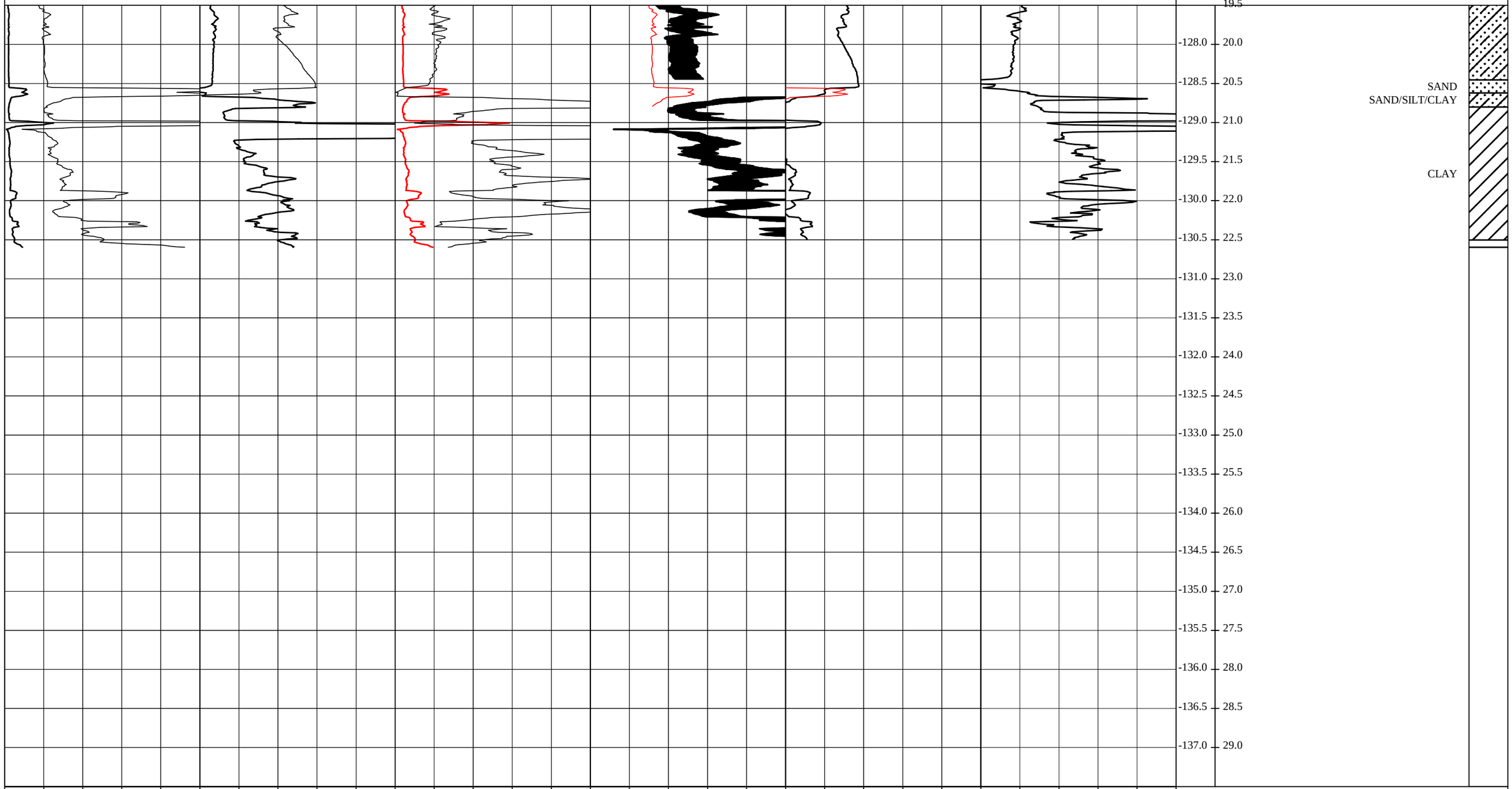
Approved	: CLB	Date : 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-122

CPT name : ST14460-CPT-122



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E	: 598525.8	Cone no.	: 130810	Rig	: GEOScope
N	: 6372519.3	Cone type	: TSP	Performed by	: JPM/2014-03-30 06:47:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles
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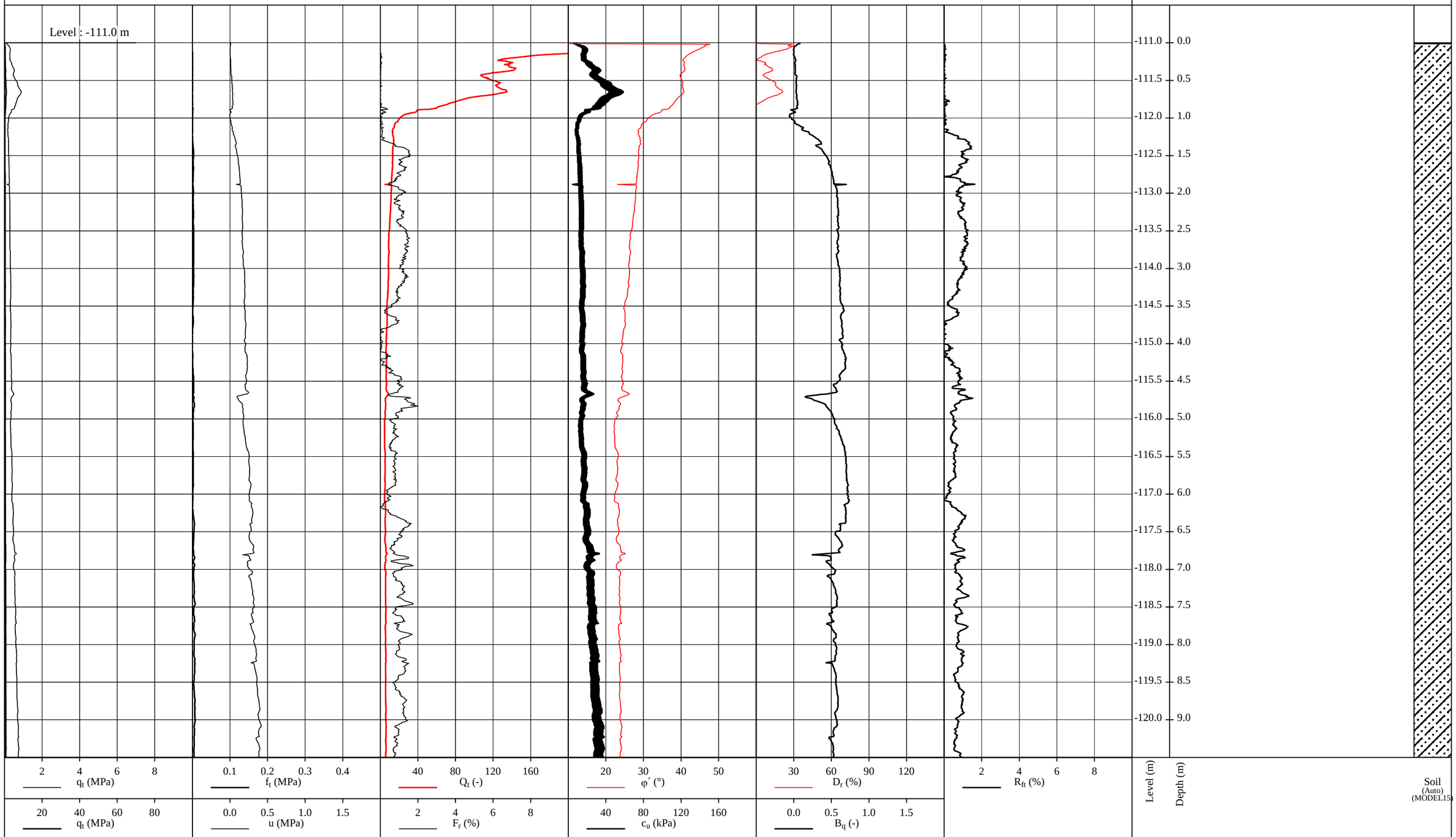
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-122

Perceptor - 1.5.10.127

Printed 2014-05-06 09:42:25

CPT name : ST14460-CPT-123



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599548.5	Cone no.	: 130711	Rig	: GEOScope
N	: 6373343.3	Cone type	: TSP	Performed by	: JPM/2014-03-31 08:42:24
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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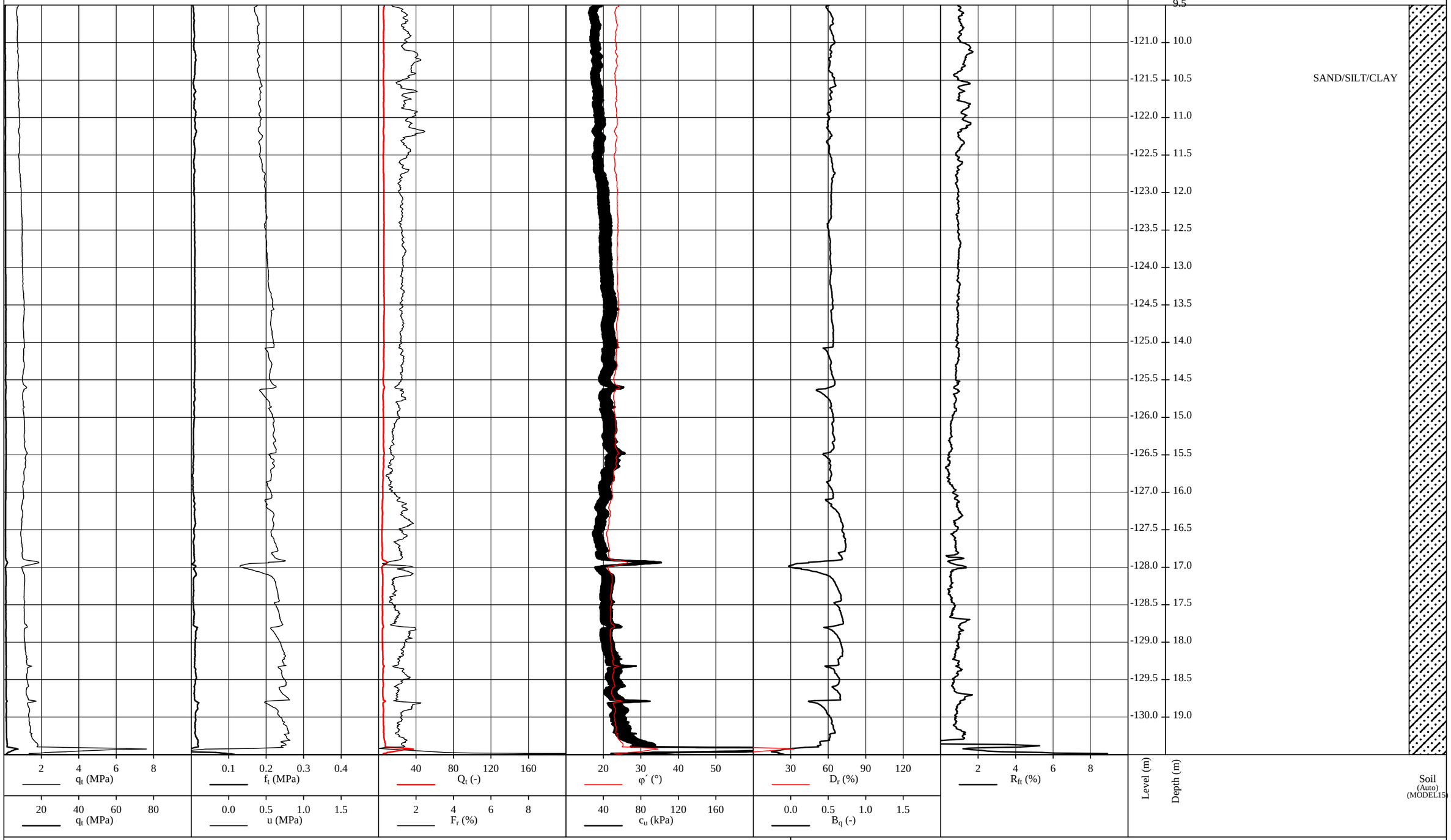
Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-123

Perceptor - 1.5.10.127

Printed 2014-05-06 09:43:04

CPT name : ST14460-CPT-123



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599548.5	Cone no.	: 130711	Rig	: GEOScope
N	: 6373343.3	Cone type	: TSP	Performed by	: JPM/2014-03-31 08:42:24
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles
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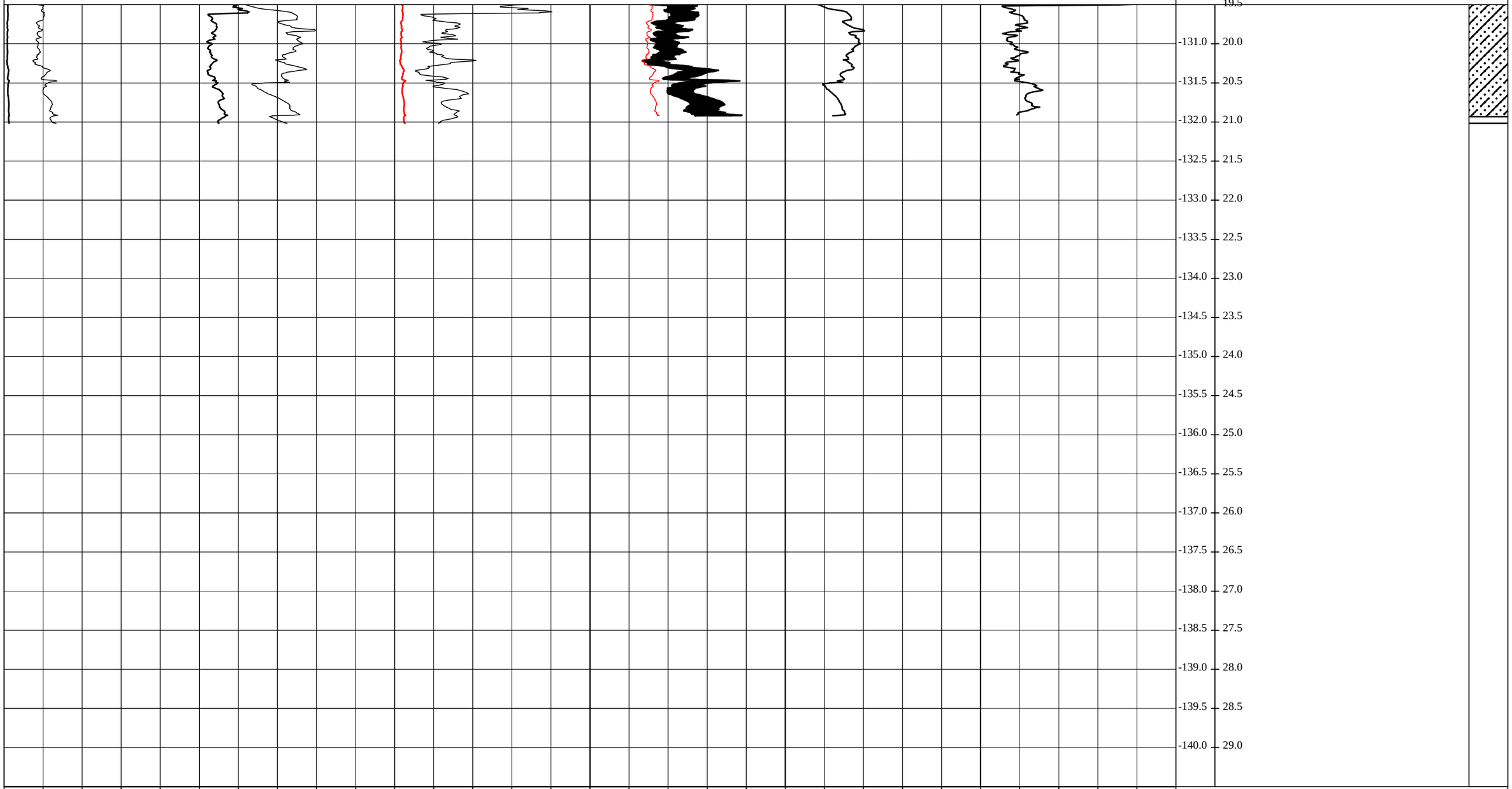
Printed 2014-05-06 09:43:09

CPT name : ST14460-CPT-123



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E	: 599548.5	Cone no.	: 130711	Rig	: GEOScope
N	: 6373343.3	Cone type	: TSP	Performed by	: JPM/2014-03-31 08:42:24
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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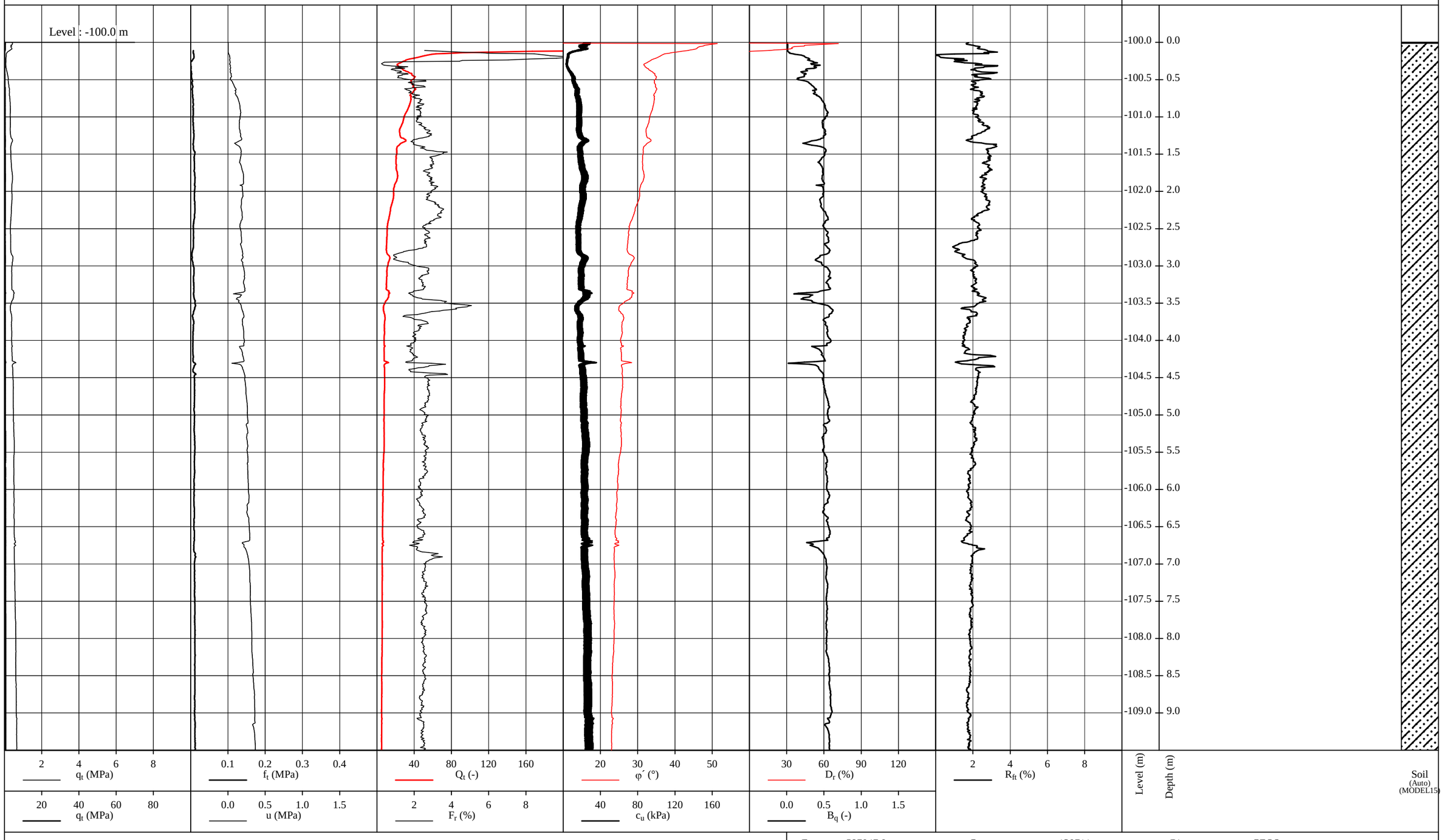
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-123

CPT name : ST14460-CPT-131



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E	: 597047.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6374478.2	Cone type	: TSP	Performed by	: ALJ/2014-03-30 15:16:33
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles	
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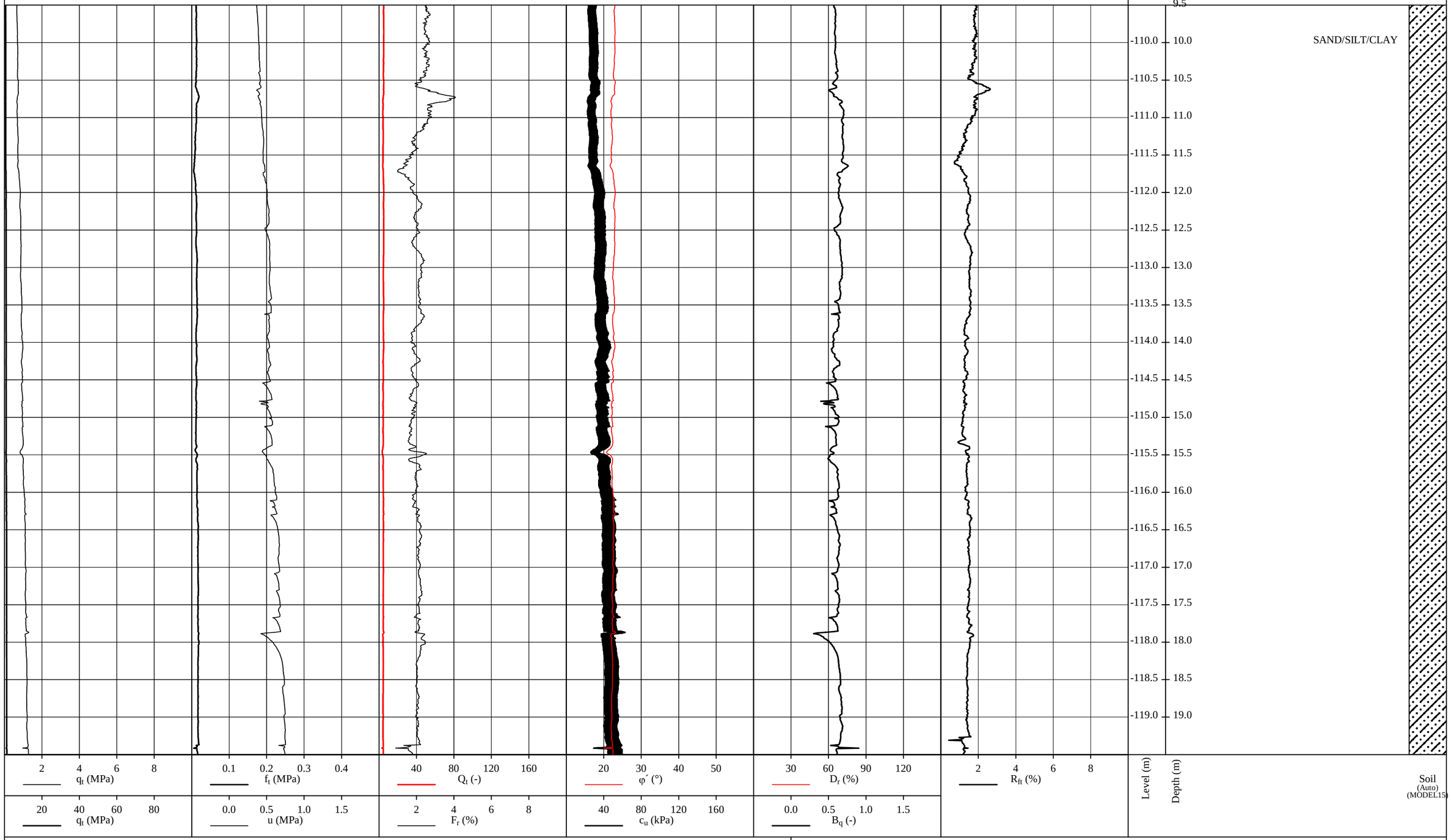
Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-131

Perceptor - 1.5.10.127

Printed 2014-05-06 09:43:57

CPT name : ST14460-CPT-131



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E	: 597047.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6374478.2	Cone type	: TSP	Performed by	: ALJ/2014-03-30 15:16:33
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles
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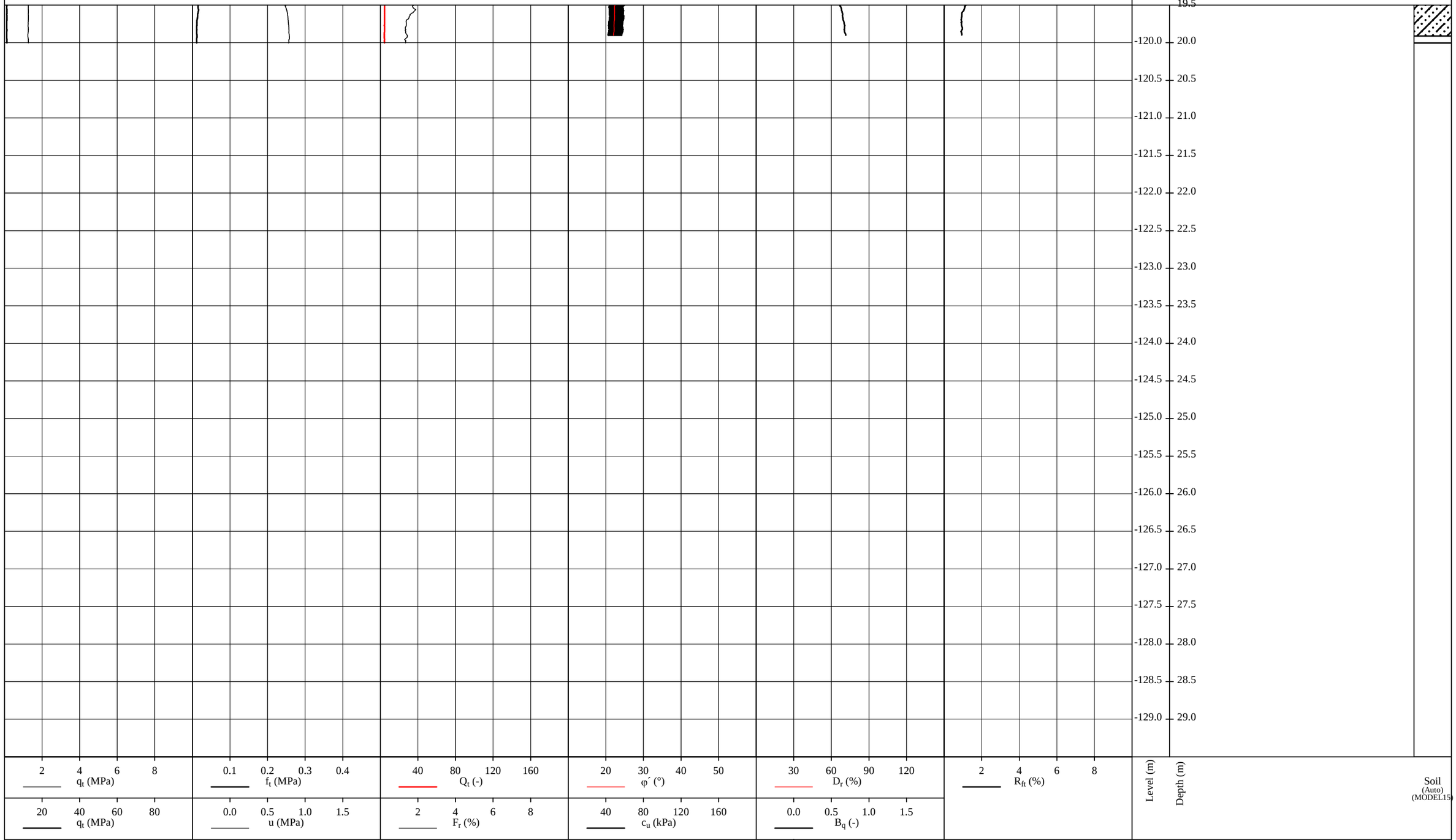
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-131

Perceptor - 1.5.10.127

Printed 2014-05-06 09:44:02

CPT name : ST14460-CPT-131



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E	: 597047.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6374478.2	Cone type	: TSP	Performed by	: ALJ/2014-03-30 15:16:33
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

GEO Danish Geotechnical Institute — Project : 36685 Hywind

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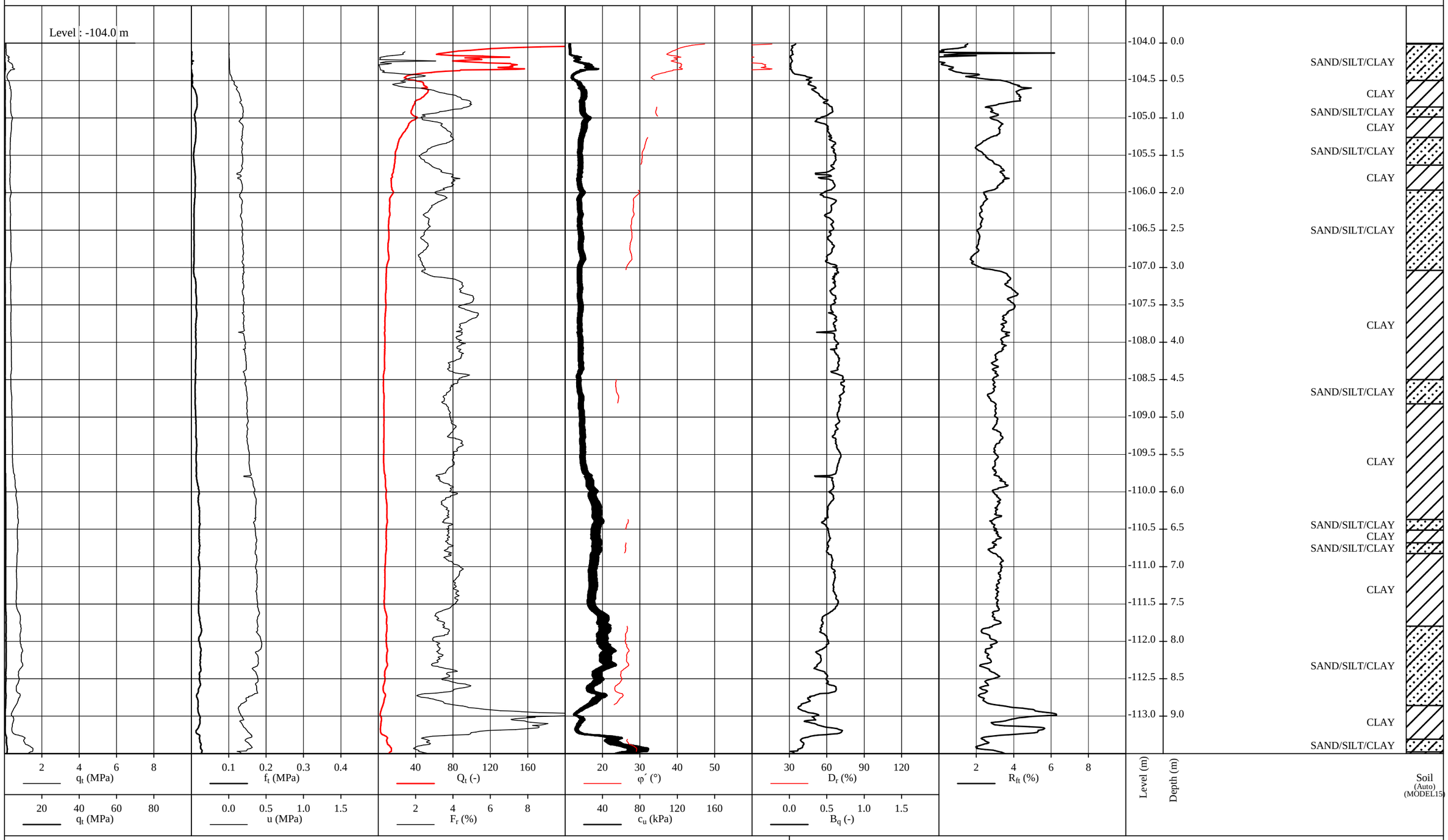
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-131

Printed 2014-05-06 09:44:07

CPT name : ST14460-CPT-132

Level : -104.0 m



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 597347.0	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373118.2	Cone type	: TSP	Performed by	: JPM/2014-04-02 08:54:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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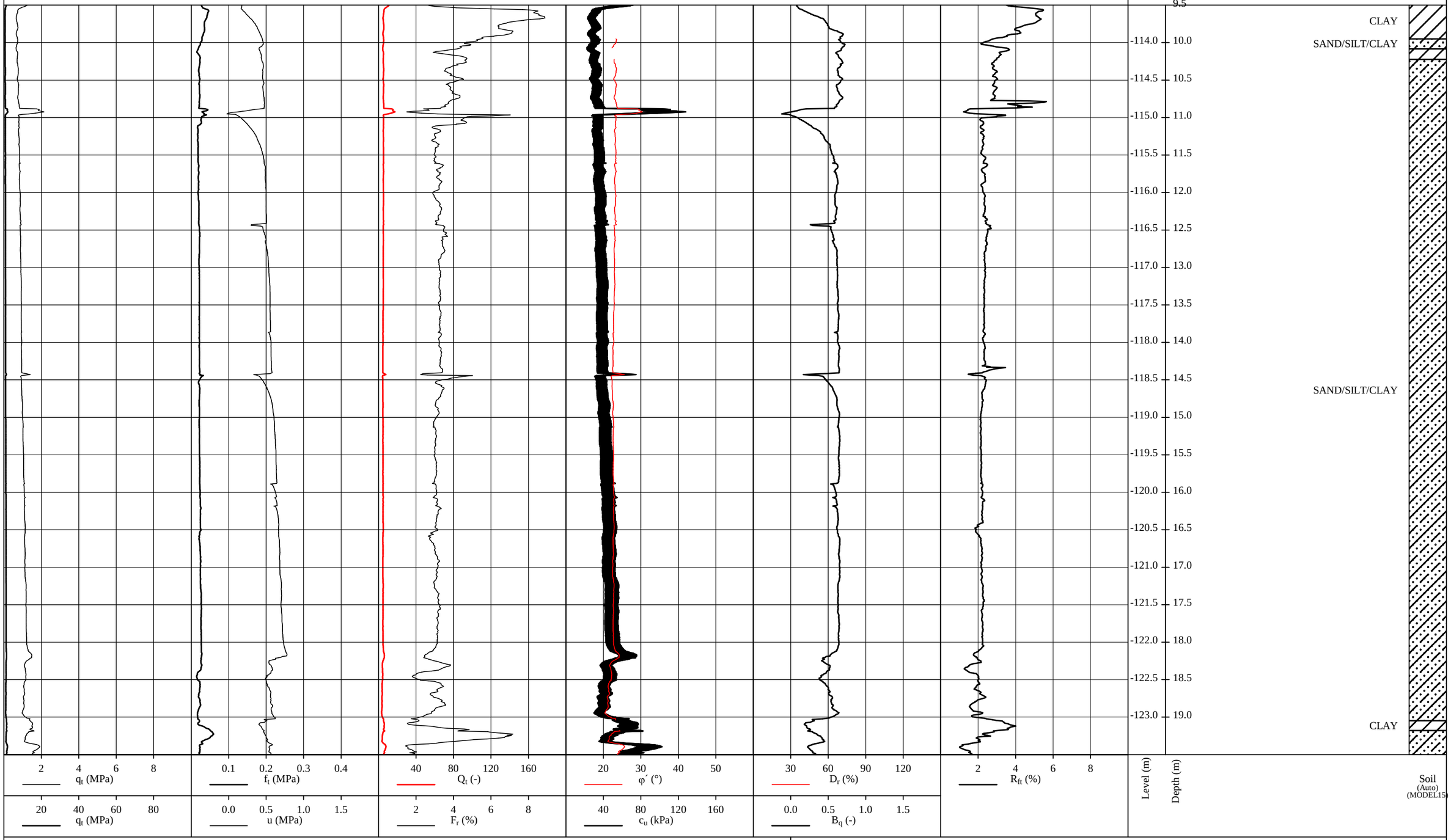
Printed 2014-05-06 09:44:48

CPT name : ST14460-CPT-132



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 597347.0	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373118.2	Cone type	: TSP	Performed by	: JPM/2014-04-02 08:54:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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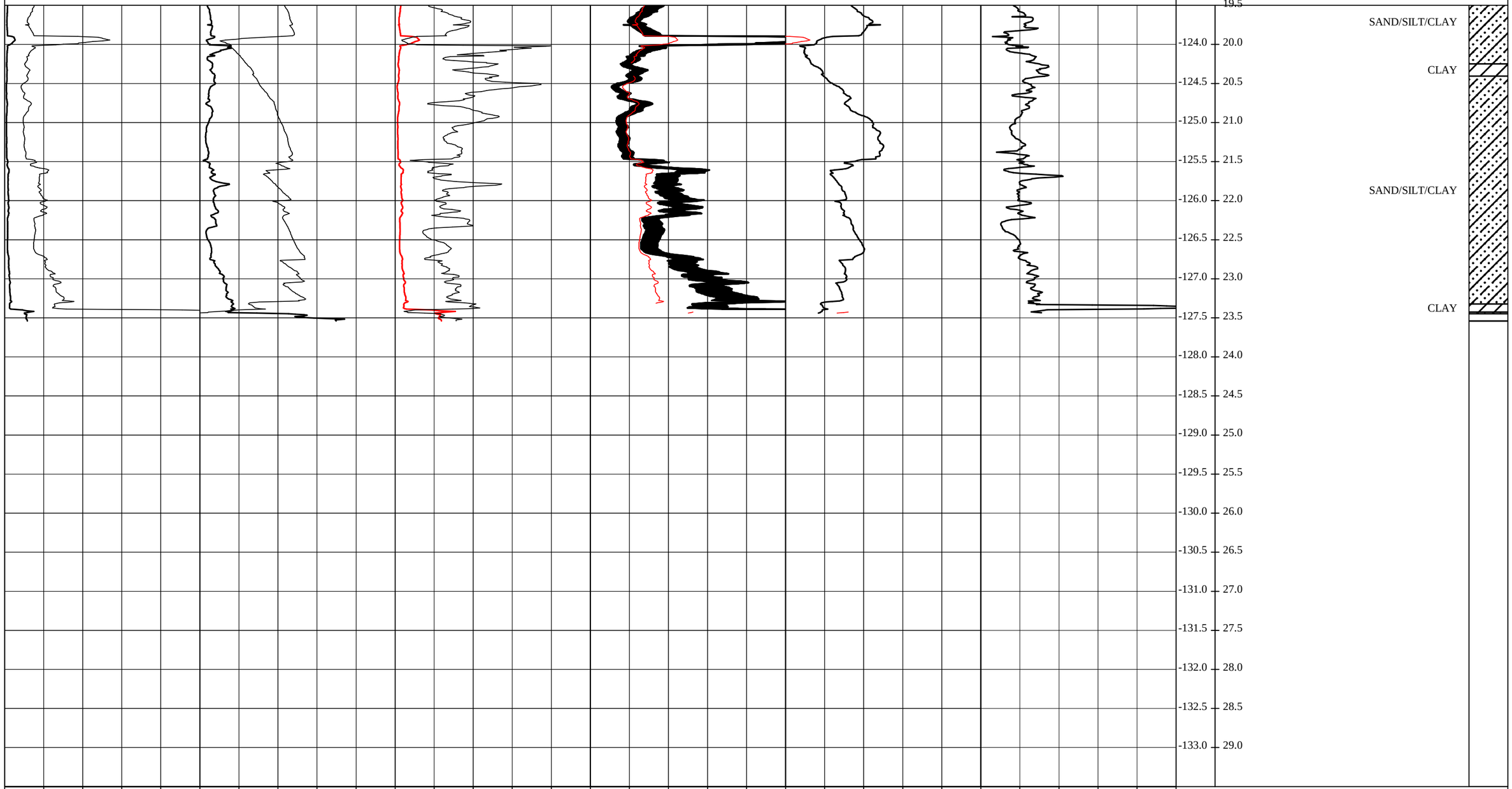
CPT name : ST14460-CPT-132



2 4 6 8 q_t (MPa)
20 40 60 80 q_t (MPa)
0.1 0.2 0.3 0.4 f_t (MPa)
0.0 0.5 1.0 1.5 u (MPa)
40 80 120 160 Q_t (-)
2 4 6 8 F_r (%)
20 30 40 50 φ' (°)
40 80 120 160 c_u (kPa)
30 60 90 120 D_r (%)
0.0 0.5 1.0 1.5 B_q (-)
2 4 6 8 R_{ft} (%)
Level (m)
Depth (m)
Soil (Auto) (MODEL15)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 597347.0	Cone no.	: Icone121113	Rig	: GEOScope
N	: 6373118.2	Cone type	: TSP	Performed by	: JPM/2014-04-02 08:54:13
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Perceptor - 1.5.10.127

Printed 2014-05-06 09:44:57

CPT name : ST14460-CPT-133

Level : -106.0 m

-106.0 0.0
-106.5 0.5
-107.0 1.0
-107.5 1.5
-108.0 2.0
-108.5 2.5
-109.0 3.0
-109.5 3.5
-110.0 4.0
-110.5 4.5
-111.0 5.0
-111.5 5.5
-112.0 6.0
-112.5 6.5
-113.0 7.0
-113.5 7.5
-114.0 8.0
-114.5 8.5
-115.0 9.0

SAND/SILT/CLAY

2 4 6 8
q_t (MPa)

20 40 60 80
q_t (MPa)

0.1 0.2 0.3 0.4
f_t (MPa)

0.0 0.5 1.0 1.5
u (MPa)

40 80 120 160
Q_t (-)

2 4 6 8
F_r (%)

20 30 40 50
φ´ (°)

40 80 120 160
c_u (kPa)

30 60 90 120
D_r (%)

0.0 0.5 1.0 1.5
B_q (-)

2 4 6 8
R_{ft} (%)

Level (m)

Depth (m)

Soil
(Auto)
(MODEL15)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598349.7	Cone no.	: 130810	Rig	: GEOScope
N	: 6374087.6	Cone type	: TSP	Performed by	: JPM/2014-03-30 09:34:09
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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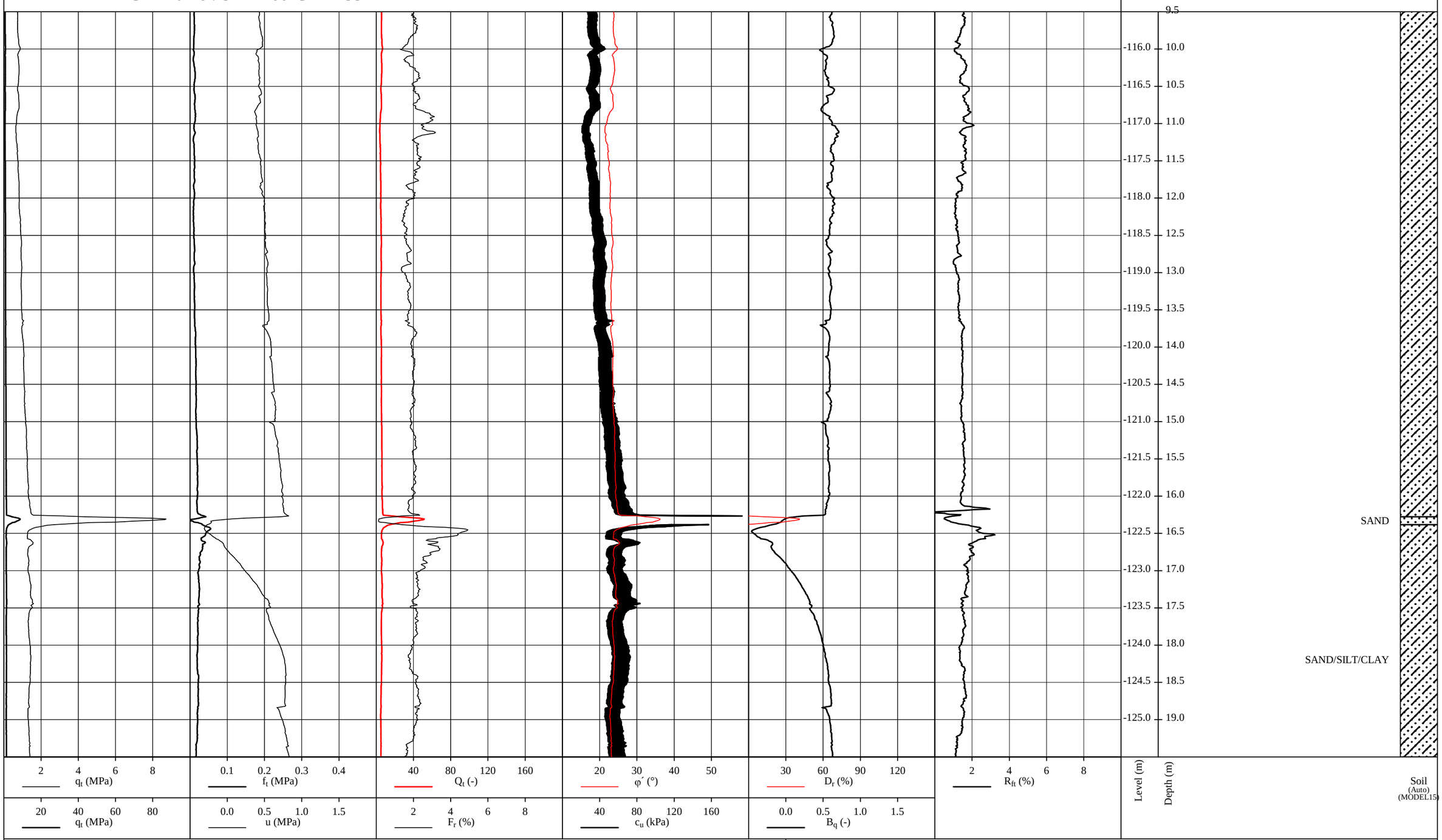
CPT name : ST14460-CPT-133



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598349.7	Cone no.	: 130810	Rig	: GEOScope
N	: 6374087.6	Cone type	: TSP	Performed by	: JPM/2014-03-30 09:34:09
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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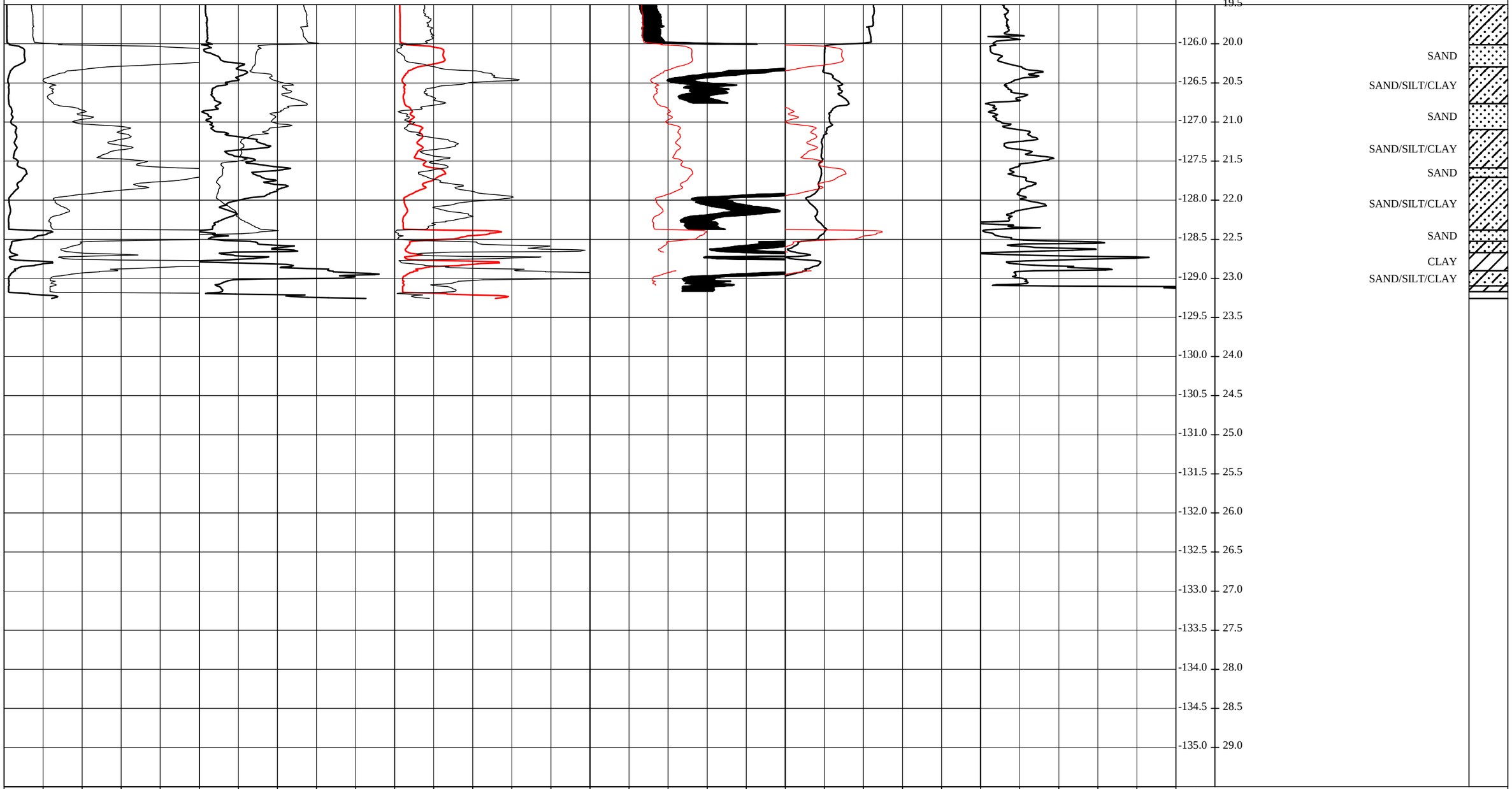
Printed 2014-05-06 09:45:37

CPT name : ST14460-CPT-133



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598349.7	Cone no.	: 130810	Rig	: GEOScope
N	: 6374087.6	Cone type	: TSP	Performed by	: JPM/2014-03-30 09:34:09
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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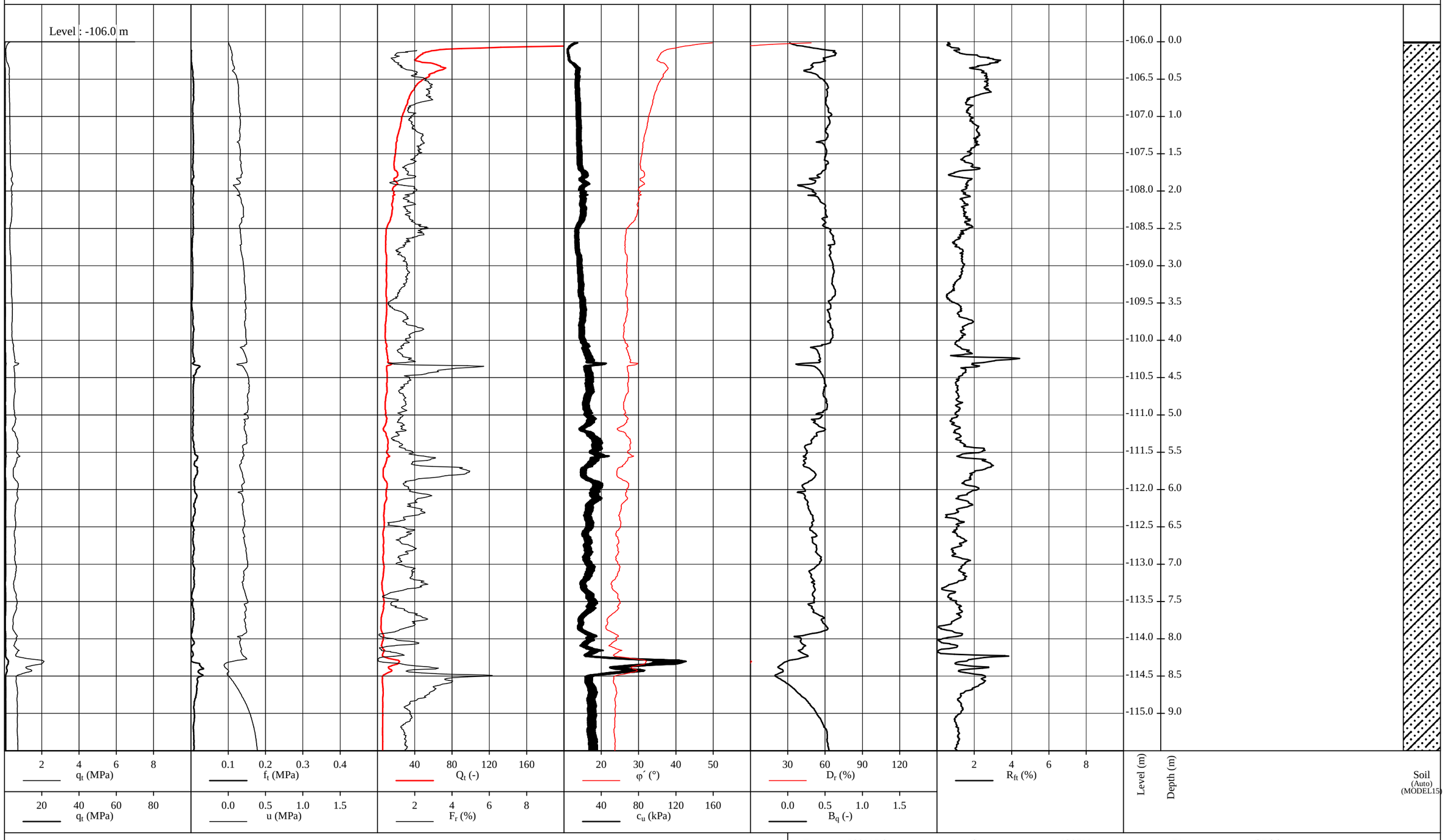
CPT name : ST14460-CPT-141

Level : -106.0 m



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598112.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6372212.9	Cone type	: TSP	Performed by	: ALJ/2014-03-31 15:57:25
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-141

Printed 2014-05-06 09:47:17

Perceptor - 1.5.10.127

CPT name : ST14460-CPT-141

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598112.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6372212.9	Cone type	: TSP	Performed by	: ALJ/2014-03-31 15:57:25
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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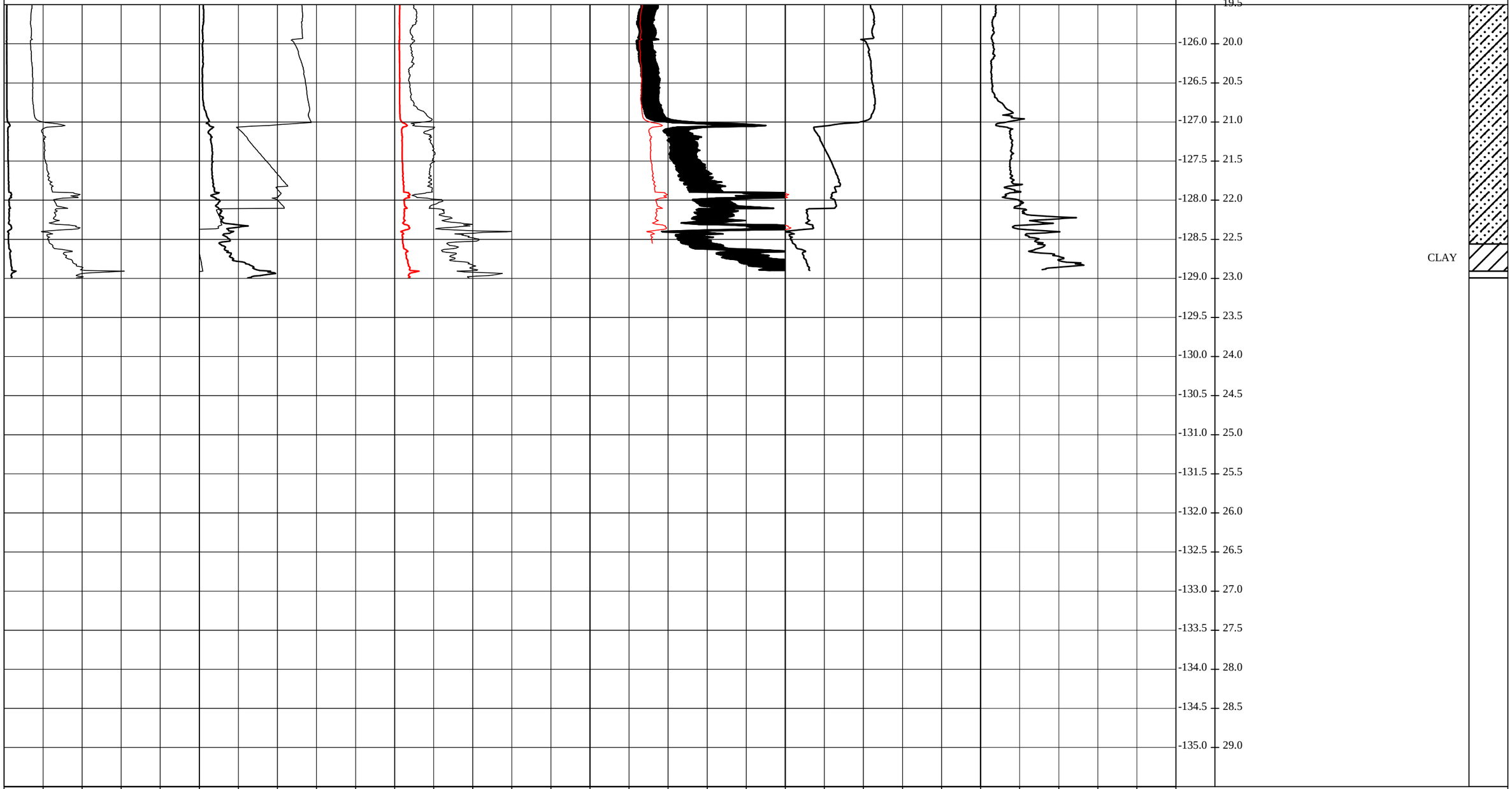
Approved	: CLB	Date: 2014-07-09	Report 1.0	Enclosure: 1.0E.01.ST14460-CPT-141

CPT name : ST14460-CPT-141



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598112.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6372212.9	Cone type	: TSP	Performed by	: ALJ/2014-03-31 15:57:25
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Printed 2014-05-06 09:47:28

CPT name : ST14460-CPT-142

Level : -111.0 m

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598785.2	Cone no.	: 130810	Rig	: GEOScope
N	: 6371019.4	Cone type	: TSP	Performed by	: JPM/2014-03-30 03:55:17
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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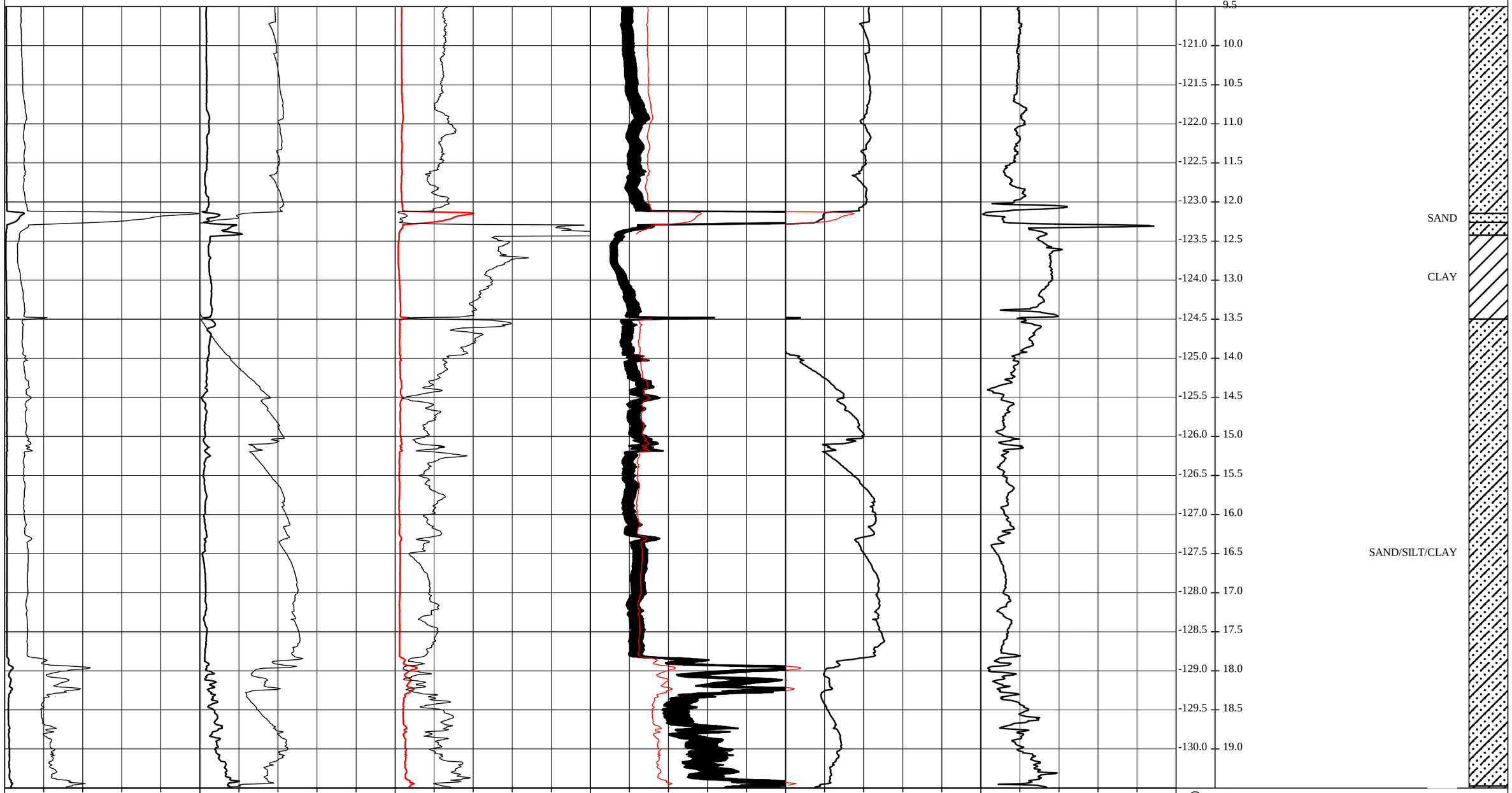
Perceptor - 1.5.10.127

Printed 2014-05-06 09:48:05

CPT name : ST14460-CPT-142



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598785.2	Cone no.	: 130810	Rig	: GEOScope
N	: 6371019.4	Cone type	: TSP	Performed by	: JPM/2014-03-30 03:55:17
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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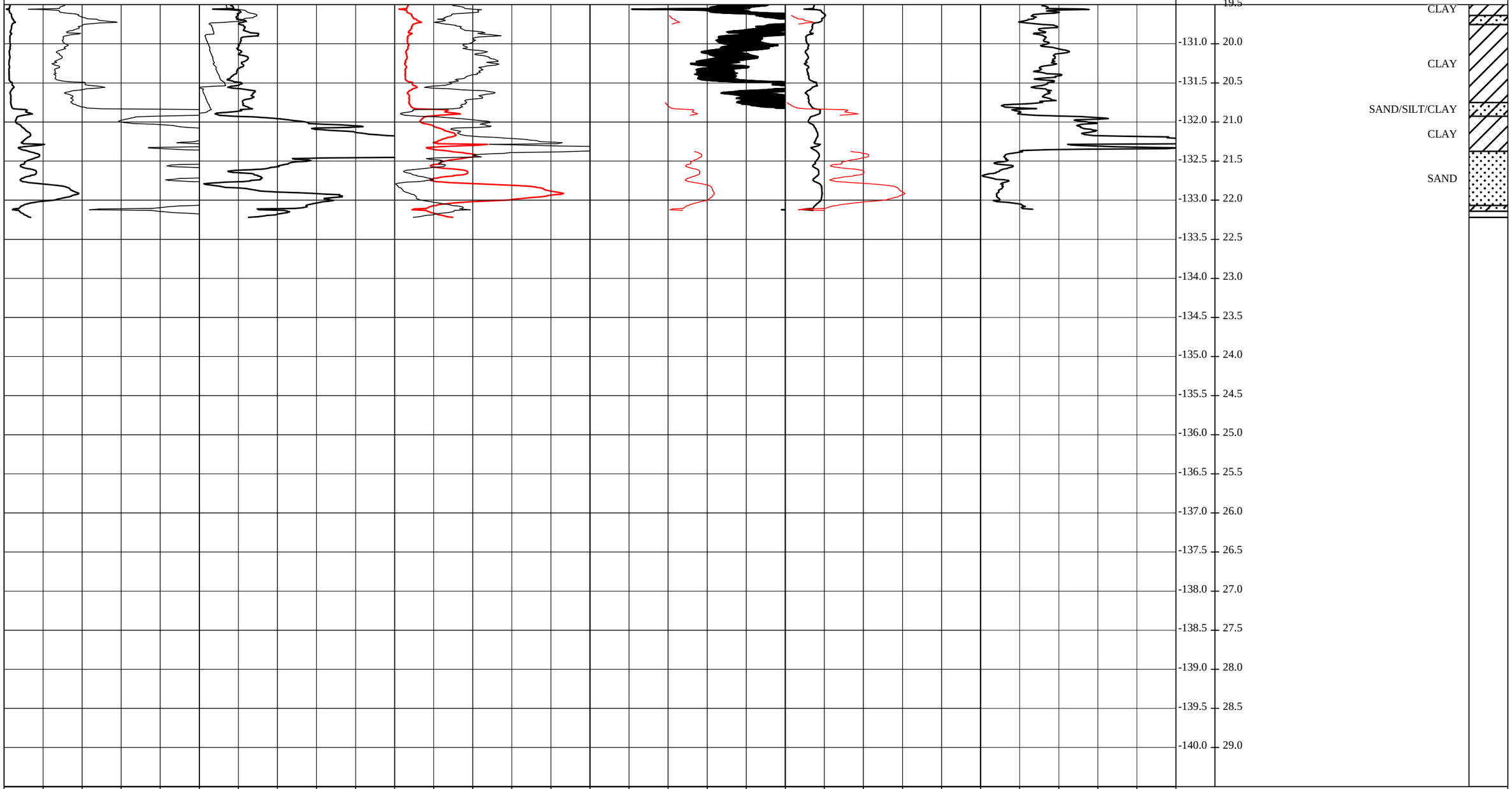
CPT name : ST14460-CPT-142



2 4 6 8 q_t (MPa)

20 40 60 80 q_t (MPa)

0.1 0.2 0.3 0.4 f_t (MPa)

0.0 0.5 1.0 1.5 u (MPa)

40 80 120 160 Q_t (-)

2 4 6 8 F_r (%)

20 30 40 50 φ' (°)

40 80 120 160 c_u (kPa)

30 60 90 120 D_r (%)

0.0 0.5 1.0 1.5 B_q (-)

2 4 6 8 R_{ft} (%)

Level (m)

Depth (m)

Soil
(Auto)
(MODEL15)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598785.2	Cone no.	: 130810	Rig	: GEOScope
N	: 6371019.4	Cone type	: TSP	Performed by	: JPM/2014-03-30 03:55:17
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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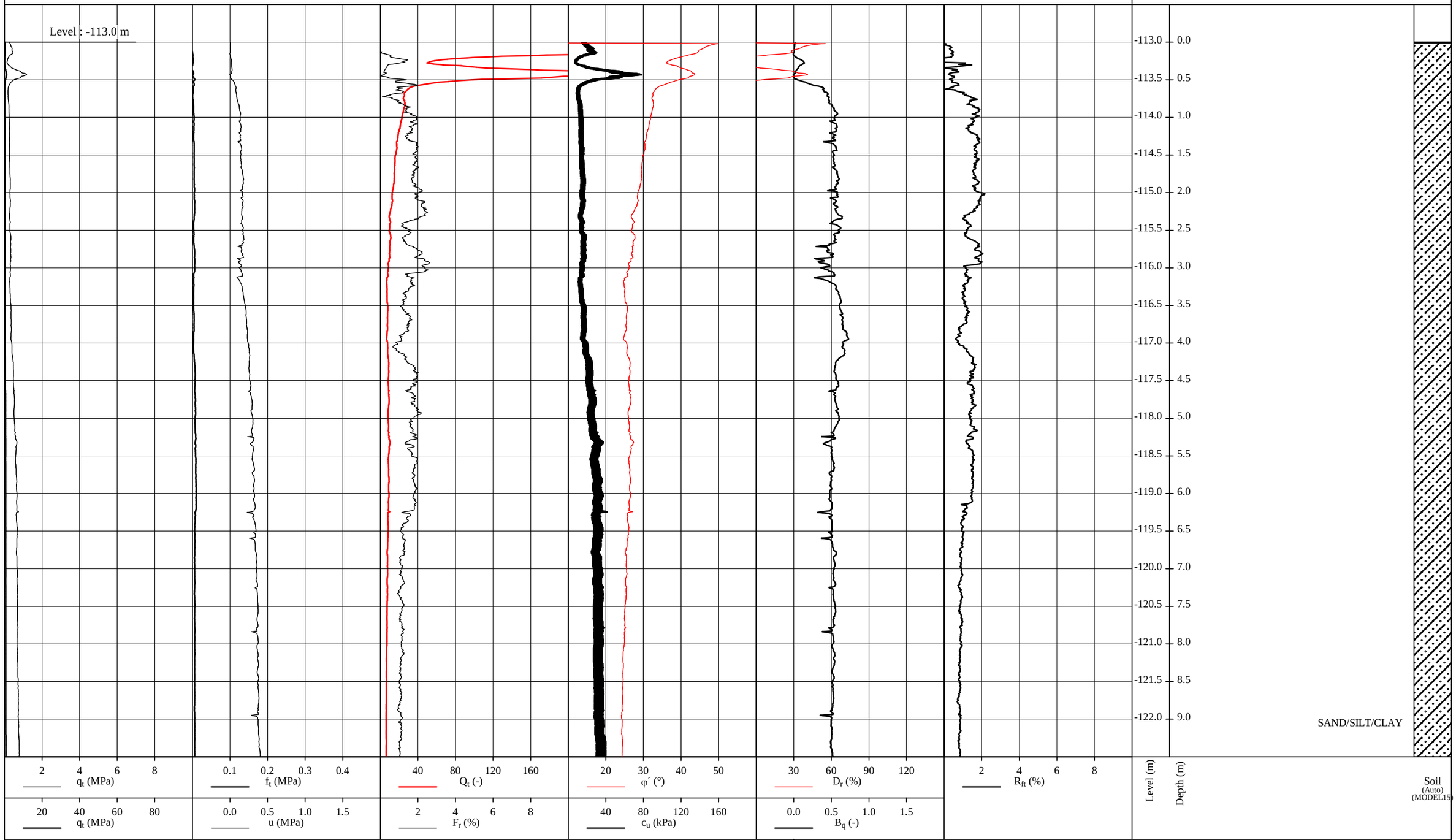
CPT name : ST14460-CPT-143



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599466.6	Cone no.	: 130711	Rig	: GEOScope
N	: 6372221.9	Cone type	: TSP	Performed by	: JPM/2014-03-31 11:08:12
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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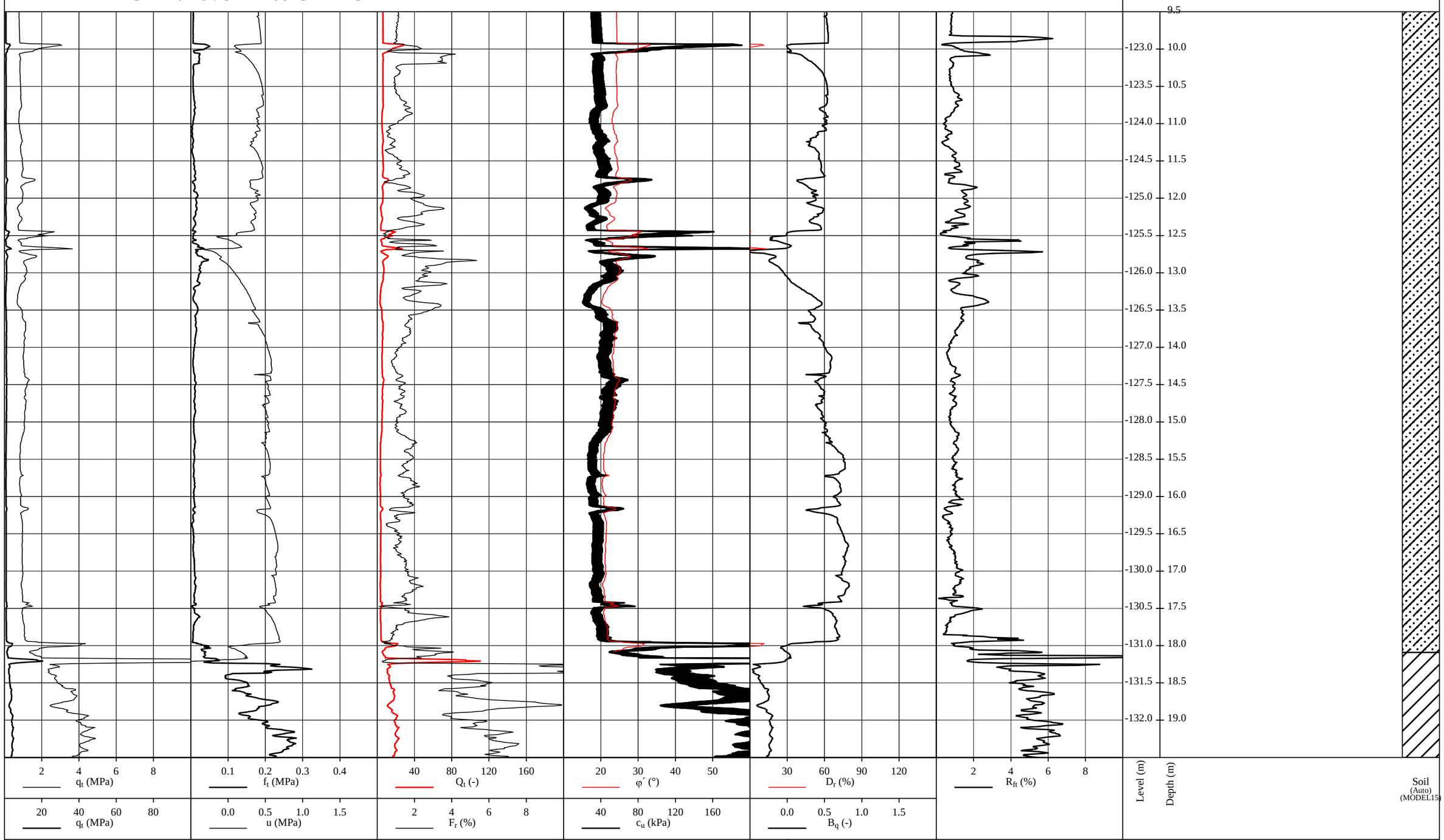
Printed 2014-05-06 09:48:59

CPT name : ST14460-CPT-143



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599466.6	Cone no.	: 130711	Rig	: GEOScope
N	: 6372221.9	Cone type	: TSP	Performed by	: JPM/2014-03-31 11:08:12
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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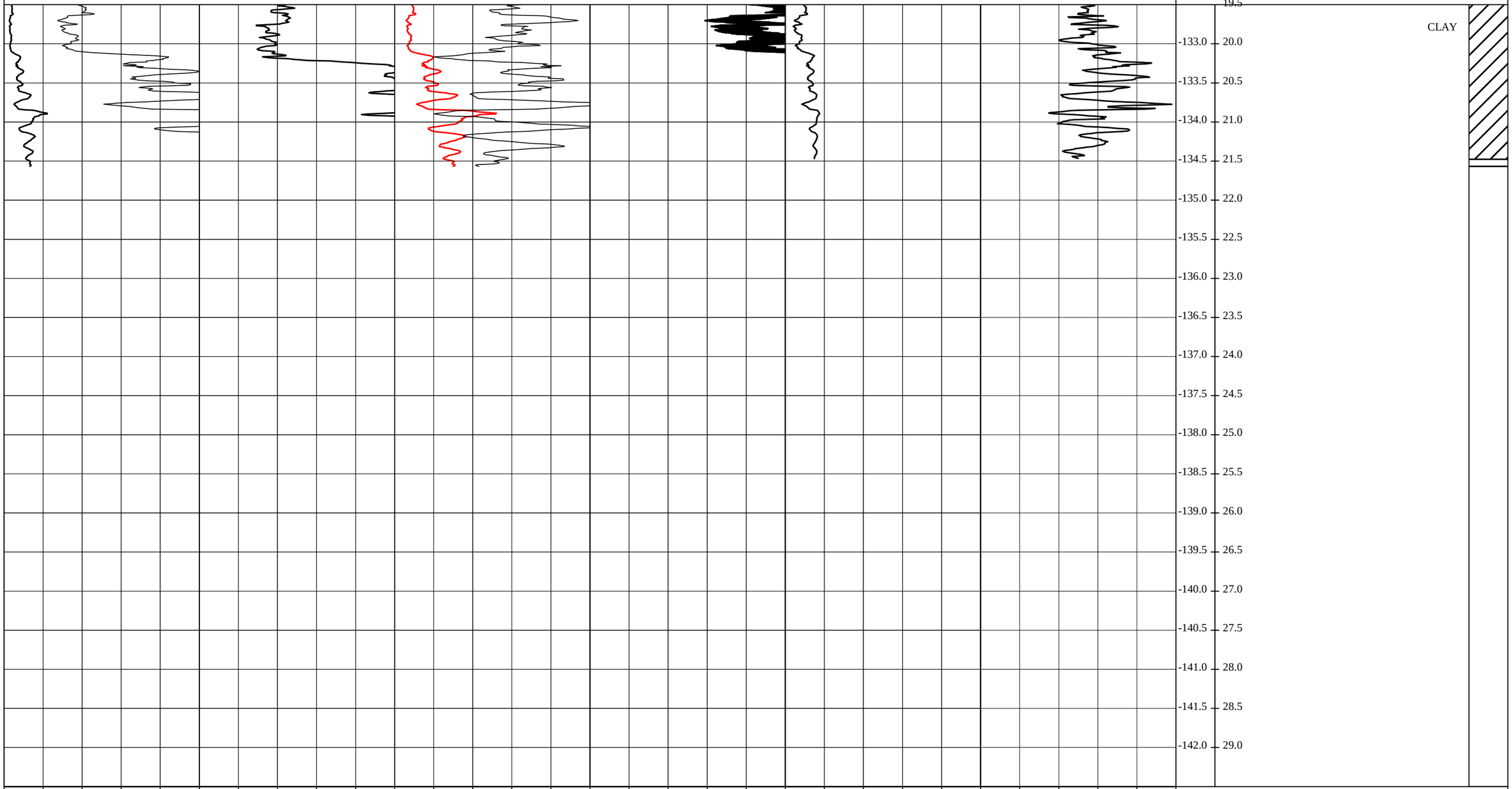
CPT name : ST14460-CPT-143



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 599466.6	Cone no.	: 130711	Rig	: GEOScope
N	: 6372221.9	Cone type	: TSP	Performed by	: JPM/2014-03-31 11:08:12
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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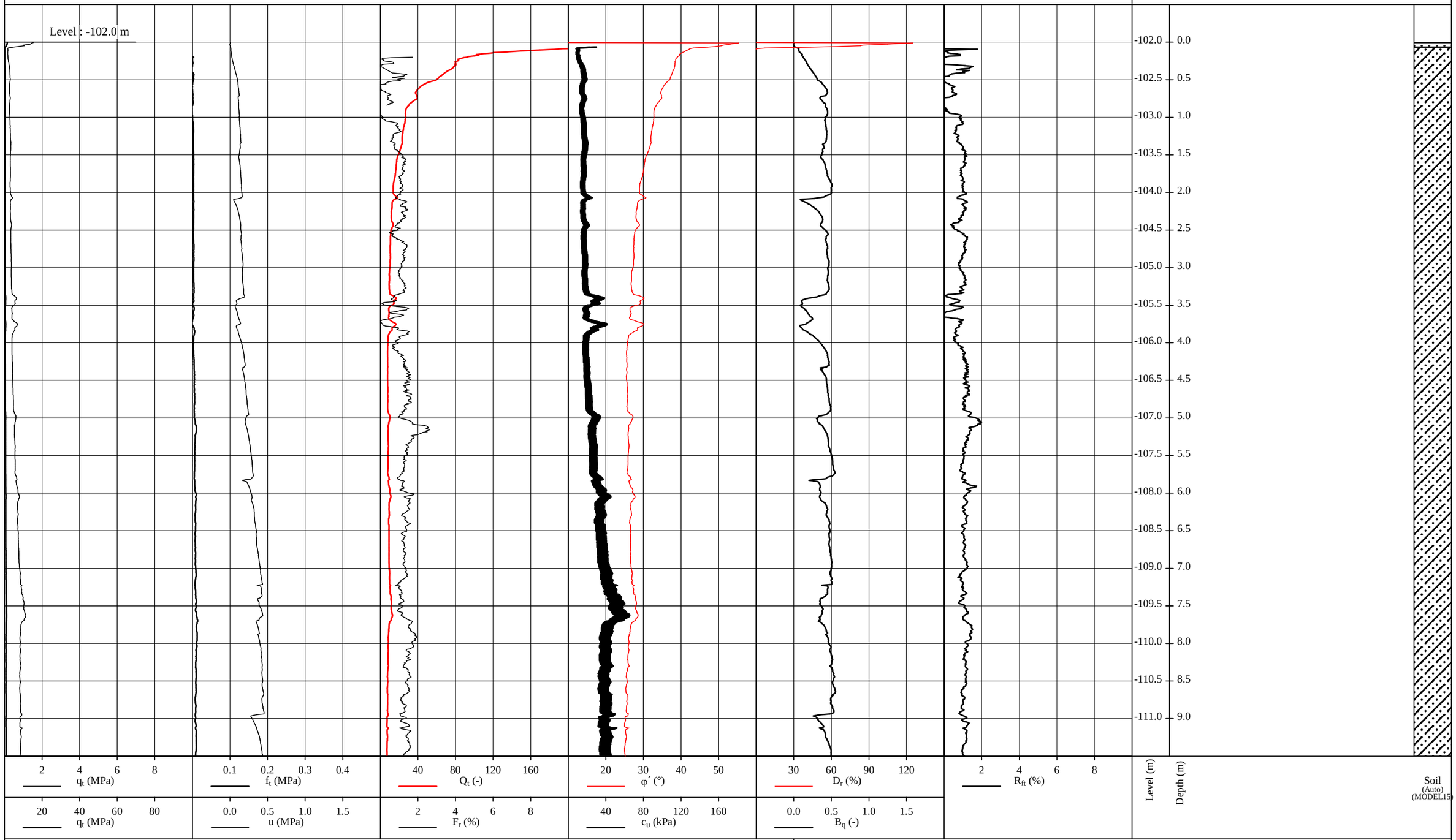
Perceptor - 1.5.10.127

Printed 2014-05-06 09:49:09

CPT name : ST14460-CPT-151

Level : -102.0 m



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 596901.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6372897.1	Cone type	: TSP	Performed by	: ALJ/2014-03-30 19:48:26
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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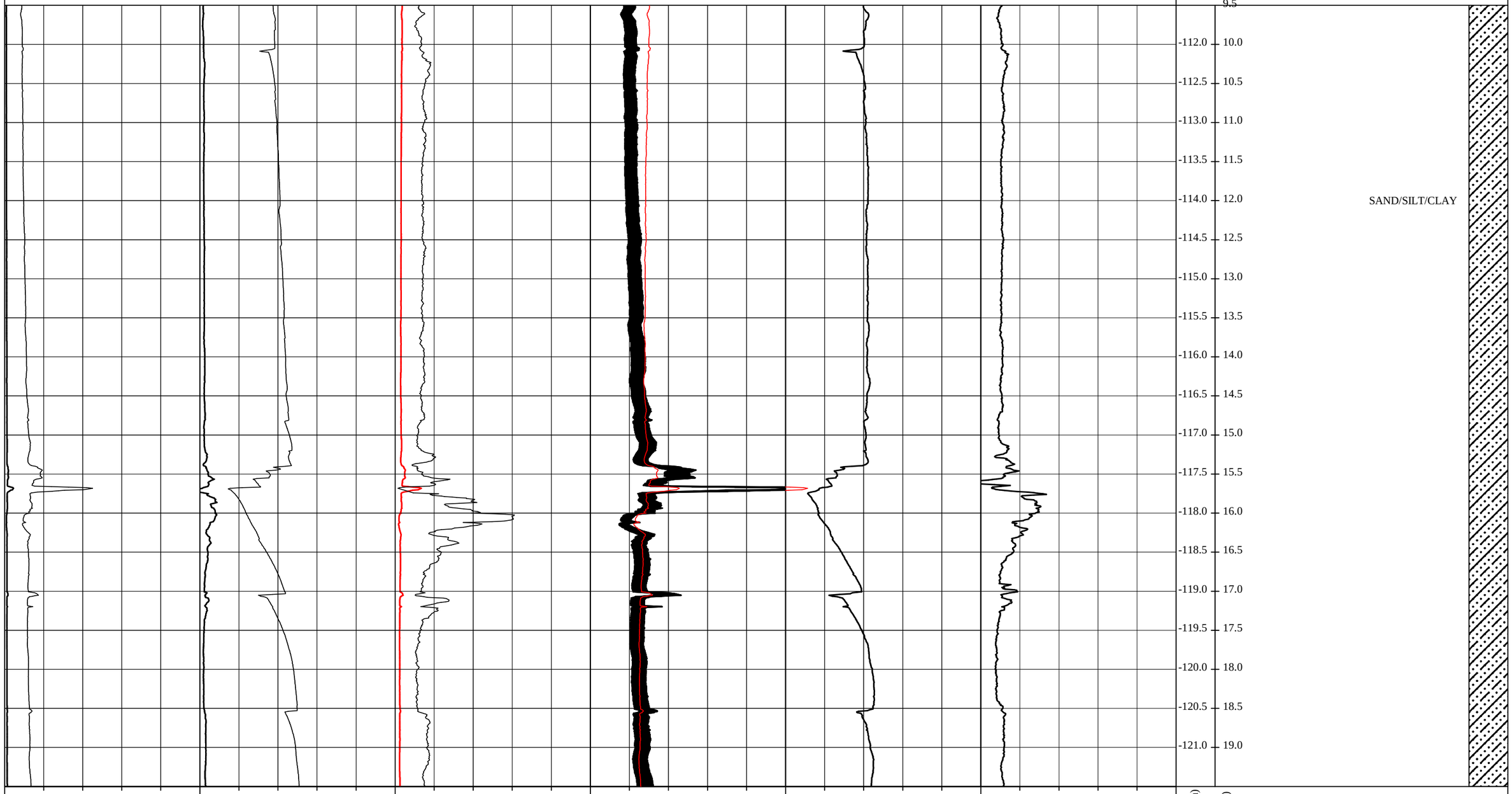
Perceptor - 1.5.10.127

Printed 2014-05-06 09:49:50

CPT name : ST14460-CPT-151



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 596901.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6372897.1	Cone type	: TSP	Performed by	: ALJ/2014-03-30 19:48:26
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Perceptor - 1.5.10.127

Printed 2014-05-06 09:49:56

CPT name : ST14460-CPT-151

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 596901.0	Cone no.	: 130711	Rig	: GEOScope
N	: 6372897.1	Cone type	: TSP	Performed by	: ALJ/2014-03-30 19:48:26
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles
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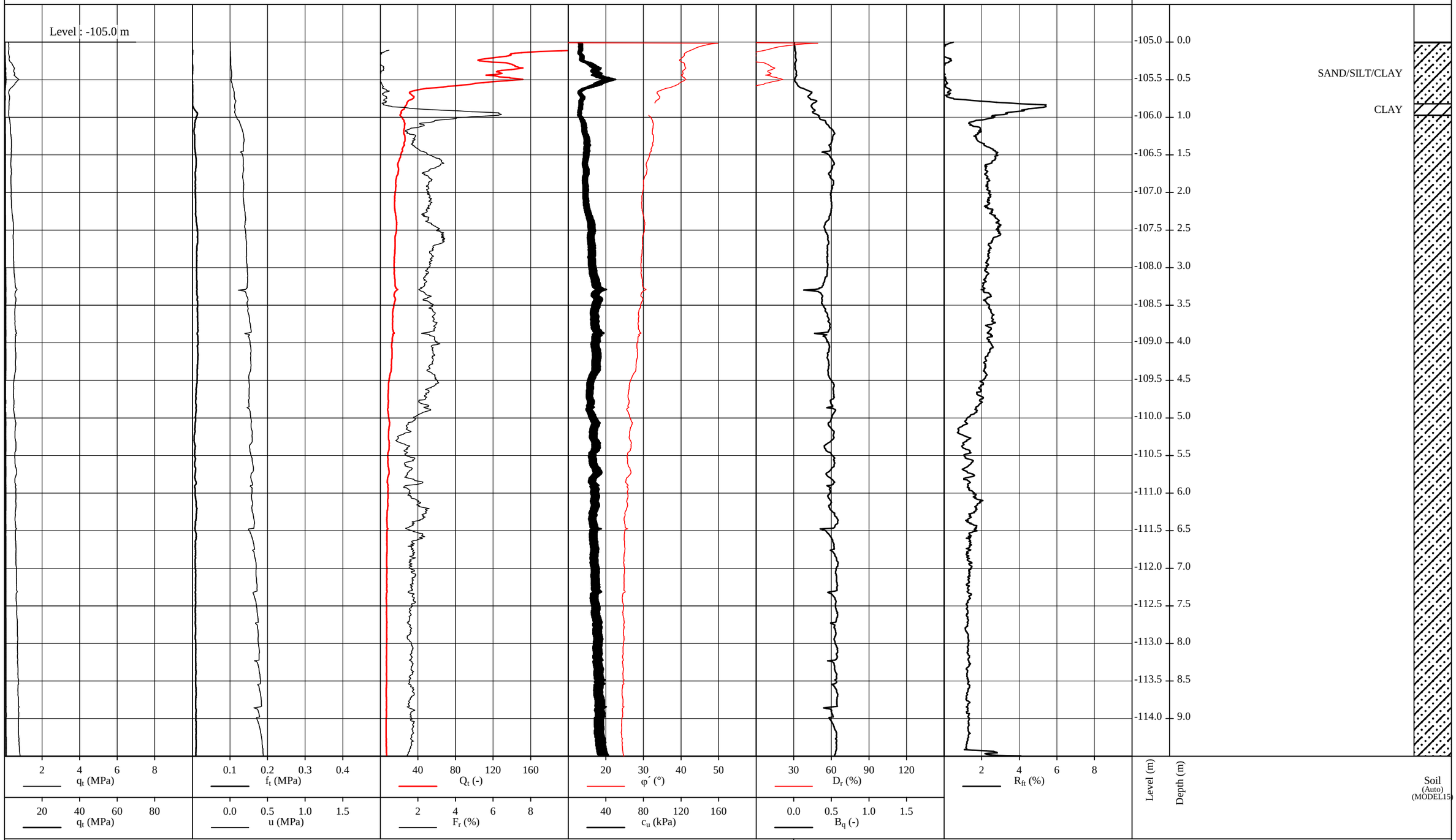
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-151

Perceptor - 1.5.10.127

Printed 2014-05-06 09:50:01

CPT name : ST14460-CPT-152

Level : -105.0 m



The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 597598.8	Cone no.	: 130711	Rig	: GEOScope
N	: 6371689.0	Cone type	: TSP	Performed by	: ALJ/2014-03-30 22:25:24
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

Danish Geotechnical Institute — Project : 36685 Hywind

Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles
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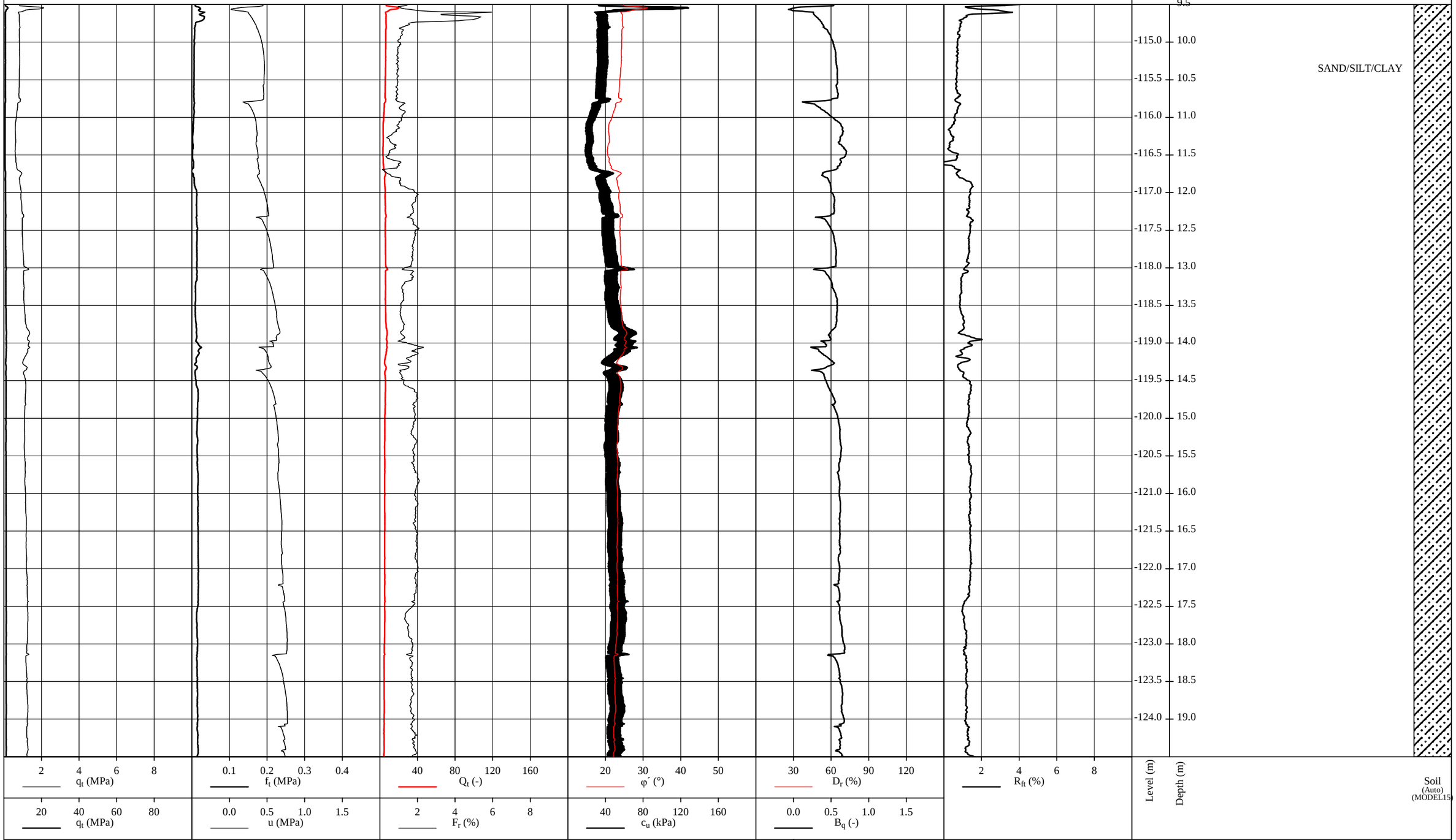
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-152

CPT name : ST14460-CPT-152



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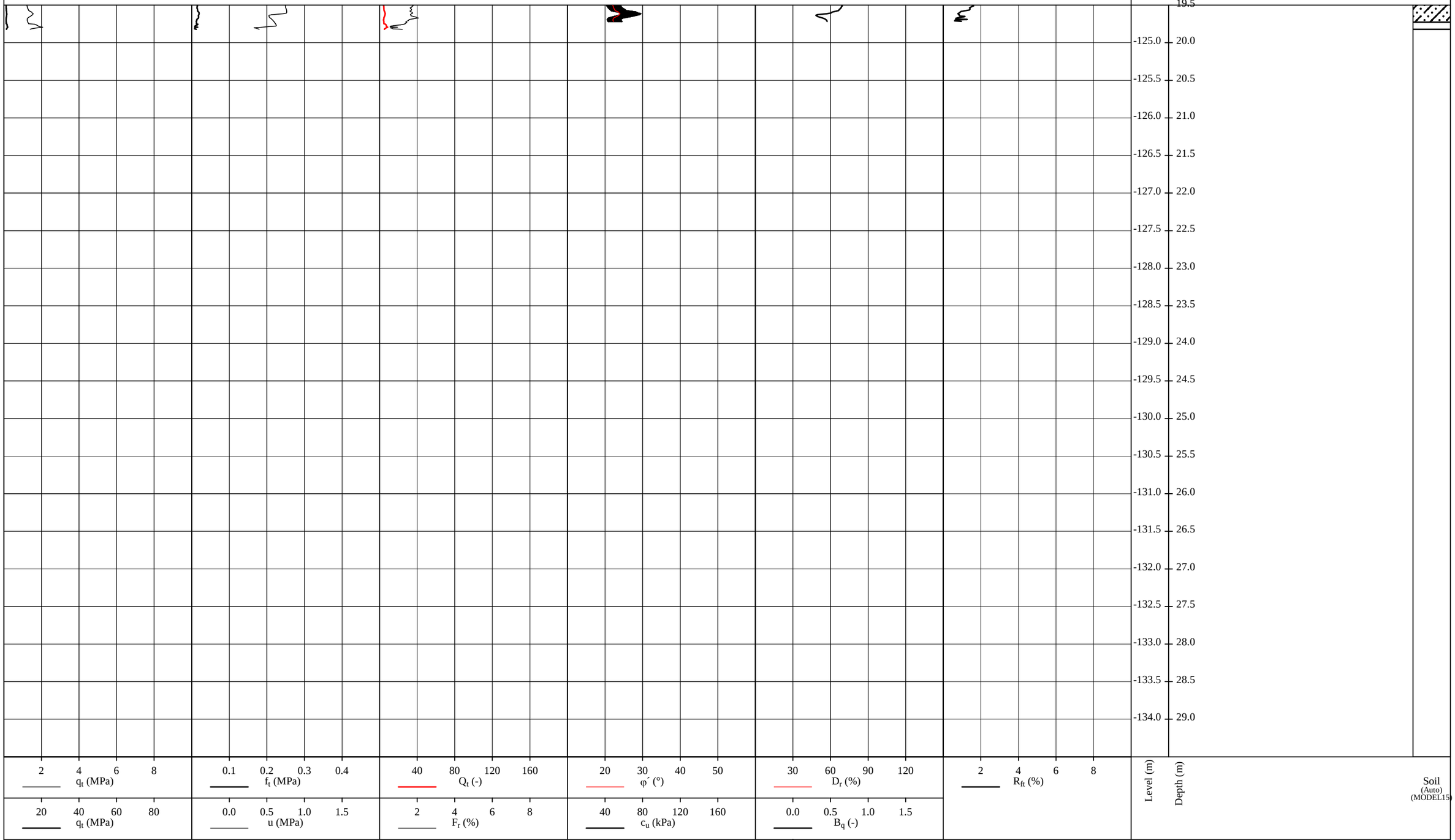
CPT name : ST14460-CPT-152



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N	: 6371689.0	Cone type	: TSP	Performed by	: ALJ/2014-03-30 22:25:24
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

GEO Danish Geotechnical Institute — Project : 36685 Hywind

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Perceptor - 1.5.10.127

Printed 2014-05-06 09:50:47

CPT name : ST14460-CPT-153

Level : -107.0 m

-107.0 0.0
-107.5 0.5
-108.0 1.0
-108.5 1.5
-109.0 2.0
-109.5 2.5
-110.0 3.0
-110.5 3.5
-111.0 4.0
-111.5 4.5
-112.0 5.0
-112.5 5.5
-113.0 6.0
-113.5 6.5
-114.0 7.0
-114.5 7.5
-115.0 8.0
-115.5 8.5
-116.0 9.0

2 4 6 8 q_t (MPa)
20 40 60 80 q_t (MPa)
0.1 0.2 0.3 0.4 f_t (MPa)
0.0 0.5 1.0 1.5 u (MPa)
40 80 120 160 Q_t (-)
2 4 6 8 F_r (%)
20 30 40 50 φ´ (°)
40 80 120 160 c_u (kPa)
30 60 90 120 D_r (%)
0.0 0.5 1.0 1.5 B_q (-)
2 4 6 8 R_{ft} (%)

Level (m)
Depth (m)
Soil (Auto) (MODEL15)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

E	: 598290.3	Cone no.	: 130711	Rig	: GEOScope
N	: 6372946.0	Cone type	: TSP	Performed by	: ALJ/2014-03-31 18:37:29
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

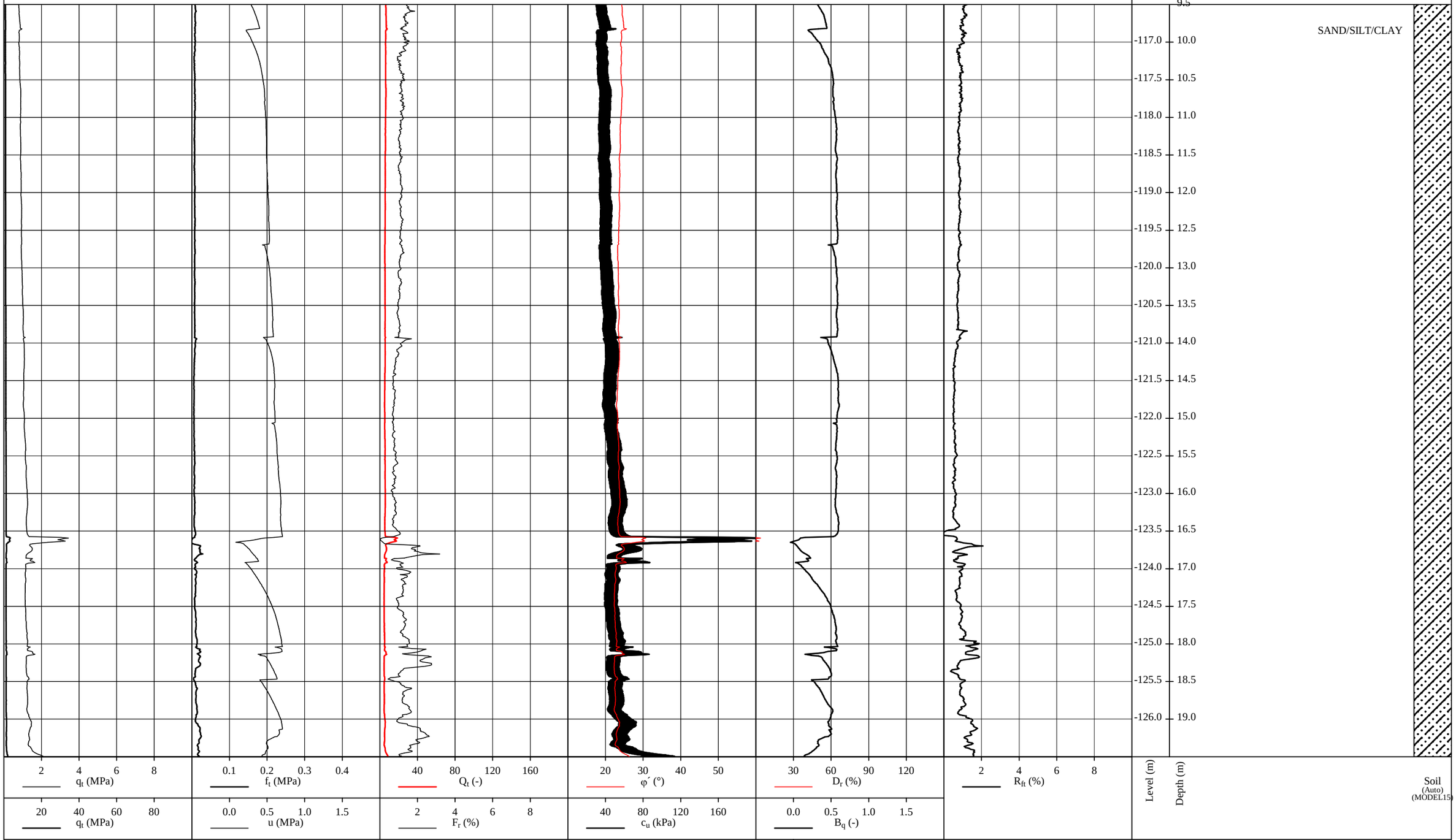
GEO Danish Geotechnical Institute — Project : 36685 Hywind

Prepared	: ABP	Date: 2014-07-09	Subject: Interpreted seabed CPTU profiles
Checked	: KNM	Date: 2014-07-09	Page 1 / 3
Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-153

Perceptor - 1.5.10.127

Printed 2014-05-06 09:51:28

CPT name : ST14460-CPT-153



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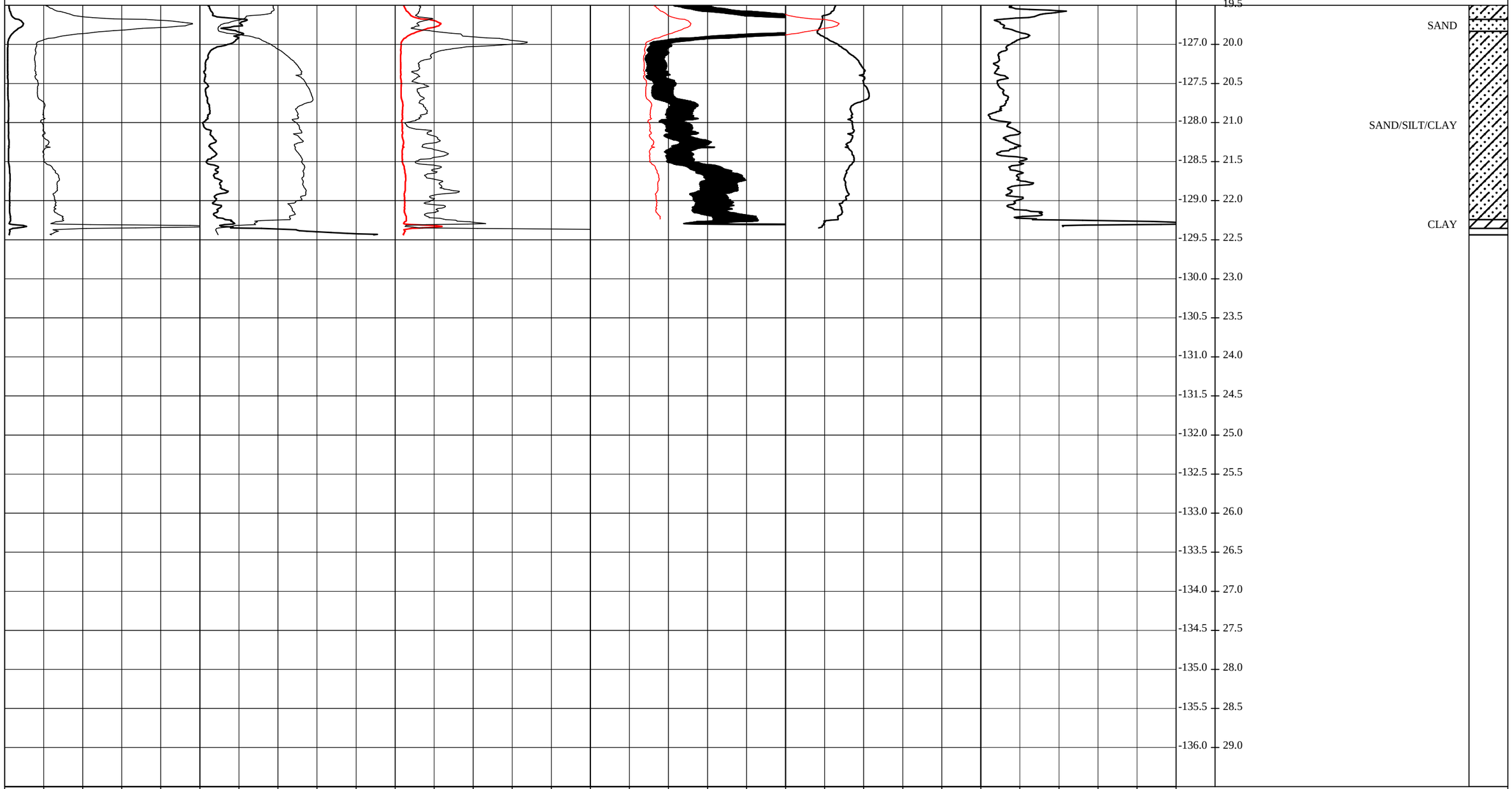
CPT name : ST14460-CPT-153



2 4 6 8 q_t (MPa)
20 40 60 80 q_t (MPa)
0.1 0.2 0.3 0.4 f_t (MPa)
0.0 0.5 1.0 1.5 u (MPa)
40 80 120 160 Q_t (-)
2 4 6 8 F_r (%)
20 30 40 50 φ´ (°)
40 80 120 160 c_u (kPa)
30 60 90 120 D_r (%)
0.0 0.5 1.0 1.5 B_q (-)
2 4 6 8 R_{ft} (%)
Level (m)
Depth (m)
Soil (Auto) (MODEL15)

The interpretation of the cu in Report 1.0 is based on Nkt values of 15-20. These Nkt values are only based on CPTU results and are not calibrated with laboratory tests i.e. cu interpretation in this Report 1.0 should be used with caution. For design purpose the shear strength presented in the interpretation Report 3.0 shall be used.

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N	: 6372946.0	Cone type	: TSP	Performed by	: ALJ/2014-03-31 18:37:29
System	: UTM30N/WGS 84	Cone area	: 10.0 cm^2	Remark	: Rev. 2, Nkt = 15-20

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Approved	: CLB	Date: 2014-07-09	Report 1.0 Enclosure: 1.0E.01.ST14460-CPT-153

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Appendix 1.0.I
Data Sheet – Toisa Voyager

Toisa Voyager

6,000 BHP - Multi-Purpose Offshore Support Vessel

OUTLINE SPECIFICATION / DATA SHEET

GENERAL

Builder / Year	Wuhu, China / 2006
Flag / POR	Bahamian / Nassau
Class	Det Norske Veritas of Shipping +1A1, Supply Vessel, SF, AUTR, HELDK-S, Tmon with Intact & Damage Stability according to IMO Resolution A.469 (XII).
Gross tonnage	3,406
Nett tonnage	1,131
Deadweight (summer)	3,426 tonnes

DIMENSIONS

Length OA	80.50 m
Breadth mld.	18.00 m
Draught (summer)	6.10 m

PERFORMANCE

Service speed	abt. 10-12 knots

CARGO DECK

Clear sheathed deck area	48.0 m x 15.0 m = 720 m^2
Deck strength	5 tonnes / m^2
Deck load	1,200 tonnes

CARGO CAPACITIES

	Approx. at 100%
Fuel oil cargo	1,000 m^3
Potable water	933 m^3
Drill water	900 m^3
Dry bulk @ 80 psi.	5 x 42.5 m^3 = 212 m^3 (7,504 ft^3)
Liquid mud @ 2.8 sg	399 m^3 - (2,508 bbls)
Brine @ 2.8 sg	367 m^3 - (2,307 bbls)
Base oil	170 m^3 - (1,069 bbls)

CARGO PUMPING

Fuel oil cargo	1 x 150 m^3/hr @ 9 bar
Potable water	1 x 150 m^3/hr @ 9 bar
Drill water	1 x 150 m^3/hr @ 9 bar
Dry bulk compressors	2 x 28.4 m^3/m @ 80 psi
Liquid mud	2 x 75 m^3/hr @ 21 bar
Brine	2 x 75 m^3/hr @ 21 bar
Base oil	1 x 150 m^3/hr @ 9 bar

HELIDECK

D value of 18.7m and max gross weight of 8.6mt
Heli-reception room and full emergency equipment.

DP SYSTEM

DP / Joystick Control	IMO Class 2 DP System - Kongsberg K-Pos DP-21
Reference Systems	2 x Independent DGPS HiPAP
Transponder Deployment	"A" Frame + 1000 m Winch

PROPULSION

Two MAK 8L26 marine diesel engines each developing 3,217 BHP @ 750 rpm each driving 1,600 kW shaft alternator and CP propeller.

Total developed power	4,800 kW (6,434 BHP)

GENERATION

	440 / 3 / 60
Shaft alternators	2 x 1,600 kW
Main alternators	2 x 350 kW
Harbour/Emergency set	1 x 190 kW

THRUSTERS

Forward tunnels	2 x 610 kW
Aft tunnels	2 x 610 kW

DECK MACHINERY

Main crane	20 tonnes @ 11 m radius 4 tonnes @ 30 m radius 9t @ abt. 800 m water depth
GP crane - offshore knuckleboom type with 2t winch.	1 tonne @ 16 m radius 2 tonnes @ 10 m radius
Windlasses	2 x 15t hyd.
Tuggers	2 x 12t hyd.
Capstans	2 x 10t hyd.

ACCOMMODATION

Wheelhouse and accommodation fully air conditioned

Single berth cabins	2 suites + 10 en-suite
Two berth cabins	24 en-suite
Hospital	1 berth
Complement	60 persons

STABILISATION

Two passive roll reduction stabilisation tanks

DECK SERVICES for ROV's etc.

Electrical Power	1,000 kW DBs 440/3/60
Compressed Air	5.6 bar / 80 psi

Sealion Shipping Limited
Gostrey House, Union Road, Farnham, Surrey GU9 7PT
Tel: +44 (0)1252 737773 Fax: +44 (0)1252 737770 Email: info@sealionshipping.co.uk www.sealionshipping.co.uk

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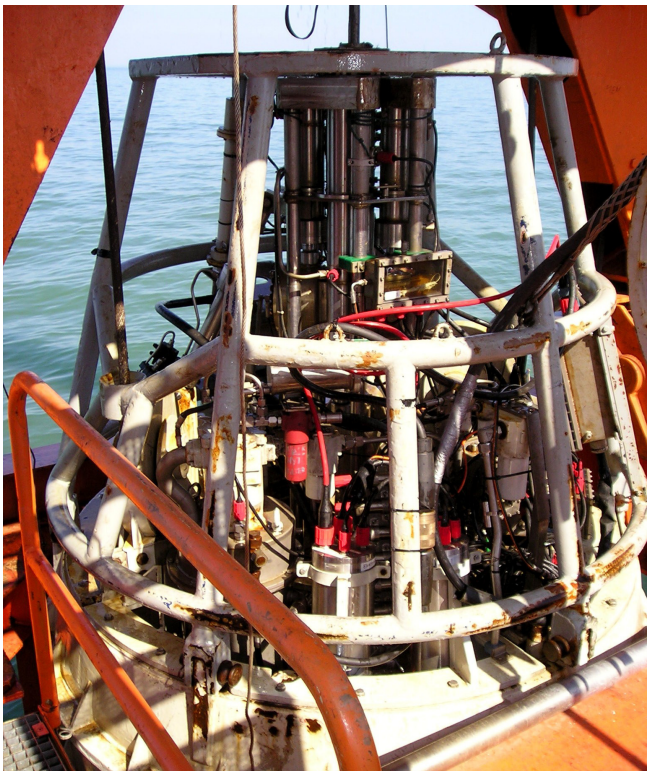
Appendix 1.0.II
Data Sheet – CPT Equipment and Cone Calibration Data

GEOscope



Heavy seabed rig for CPT
GEO's heavy seabed rig, GEOscope, is a cost-effective and fast operating system for CPT-testing (Cone Penetration Test) in offshore site investigations for wind farms, jack-up rig installations, platforms and subsea structures, bridge and construction works.

Description:
GEOscope is one of the heaviest seabed rigs on the market and well suited for hard sediments. It has penetrated up to 45 m at sites in the North Sea area.

Despite its weight, GEOscope is flexible and has an easy setup. It operates from both platforms and vessels trough either a moon pool or "over the side".

It is a reliable, thoroughly tested system and highly efficient as it conducts up to one test per hour, depending on the composition of the seabed and the weather conditions.

Main features:
Continuous push/pull thrust machine using a dual hydraulic clamp system.

Modular system configuration allowing 80-200 kN effective thrust.

Up to 10° inclination adjustment of thrust module, this allows work on a steep and sloping seabed.

Current operational limit 270 m water depths.

Continuous registration of all rig and cone parameters combined with fast auto stop functions.

Operated with GEO's "over the side" and moon pool launch and recovery set-up, which ensures safe and controlled operations.

Data for GEOscope:

Manufacture	GEO
Dimensions (Diameter/Hight m)	2.40/3.40
Weight in air (kg)	13,000 - 30,000
Weight in water (kg)	9,000 - 25,000
Thrust system	Dual hydraulic clamps for 10 cm² CPT
Thrust capacity (kN)	200
Rate of penetration (mm/sec)	20
Maximum operational water depth (m)	350 (Current operational limit 270 m)
Inclination adjustment/thrust machine (°)	10
Power requirements	440 VAC/60 Hz or 380 VAC/50 Hz - 18 kW
Hydraulic oil type	Q8 Handel 32
Data acquisition	GEO in-house data acquisition package registration of: - rig inclination - water depth - seabed contact - hydraulic thrust values - hydraulic thrust and operation values - all raw data communication GEO in-house data acquisition system for CPT cone values.
Launch options	GEOscope "Over the side" platform or through moon pool
Deck space requirement	Approx. 55 m² including platform and containers

GEO takes reservations for technical changes

GEOscope 2011-01-03

GEO is a Danish engineering consultant and contractor offering geotechnical and geophysical services. In GEO 200 employees offer Denmark's most comprehensive expertise concerning soil and water.

The company's core competences are within geotechnical site investigations, both onshore and offshore. GEO also specializes in geotechnical engineering and is world-leading in geomechanical modelling and geotechnical laboratory testing, particularly Rock Mechanics.

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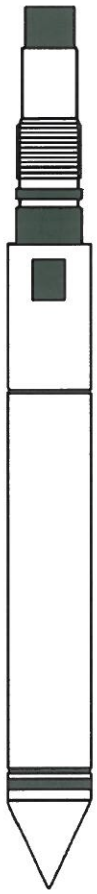
Soedalsparken 12
DK-8220 Brabrand
Web: www.geo.dk
Mail: geo@geo.dk
Tel.: +45 8627 3111

Calibration Certificate

Type	: Icone (TSPI)
Manufacture	: A.P. Van den Berg
Serial number	: Icone121113

Cone resistance

Date for calibration	:	2013-05-01	
Constant	:	9.833	kN/VdB
Intersection with Y	:	2.309	kN
Area	:	10	cm²
Nominal load	:	75.000	MPa
Maximum Load	:	150.000	MPa



Sleeve friction

Date for calibration	:	2013-05-01	
Constant	:	3.755	kN/VdB
Intersection with Y	:	0.995	kN
Area	:	150	cm²
Distance tip to sleeve center	:	10.5	cm
Nominal load	:	1.000	MPa
Maximum Load	:	3.000	MPa

Pore pressure

Date for calibration	:	2013-05-01	
Constant	:	0.556	MPa/VdB
Intersection with Y	:	-0.422	MPa
Nominal load	:	2.000	MPa
Maximum Load	:	3.000	MPa

GEO

Calibrated by	: BON	Date	: 2013-05-01
Checked	: ALJ	Date	: 2013-05-01
Approved	:	Date	: 2013.05.07

Note : Vdb = Van den Berg units

Printed 2013-05-01 Kl. 10:57:10

Calibration Certificate

Type	: Icone (TSPI)
Manufacture	: A.P. Van den Berg
Serial number	: Icone130711

Cone resistance

Date for calibration	:	2014-03-07	
Constant	:	9.757	kN/VdB
Intersection with Y	:	0.919	kN
Area	:	10	cm²
Nominal load	:	75.000	MPa
Maximum Load	:	150.000	MPa

Sleeve friction

Date for calibration	:	2014-03-07	
Constant	:	3.740	kN/VdB
Intersection with Y	:	0.046	kN
Area	:	150	cm²
Distance tip to sleeve center	:	10.5	cm
Nominal load	:	1.000	MPa
Maximum Load	:	3.000	MPa

Pore pressure

Date for calibration	:	2014-03-07	
Constant	:	3.281	MPa/VdB
Intersection with Y	:	-2.900	MPa
Nominal load	:	10.000	MPa
Maximum Load	:	15.000	MPa

GEO

Calibrated by	: LEJ	Date	: 2014-03-07
Checked	: BON	Date	: 2014-03-10
Approved	: JKR	Date	: 2014-03-10

Note : Vdb = Van den Berg units

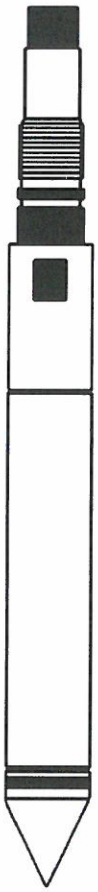
Printed 2014-03-10 Kl. 09:16:57

Calibration Certificate

Type	: Icone (TSPI)
Manufacture	: A.P. Van den Berg
Serial number	: Icone130810

Cone resistance

Date for calibration	:	2014-03-07	
Constant	:	9.727	kN/VdB
Intersection with Y	:	1.695	kN
Area	:	10	cm²
Nominal load	:	75.000	MPa
Maximum Load	:	150.000	MPa



Sleeve friction

Date for calibration	:	2014-03-07	
Constant	:	3.680	kN/VdB
Intersection with Y	:	0.104	kN
Area	:	150	cm²
Distance tip to sleeve center	:	10.5	cm
Nominal load	:	1.000	MPa
Maximum Load	:	3.000	MPa

Pore pressure

Date for calibration	:	2014-03-10	
Constant	:	4.146	MPa/VdB
Intersection with Y	:	-3.293	MPa
Nominal load	:	10.000	MPa
Maximum Load	:	15.000	MPa

GEO

Calibrated by	: LEJ	Date	: 2014-03-07
Checked	: BON	Date	: 2014-03-10
Approved	: JBR	Date	: 2014.03.10

Note : Vdb = Van den Berg units

Printed 2014-03-10 Kl. 09:12:27

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Appendix 1.0.III
Data Sheet – GEO-Corer 6000

Vibrocore

Applications
The Vibrocorer is a high frequency, electrically driven system capable to penetrate fast into all common seabed sediments ranging from compact sands to stiff clays and even unconsolidated chalk. It can be deployed from a small vessel and is easy to handle.

Thanks to its lightweight construction and small pull-out system, it requires a limited hoisting power of 5 tons maximum, when working in stiff clays.

It can be applied for stratigraphic studies, geological mapping, mineral exploration, environmental surveys, pollution investigations, geotechnical investigations, etc.

Description
The standard configuration is designed for taking cores of 6 m length in ordinary PVC liners with an internal diameter of 106 mm. The system can be easily modified for taking shorter cores of 3 m. The force on the cutting shoe can be adjusted using different dead weight on the vibro-unit.

The Vibrocore system is a straightforward concept and the high quality construction guarantee a simple and reliable operation with a minimum of maintenance. In fact it has been designed so that all structural parts can be handled by human force.

Main features
- High frequency vibration
- Proven performance
- Small vessel operation
- Reliable & cost effective
- Easy to handle & modular
- Pivoting barrel head
- High quality cores

Main data

Type	Geo-Core 6000/3000
Max weight in air (kg)	1000-1200 (depending on dead weight in use)
Max weight in water (kg)	850-1050 (depending on deadweights in use)
Fully containerized system	The system is designed to fit into a standard 20-foot container. The same container is used for storage of barrels and liners during operation offshore
Total height (6 m configuration m)	7.2
Total height (3 m configuration m)	4.4
Footprint (6 m configuration m)	Diameter 4.6
Footprint (3 m configuration m)	Diameter 2.8
Vibro unit	Electrically driven (5 kW) double vibrator
Vibration frequency (Hz)	28
Dead weights on vibrator unit (kg)	Adjustable: 150-300
Electric power	380 VAC, 3 phase, 50 Hz Starting power 25 A Running power 8 A
Core liner	ID/OD: 105 mm / 110 mm, PVC
Core liner length (m)	6 or 3
Operational depth (m)	Standard: 600. Greater depth range is optional

Vibrocore 2011-12-12

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The company's core competences are within geotechnical site investigations, both onshore and offshore. GEO also specializes in geotechnical engineering and is world-leading in geomechanical modelling and geotechnical laboratory testing, particularly Rock Mechanics.

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Web: www.geo.dk
Mail: offshore@geo.dk
Tel.: +45 8627 3111

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Appendix 1.0.IV
Positioning Equipment and Positioning Check

C-Nav
WORLD DGPS

C-Nav3050

C-Nav3050 FEATURES:

- 66-channel combined GPS/GNSS/L-band receiver provides sub-meter, precise point positioning accuracy worldwide between 72N and 72S
- Multi-constellation support and tracks GPS, GLONASS, Galileo, StarFire, other SBAS (WAAS/EGNOS) signals, and accepts external RTCM input.
- Small and lightweight for fast and hassle-free setup
- Easily configured utilizing “C-Setup”, a free PC based software
- Easily configured utilizing C-Nav proprietary PC-based controller software
- Easily monitored with intuitive front-panel LEDs or a C-NaviGator II Control/Display Unit.

Bluetooth™

GSA Contract Holder
FSS Contract GS-07F-5671P

0191/08

C-Nav3050 TECHNICAL SPECS

FEATURES

- "All-in-view" parallel tracking with 66 channels
- SBAS (WAAS/EGNOS/MSAS/GAGAN) Tracking
- Built-in StarFire L-band receiver
- L1, L2, L5, G1 & G2 full wavelength carrier phase tracking
- C/A, P1, P2, L2C, L5, G1 and G2 code tracking
- Software upgradeable for Galileo signal reception (E1, E5a)
- High sensitivity / Low signal level tracking
- Fast signal acquisition / re-acquisition
- Superior interference suppression (both in and out of band)
- Patented multipath rejection
- RTK Extend and StarFire Over-The-Air activation capabilities
- Configurable as RTK base or rover
- Programmable output rates
- Event Marker input / 1PPS output
- 2GB Internal data storage

PHYSICAL/ENVIRONMENTAL

- Size (L x W x H): 6.47" x 4.60" x 2.37" (164 x 117 x 60mm)
- Weight: 1.1 lbs (0.5 kg)
- Front Status Indication: Power/GPS Status, Correction Service Status, Interface Status, and Bluetooth Status
- External Power
  - Input: AC/DC Adapter 110/220VAC 12VDC Nominal 0.5A (9.0V to 32VDC)
- Connectors
  - I/O Ports: 2 x 9 pin Positronic
  - DC Power: 1 x 9 pin Positronic
  - RF Connector: TNC (with 5VDC bias for antenna/LNA)
- Temperature (ambient)
  - Operating: -40° C to +70° C (-40° F to 158° F)
  - Storage: -40° C to +85° C (-40° F to 185° F)
- Humidity: 95% non-condensing
- Tested in accordance with MIL-STD-810F for: Low pressure, solar radiation, rain, humidity, salt fog, sand dust, and vibration

COMPLIANCE/APPROVALS

- Compliance with the following standards:
  - > IMO performance standard for GPS* > IEC 60529
  - > FCC Part 15 Class B, CE
- Type Approvals:
  - > Wheelmark
  - > USCG

PERFORMANCE

GPS RECEIVER PERFORMANCE

- Accuracy (RMS): Horizontal / Vertical
  - RTK (<40km): 1cm + 0.5ppm / 2cm + 1ppm
  - StarFire: <10cm / <15cm
  - Code DGPS (<200km): 45cm + 3ppm / 90cm + 3ppm
  - Velocity: 0.01ms
  - RTK Extend (<15 mins): 3cm + 1ppm / 6cm + 2ppm
- User Programmable Output Rates
  - Position/Velocity/Time: 1, 5, 10, 25, 50, & 100 Hz
  - Raw Data: 1, 5, 10, 25, 50, & 100 Hz
- Data Latency
  - Position/Velocity/Time: 10ms at all rates
  - Raw Data: 10ms at all rates
- Time-to-First-Fix
  - Cold/Warm/Hot: <60s / <50s / <20s (typical values measured per ION-STD 101)
- Dynamics
  - Acceleration*: up to 6g
  - Speed*: <515m/s (1000 knots)
  - Altitude*: <60,000ft (18.3km)

*Restrictions due to export control laws

I/O CONNECTOR ASSIGNMENTS

- Data Interfaces: 2 x RS232 (1 - changeable to RS422, 4800-115200 baud rates)
  1 x USB 2.0 (Host or Device)
  Bluetooth
  Ethernet (10T/100T)

INPUT/OUTPUT DATA MESSAGES

- NMEA-0183: ALM, GBS, GGA, GLL, GRS, GSA, GST, GSV, RMC, RRE, VTG, ZDA, NCT
- Differential Correction: RTCM 2.3 and 3.0, SBAS and StarFire (proprietary)
- RTK Correction: CMR/CMR+, RTCM, NavCom Ultra RTK
- Receiver Control: NavCom Proprietary Commands (ASCII)

C-NaviGator® CONTROL DISPLAY UNIT OPTION

- Dimensions (W x H x D):
  13.4" x 10.3" x 3.3" (34.0 x 26.2 x 8.4cm)

C-NaviGator® Control Display Unit

*IMO require all SOLAS class ships to carry a type-approved GPS and further that any new GPS installation shall be compliant with the new performance standard for GPS. This was defined by MSC 112(73) and resulted in the associated test standard IEC 61108-1 Ed. 2.

WWW.CNavGPS.COM

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BRASIL
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CEP 22640-210, BARRA DA TIJUCA
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BURY ST EDMUNDS
SUFFOLK, IP32 7EA, UK
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FAX: (+44) 1284.701.004

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OSSIA INTERNATIONAL BUIDING #03-01B
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SOUTH AFRICA
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ANGOLA
RUA ANTONIO MARQUES
MONTEIRO N° 36/38
LUANDA - ANGOLA
TEL: (+244) 222.330202
FAX: (+244) 222.335464

090616

POS MV™ SPECIFICATIONS

Robust Position and Orientation Solutions for Marine Mapping

Applanix Position and Orientation Systems for Marine Vessels (POS MV) are engineered to support water science data collection operations, particularly those where accurate, uninterrupted, and robust solutions are needed for direct georeferencing and mapping. Professionals involved in surf zone and costal area mapping, harbor lane surveys, environmental assessments, channel inspection and dredging assessment, offshore resource exploration, erosion mapping, maritime and coastal waterway infrastructure inventory mapping depend on POS MV solutions.

Employing state-of-the-art high precision gyros which are tightly coupled to supporting GPS, the POS MV provides continuous and accurate position and orientation data logging for vessel and sensor guidance. Reliable POS MV output is produced in severe sea conditions, during periods of blocked or intermittent GPS, in areas where GPS reception is compromised by multipath effects, or at times when position drift must be reduced and faster signal reacquisition is essential.

POS MV delivers a full six degree-of-freedom position and orientation solution measuring location, velocity, attitude, and heave plus acceleration and angular rate vectors. Applanix marine solutions are able to affix position and orientation data accurately under the most demanding conditions, regardless of vessel dynamics, 200 times each second, making direct georeferencing and motion compensation for maritime remote sensing operations a productive and practical option.

PERFORMANCE SUMMARY - POS MV Accuracy

POS MV 320	DGPS	RTK	GPS Outage
Position	0.5 - 2 m[1]	0.02 - 0.10 m[1]	<2.5 m for 30 s outages, <6 m for 60 s outages
Roll & Pitch	0.020°	0.010°	0.020°
True Heading	0.020° with 2 m baseline 0.010° with 4 m baseline	-	Drift less than 1° per hour (negligible for outages <60 s)
Heave	5 cm or 5%[2]	5 cm or 5%[2]	5 cm or 5%[2]

POS MV WaveMaster	DGPS	RTK	GPS Outage
Position	0.5 - 2 m[1]	0.02 - 0.10 m[1]	<3 m for 30 s outages, <10 m for 60 s outages
Roll & Pitch	0.030°	0.020°	0.040°
True Heading	0.030° with 2 m baseline	-	Drift less than 2° per hour
Heave	5 cm or 5%[2]	5 cm or 5%[2]	5 cm or 5%[2]

POS MV Elite	DGPS	RTK	GPS Outage
Position	0.5 - 2 m[1]	0.02 - 0.10 m[1]	<1.5 m for 60 s outages DGPS, <0.5 m for 60 s outage RTK
Roll & Pitch	0.005°	0.005°	0.005°
True Heading	0.025°	0.025°	Drift less than 0.1° per hour (negligible for outages <60 s)
Heave	3.5 cm or 3.5%[2]	3.5 cm or 3.5%[2]	3.5 cm or 3.5%[2]

AVAILABLE OPTIONS

	PCS-80	PCS-76	IMU-35	IMU-36	IMU-33
POS MV 320	X	X	X		
POS MV WaveMaster	X	X		X	
POS MV Elite	X				X

[1] One Sigma, depending on quality of differential corrections
[2] Whichever is greater, for periods of 20 seconds or less

SYSTEM SPECIFICATIONS

COMPONENT	DIMENSIONS	WEIGHT	TEMPERATURE	HUMIDITY	POWER
PCS-80	L = 483mm, W = 334mm, H =444mm	3.9 Kg	-20 ºC to +70ºC	10 - 80% RH[3]	110/230 Vac, 50/60 Hz, auto-switching 40 W
PCS-76	L = 167mm, W = 185mm, H = 68mm	2.5 Kg	-20 ºC to +60 ºC	0- 100% RH	24 Vdc, 35 W (peak)

HOUSING AND ADAPTOR PLATES

COMPONENT	DIMENSIONS	IP RATING
Waterproof Housing	L = 209mm, H = 196mm	IP68
Adaptor Plate	L = 135mm, W = 142mm, H = 19mm	IP68

INERTIAL MEASUREMENT UNIT (IMU)

TYPE	DIMENSIONS	WEIGHT	TEMPERATURE	ORIGIN
IMU-35	L = 158mm, W = 158mm, H = 124mm	2.5 Kg	-40 ºC to +70 ºC	US
IMU-36	L = 158mm, W = 158mm, H = 124mm	2.5 Kg	-40 ºC to +60 ºC	US
IMU-33	L = 229mm, W = 315mm, H = 196mm	3.5 Kg	-40 ºC to +60 ºC	US

GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)

COMPONENT	DIMENSIONS	WEIGHT	TEMPERATURE	HUMIDITY
GPS Antenna	(Diameter) 165mm, W = 76mm	0.64 Kg	-40 ºC to +70 ºC	0-100% RH

1. ETHERNET INPUT OUTPUT

Ethernet	(10/100/1000 base-T)
Parameters	Time tag, status, position, attitude, heave, velocity, track and speed, dynamics, performance metrics, raw IMU data, raw GPS data
Display Port	Low rate (1 Hz) UDP protocol output
Control Port	TCP/IP input for system commands
Primary Port	Real-time (up to 200 Hz) UDP protocol output
Secondary Port	Buffered TCP/IP protocol output for data logging to external device

2. SERIAL RS232 INPUT OUTPUT

4 COM Ports User assignable to: NMEA output (0-4), Binary output (0-4), Auxiliary GPS input (0-2), Base GPS correction input (0-2)

3. NMEA ASCII OUTPUT

Parameters	NMEA Standard ASCII messages: Position ($INGGA), Heading ($INHDT), Track and Speed ($INVTG), Statistics ($INGST), Attitude ($PASHR, $PRDID), Time and Date ($INZDA, $UTC).
Rate	Up to 50 Hz (user selectable)
Configuration	Output selections and rate individually configurable on each assigned com port.

4. HIGH RATE ATTITUDE OUTPUT

Parameters	User selectable binary messages: attitude, heading, speed
Rate	Up to 200 Hz (user selectable)
Configuration	Output selections and rate individually configurable on each assigned com port.

5. AUXILIARY GPS INPUTS

Parameter	NMEA Standard ASCII messages: $GPGGA, $GPGST, $GPGSA, $GPGSV. Uses Aux input with best quality.
Rate	1 Hz

6. BASE GPS CORRECTION INPUTS

Parameter	RTCM V2.x, RTCM V3.x, CMR and CMR+ input formats accepted. Combined with raw GPS observables in navigation solution.
Rate	1 Hz

6. DIGITAL I/O

1PPS	1 pulse-per-second Time Sync output, normally high, active low pulse
Event Input (2)	Time mark of external events. TTL pulses > 1 msec width, rising or falling edge, max rate 200 Hz.

7. USER SUPPLIED EQUIPMENT

- PC for POS Controller (Required for configuration): Pentium 90 processor (minimum), 16 MB RAM, 1 MB free disk space, Ethernet adapter (RJ45 100 base T), Windows 98/2000/NT/XP/Windows 7
- PC for POSPac Post-processing Software: Pentium III 800Mhz or equivalent (minimum), 512 MB RAM, 400 MB free disk space, USB Port (For Security Key), Windows XP or Windows 7.

[3] - Non-condensing

Headquarters: 85 Leek Crescent Richmond Hill, ON Canada L4B 3B3 **T** 905.709.4600 **F** 905.709.6027
United Kingdom: Forester's House, Old Racecourse Oswestry UK SY10 7PW **T** 44 1691 659359 **F** 44 1691 659299
Texas: 17461 Village Green Drive, Houston TX USA 77040 **T** 713.896.9900 **F** 713.896.9919
www.applanix.com

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GEO Marine Survey Department	Doc no.: F-04-06-POSICHECK-01
Positioning Check Form	Page: 1 of 4

Project Name:	Valiant TD	**No.:**	37388
Location:	Damen ship yard		
Date:	2014-03-06		

Positioning System

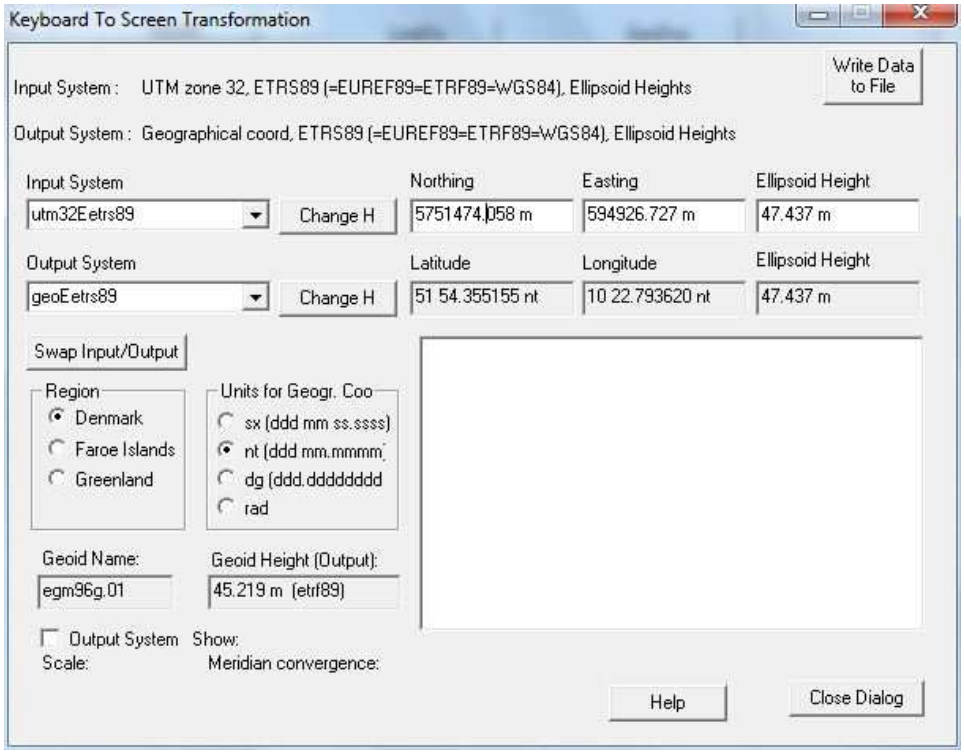
Base station	Primary	Secondary	Land measurement

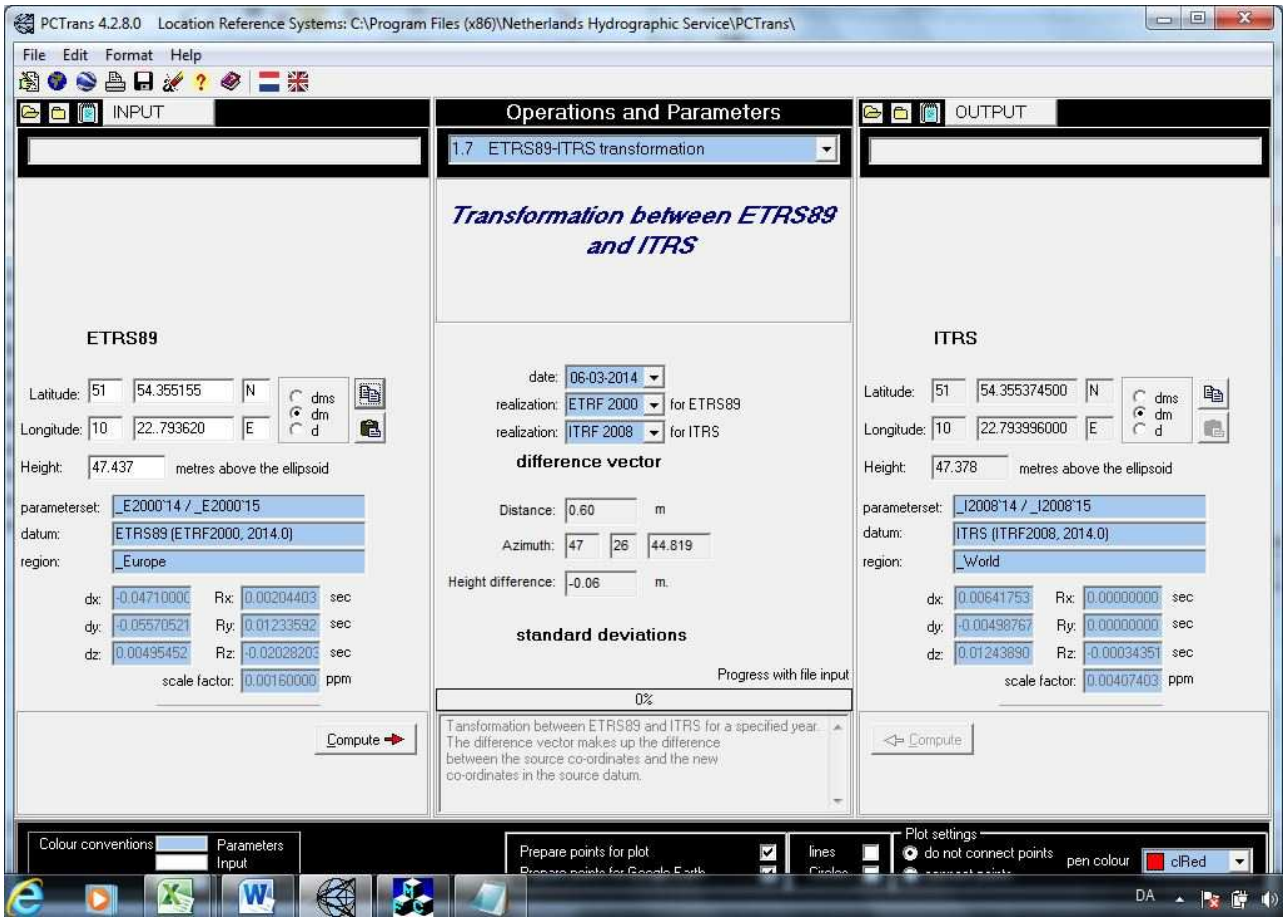
Coordinate System:	UTM 32 Euref 89		
Land measured position: (EUREF89)	**Easting (m)**	**Northing (m)**	**Height (m)**
	594926,727	5751474,058	47,437
Transform to ITRF	594 927.150	5 751 474.472	47.378

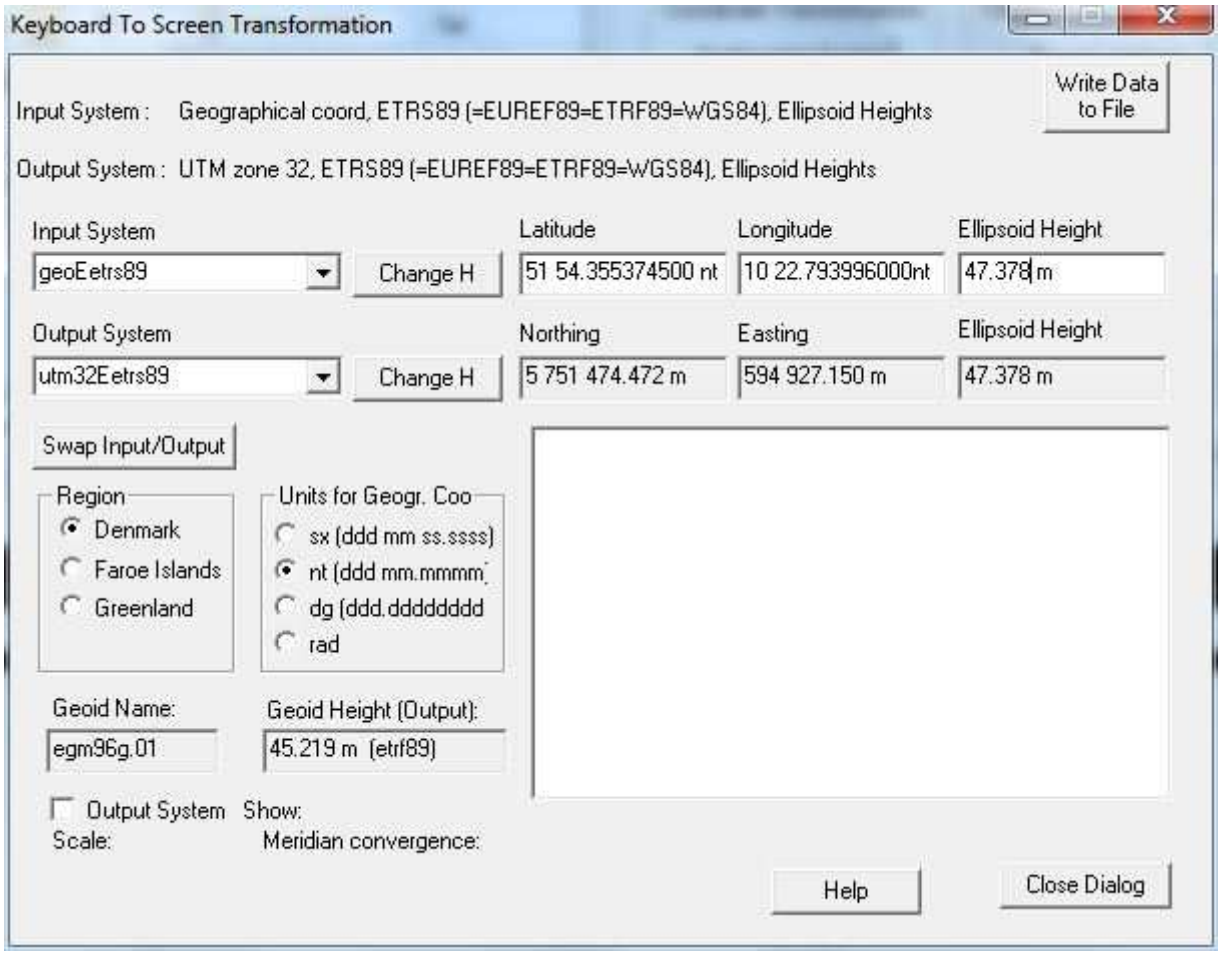
Position	Easting (m)	Northing (m)	Height (m)	Offset height (bottom to antenna phase center)	Corrected Height (m)	Dev. to measured position		
						Easting (m)	Northing (m)	Height (m)
Primary	594927,264	5751474,590			47,43	0,114	0,118	0,052
Secondary								

Remarks:
The land mesured position was logged over 1 minutes and average position an height was calculated-
The primary position and height was logged over 1 minutes and the average position and height was calculated.
The 2 mesured positions and heigts were mesured over the same period.
The Land measured position was measured in ETRS89 UTM32N and height. The land measured position/height was transformed to ITRF08 UTM32N position and Height with Kmstrans from Danish GEOData agency and PCTrans429 from The Netherlands Hydrographic Service.

Authority	Initial	Date
Prepared by	ALJ	2014-03-06
Approved by	MHF	2014-03-06


Keyboard To Screen Transformation
Write Data to File
Input System : UTM zone 32, ETRS89 (=EUREF89=ETRF89=WGS84), Ellipsoid Heights
Output System : Geographical coord, ETRS89 (=EUREF89=ETRF89=WGS84), Ellipsoid Heights
Input System
utm32Eetrs89
Change H
Northing
5751474.058 m
Easting
594926.727 m
Ellipsoid Height
47.437 m
Output System
geoEetrs89
Change H
Latitude
51 54.355155 nt
Longitude
10 22.793620 nt
Ellipsoid Height
47.437 m
Swap Input/Output
Region
Denmark
Faroe Islands
Greenland
Units for Geogr. Coo
sx (ddd mm ss.ssss)
nt (ddd mm.mmmm)
dg (ddd.dddddddd
rad
Geoid Name:
egm96g.01
Geoid Height (Output):
45.219 m (etrf89)
Output System Scale:
Show:
Meridian convergence:
Help
Close Dialog


PCTrans 4.2.8.0 Location Reference Systems: C:\Program Files (x86)\Netherlands Hydrographic Service\PCTrans\
File Edit Format Help
INPUT
Operations and Parameters
1.7 ETRS89-ITRS transformation
OUTPUT
Transformation between ETRS89 and ITRS
ETRS89
Latitude: 51 54.355155 N
Longitude: 10 22..793620 E
dms dm d
Height: 47.437 metres above the ellipsoid
parameterset: _E2000'14 / _E2000'15
datum: ETRS89 (ETRF2000, 2014.0)
region: _Europe
dx: -0.04710000 Rx: 0.00204403 sec
dy: -0.05570521 Ry: 0.01233592 sec
dz: 0.00495452 Rz: -0.02028203 sec
scale factor: 0.00160000 ppm
Compute
date: 06-03-2014
realization: ETRF 2000 for ETRS89
realization: ITRF 2008 for ITRS
difference vector
Distance: 0.60 m
Azimuth: 47 26 44.819
Height difference: -0.06 m.
standard deviations
Progress with file input
0%
Transformation between ETRS89 and ITRS for a specified year. The difference vector makes up the difference between the source co-ordinates and the new co-ordinates in the source datum.
ITRS
Latitude: 51 54.355374500 N
Longitude: 10 22.793996000 E
Height: 47.378 metres above the ellipsoid
parameterset: _I2008'14 / _I2008'15
datum: ITRS (ITRF2008, 2014.0)
region: _World
dx: 0.00641753 Rx: 0.00000000 sec
dy: -0.00498767 Ry: 0.00000000 sec
dz: 0.01243890 Rz: -0.00034351 sec
scale factor: 0.00407403 ppm
Compute
Colour conventions
Parameters
Input
Prepare points for plot
lines
Plot settings
do not connect points
pen colour
clRed
DA


Keyboard To Screen Transformation
Write Data to File
Input System : Geographical coord, ETRS89 (=EUREF89=ETRF89=WGS84), Ellipsoid Heights
Output System : UTM zone 32, ETRS89 (=EUREF89=ETRF89=WGS84), Ellipsoid Heights
Input System
geoEetrs89
Change H
Latitude
51 54.355374500 nt
Longitude
10 22.793996000nt
Ellipsoid Height
47.378 m
Output System
utm32Eetrs89
Change H
Northing
5 751 474.472 m
Easting
594 927.150 m
Ellipsoid Height
47.378 m
Swap Input/Output
Region
Denmark
Faroe Islands
Greenland
Units for Geogr. Coo
sx (ddd mm ss.ssss)
nt (ddd mm.mmmm)
dg (ddd.dddddddd
rad
Geoid Name:
egm96g.01
Geoid Height (Output):
45.219 m (etrf89)
Output System
Show:
Scale:
Meridian convergence:
Help
Close Dialog

Landmeetkundig buro Geo Plus
Tussen Baide Meulens 18
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VESSEL GEOMETRY REPORT

Measurement of the sensors and antennas on board Multi Purpose Offshore Vessel " Toisa Voyager"

00	28-02-2012	1st Edition	HKPW
Revision	**Date**	**Description**	**By**

Table of contents

Project details

Project: 39101_Toisa Voyager

Date of measurement:	06th March 2014
Location:	Damen Shiprepair
Schiedam	
Surveyors:	H. Kouprie & M. Klomp
Description:	Complete vessel geometry,
	Position check
	MRU&Geoscope
Used instruments:	
Total station: Trimble S6	
Topcon hiper pro GPS	

Contractor:

EKSPERTER I JORD OG VAND

Maglebjergvej 1
DK-2800 Lyngby
Denmark

1. Introduction

This report details the vessels geometry survey, the determination of the vessels coordinate system, the position check Geoscope and MRU.

The vessels geometry survey defines in the chosen vessels coordinate system:

- Offsets of MRU, geoscope, 2 dgps antannas and 3 gps antennas
- Heading MRU and antenna bar related to centerline
- Position check MRU and Geoscope (C-O)

2. Vessels geometry survey

The measurements were performed using a total station, A network of temporary points was established on the vessel, which allowed to perform observations from different total station positions in the same reference system.

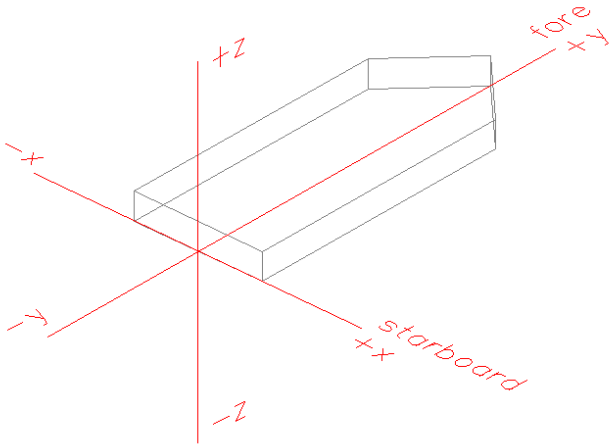
At the time of the measurement the weather conditions were good, The vessel was in the water at the shipyard.

The observations were afterwards analyzed and checked using move3d.

3. Defined coordinate system

The co-ordinate reference system is defined as:

- CRP (X=0, Y=0, Z=0) top of MRU
- Y-axis: parallel to measured points at edge working deck
- X-axis: positive direction to starboard
- Z-axis: positive direction up



4. Offsets sensors and antennas

Pointno.	x	y	z	description
1001	0	0	0	mru top
1009	13.149	-21.012	-1.506	referencemark stern
1014	9.176	-24.218	1.589	top geoscope
1022	8.888	32.163	25.366	dgps1
1023	11.884	30.367	25.277	dgps2
1024	-0.004	0.045	4.41	gps1 trimble
1025	0.011	-0.98	4.433	gps2 C-nav
1026	0.031	-2.012	4.449	gps3 trimble

For an overview, see Appendix A
For photos, see Appendix B

5. Heading MRU and Antenna bar related to centerline

The heading of the MRU is determined in the ships reference frame by measuring the sharp egdes at the bottom of the unit.
The heading of the antenna bar is determined in the ships reference frame by measuring the both ends of the bar.

Heading related to centerline (+ clockwise)

Heading MRU: 1.2
Heading antenna bar : -0.7 degree

6. Postion check MRU and Geoscope

The MRU (pointno.1001) and the geoscope (pointno.1014) were measured during 13 minutes (16:18 - 16:31)

The calculated (geodetic) position (measured with RTK GPS and Total Station) are compared to the observed position in the ships system at the same time.

For the geodetic measurements the following parameters were used:
UTM zone: 31
Datum: WGS84

The results are analyzed and filterd in an excel calculation sheet.

Results Geoscope:

Number off sychronized observations	756
Number off rejected sychronized observations	191
Number off used sychronized observations	565

C(alculated) - O(bserverd)

easting	-0.552
northing	-0.465
ell height	0.091

Results MRU:

Number off sychronized observations	774
Number off rejected sychronized observations	265
Number off used sychronized observations	509

C(alculated) - O(bserverd)

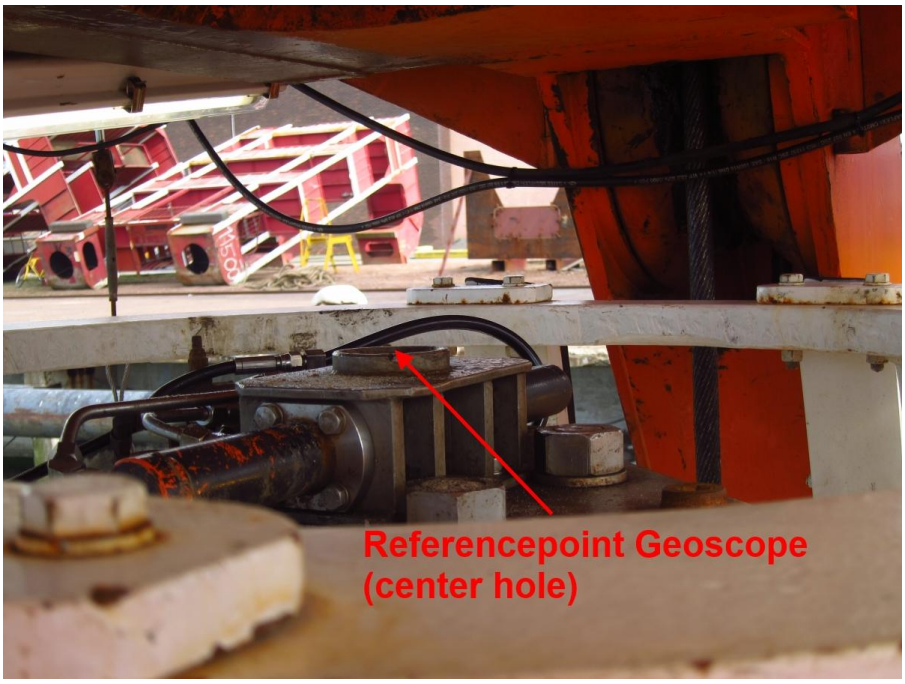
easting	-0.450
northing	-0.488
ell height	0.071

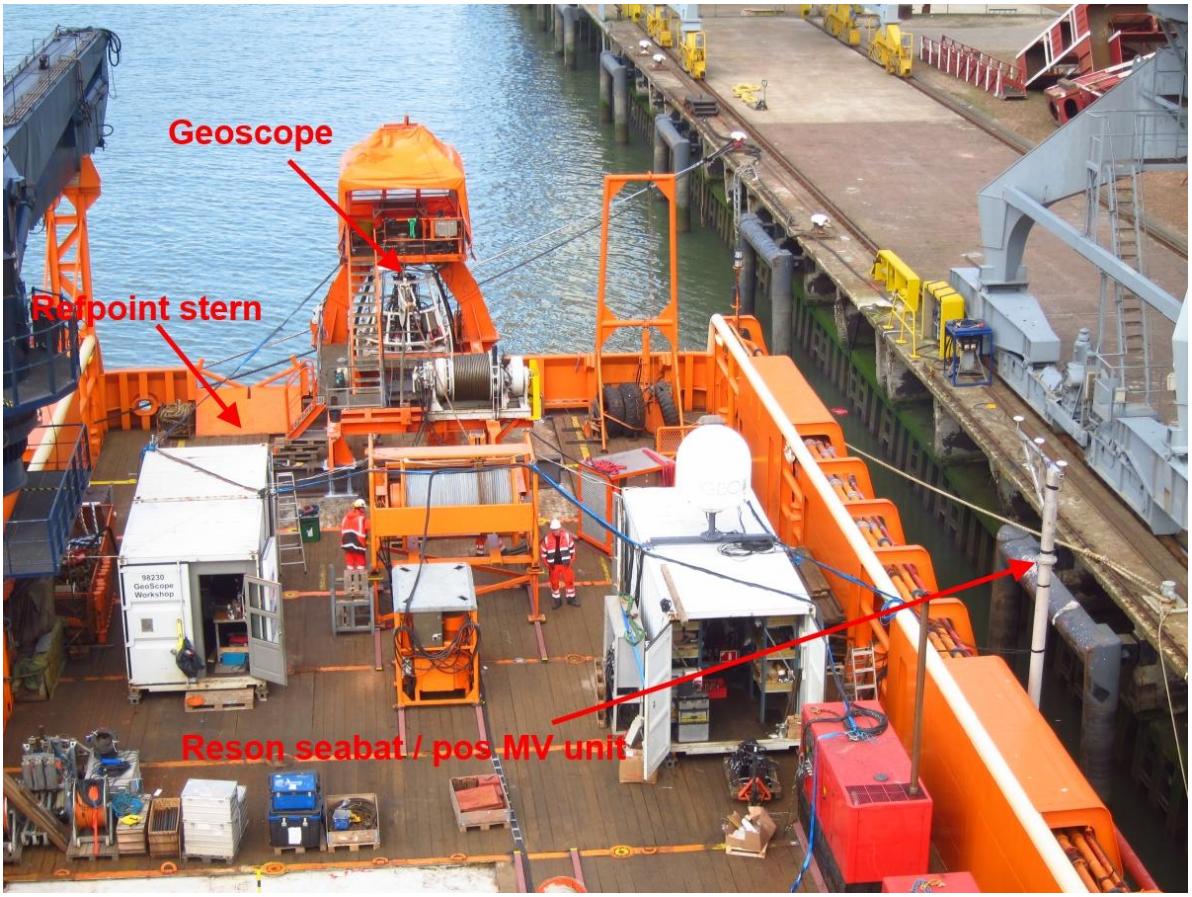
7. Appendices

A. Overview measured points
B. Photos

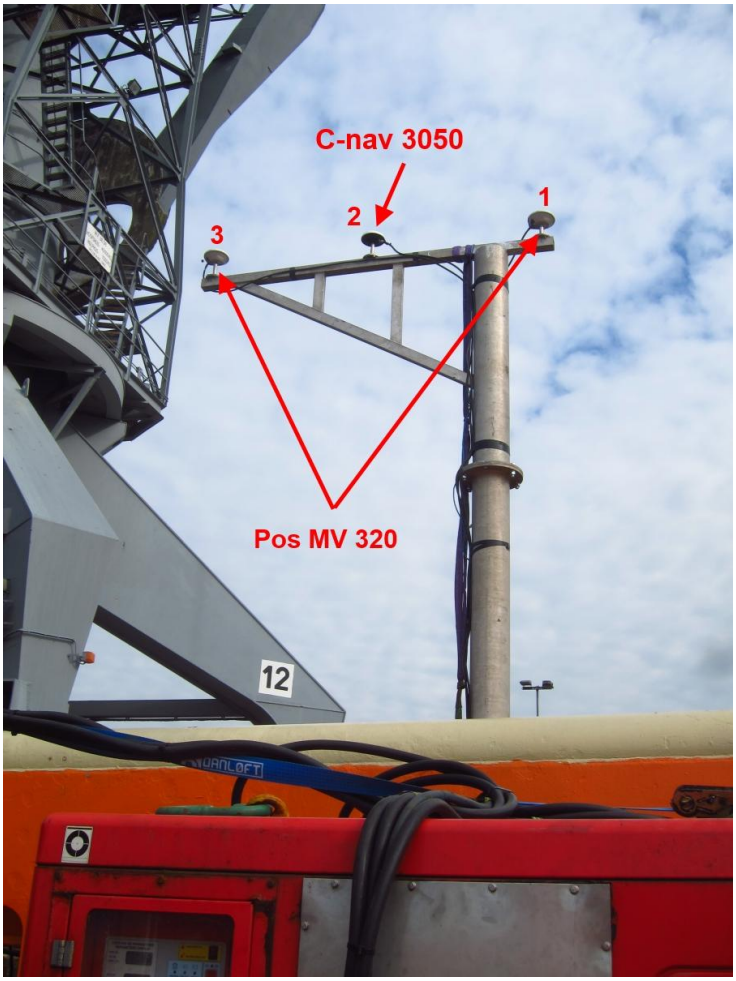
APPENDIX A; Overview measured points

APPENDIX B; Photos


Referencepoint Geoscope
(center hole)

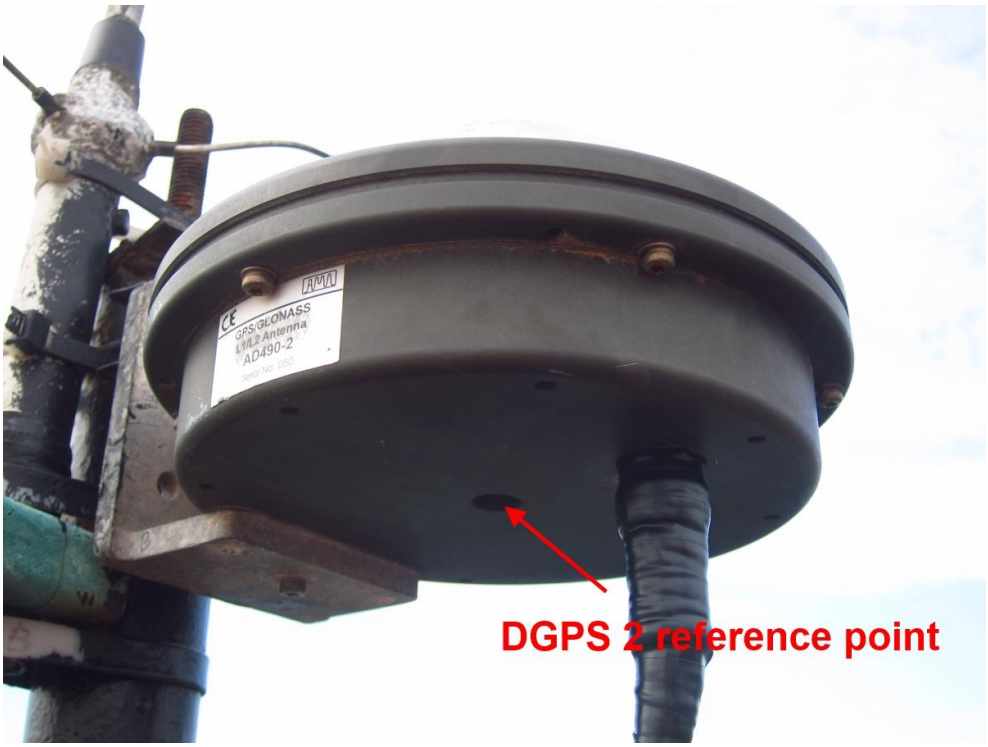

Geoscope
Refpoint stern
Reson seabat / pos MV unit

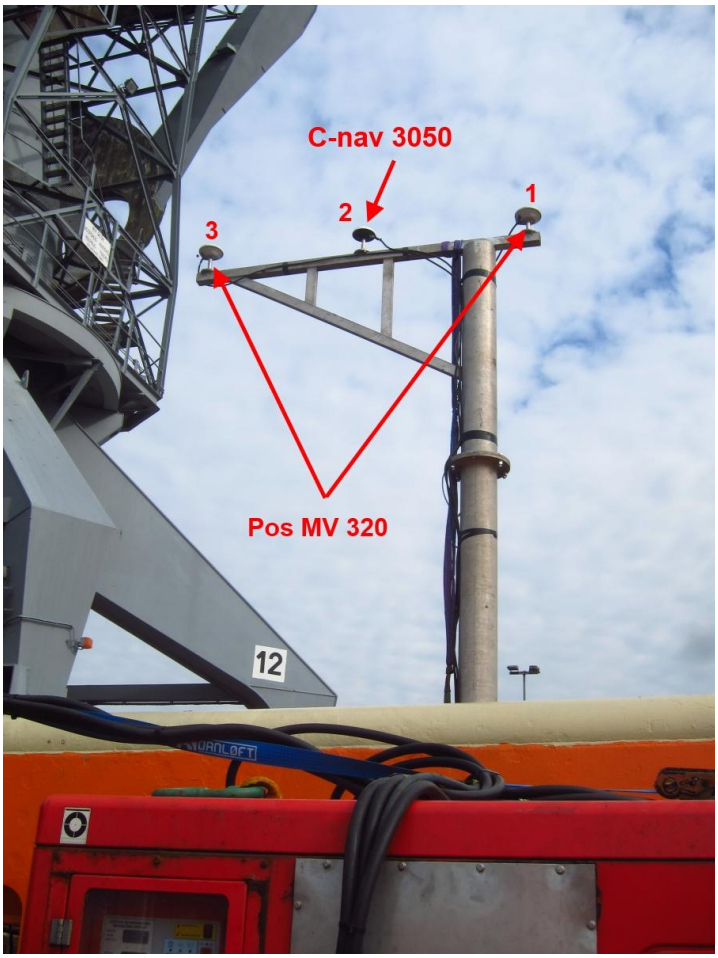

DGPS 1
DGPS 2


C-nav 3050
1
2
3
Pos MV 320
12


Referencepoint stern


DGPS 1 reference point

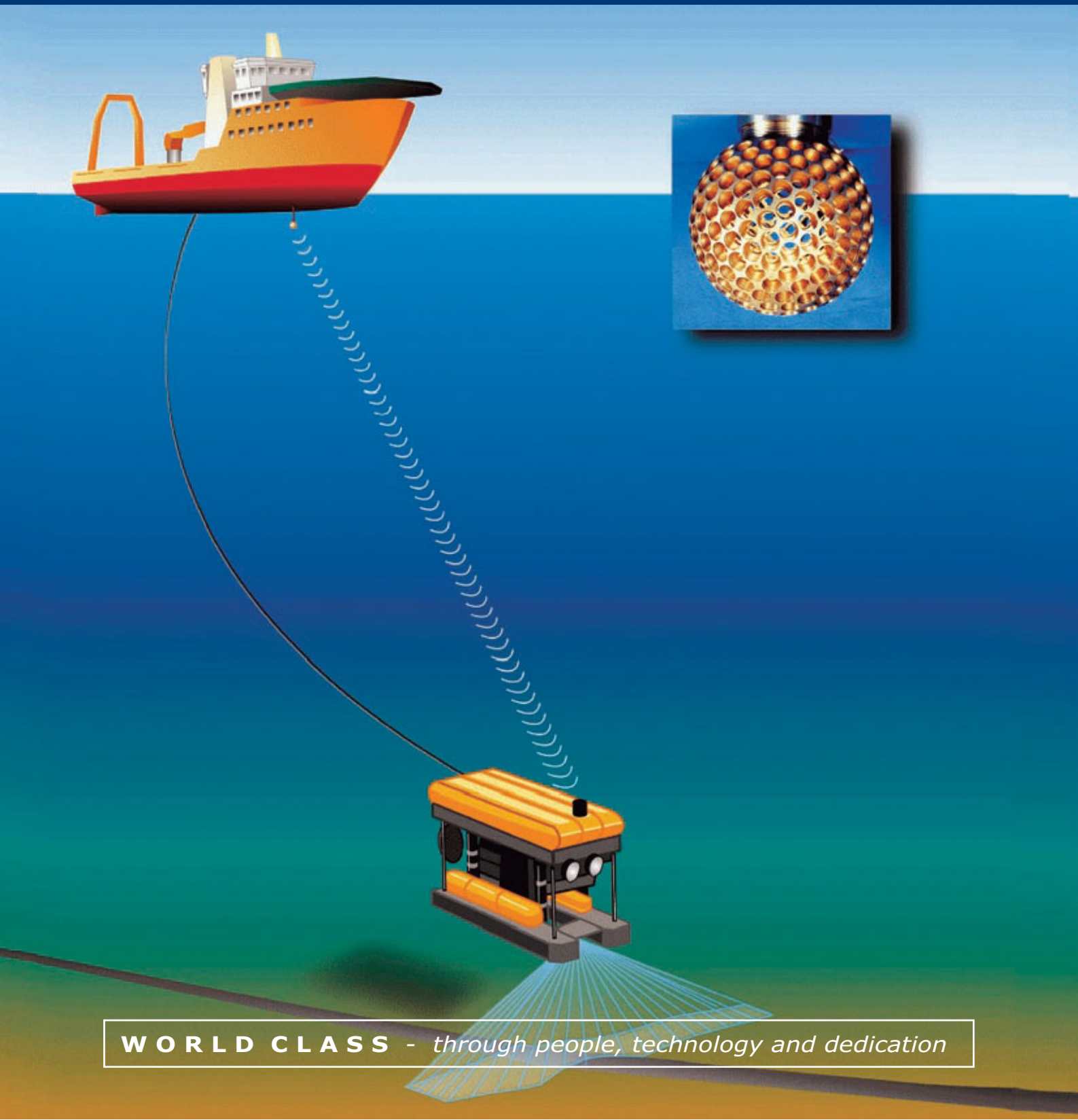

GPS/GLONASS
L1/L2 Antenna
AD490-2
DGPS 2 reference point


C-nav 3050
1
2
3
Pos MV 320
12

KONGSBERG

HiPAP® 500

High Precision Acoustic Positioning System



WORLD CLASS - *through people, technology and dedication*

Introduction

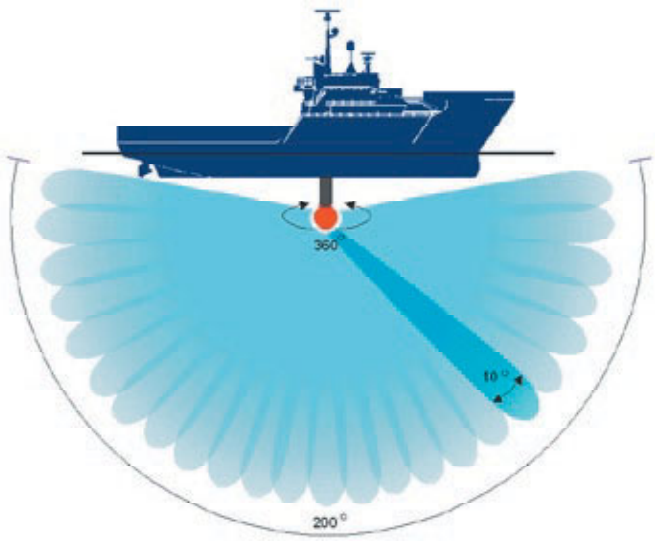
The HiPAP 500 is an underwater positioning system using the Super Short Base Line (SSBL) principle. The main advantage of this principle is that it only requires installation of one hull-mounted transducer and one subsea transponder.

The system design was based on a market requirement of avoiding the Long Base Line (LBL) principle in deep water accurate seabed survey applications. The unique transducer technology and advanced signal processing used in HiPAP 500 was found to be the solution for obtaining the optimal position accuracy required in these deeper waters.

Extreme accuracy - a quantum leap

The HiPAP 500 establishes subsea positioning so accurate that the more complex, but common, LBL principle was made redundant within reasonable depths. Time and cost of survey operations was therefore reduced to a minimum.

The HiPAP 500 system proves to have succeeded the quantum leap in technology with hundreds of elements in the spherical transducer. All these elements also secure an extremely high internal redundancy and reliability. The advanced transducer technology and acoustic signal processing makes the HiPAP 500 the most accurate SSBL system in the world.



Suppression of noise using beam pointing control

The system dynamically controls a 10-degree cone acoustic listening beam. This cone points towards the transponder(s), wherever they are located below the vessel.

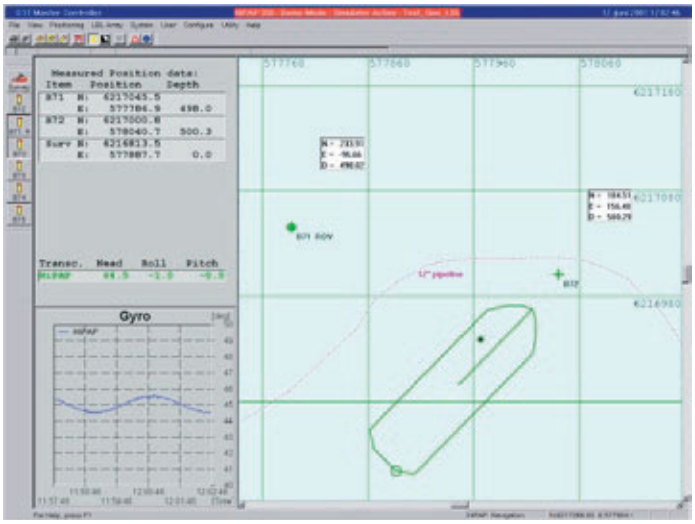
The HiPAP system is so far the only system that can control a focused listening beam towards the transponder(s). This means that noise from other directions is suppressed. This provides a good foundation for further signal processing.

Beam steering is the major key for successful acoustic performance through maximum range and accuracy.

Long Base Line functionality

At some point of range, depending on the application, the SSBL principle will have accuracy limitation. LBL accuracy is independent of range. An LBL system can position more accurately, but only within an array of seabed transponders. The HiPAP with optional LBL features implemented is a very flexible system combining the advantages of both SSBL and LBL.

The HiPAP has better long range performance than traditional wide beam systems. This is because the Signal-to-Noise ratio of the detected seabed transponders' replies are higher than when using one wide beam that needs to cover the seabed footprint of a transponder array.



Multi vessel positioning

The Multi-User LBL (MULBL) function enables several individual vessels and ROV units to position themselves using the same seabed transponder array.

LBL for subsea construction

Kongsberg Simrad introduced the LBL system in 1992, and has since then become the market leader for supply of LBL and combined LBL/SSBL systems for vessel positioning.

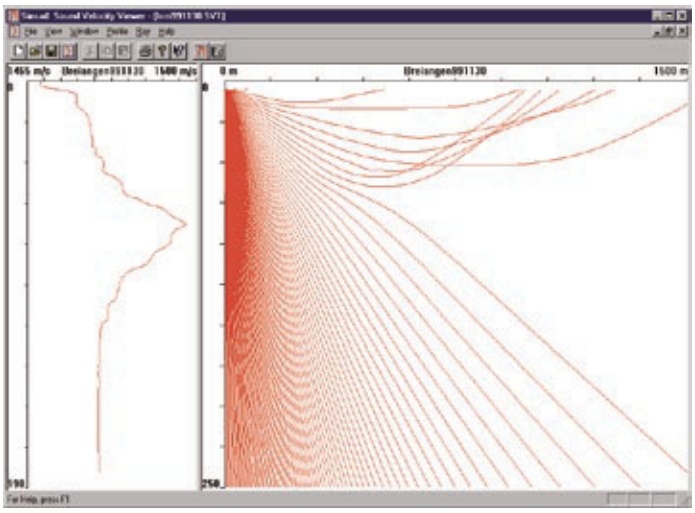
The current LBL systems use intelligent, instrumented transponders, transceivers and transducers. These are all rated for 3000 m water depth, and fulfil any requirements within subsea construction, survey and metrology.

" World Record" in transponder channels

The HiPAP systems can operate with maximum 56 transponder channels, and has transponder telemetry communication for use with transponder release, sensor readings and LBL auto calibration.

Automatic compensation for ray bending and sound velocity errors

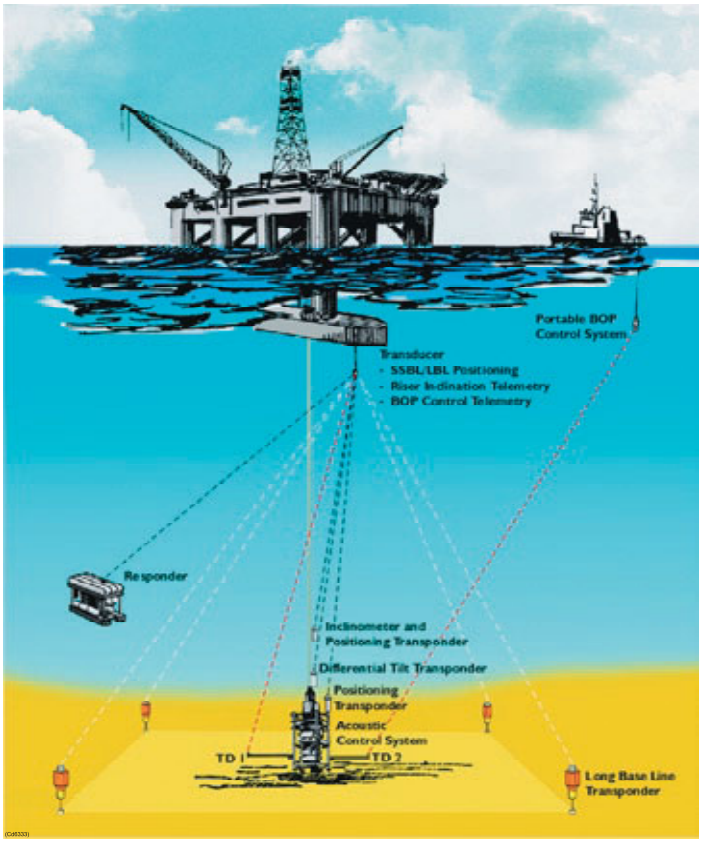
The HiPAP can take input of the sound velocity profile in the water column. Based on this profile, the system will automatically compensate for the error contribution from both wrong angle and range detection.

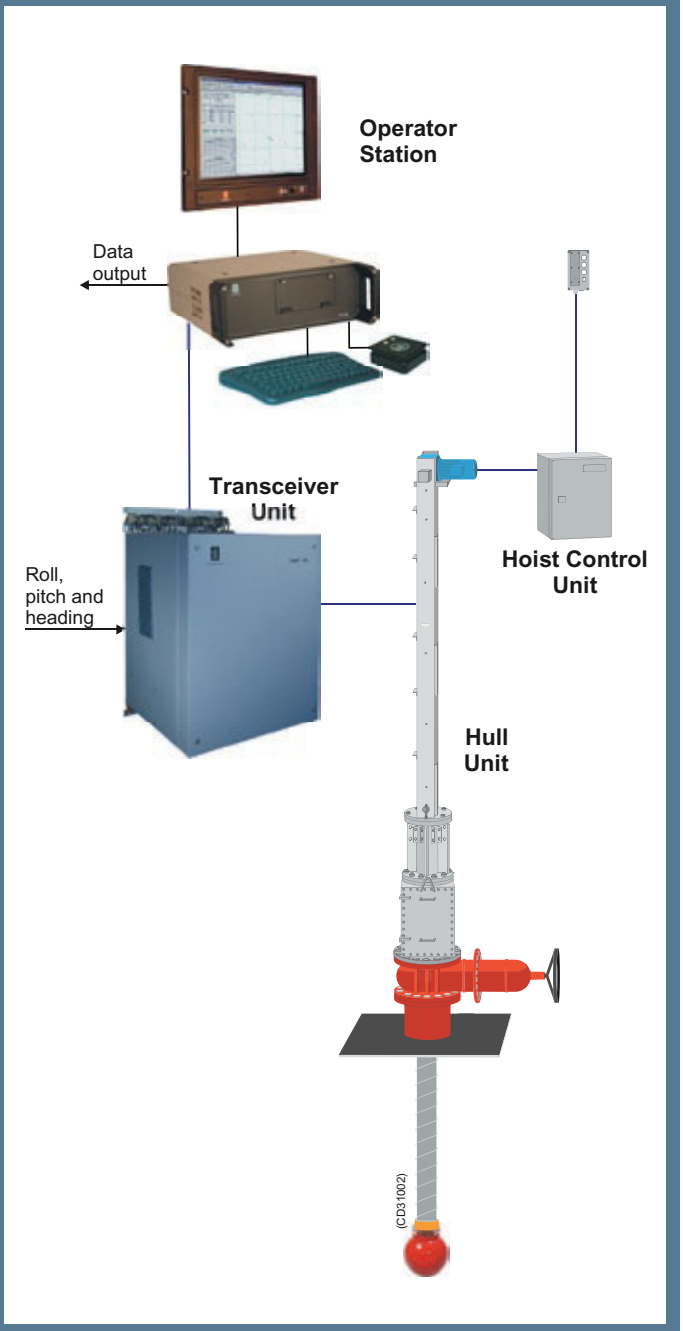


You can also see the ray-trace on the display, which will often explain the reason for “no reply” problems.

Preferred system also for dynamic positioning reference

With its high accuracy, good repeatability and high reliability, HiPAP 500 is the multi-purpose system for any application.





Typical HiPAP® 500 system configuration

The HiPAP 500 system operates with the transducer mounted on a hull unit. Several hull unit models are available, these enable the transducer to be lowered approximately 1.5 to 5.5 m below the keel. A Transceiver Unit containing transmitter, preamplifiers and beamforming electronics is mounted close to the hull unit. The system can be configured with one or two hull mounted transducers. The use of two transducers may increase accuracy and redundancy.

The system operation is performed on a Windows XP® based operator station.

Technical specifications

HiPAP 500 basic specifications

Gate valve size required:	500 mm (20 inches)
Transducer diameter:	400 mm
Acoustic operating area:	+/- 100° (Recommended)
Number of active elements:	241
Angle accuracy:[1)]	0 dB S/N: 0.30°
	10 dB S/N: 0.18°
	20 dB S/N: 0.12°
Accuracy dual mode option, dual transducer system:[1)]	20 dB S/N: 0.085°
Range detection accuracy:[1)]	< 20 cm
Typical operating range:[1)]	1 to 4000 m
Narrow pointing receiver beam:	+/- 5°

Note that the technical specifications are subject to change without prior notice.

1) The specifications are based on; Line of sight from transducer to transponder, no influence from ray bending, Signal-to-Noise ratio as specified in water in the 250 Hz receiver band, no error from heading/roll/pitch sensors, and use of correct sound velocity. Operating ranges are typical and conservative, and are assued by using sufficient transponder source level (up to 206 dB dependant on range).

HiPAP 500 standard features

56 transponder channels
Hull unit for transducer deployment
WindowsXP® based operation system

Receive frequency band:	27,0 – 30,5 kHz
Telemetry frequency band:	24,5 – 27,0 kHz
Transmit frequency band:	21,0 – 24,5 kHz

Comprehensive on-line help
Automatic transducer alignment calibration
Compensation for ray-bending
Display of ray-bending
External Depth sensor interface
Position and angle alarm limits
Responder mode
Telegram output to dynamic positioning system
Telegram output to survey system
Transponder Telemetry for full utilization
DGPS Interface

HiPAP 500 optional features

Beacon Mode
Compass Transponder Mode
Depth Sensor Transponder Mode
Inclinometer Transponder Mode
Long Base Line (LBL) functionality
Geographical LBL Calibration
Multi-User LBL functionality (MULBL)
Operator Station Master / Slave function
Blow out preventer (BOP) telemetry function
Offshore Loading Telemetry function
Submerged Turret Loading function
Fast LBL Transponder Positioning mode *
LBL Accurate Metrology mode*
(standard in LBL function)*

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DANISH GEOTECHNICAL INSTITUTE

Appendix 1.0.V
CPT Interpretation – GEO Model 15

MODEL15

Soil Definitions,

SAND $\gamma = 20.0$ φ = CAL08
D_r = CAL12 M_0 = CAL15 - SAND

CLAY $\gamma = 20.0$ N_{kt} = 15-20 c_u = CAL05
M_0 = CAL15 - CLAY

SAND/SILT/CLAY $\gamma = 20.0$ N_{kt} = 15-20 φ = CAL08 c_u = CAL05
D_r = CAL12 M_0 = CAL15 - SAND

SILT $\gamma = 20.0$ N_{kt} = 15-20 φ = CAL08 c_u = CAL05
D_r = CAL12 M_0 = CAL15 - SAND

SAND/SILT $\gamma = 20.0$ N_{kt} = 15-20 φ = CAL08 c_u = CAL05
D_r = CAL12 M_0 = CAL15 - SAND

CLAY/SILT $\gamma = 20.0$ N_{kt} = 15-20 c_u = CAL05
M_0 = CAL15 - CLAY

LIMESTONE $\gamma = 22.0$

GYTTJA/Highly Plastic CLAY $\gamma = 13.0$ N_{kt} = 15-20 φ = CAL08 c_u = CAL05
D_r = CAL12 M_0 = CAL15 - CLAY

Gc CLAY $\gamma = 20.0$ N_{kt} = 15-20 c_u = CAL05
M_0 = CAL15 - CLAY

Pg CLAY $\gamma = 20.0$ N_{kt} = 15-20 c_u = CAL05
M_0 = CAL15 - CLAY

Possible LIMESTONE $\gamma = 22.0$

BB $\gamma = 0.0$ $N_{kt} = 15\text{-}20$ c_u = CAL05
M_0 = CAL15 - CLAY

SB $\gamma = 0.0$ $N_{kt} = 15\text{-}20$ c_u = CAL05
M_0 = CAL15 - CLAY

MODEL15

Calculations

$q_t = q_c + 0.25 \cdot u$

$f_t = f_s - 0.005 \cdot \Delta u$

$R_{ft} = 100 \cdot f_t / q_t$

$Q_t = (q_t - \sigma_{v0}) / \sigma'_{v0}$

$F_r = f_s / (q_t - \sigma_{v0})$

$c_u = (q_t - \sigma_{v0}) / N_{kt}$

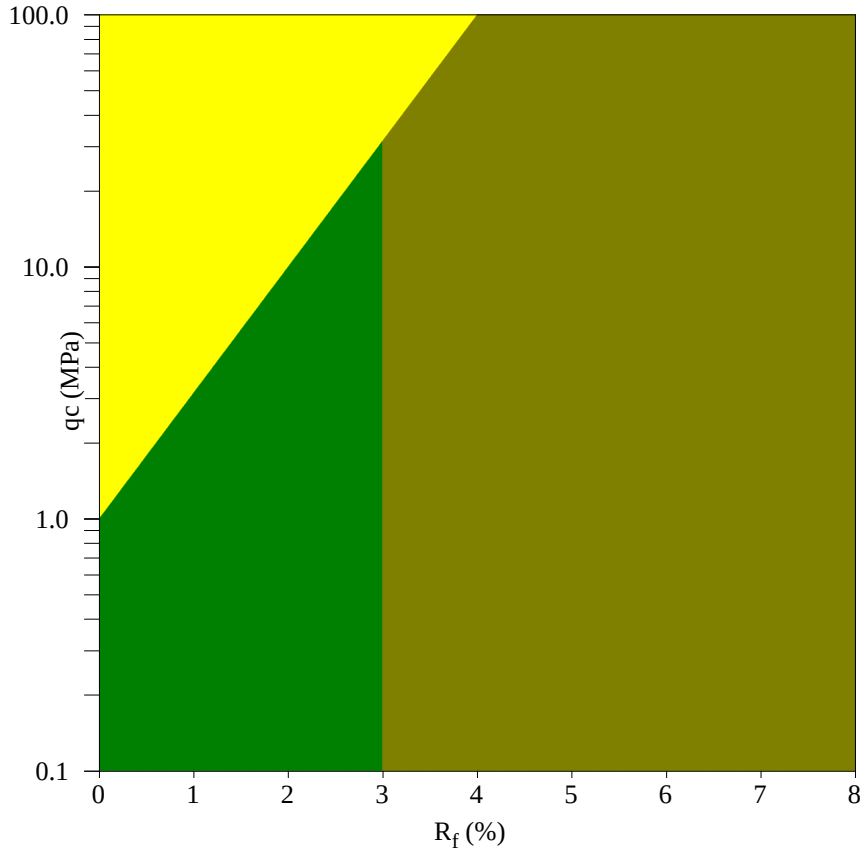
$B_q = \Delta u / (q_t - \sigma_{v0})$

$\Delta u = u - u_0$

$N_q = q_t/\sigma'_{v0} = \tan^2(\pi/4 + \varphi'/2) \cdot \exp((\pi/3 + 4 \cdot \varphi') \cdot \tan(\varphi'))$ where q_t is kPa and φ' is rad

$D_r = 1/a \cdot \ln(q_c / (b \cdot ((1 + 2 \cdot k_0)/3 \cdot \sigma'_{v0})^c)) \cdot 100\%$ where a=2.61 b=181 c=0.55 k_0=1

Auto Interpretation Model



- SAND
- SBMESTONE
- CLAY
- GYTTJA/Highly Plastic CLAY
- SAND/SILT/CLAY
- Gc CLAY
- SILT
- Pg CLAY
- SAND/SILT
- Possible LIMESTONE
- CLAY/SILT
- BB