APRIL 2021
ENERGINET ELTRANSMISSION A/S

THOR OFFSHORE WIND FARM

LANDFALL SITE INVESTIGATIONS

GEOTECHNICAL INVESTIGATION
REPORT NO. 1

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PROJECT NO.	DOCUMENT NO.
A224691	A224691-001.1

VERSION	DATE OF ISSUE	DESCRIPTION	PREPARED	CHECKED	APPROVED
2.0	21 April 2021		HRMO	SPN	HRMO

CONTENTS

ENCLOSURES

Profiles and plans

1 Purpose of the investigation

A geotechnical investigation has been undertaken at the landfall site of the Thor Offshore Wind Farm project at Fjaltring.

The purpose of the investigation is to provide geological and geotechnical data in sufficient detail for the planning and design of the HDD at the site.

2 Project

The location of the landfall site and a planned 300m wide corridor for the HDD is shown on the location plan "G002", dated 10 August 2017 and prepared by Energinet Eltransmission A/S.

The location plan Encl. No. 1.14. is based on location plan "G002" and shows the planned centreline of corridor for the HDD.

Currently, there is no information about the planned depth of the HDD. However, the planed investigation depth for geotechnical investigation has been set to level -25m, DVR90 by Energinet.

3 Field investigation and laboratory work

The geotechnical field investigations were performed during the period 3 to 16 March 2021 and comprised 3 nos. geotechnical boreholes denoted B/CPT 1, B/CPT 3 and B/CPT 4, and 6 nos. CPTs denoted CPT 1 – CPT 6.

The locations of the boreholes and CPTs were surveyed using GPS equipment.

The locations of the boreholes and CPTs are shown on the Site Location Plan, Encl. No. 1.14.

The geotechnical boreholes were performed to a depth of 27.0 – 31.0 m below ground level (m b. g. l.).

The boreholes were drilled with a hydraulic rig, using casing, shell and auger techniques and with a borehole diameter of 150 mm.

The CPTs were performed to a depth of 12.8 – 21.5m b. g. l.

The depth of the CPTs were planned to match the depth of the neighbouring boreholes. However, all CPTs were terminated at maximum thrust of the CPT equipment at approx. 10 tons. Under level of refusal, SPT tests were performed in cohesionless soils for every 2 - 3m in the neighbouring borehole.

The CPTs were carried out with a piezocone, which enables measurements of tip and sleeve resistance as well as pore water pressure.

SPT tests shows the number of blows, N, necessary to achieve a penetration of the sampler of 300mm, $N_{300.}$

During the drilling, the thicknesses and depths of all encountered strata were noted. Representative, disturbed samples were recovered from all layers and at intervals not exceeding 0.5m.

In the boreholes undisturbed tube samples (A-tubes) or large, disturbed samples (approx. 10 kg) were recovered for approx. every 5.0m from approx. 5.0m b. g. l. A-tubes were recovered in cohesive soils and disturbed samples were recovered in sand deposits.

Field vane tests were carried out in cohesive soils in order to determine the undrained shear strengths of the materials in the undisturbed state, as well as after remoulding (c_{fv} respectively c_{fvr}).

A standpipe, consisting of Ø25mm PVC tube with slots at the base, was installed in the boreholes B/CPT 4 and B/CPT 5 to allow monitoring of the ground water level in the boreholes. A bentonite plug was installed above the filter to prevent surface water from influencing the water level in the standpipe.

Monitoring of the water levels was performed on 29 March 2021.

A geological description and classification of all soil samples was carried out in the laboratory. This work was performed in accordance with the guidelines in the Danish Geological Society's publication "Vejledning i ingeniørgeologisk prøvebeskrivelse" dated February 2009.

The carbonate content of the soil samples was qualitatively evaluated by the reaction of the samples to 10 % hydrocloric acid.

The natural water content, w, of the soil samples was determined on selected samples.

The bulk density of the soil was conducted on all suitable undisturbed samples.

The Plasticity Index by Atterberg limit tests was determined on selected soil samples.

The results of the field and laboratory work are presented on the borehole logs, Enclosure Nos. 1.1, 1.4, 1.5 and the CPT logs, Enclosure Nos. 1.1CPT – 1.6CPT.

The results of the above has been reported to the Jupiter Database.

The particle size distribution by sieve analysis and by combined sieve and hydrometer analysis was determined on selected soil samples. The results of these teste are given in table 3 and in Enclosure Nos. 1.7 – 1.9.

The thermal conductivity was determined on selected soil samples. The results of these teste are given in table 4 and in Enclosure Nos. 1.10 – 1.12.

A legend for the symbols used on the boreholes and CPT logs is presented in Encl. A-1.

4 Levels and coordinates

All depths are measured from the ground surface as meters below ground level, (m b. g. l.).

All levels refer to the Danish National Survey System, "Dansk Vertikal Reference 1990" (DVR90).

The system DVR90 is approximately coinciding with Mean Sea Level at the shoreline.

The coordinate system used for determining coordinates for the locations of the boreholes and CPTs is UTM32.

Levels and coordinates for all boreholes and CPTs are shown in Table 1.

Table 1: Levels and coordinates at boreholes and CPTs

Borehole No. CPT No.	**Ground Level Elevation (m)**	**X (m)**	**Y (m)**
B/CPT 1 CPT 1	+1.3	446,032	6,257,440
CPT 2	+1.2	446,012	6,257,295
CPT 3	+3.7	446,239	6,257,460
B/CPT 4 CPT 4	+2.7	446,221	6,257,293
B/CPT 5 CPT 5	+5.1	446,407	6,257,482
CPT 6	+3.3	446,366	6,257,310

5 Subsurface conditions

5.1 General

In general, the subsurface conditions encountered in the boreholes comprise of postglacial sand and gravel overlying late glacial and glacial clay, sand and gravel deposits. These deposits are then primarily overlying Miocene clay and sand deposits along with Miocene Gyttja.

In the boreholes B/CPT 4 and B/CPT 5 the upper 0.6 and 0.8 m comprises of topsoil.

Below the topsoil and from terrain in borehole B/CPT 1 postglacial sand and gravel is found to a depth of 3.7 – 4.9 m b. g. l. The postglacial deposits are underlain by late glacial and glacial sand, gravel and clay to 14.7 – 17.2 m b. g. l. Most of the clay deposits are very high plasticity clay.

In borehole B/CPT 5 the late glacial and glacial deposits are underlain by 0.3 m of glacial clay till. Under the clay till in borehole B/CPT 5, and under the late glacial and glacial deposits in the other boreholes, Miocene deposits, primarily consisting of clay and sand, are encountered to the base of the boreholes 27.0 – 30.0 m b. g. l. However, in borehole B/CPT 4 and B/CPT 5 Miocene gyttja is encountered from 22.5 to 25.3 m b. g. l. Most of the clay deposits are very high plasticity clay.

CPT tip resistances from 5 to >20 MPa are recorded in the late glacial sand, indicating that these deposits are medium dense to dense.

In the Miocene sand deposits, SPT tests results are generally greater than 50 blows pr. 300 mm, indicating that these deposits are generally very dense.

The subsurface conditions can be divided into the general layers as shown in Table 2.

Table 2: Subsurface conditions

Soil type	B/CPT 1 Elev. (m)	B/CPT 4 Elev. (m)	B/CPT 5 Elev. (m)
TOPSOIL and SAND, Re	-	+2.7 - +1.9	+5.1 - +4.5
SAND and GRAVEL, Pg	+1.3 - -3.3	+1.9 - -2.3	+4.5 - +1.4
SAND and GRAVEL, Lg	-	-2.3 - -2.5	+1.4 - -1.3
CLAY, Lg/Gc	-3.3 - -12.3	-2.5 - -9.4	-1.3 - -8.9
SAND, Lg/Gc	-	-9.4 - -11.3	-
CLAY, Lg/Gc	-	-11.3 - -12.3	-
GRAVEL, Lg/Gc	-	-12.3 - -12.5	-8.9 – -10.0
SAND, Lg/Gc	-12.3 - -13.4	-	-10.0 - -12.1
CLAY TILL, Gc	-	-	-12.1 - -12.4
CLAY, Mi	-	-12.5 - -13.6	-
SAND, Mi	-13.4 - -18.0	-13.6 - -19.8	-12.4 - -18.7
GYTTJA, Mi	-	-19.8 - -20.5	-18.7 - -20.2
CLAY, Mi	-18.0 - -22.8	-20.5 - -22.7	-20.2 - -25.9
SAND, Mi	-22.8 - -25.7	-22.7 - -25.3	-

5.2 Geology

The geological conditions that apply to the area around the planned line for the HDD are briefly described here. The description is based on data from the GeoAtlas and Jupiter database and boreholes and CPTs carried out in connection with the present project.

A conceptual geological profile along the expected corridor for the project can be seen in Enclosure Nos. 1.13.

As described in section 5.1 the area is generally made up of the following layers:

Postglacial SAND and GRAVEL (S1) overlying late glacial and glacial CLAY (C1), SAND and GRAVEL (S2) and CLAY TILL (C 2) deposits. These deposits are then primeryly overlying Miocen CLAY (C3) and SAND (S3) deposits along with Miocene GYTTJA (G1).

5.3 Particle Size Distribution

The particle size distribution by sieve analysis and by combined sieve and hydrometer analysis was determined on sample 30A and 40A from borehole B/CPT 1, sample 22A and 43A from borehole B/CPT 4 and sample 26A and 44A from borehole B/CPT 5. The results of these teste are given in Table 3 and in Enclosure Nos. 1.7 – 1.9.

Table 3: Particle Size Distribution

Borehole No.	Sample No.	Geological Description	d_{10} (mm)	d_{50} (mm)	U (d_{60} /d_{10})
B/CPT 1	30A	SAND, fine, silty, micaceous, with small lignite fragments, sorted	0.07	0.16	2,7
B/CPT 1	40A	CLAY, very high plasticity, micaceous	-*	0.01	-*
B/CPT 4	22A	CLAY, very high plasticity	-*	0.01	-*
B/CPT 4	43A	SAND, fine, micaceous, with small fragments of lignite, sorted	0.06	0.11	2.1
B/CPT 5	26A	CLAY, very high plasticity, with many thin layers of silt	-*	0.00	-*
B/CPT 5	44A	SAND, medium - coarse, with a few gravels, sorted	0.18	0.44	3.0

** Contains more than 10% silt/clay*

5.4 Thermal Conductivity

The thermal conductivity was determined on sample 40A from borehole B/CPT 1, sample 43A from borehole B/CPT 4 and sample 26A from borehole B/CPT 5. The results of these teste are given in Table 4 and in Enclosure Nos. 1.10 – 1.12.

Table 4: Thermal Conductivity

Borehole No.	Sample No.	Depth (m b. g. l.)	Geological Description	Thermal Conductivity (W / (m*K))
B/CPT 1	40A	20.0 – 20.6	CLAY, very high plasticity, micaceous	1.549
B/CPT 4	43A	20.0	SAND, fine, micaceous, with small fragments of lignite, sorted	2.207
B/CPT 5	26A	13.0 – 13.5	CLAY, very high plasticity, with many thin layers of silt	1.669

The results of the conducted tests show that the thermal conductivity of the tested samples is in the range of 1.549 – 2.207 W/(m*K).

6 Water levels

The water level in the standpipes in the boreholes was measured the 29 March 2021. The results are presented in Table 5 below:

Table 5: Water level measurements 29 March 2021

Borehole No.	Elev. (m)	Filter level (m b. g. l.)	Date	Water Level	
				Depth (m b. g. l.)	Elev. (m)
B/CPT 4	+2.7	4.4 – 5.0	29-03-2021	1.7	+1.0
B/CPT 5	+5.1	5.3 – 6.0	29-03-2021	2.5	+2.6

The ground water level is expected to vary during the cause of the year due to seasonal variations.

A more detailed description of the encountered subsurface conditions can be seen on the borehole logs.

7 Geotechnical interpretations

The terrain at the boreholes and CPTs varies from +5.1 to +1.2 m.

Based on the boreholes and CPTs it is expected that the HDD will primarily be drilled in late glacial/glacial clay or in Miocene sand and clay deposits.

Field vane tests in the late glacial/glacial clay deposits show an undrained shear strength of approx. 100 – 300 kN/m^3. Field vane tests in the late Miocene clay deposits show an undrained shear strength of approx. 600 – >700 kN/m^3.

Furthermore, most of the late glacial, glacial and Miocene clay deposits have a very high plasticity, which is based on their water content and the visual classification of the samples

There is a potential risk of swelling for high and very high plasticity clay. If the HDD is placed in the late glacial, glacial and Miocene clay deposits, appropriate measures must be taken to ensure that the drilling equipment does not stop as a result of increased surface pressure from the clay.

The performed Atterberg limit tests shows Plasticity Indexes ranging from 6.6 to 33.5 as shown on the borehole logs Enclosure Nos. 1.1, 1.4, 1.5. indicating a lower plasticity. However, based on the water content and the visual classification of the samples, it is estimated that the potential risk of swelling will be that of very high plasticity clay.

The Miocene sand deposits at the western part of the line are mainly fine grained and silty. At the eastern part of the line the sand deposits are mainly fine – coarse grained. The SPT tests conducted in the Miocene sand deposits indicates, that these deposits are generally very dense.

The primary challenges for the HDD will be:

- Risk of swelling of clays with high and very high plasticity
- Very dense Miocene sand and clay deposits
- Loss of pressure in sand and gravel layers

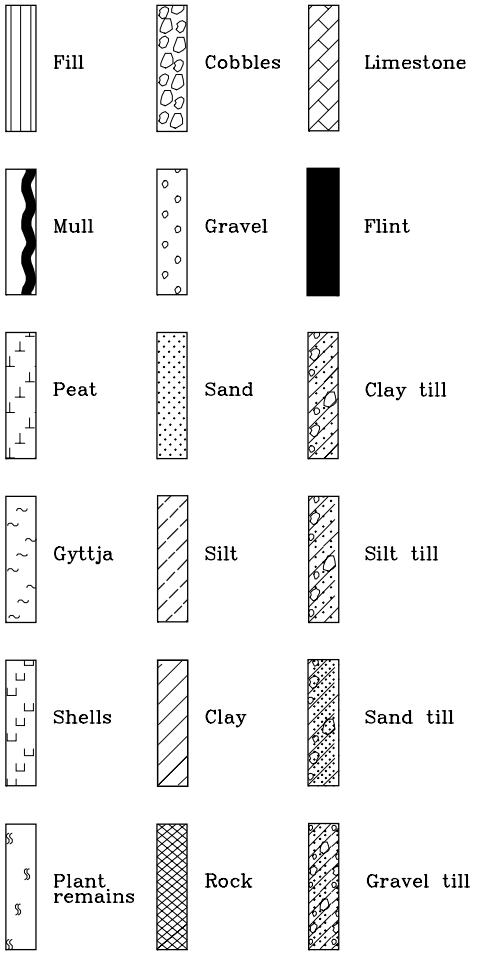
8 Final remarks

The recovered soil samples will be stored for a period of one year from the date of this report. After this period the samples will be disposed of unless other agreed with Energinet.

COWI is available for further discussions regarding geotechnical and foundation issues in relation to the project.

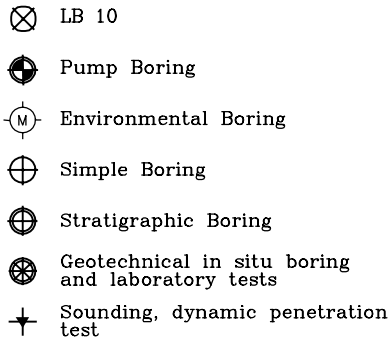
LEGEND FOR BOREHOLE LOGS

Soil Signature

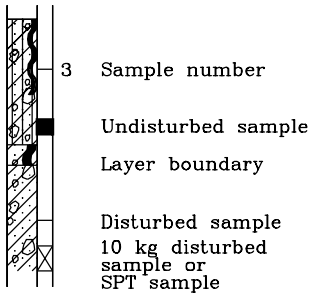


Till deposits can be expected to contain cobbles and boulders (not apparent in borings).

Location Plan



Borehole log



Geological abbreviations

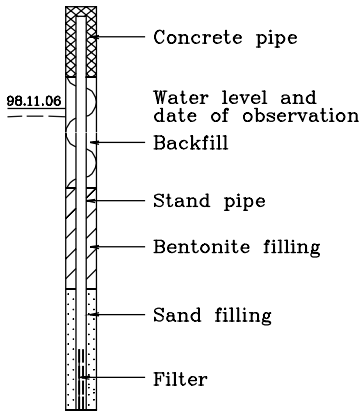
Environment :

Fw	Freshwater deposit
Ss	Solifluction soil
Fi	Fill
Gl	Glacier deposit
Ma	Marine deposit
Wd	Washdown deposit
Ts	Top soil
Ls	Landslide deposit
Mw	Meltwater deposit
Ae	Aeolian (wind) deposit

Age :

Re	Recent
Pg	Postglacial
Lg	Late Glacial
Gc	Glacial
Ig	Interglacial
Te	Tertiary
Ct	Cretaceous
Da	Danian

Stand pipe



Definitions

Signature	Parameter	Sym.	Unit	Definition
	Water content	w	%	Weight of water in percent of solid matter
	Liquid limit	w_L	%	Water content at yield point
	Plastic limit	w_P	%	Water content at plastic limit
	Plastic index	I_P	%	$w_L - w_P$
	Volume weight	γ	kN/m³	Ratio between total weight and total volume
	Loss by combustion	gl	%	Weight loss of combustion in percent of solid matter
	Reduced loss by combustion	gl_{red}	%	gl − ka
	Lime content	ka	%	Weight of $CaCo^3$ in percent of solid matter
−/(+)/+/++	Lime sample	kp	−	Reaction w. hydrochoric acid: − = no lime; (+) = low content of lime; + = limy; ++ = high content of lime
	Shear strength	c_v	kN/m²	Shear strength measured with a vane test in undisturbed soil
	Shear strength, remoulded	c_{vr}	kN/m²	Shear strength measured with a vane test in disturbed soil
	Drilling resistance Loaded flat drill	R_{SP}	N_{200}	No. of ½−rotations pr. 200 mm penetration
	Sounding resistance Swedish penetration test	R_{RS}	N_{200}	No. of strokes pr. 200 mm penetration
	Sounding resistance Light penetration test	R_{LSD}	N_{200}	No. of strokes pr. 200 mm penetration
	Sounding resistance SPT−probe, closed/open	SPT	N_{300}	No. of strokes pr. 300 mm penetration

Date	Designed	Controlled	Approved	Dokument no.	Page
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LEGEND FOR BOREHOLE LOGS

Data sheet A−1

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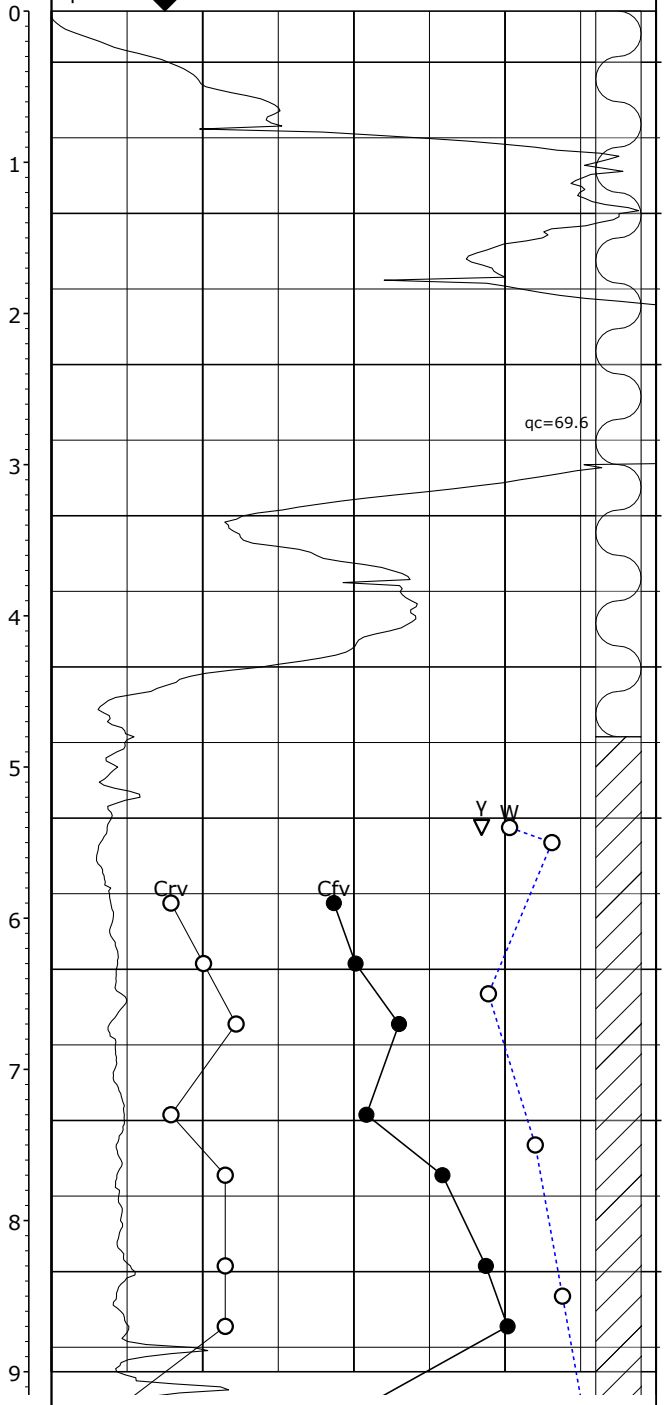

No.	Geological Description	Env.	Age	Frost	$CaCO_3$
1	SAND, fine - medium, sorted, moderate yellowish brown	Ma	Pg		-
2	SAND, fine - coarse, slightly gravelly, poorly graded, moderate yellowish brown	Ma	Pg		-
3	SAND - " -	Ma	Pg		-
4	SAND, fine - coarse, gravelly, graded, moderate yellowish brown	Ma	Pg		-
5	GRAVEL, very sandy, graded, moderate yellowish brown	Mw	Lg		-
6	SAND, fine - coarse, gravelly, slightly stony, graded, moderate yellowish brown	Mw	Lg		-
7	SAND, fine - medium, sorted, moderate brown	Mw	Lg		-
8	SAND, fine - medium, sorted, moderate yellowish brown	Mw	Lg		-
9	SAND, fine - medium, sorted, dark yellowish brown	Mw	Lg		-
10	CLAY, silty, sandy, dark yellowish brown	Mw	Lg/Gc		-
10A 11	CLAY, very high plasticity, with thin silty layers, olive grey	Mw	Lg/Gc		(+)
12	CLAY, very high plasticity, olive grey	Mw	Lg/Gc		(+)
13	CLAY, high plasticity, olive grey	Mw	Lg/Gc		(+)
14	CLAY, very high plasticity, olive grey	Mw	Lg/Gc		+
15	CLAY - " -	Mw	Lg/Gc		+
16	CLAY - " -	Mw	Lg/Gc		+
17	CLAY - " -	Mw	Lg/Gc		+
18	CLAY, very high plasticity, with silty layers, with sandy layers, olive grey	Mw	Lg/Gc		+

Continue

○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○ ●	100	200	300	Crv,Cfv (kPa)
→	5	10	15	qc (MPa)

Sample 11, 24, 47 and 48: Layered. Sample 17: Slightly layered
Sample 18-23: Varved. Sample 17-24: Ice dammed lake deposits
Sample 27: Gravels windpolished. Sample 29: Stones windpolished

Method: 6'' auger with casing
Projection: UTM32E89
X: 446032 (m) Y: 6257440 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./SNC Date: 2021.03.08 Geologist: Geob./LC Public No.: Borehole: B/CPT1

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.1 P. 1/3

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Borehole Log

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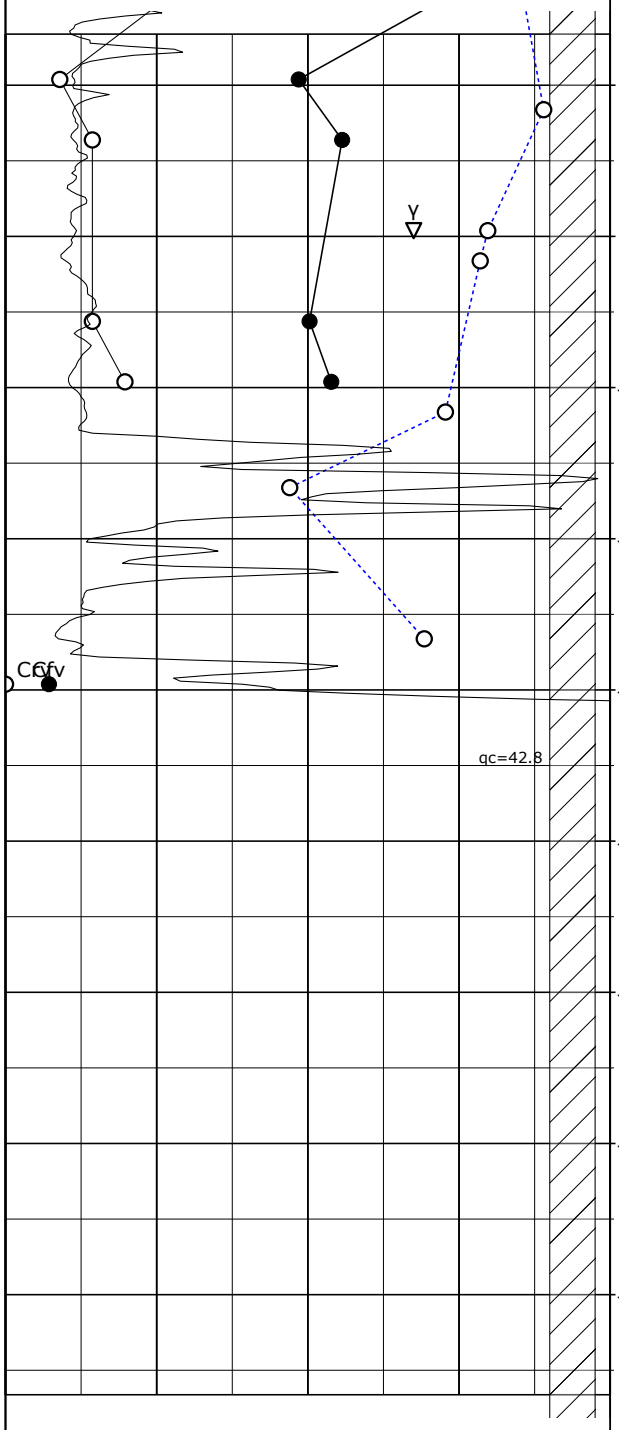

Depth (m)	Level (m)	Geology	Sample	No.	Geological Description	Env.	Age	Frost	$CaCO_3$
					Continued				
9				18	CLAY, very high plasticity, with silty layers, with sandy layers, olive grey	Mw	Lg/Gc		+
	-8			19	CLAY, very high plasticity, with silty layers, medium dark grey	Mw	Lg/Gc		+
10				20	CLAY - " -	Mw	Lg/Gc		+
	-9			20A					
				21	CLAY - " -	Mw	Lg/Gc		+
11				22	CLAY - " -	Mw	Lg/Gc		+
	-10			23	CLAY, high plasticity, with thick silty layers, medium dark grey	Mw	Lg/Gc		+
12				24	CLAY, high plasticity, with sandy layers, olive grey	Mw	Lg/Gc		(+)
	-11			25	CLAY, silty, sandy, olive grey	Mw	Lg/Gc		(+)
13				26	CLAY, high plasticity, olive grey	Mw	Lg/Gc		(+)
	-12			27	CLAY, sandy, silty, slightly gravelly, olive grey	Ss	Lg/Gc		-
14				28	SAND, fine - medium, sorted, medium dark grey	Ss	Lg/Gc		-
	-13			29	SAND, fine - coarse, stony, gravelly, medium dark grey	Ss	Lg/Gc		-
15				30	SAND, fine, silty, micaceous, with small lignite fragments, sorted, brownish grey	Fw	Mi		-
	-14			30A					
				31	SAND, fine, silty, micaceous, with small lignite fragments, sorted, dark grey	Fw	Mi		-
16				32	SAND, fine, micaceous, with pieces of lignite, sorted, brownish grey	Fw	Mi		-
	-15			33	SAND, fine, micaceous, sorted, brownish grey	Fw	Mi		-
17				34	SAND, fine - medium, micaceous, sorted, medium grey	Fw	Mi		-
	-16			35	SAND, fine - medium, micaceous, with inclusions of gyttja, sorted, brownish grey	Fw	Mi		-
18				36	SAND, fine - medium, micaceous, with	Fw	Mi		-

Continue

○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○●	100	200	300	Crv,Cfv (kPa)
→	5	10	15	qc (MPa)

Sample 11, 24, 47 and 48: Layered. Sample 17: Slightly layered
Sample 18-23: Varved. Sample 17-24: Ice dammed lake deposits
Sample 27: Gravels windpolished. Sample 29: Stones windpolished

Method: 6'' auger with casing
Projection: UTM32E89
X: 446032 (m) Y: 6257440 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./SNC Date: 2021.03.08 Geologist: Geob./LC Public No.: Borehole: B/CPT1

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.1 P. 2/3

COWI

Borehole Log

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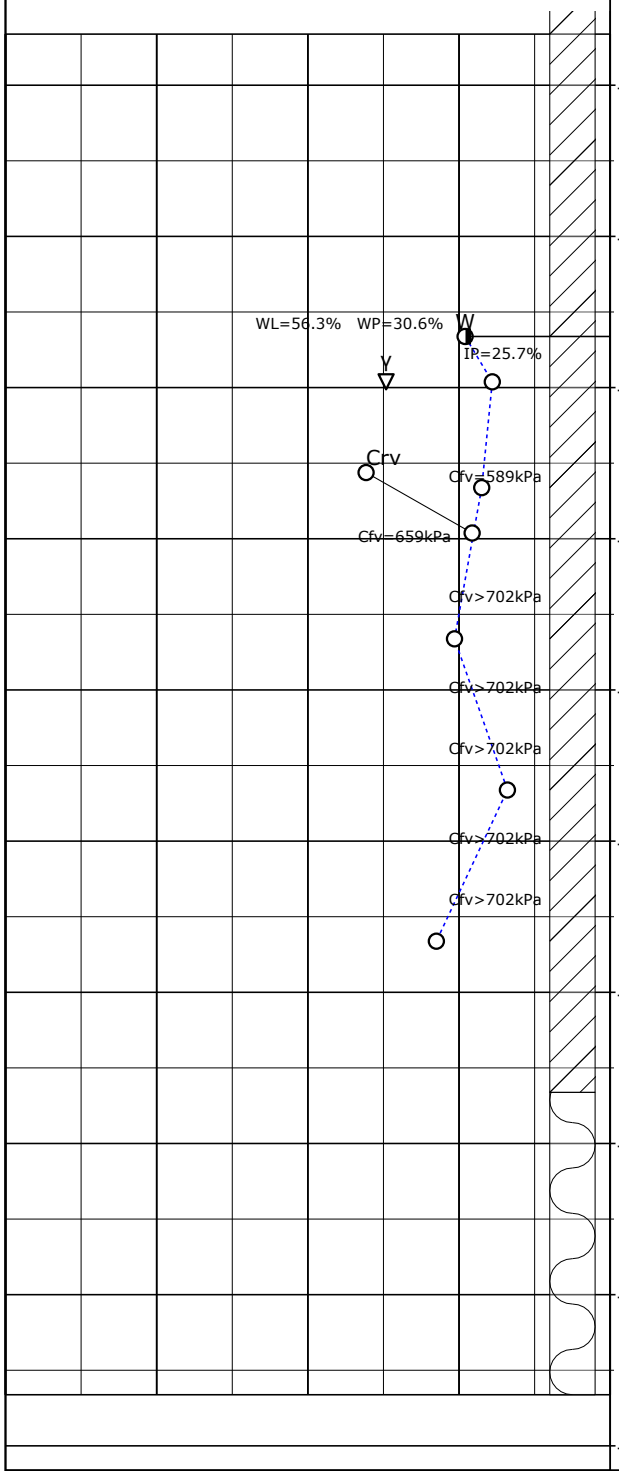


Depth (m)	Level (m)	Sample	No.	Geological Description	Env.	Age	Frost	$CaCO_3$
				Continued				
18	-17		36	SAND, fine - medium, micaceous, with big inclusions of gyttja, with big inclusions of plant fragments, sorted, brownish grey	Fw	Mi		-
			37	SAND - " -	Fw	Mi		-
19	-18		38	SAND, fine - medium, micaceous, sorted, brownish grey	Fw	Mi		-
			39	CLAY, very sandy, micaceous, with inclusions of gyttja, dark brown	Ma	Mi		-
20	-19		40	CLAY, very high plasticity, micaceous, dark brown	Ma	Mi		-
			40A					
			41	CLAY - " -	Ma	Mi		-
21	-20		42	CLAY - " -	Ma	Mi		-
			43	CLAY - " -	Ma	Mi		-
22	-21		44	CLAY - " -	Ma	Mi		-
			45	CLAY - " -	Ma	Mi		-
23	-22		46	CLAY, high plasticity, with big inclusions of sand, micaceous, dark brown	Ma	Mi		-
			47	CLAY, very high plasticity, with many layers of fine sand, micaceous, dark brown	Ma	Mi		-
24	-23		48	CLAY, sandy, silty, micaceous, medium dark grey	Fw	Mi		-
			49	SAND, fine, silty, micaceous, sorted, brownish grey	Fw	Mi		-
25	-24		50	SAND, fine, silty, clayey, micaceous, poorly graded, brownish grey	Fw	Mi		-
			50A					
			51	SAND, fine, silty, micaceous, sorted, brownish grey	Fw	Mi		-
26	-25		52	SAND, fine, silty, clayey, micaceous, poorly graded, brownish grey	Fw	Mi		-
			53	SAND, fine, silty, micaceous, sorted, brownish grey	Fw	Mi		-
27	-26		54	SAND, fine, silty, clayey, micaceous, poorly graded, brownish grey	Fw	Mi		-

○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○●	100	200	300	Crv,Cfv (kPa)
→	5	10	15	qc (MPa)

Sample 11, 24, 47 and 48: Layered. Sample 17: Slightly layered
Sample 18-23: Varved. Sample 17-24: Ice dammed lake deposits
Sample 27: Gravels windpolished. Sample 29: Stones windpolished

Method: 6'' auger with casing
Projection: UTM32E89
X: 446032 (m) Y: 6257440 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./SNC Date: 2021.03.08 Geologist: Geob./LC Public No.: Borehole: B/CPT1

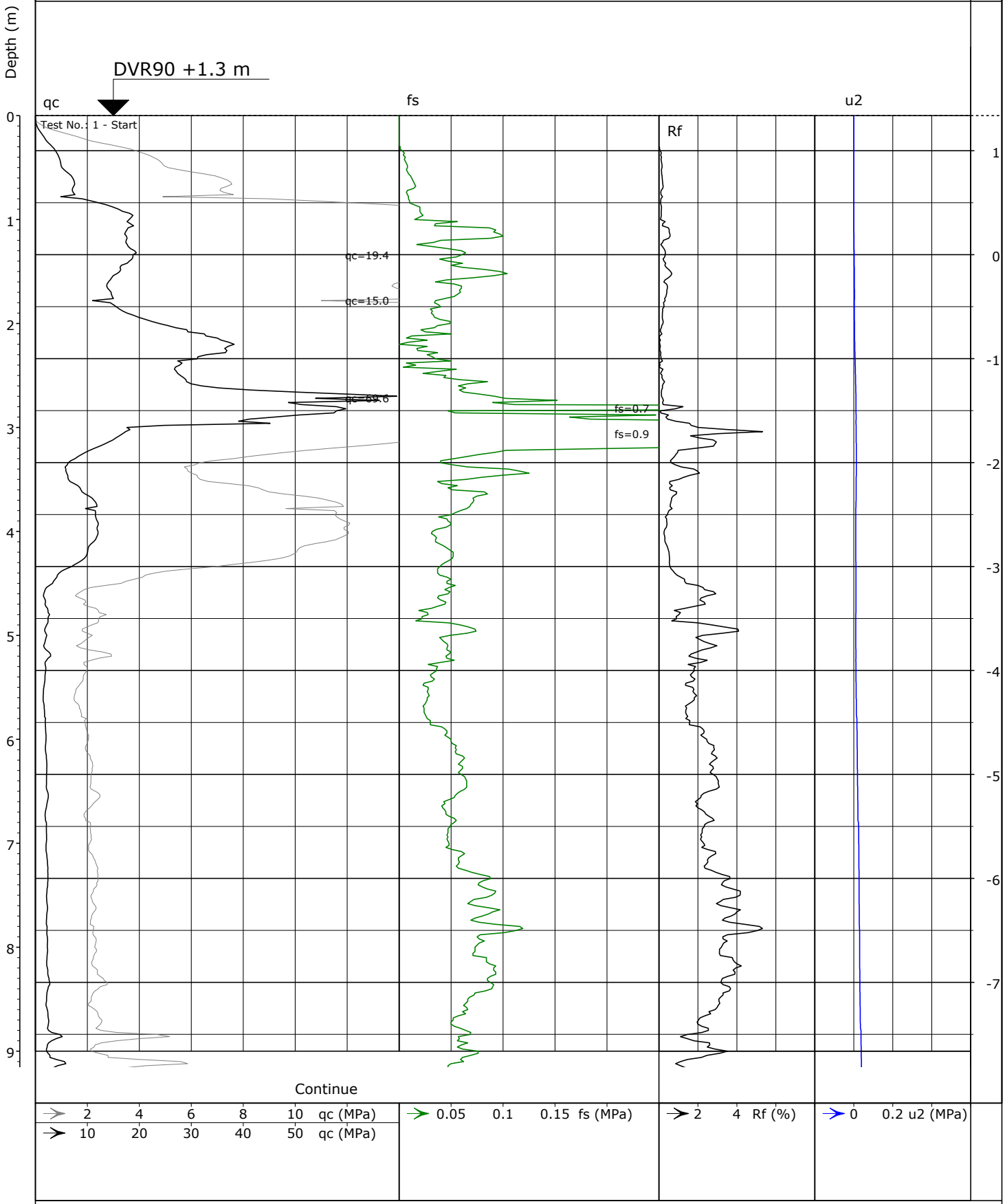
Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.1 P. 3/3

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:19

Test Results



Data for the used CPT is: Probe no.: 130627
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446032 (m)
Y: 6257440 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT1

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.1CPT P. 1/2

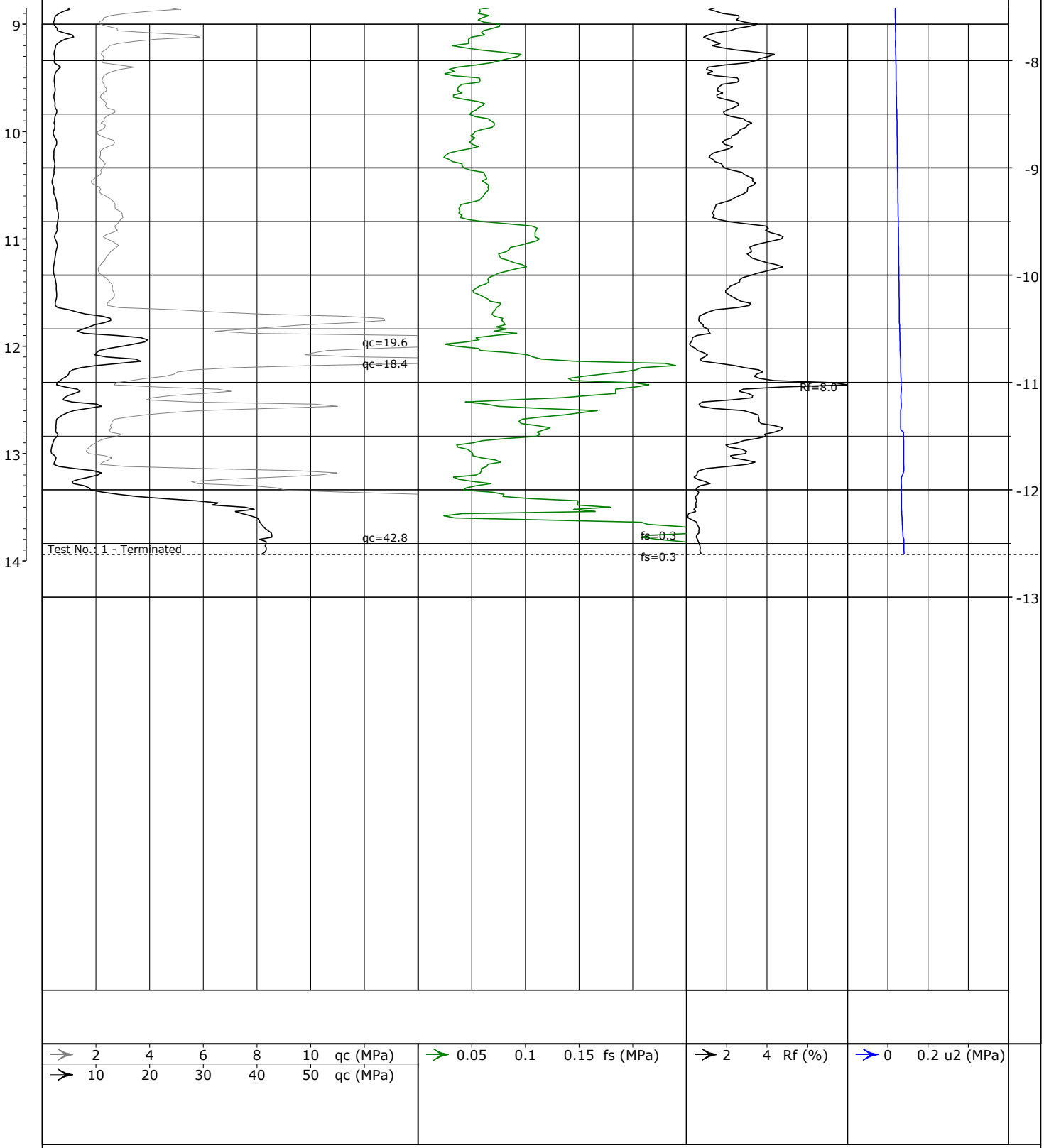
COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:19

Test Results

Continued



Data for the used CPT is: Probe no.: 130627
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446032 (m)
Y: 6257440 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT1

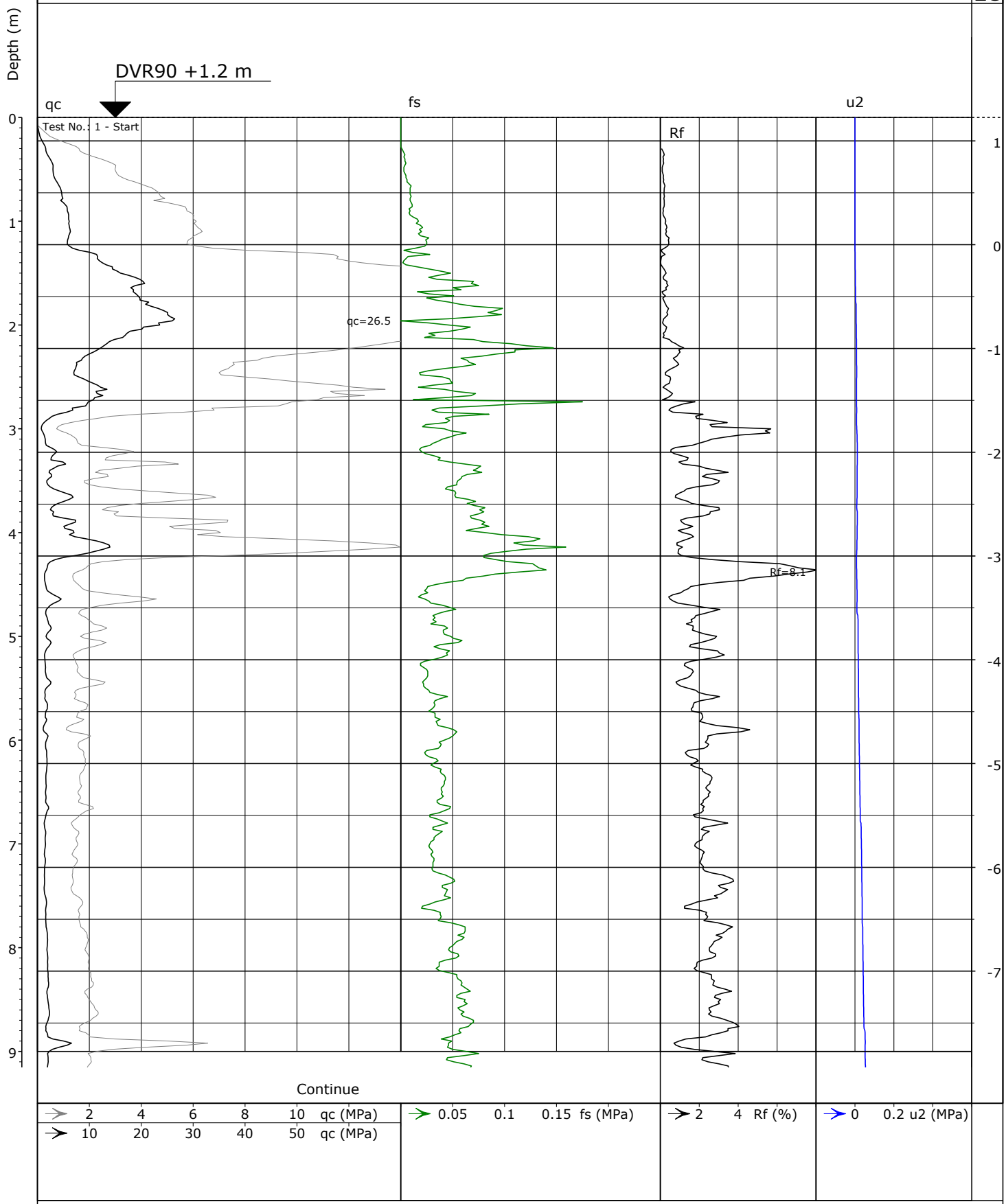
Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.1CPT P. 2/2

COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:19

Test Results



Data for the used CPT is: Probe no.: 130627
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446012 (m)
Y: 6257295 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT2

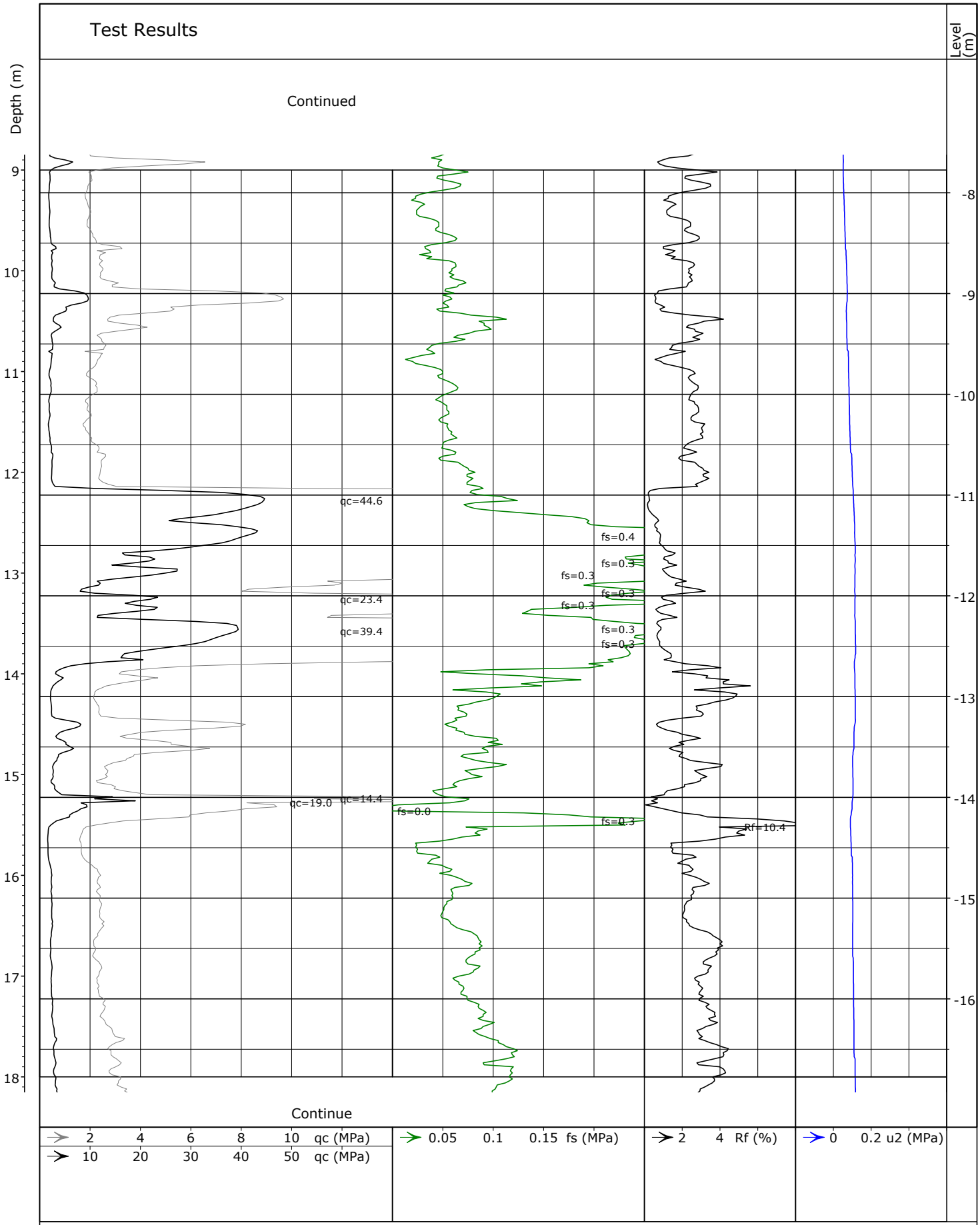
Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.2CPT P. 1/3

COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:24

Test Results



Data for the used CPT is: Probe no.: 130627
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446012 (m)
Y: 6257295 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT2

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.2CPT P. 2/3

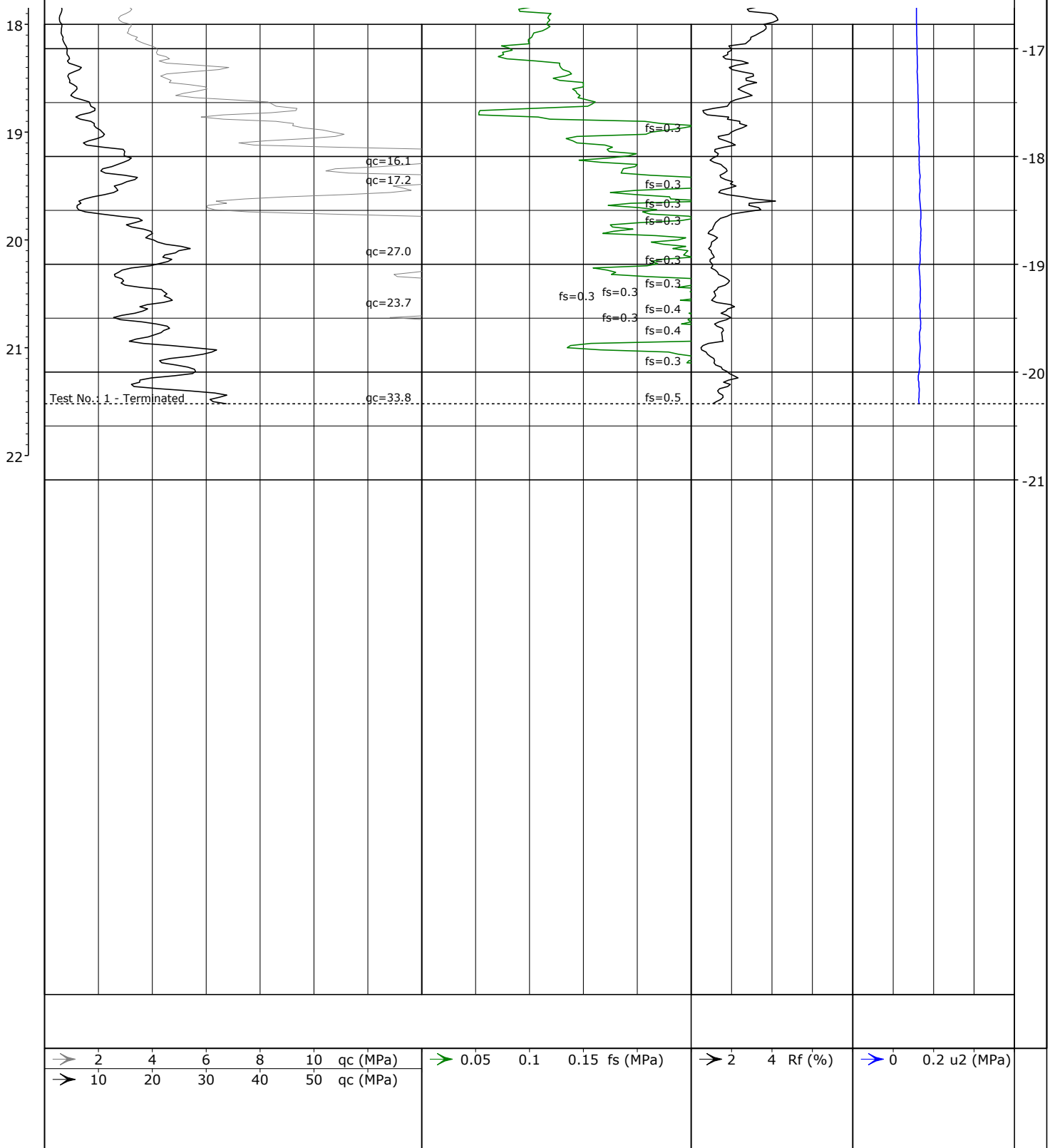
COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:24

Test Results

Continued



Data for the used CPT is: Probe no.: 130627
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446012 (m)
Y: 6257295 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT2

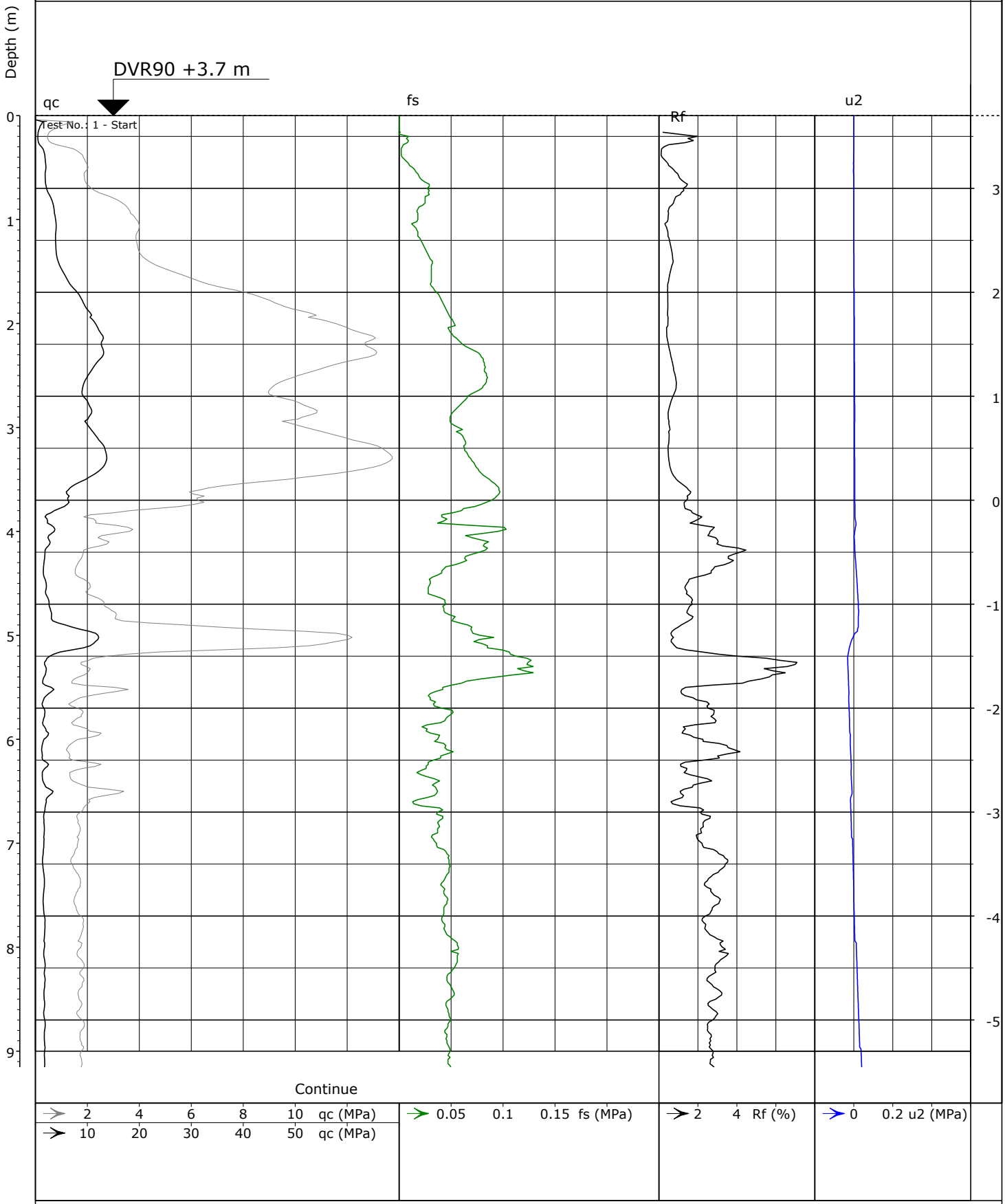
Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.2CPT P. 3/3

COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:24

Test Results



Data for the used CPT is: Probe no.: 200636
Ares factor A: 0.75
Tip area: 15 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446239 (m)
Y: 6257460 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT3

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.3CPT P. 1/2

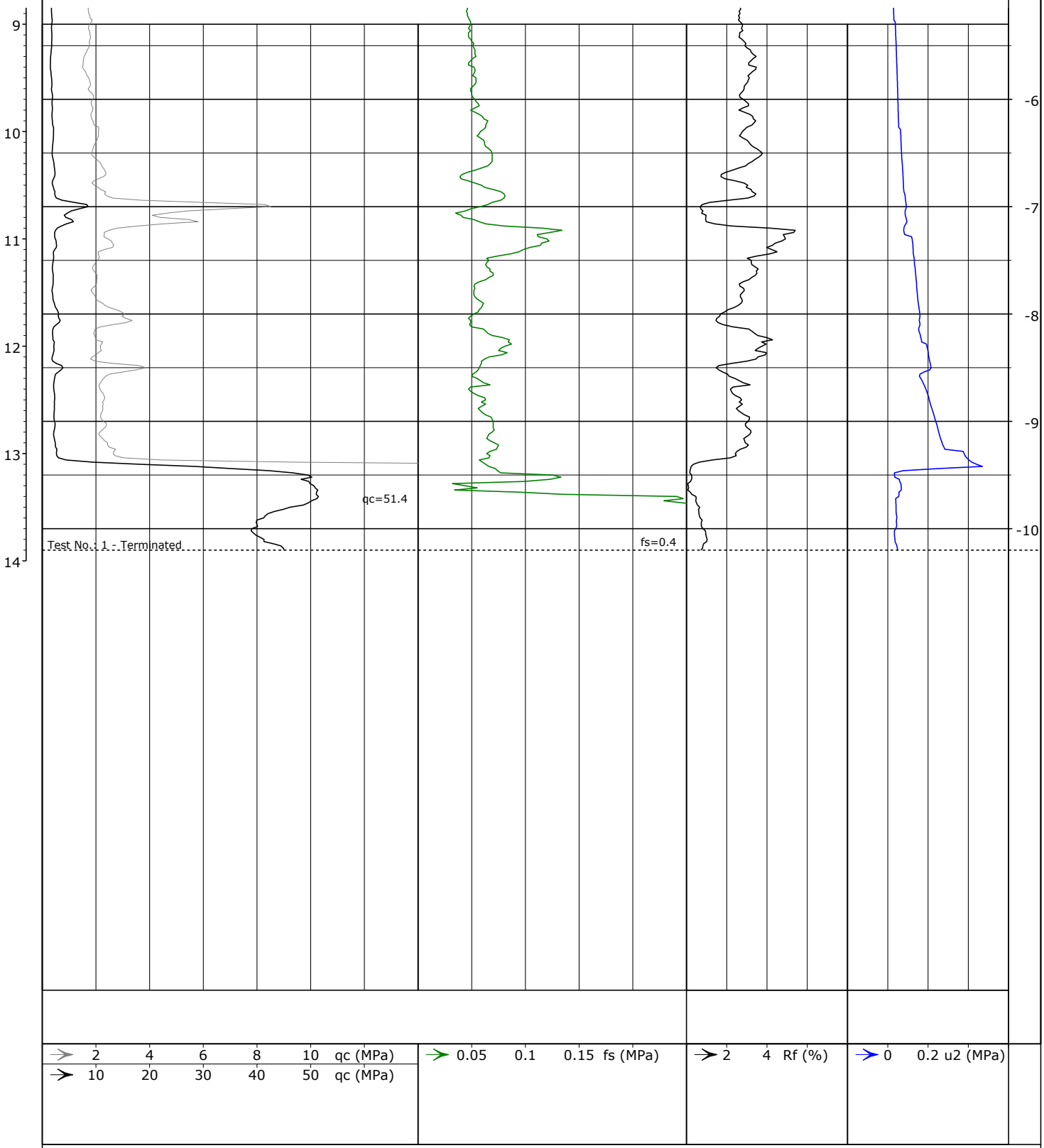
COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:26

Test Results

Continued



Data for the used CPT is: Probe no.: 200636
Ares factor A: 0.75
Tip area: 15 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446239 (m)
Y: 6257460 (m)

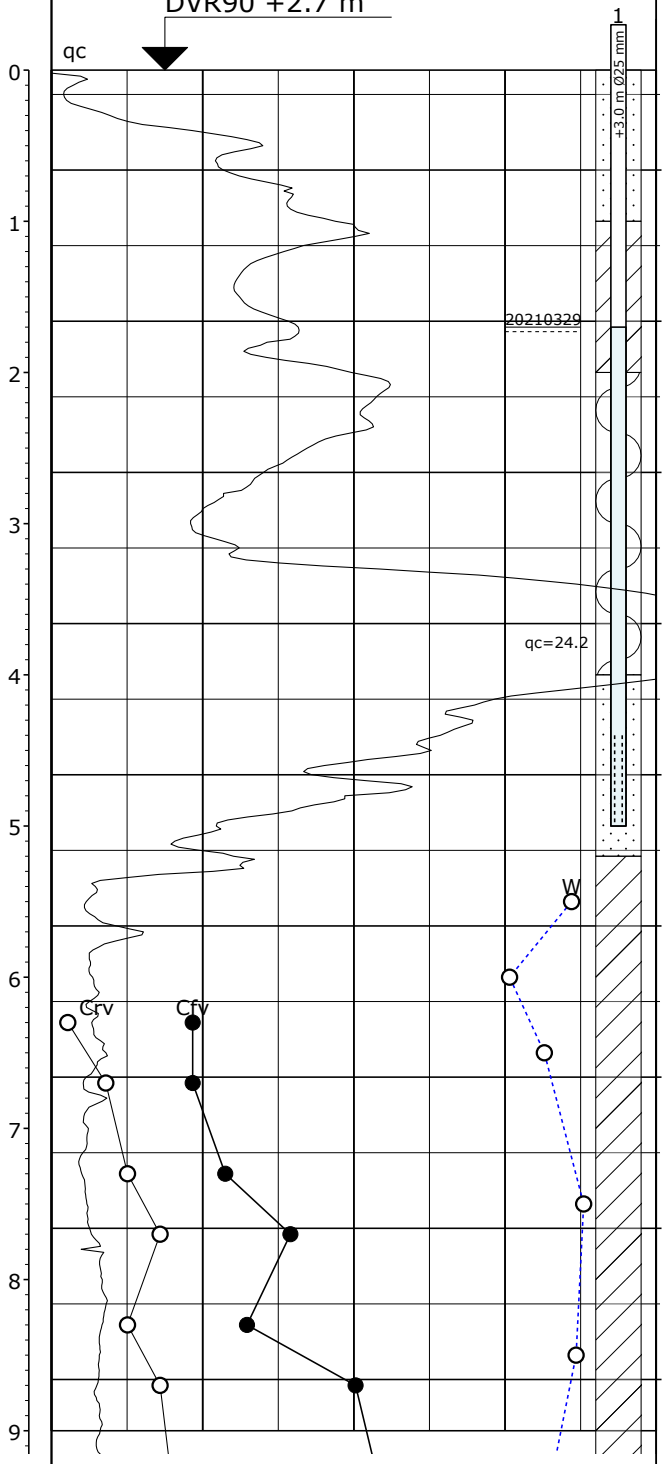
Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT3

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.3CPT P. 2/2

COWI

CPT Log



Depth (m)	Level (m)
0	2
1	1
2	0
3	-1
4	-2
5	-3
6	-4
7	-5
8	-6
9	

No.	Geological Description	Env.	Age	Frost	$CaCO_3$
1	TOPSOIL, sandy, clayey, with a few gravels, dark brown	Ts	Re		-
2	SAND, fine - medium, clayey, humic, with a few gravels, graded, dark greyish brown	Ts	Re		-
3	SAND, fine - medium, sorted, dark reddish brown	Ae	Pg		-
4	SAND, fine, sorted, moderate yellowish brown	Ae	Pg		-
5	SAND, fine, slightly silty, sorted, moderate yellowish brown	Ae	Pg		-
6	SAND, fine, sorted, moderate yellowish brown	Ae	Pg		-
7	SAND, fine, slightly silty, sorted, moderate yellowish brown	Ae	Pg		-
8	SAND - " -	Ae	Pg		-
9	SAND - " -	Ae	Pg		-
10	SAND, fine, slightly silty, sorted, dark yellowish brown	Ae	Pg		-
11	SAND - " -	Ae	Pg		-
12	SAND, fine - coarse, clayey, slightly gravelly, graded, dusky, yellowish brown	Mw	Lg		-
11A					
13	CLAY, very high plasticity, olive grey	Mw	Lg/Gc		(+)
14	CLAY - " -	Mw	Lg/Gc		+
15	CLAY - " -	Mw	Lg/Gc		+
16	CLAY - " -	Mw	Lg/Gc		+
17	CLAY - " -	Mw	Lg/Gc		+
18	CLAY - " -	Mw	Lg/Gc		+
19	CLAY - " -	Mw	Lg/Gc		+
20	CLAY - " -	Mw	Lg/Gc		+

Continue

○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○●	100	200	300	Crv,Cfv (kPa)
▼	10	20	30	N (Blows/30 cm)
→	5	10	15	qc (MPa)

Sample 21-25 and 31: Varved
Sample 21-25 and 31: Ice dammed lake deposits
Sample 50: Layered

Method: 6'' auger with casing
Projection: UTM32E89
X: 446221 (m) Y: 6257293 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

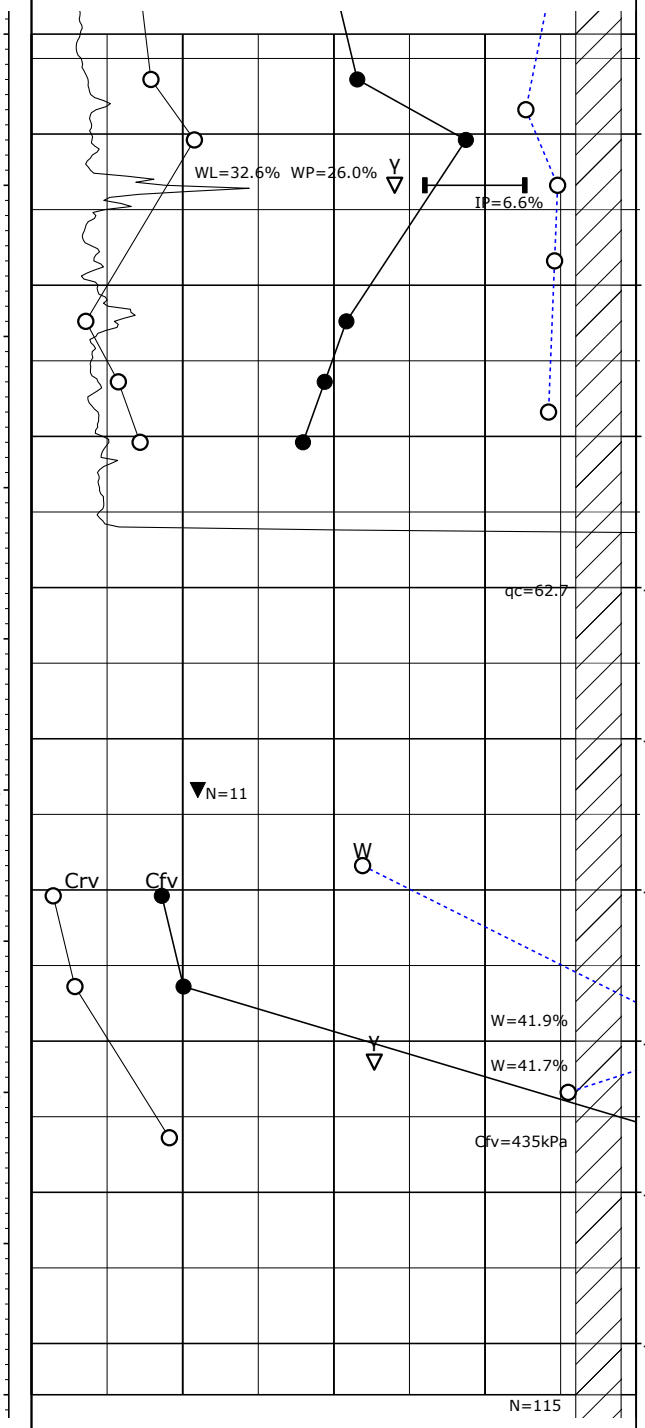
Drilled by: Geob./SNC Date: 2021.03.11 Geologist: Geob./LC Public No.: Borehole: B/CPT4

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.4 P. 1/4

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:25



Depth (m)	Level (m)	Sample	No.	Geological Description	Env.	Age	Frost	$CaCO_3$
				Continued				
9			20	CLAY - " -	Mw	Lg/Gc		+
	-7		21	CLAY - " -	Mw	Lg/Gc		+
10			22	CLAY - " -	Mw	Lg/Gc		+
			22A					
	-8		23	CLAY - " -	Mw	Lg/Gc		+
11			24	CLAY, very high plasticity, with thin layers of silt, olive grey	Mw	Lg/Gc		+
	-9		25	CLAY, very high plasticity, olive grey	Mw	Lg/Gc		(+)
12			26	CLAY - " -	Mw	Lg/Gc		+
	-10		27	SAND, fine - medium, stony, gravelly, well graded, dark yellowish brown	Ss	Lg/Gc		-
13			28	SAND, fine - medium, sorted, light olive grey	Mw	Lg/Gc		-
	-11		29	SAND - " -	Mw	Lg/Gc		-
14			30	SAND, fine - coarse, stony, gravelly, well graded, light olive grey	Ss	Lg/Gc		-
	-12		31	CLAY, medium plasticity, with sand layers, olive grey	Mw	Lg/Gc		(+)
15			32	CLAY, medium plasticity, olive grey	Mw	Lg/Gc		-
			33	GRAVEL, stony, dark yellowish brown	Ss	Lg/Gc		-
	-13		34	CLAY, silty, high organic content, slightly micaceous, dark brown	Fw	Mi		-
16			34A					
			35	CLAY, very sandy, micaceous, dark brown	Fw	Mi		-
	-14		36	SAND, fine, silty, micaceous, sorted, dark brown	Fw	Mi		-
17			37	SAND - " -	Fw	Mi		-
			38	SAND - " -	Fw	Mi		-
	-15		39	SAND - " -	Fw	Mi		-
18				Continue				

○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○●	100	200	300	Crv,Cfv (kPa)
▼	10	20	30	N (Blows/30 cm)
→	5	10	15	qc (MPa)

Sample 21-25 and 31: Varved
Sample 21-25 and 31: Ice dammed lake deposits
Sample 50: Layered

Method: 6'' auger with casing
Projection: UTM32E89
X: 446221 (m) Y: 6257293 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

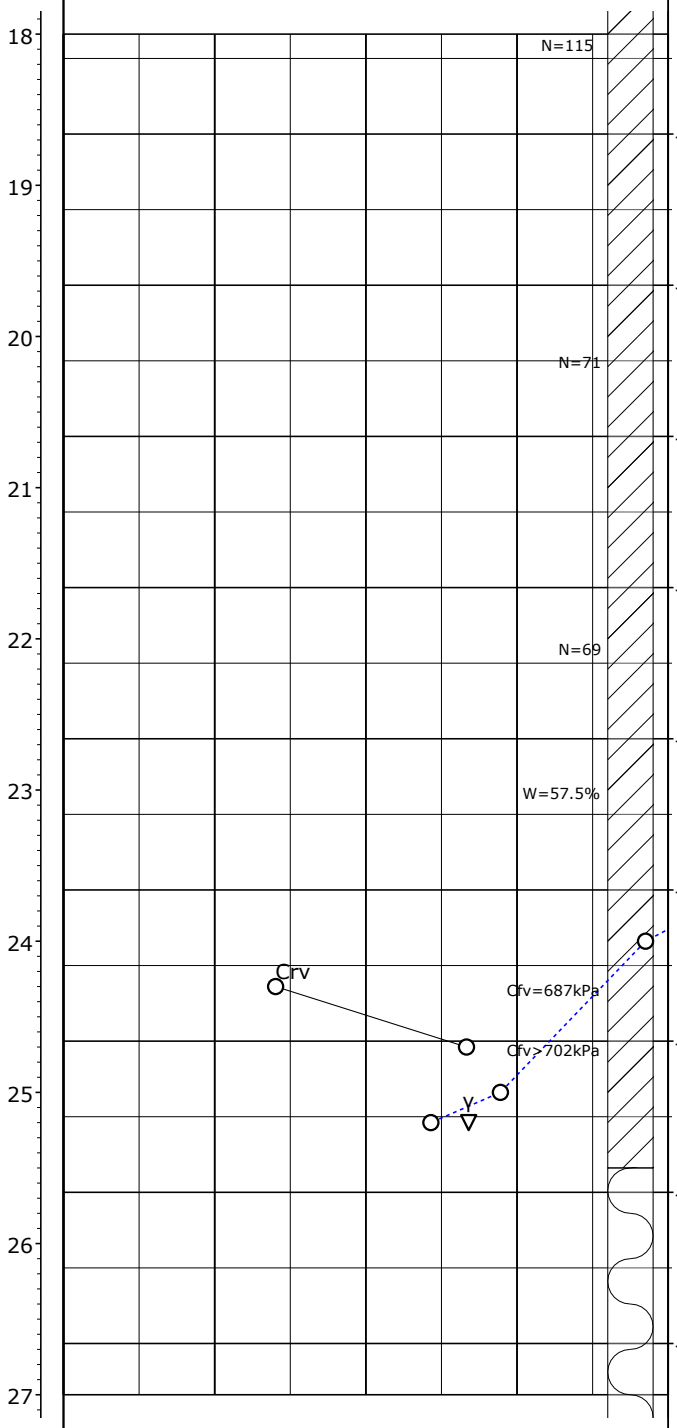
Drilled by: Geob./SNC Date: 2021.03.11 Geologist: Geob./LC Public No.: Borehole: B/CPT4

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.4 P. 2/4

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:25



Depth (m)	Level (m)	Sample No.	Geological Description	Env.	Age	Frost	$CaCO_3$
			Continued				
18	-16	39	SAND - " -	Fw	Mi		-
		40	SAND, fine, silty, micaceous, sorted, medium dark brown	Fw	Mi		-
19		41	SAND, fine, micaceous, with small fragments of lignite, sorted, brownish grey	Fw	Mi		-
	-17	42	SAND - " -	Fw	Mi		-
20		43	SAND - " -	Fw	Mi		-
		43A					
	-18	44	SAND - " -	Fw	Mi		-
21		45	SAND - " -	Fw	Mi		-
		46	SAND - " -	Fw	Mi		-
22	-19	47	SAND - " -	Fw	Mi		-
		48	GYTTJA, clayey, sandy, micaceous, dark brown	Fw	Mi		-
23	-20	49	GYTTJA, very clayey, sandy, micaceous, dark brown	Fw	Mi		-
		50	CLAY, high plasticity, with thin layers of sand, micaceous, dark brown	Ma	Mi		-
24	-21	51	CLAY, very high plasticity, with inclusions of sand and lignite fragments, black	Ma	Mi		-
		52	CLAY, very high plasticity, micaceous, brownish black	Ma	Mi		-
25	-22	53	CLAY, high plasticity, micaceous, with inclusions of sand, brownish black	Ma	Mi		-
		53A					
	-23	54	SAND, fine, silty, micaceous, sorted, brownish grey	Fw	Mi		-
26		55	SAND, fine, silty, clayey, micaceous, poorly graded, brownish grey	Fw	Mi		-
	-24	56	SAND, fine, silty, micaceous, sorted, brownish grey	Fw	Mi		-
27		57	SAND - " -	Fw	Mi		-
			Continue				

○	10	20	30 W (%)
▽	12	16	20 γ (kN/m³)
○●	100	200	300 Crv,Cfv (kPa)
▼	10	20	30 N (Blows/30 cm)
→	5	10	15 qc (MPa)

Sample 21-25 and 31: Varved
Sample 21-25 and 31: Ice dammed lake deposits
Sample 50: Layered

Method: 6'' auger with casing
Projection: UTM32E89
X: 446221 (m) Y: 6257293 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./SNC Date: 2021.03.11 Geologist: Geob./LC Public No.: Borehole: B/CPT4

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.4 P. 3/4

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:25

Depth (m)	Test Results	Level (m)	Geology	Sample	No.	Geological Description	Env.	Age	Frost	$CaCO_3$
						Continued				
27					57	SAND - " -	Fw	Mi		-
		-25			58	SAND - " -	Fw	Mi		-
28					59	SAND - " -	Fw	Mi		-

○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○●	100	200	300	Crv,Cfv (kPa)
▼	10	20	30	N (Blows/30 cm)
→	5	10	15	qc (MPa)

Sample 21-25 and 31: Varved
Sample 21-25 and 31: Ice dammed lake deposits
Sample 50: Layered

Method: 6'' auger with casing
Projection: UTM32E89
X: 446221 (m) Y: 6257293 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./SNC Date: 2021.03.11 Geologist: Geob./LC Public No.: Borehole: B/CPT4

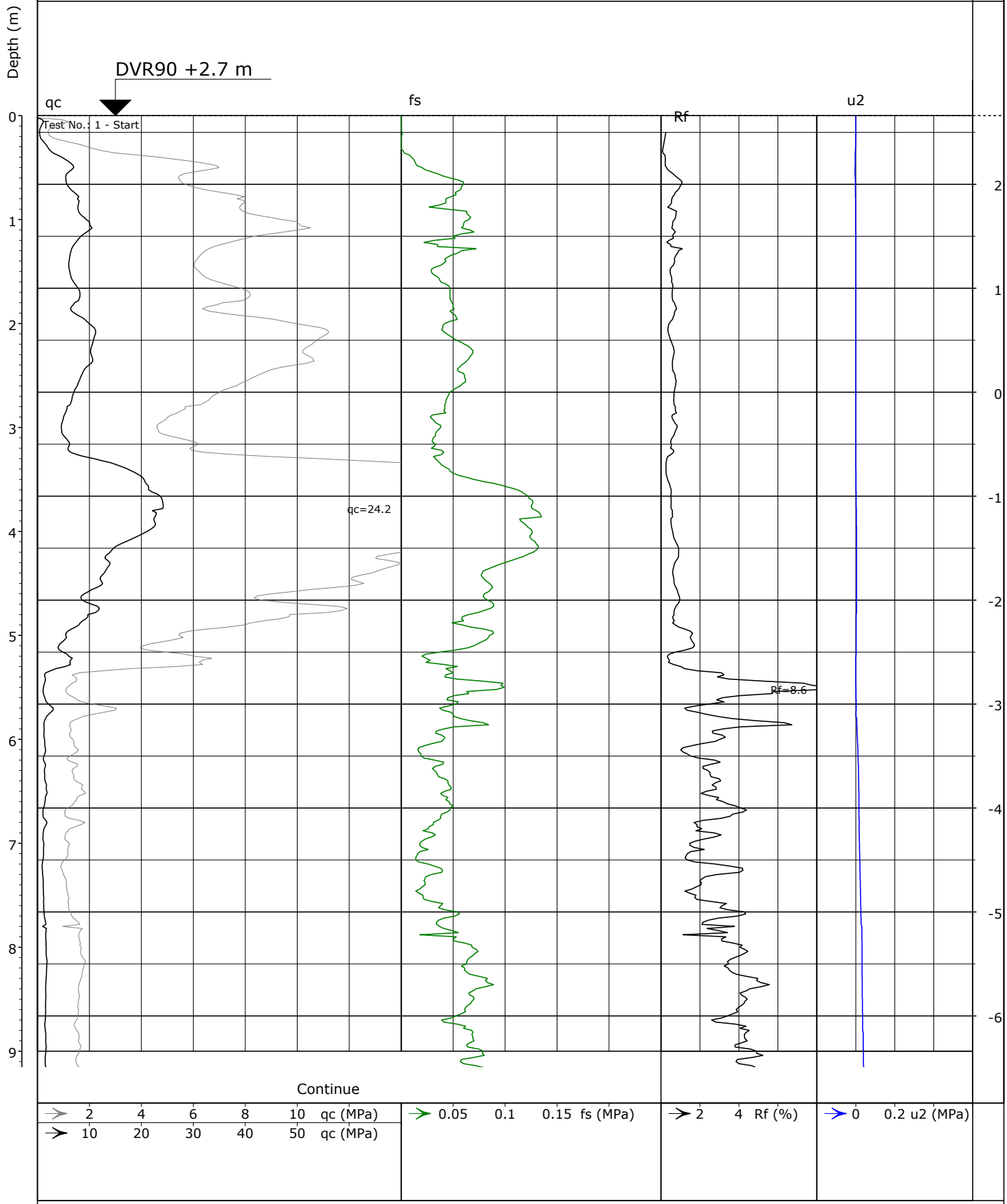
Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.4 P. 4/4

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:25

Test Results



Data for the used CPT is: Probe no.: 130627
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446221 (m)
Y: 6257293 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT4

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.4CPT P. 1/2

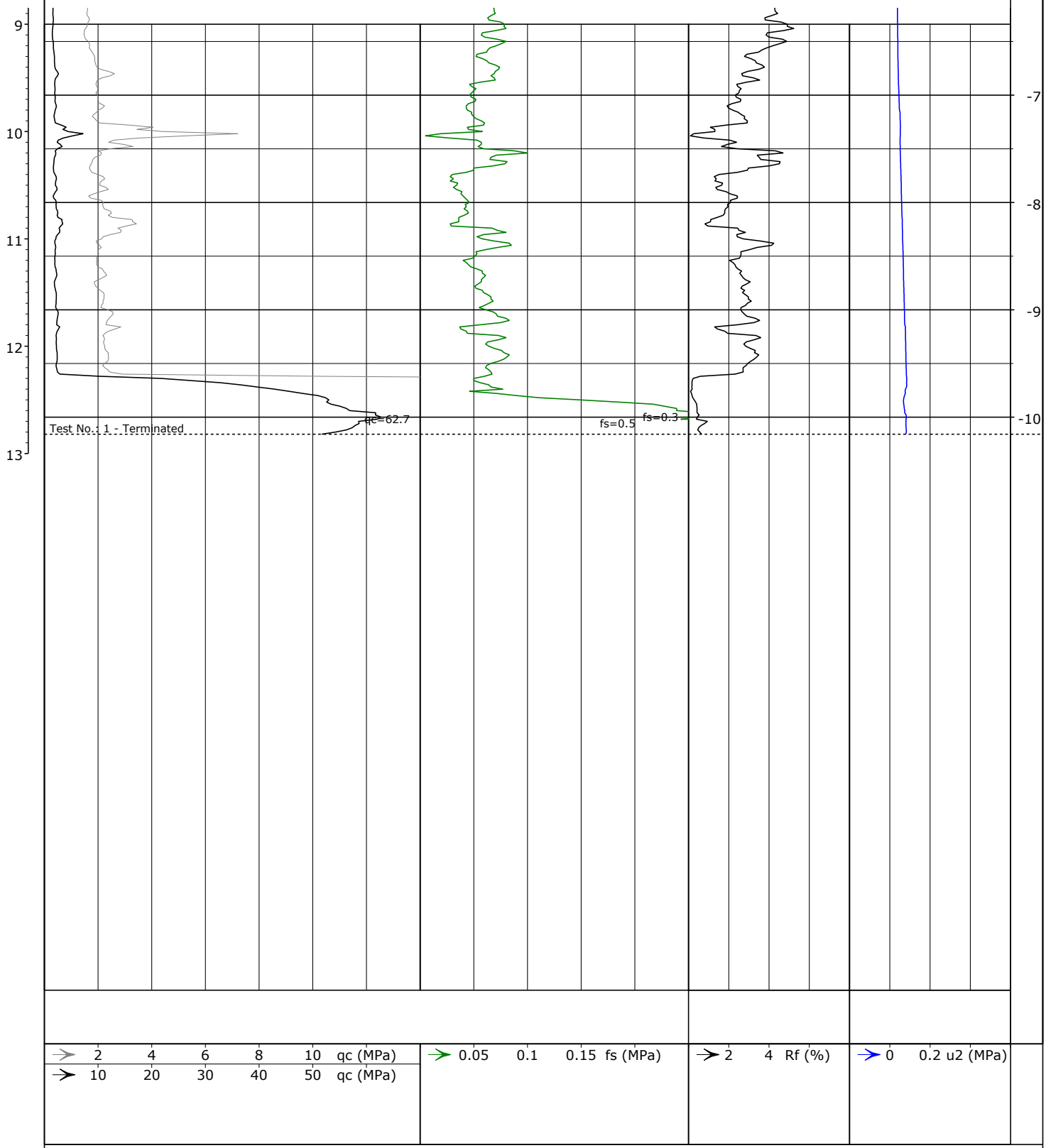
COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:27

Test Results

Continued



Data for the used CPT is: Probe no.: 130627
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446221 (m)
Y: 6257293 (m)

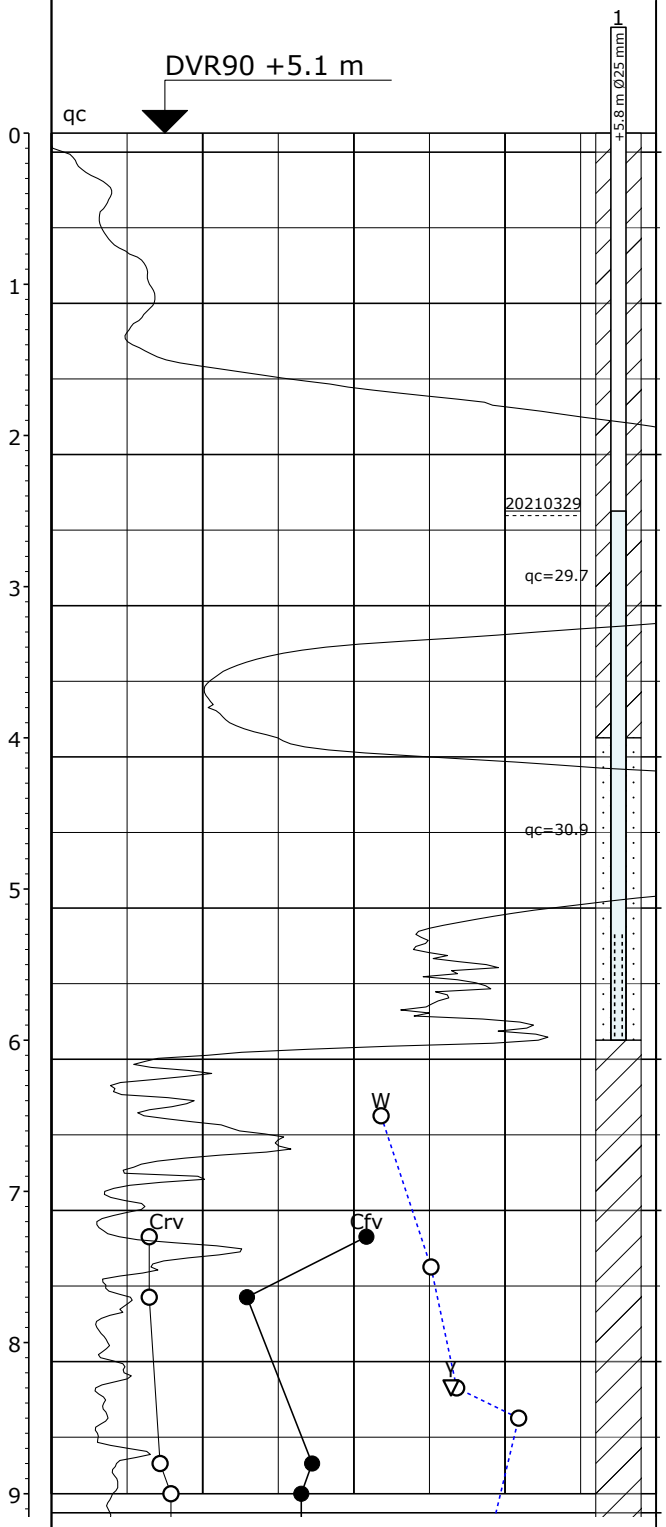
Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT4

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.4CPT P. 2/2

COWI

CPT Log



Depth (m)	Level (m)
0	5
1	4
2	3
3	2
4	1
5	0
6	-1
7	-2
8	-3
9	-4

No.	Geological Description	Env.	Age	Frost	$CaCO_3$
1	TOPSOIL, sandy, with plant fragments, dark brown	Ts	Re		-
2	SAND, fine, sorted, moderate reddish brown	Ae	Pg		-
3	SAND, fine, sorted, moderate yellowish brown	Ae	Pg		-
4	SAND - " -	Ae	Pg		-
5	SAND - " -	Ae	Pg		-
6	SAND, fine, sorted, moderate brown	Ae	Pg		-
7	SAND, fine, sorted, moderate yellowish brown	Ae	Pg		-
8	SAND, fine - medium, sorted, moderate yellowish brown	Mw	Lg		-
8A 9	SAND, fine, sorted, moderate yellowish brown	Mw	Lg		-
10	SAND - " -	Mw	Lg		-
11	SAND, fine - medium, sorted, moderate yellowish brown	Mw	Lg		-
12	GRAVEL, very sandy, sorted, moderate yellowish brown	Mw	Lg		-
13	CLAY, silty, olive grey	Mw	Lg/Gc		(+)
14	CLAY - " -	Mw	Lg/Gc		+
15	CLAY - " -	Mw	Lg/Gc		+
16	CLAY - " -	Mw	Lg/Gc		+
16A 17	CLAY, very high plasticity, olive grey	Mw	Lg/Gc		+
18	CLAY - " -	Mw	Lg/		+

Continue

○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○●	100	200	300	Crv,Cfv (kPa)
▼	10	20	30	N (Blows/30 cm)
→	5	10	15	qc (MPa)

Sample 14-16 and 23-28: Varved
Sample 14-16 and 23-28: Ice dammed lake deposits
Sample 36-47: Quartz sand

Method: 6'' auger with casing
Projection: UTM32E89
X: 446407 (m) Y: 6257482 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

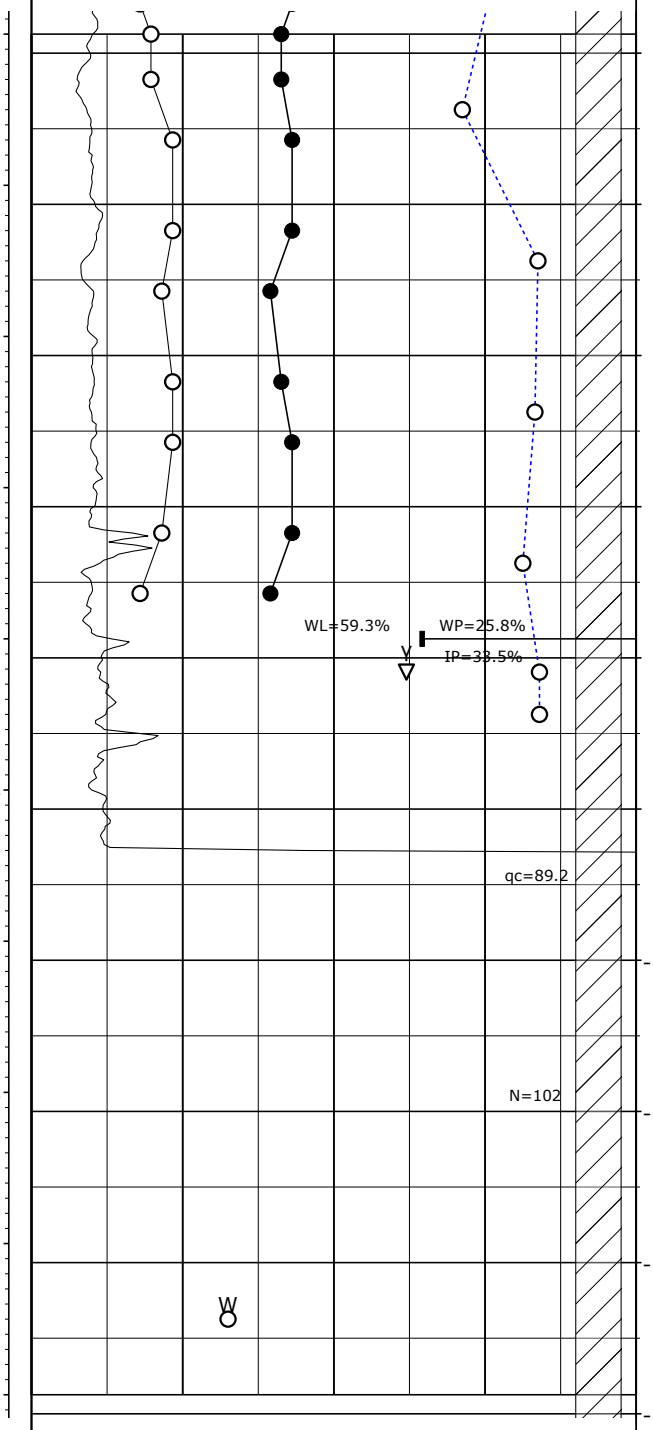
Drilled by: Geob./MGS Date: 2021.03.16 Geologist: Geob./LC Public No.: Borehole: B/CPT5

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.5 P. 1/4

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:32



Depth (m)	Level (m)
9	-4
10	-5
11	-6
12	-7
13	-8
14	-9
15	-10
16	-11
17	-12
18	-13

Test Results

Continued

No.	Geological Description	Env.	Age	Frost	$CaCO_3$
18	CLAY - " -	Mw	Lg/Gc		+
19	CLAY, high plasticity, olive grey	Mw	Lg/Gc		+
20	CLAY, very high plasticity, olive grey	Mw	Lg/Gc		+
21	CLAY - " -	Mw	Lg/Gc		+
22	CLAY - " -	Mw	Lg/Gc		+
23	CLAY - " -	Mw	Lg/Gc		+
24	CLAY - " -	Mw	Lg/Gc		+
25	CLAY, very high plasticity, with many thin layers of silt, olive grey	Mw	Lg/Gc		+
26	CLAY - " -	Mw	Lg/Gc		+
26A					
27	CLAY - " -	Mw	Lg/Gc		+
28	CLAY - " -	Mw	Lg/Gc		+
29	GRAVEL, stony, very sandy, graded, pale yellowish brown	Ss	Lg/Gc		-
30	GRAVEL, stony, very sandy, graded, medium light grey	Ss	Lg/Gc		-
31	SAND, fine - coarse, with a few gravel, sorted, medium light grey	Mw	Lg/Gc		-
32	SAND, fine - coarse, slightly gravelly, poorly graded, medium light grey	Mw	Lg/Gc		-
33	SAND, fine - medium, with a few gravel, sorted, light grey	Mw	Lg/Gc		-
34	SAND - " -	Mw	Lg/Gc		-
34A					
35	CLAY TILL, sandy, olive grey	Gl	Gc		-
36	SAND, medium - coarse, slightly gravelly, poorly graded, light grey	Fw	Mi		-

Continue

○	10	20	30 W (%)
▽	12	16	20 γ (kN/m³)
○●	100	200	300 Crv,Cfv (kPa)
▼	10	20	30 N (Blows/30 cm)
→	5	10	15 qc (MPa)

Sample 14-16 and 23-28: Varved
Sample 14-16 and 23-28: Ice dammed lake deposits
Sample 36-47: Quartz sand

Method: 6'' auger with casing
Projection: UTM32E89
X: 446407 (m) Y: 6257482 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

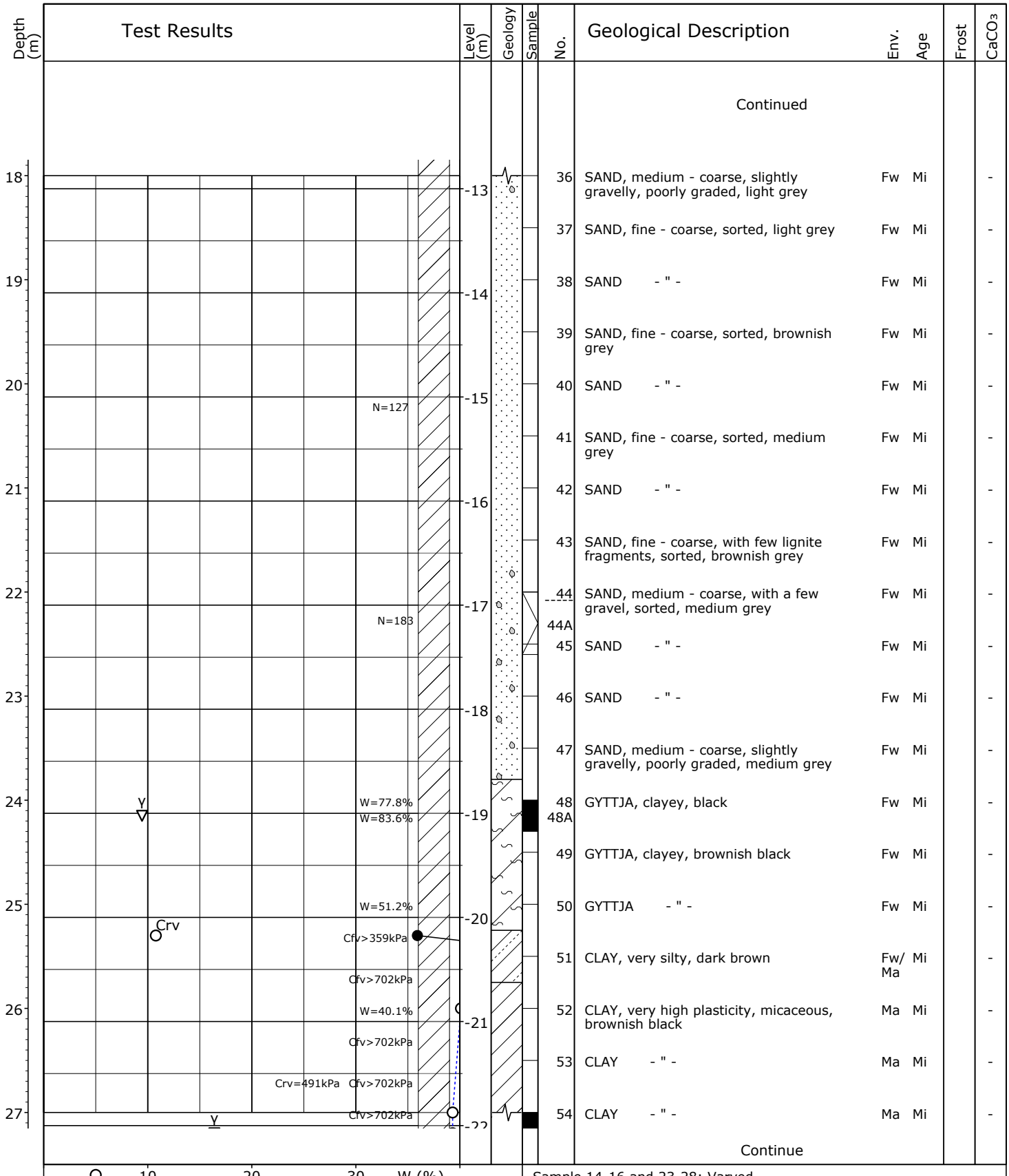
Drilled by: Geob./MGS Date: 2021.03.16 Geologist: Geob./LC Public No.: Borehole: B/CPT5

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.5 P. 2/4

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:32



○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○●	100	200	300	Crv,Cfv (kPa)
▼	10	20	30	N (Blows/30 cm)
→	5	10	15	qc (MPa)

Sample 14-16 and 23-28: Varved
Sample 14-16 and 23-28: Ice dammed lake deposits
Sample 36-47: Quartz sand

Method: 6'' auger with casing
Projection: UTM32E89
X: 446407 (m) Y: 6257482 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

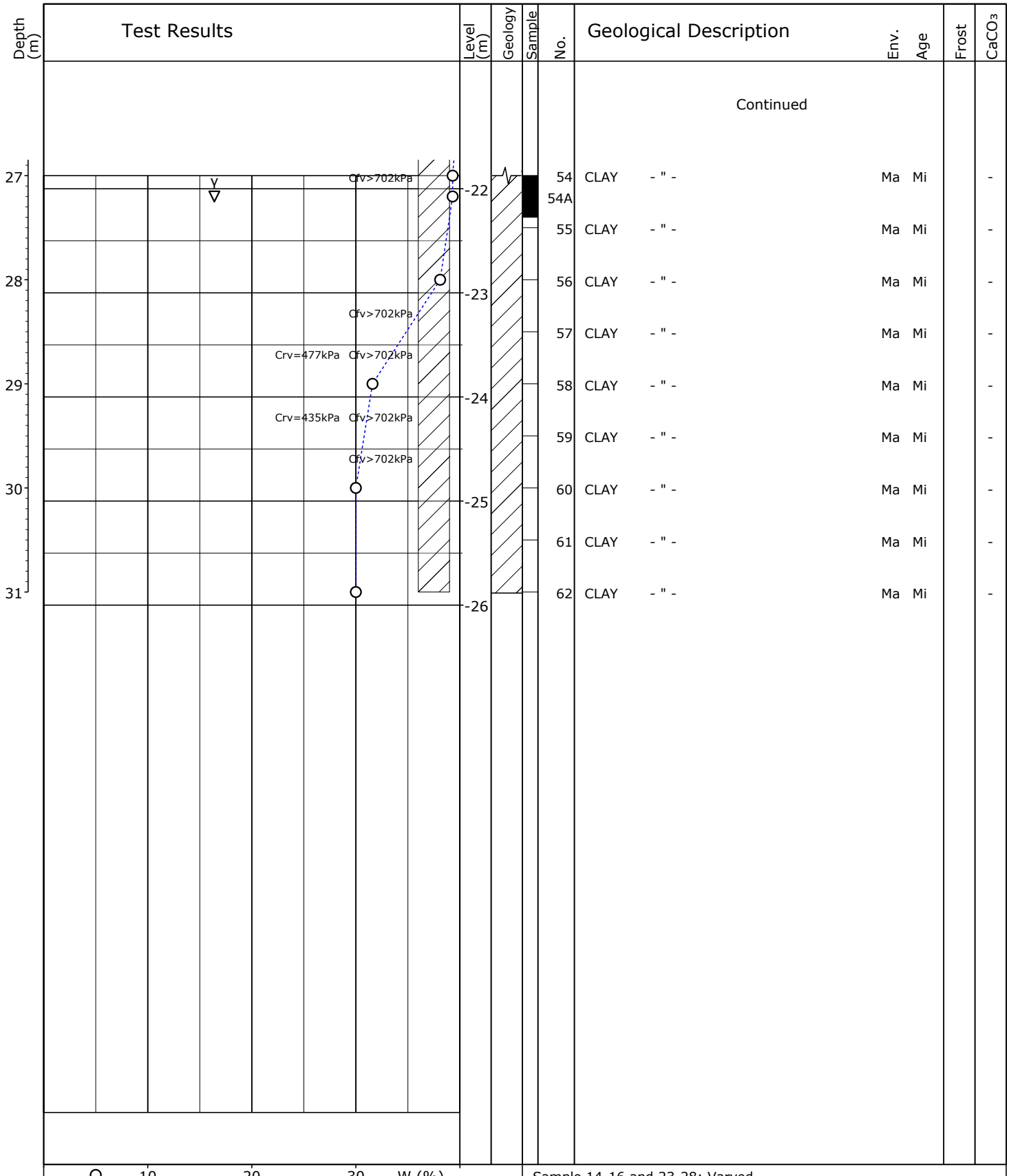
Drilled by: Geob./MGS Date: 2021.03.16 Geologist: Geob./LC Public No.: Borehole: B/CPT5

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.5 P. 3/4

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:32



○	10	20	30	W (%)
▽	12	16	20	γ (kN/m³)
○●	100	200	300	Crv,Cfv (kPa)
▼	10	20	30	N (Blows/30 cm)
→	5	10	15	qc (MPa)

Sample 14-16 and 23-28: Varved
Sample 14-16 and 23-28: Ice dammed lake deposits
Sample 36-47: Quartz sand

Method: 6'' auger with casing
Projection: UTM32E89
X: 446407 (m) Y: 6257482 (m) Plan:

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./MGS Date: 2021.03.16 Geologist: Geob./LC Public No.: Borehole: B/CPT5

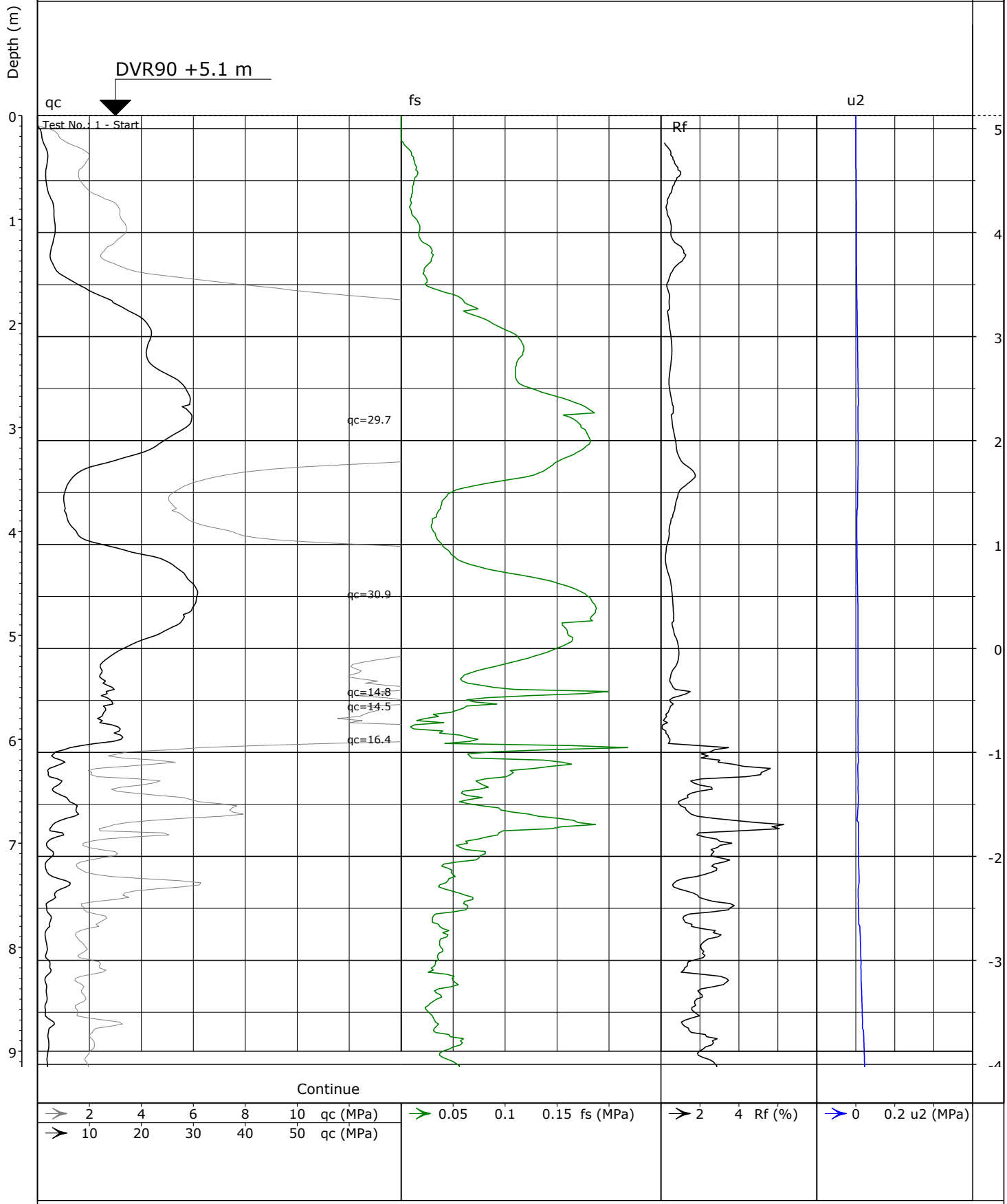
Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.5 P. 4/4

COWI

Borehole Log

GeoGIS2020 20.03.36 PSTR 16-04-2021 11:24:32

Test Results



Data for the used CPT is: Probe no.: 200806
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446407 (m)
Y: 6257482 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT5

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.5CPT P. 1/2

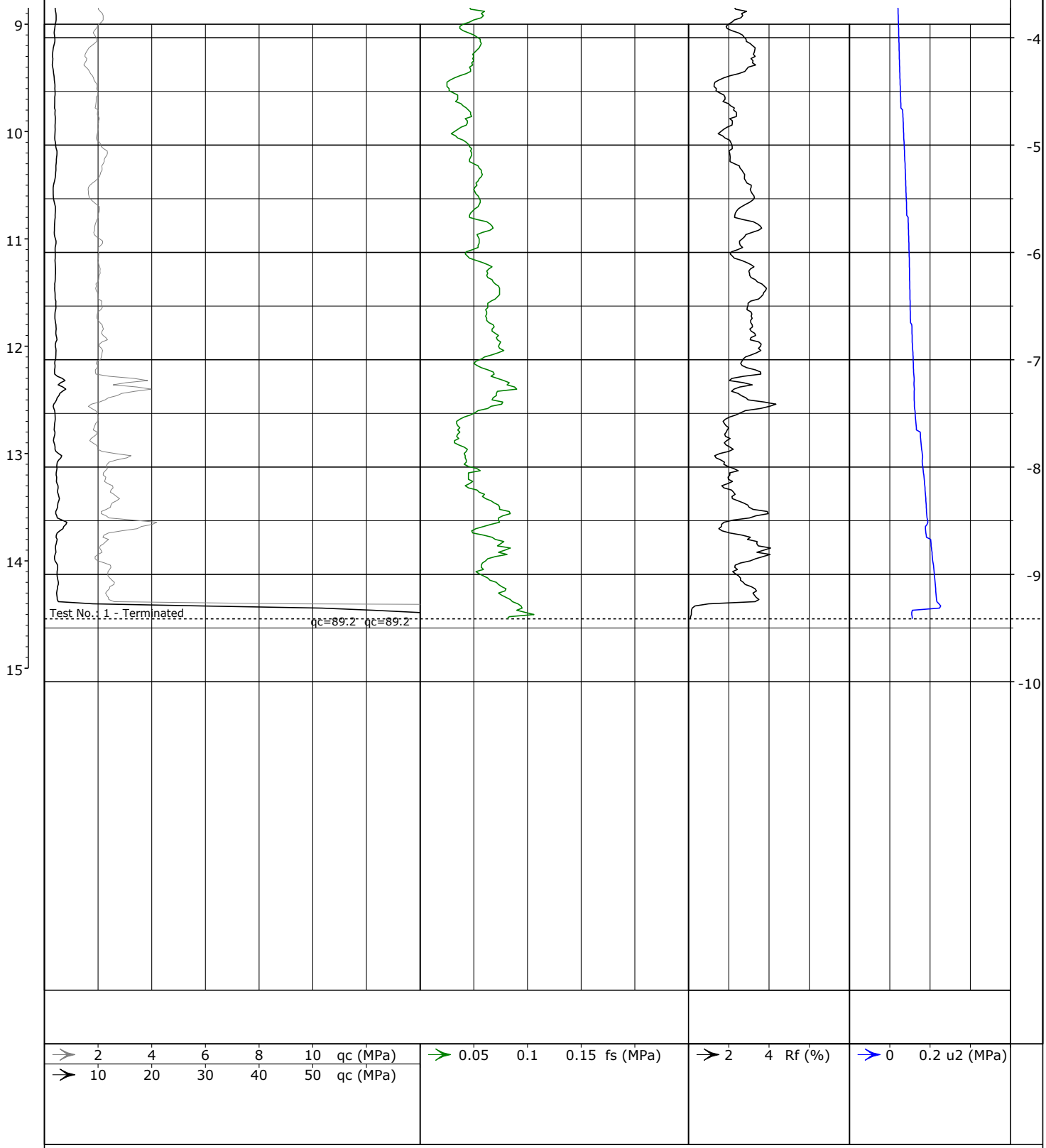
COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:30

Test Results

Continued



Data for the used CPT is: Probe no.: 200806
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446407 (m)
Y: 6257482 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

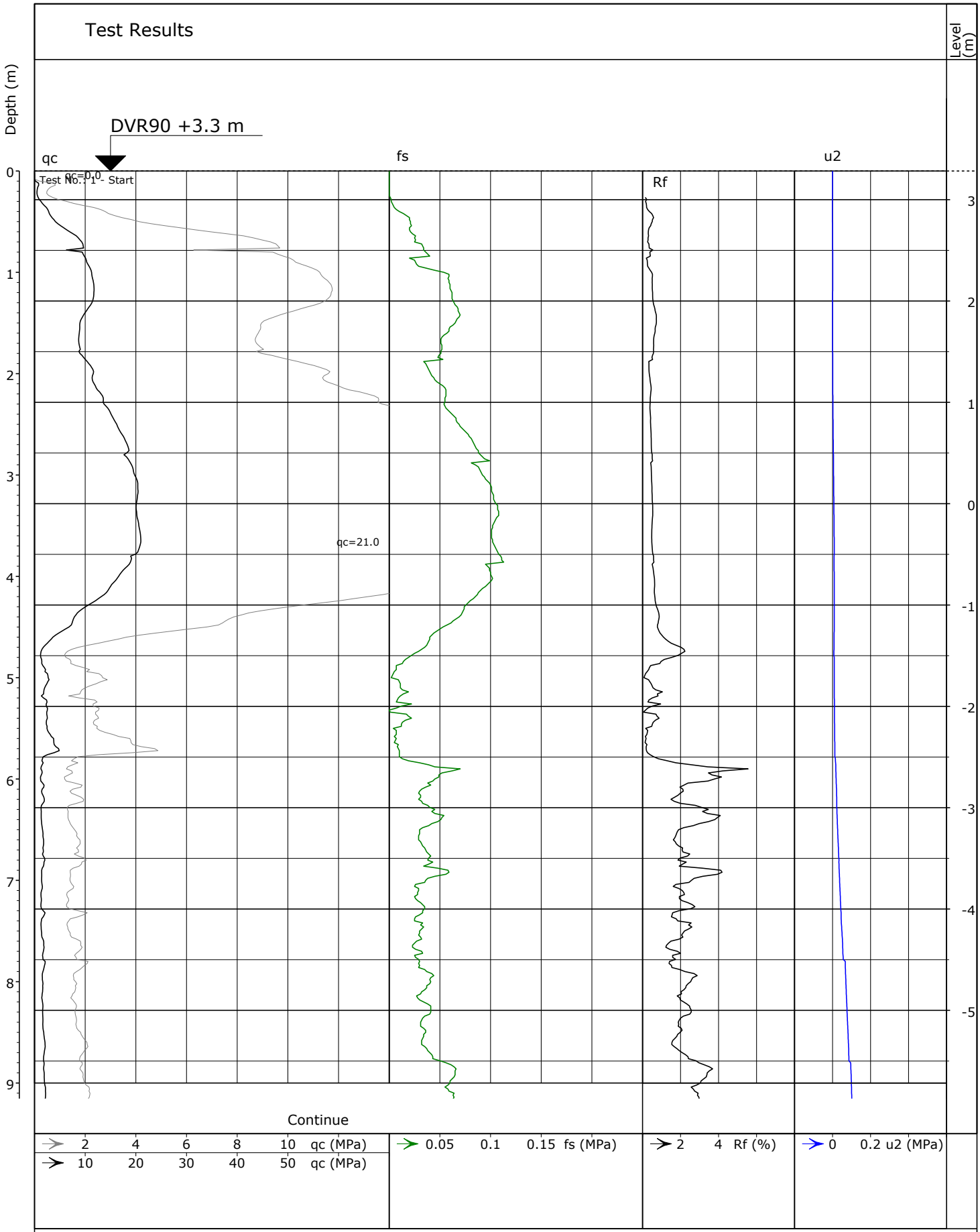
Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT5

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.5CPT P. 2/2

COWI

CPT Log

Test Results



Data for the used CPT is: Probe no.: 200806
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446366 (m)
Y: 6257310 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT6

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.6CPT P. 1/2

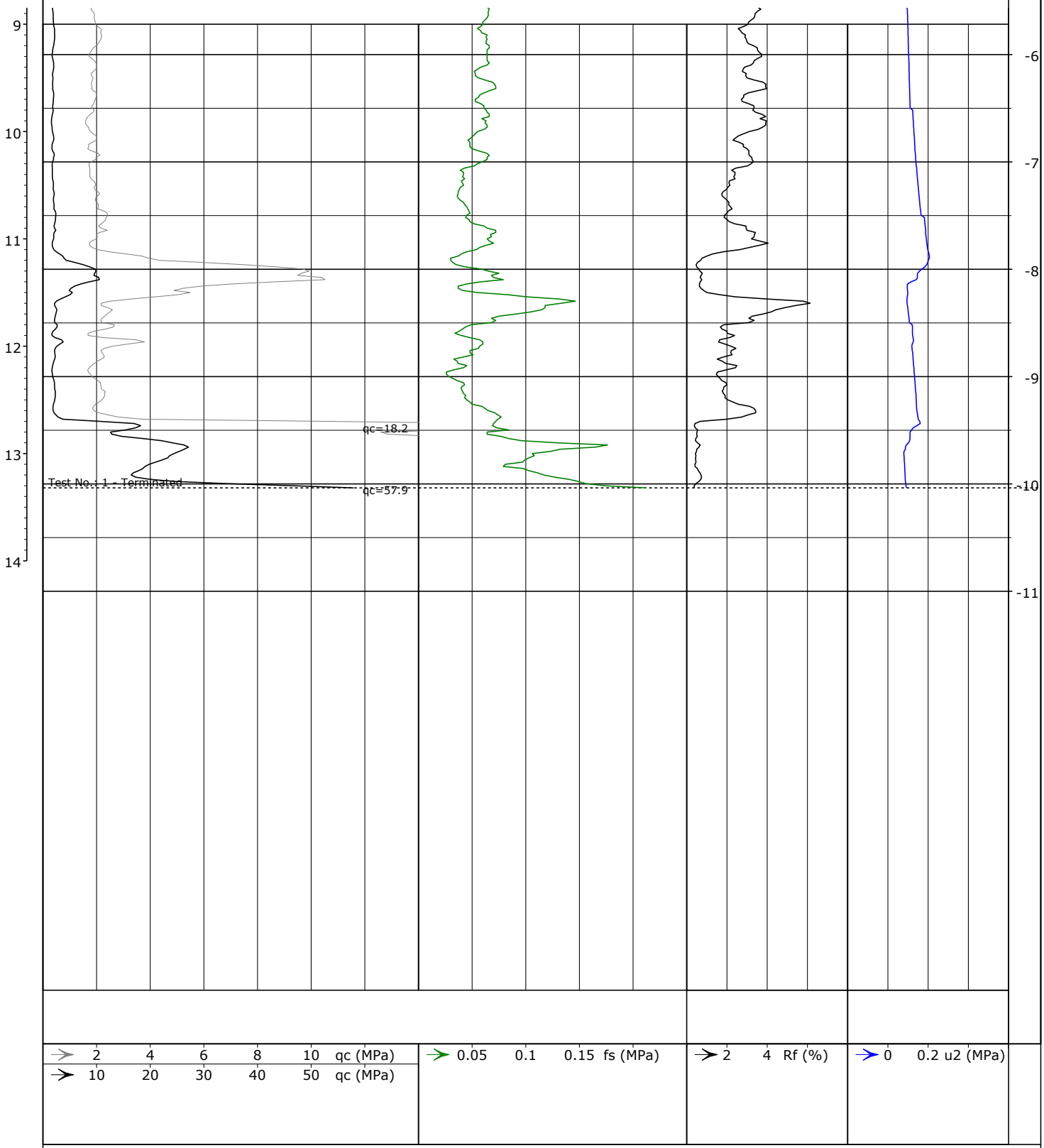
COWI

CPT Log

GeoGIS2020 20.03.36 PSTCPT1 16-04-2021 11:23:31

Test Results

Continued



Data for the used CPT is: Probe no.: 200806
Ares factor A: 0.75
Tip area: 10 cm²

Method: CPT
Projection: UTM32E89
Plan:

X: 446366 (m)
Y: 6257310 (m)

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Drilled by: Geob./CH Date: 2021.03.09 Geologist: Public No.: Borehole: CPT6

Prepared by: LNJE Checked by: TKSV Approved by: HRMO Date: 2021.04.16 Encl. No.: 1.6CPT P. 2/2

COWI

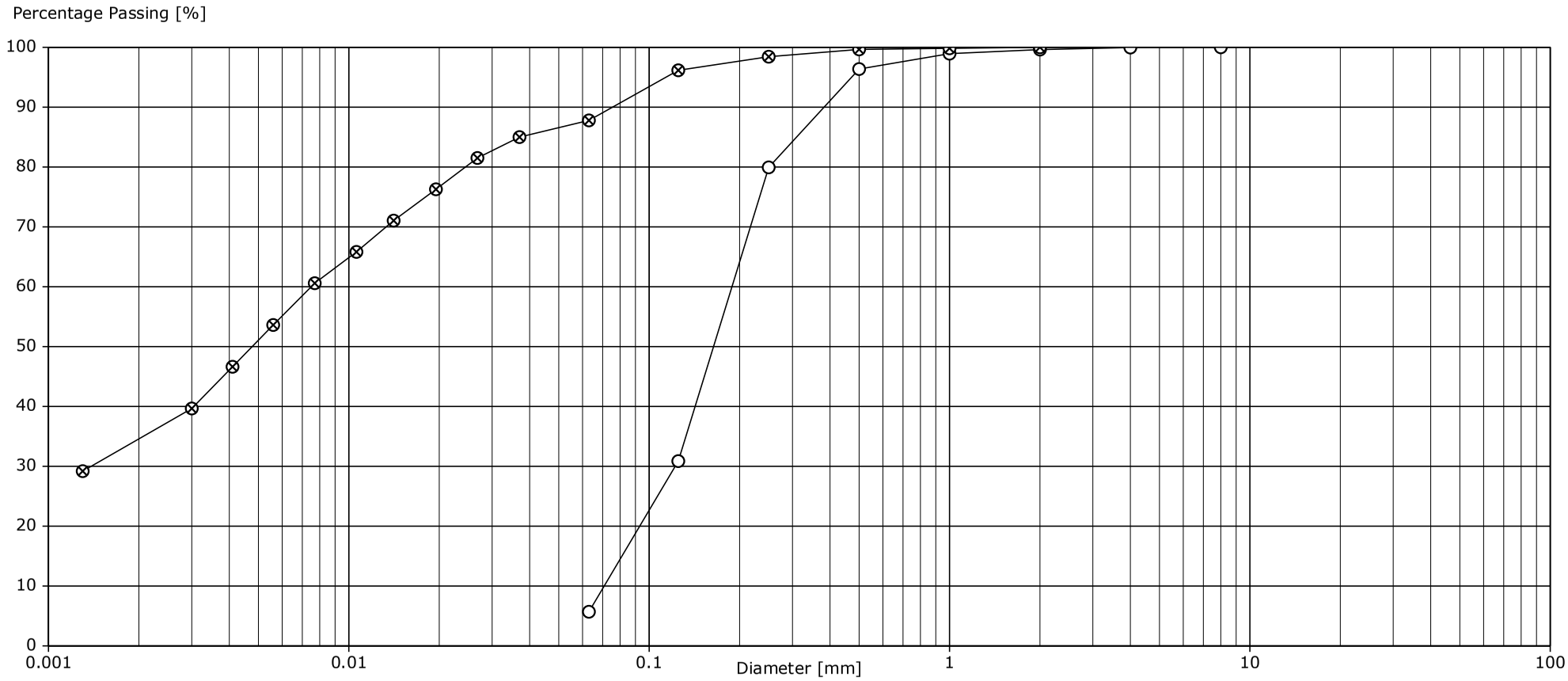
CPT Log

COWI

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Test: HJT Check: HRMO Approved: HRMO Date: 2021.04.08 Encl. No.: G 1.7 P. 1/1

Grain Size



	Fine	Medium	Course	Fine	Medium	Course	Fine	Medium	Course	
CLAY	SILT			SAND			GRAVEL			STONE

Borehole / Sample No.:	○ B/CPT1 / 30A	⊗ B/CPT1 / 40A			
Depth / Level [m]:	15,30 / -13,96	20,30 / -18,96			
Geology:					
Medium grain size, d50 [mm]	0.164	0.0048			
Uniformity coeff., d60 [mm] / d10 [mm] = U	0.189 / 0.0708 = 2,7	0.0075 / =			
Plasticity Index, WL - WP = IP [%]	- =	- =			
Aktivity, IP [%] / Clay [%] = IA	/ =	/ 34.6 =			
CaCO3 [%]					
Density of Solids, dS					
Sand Equivalent, SE					

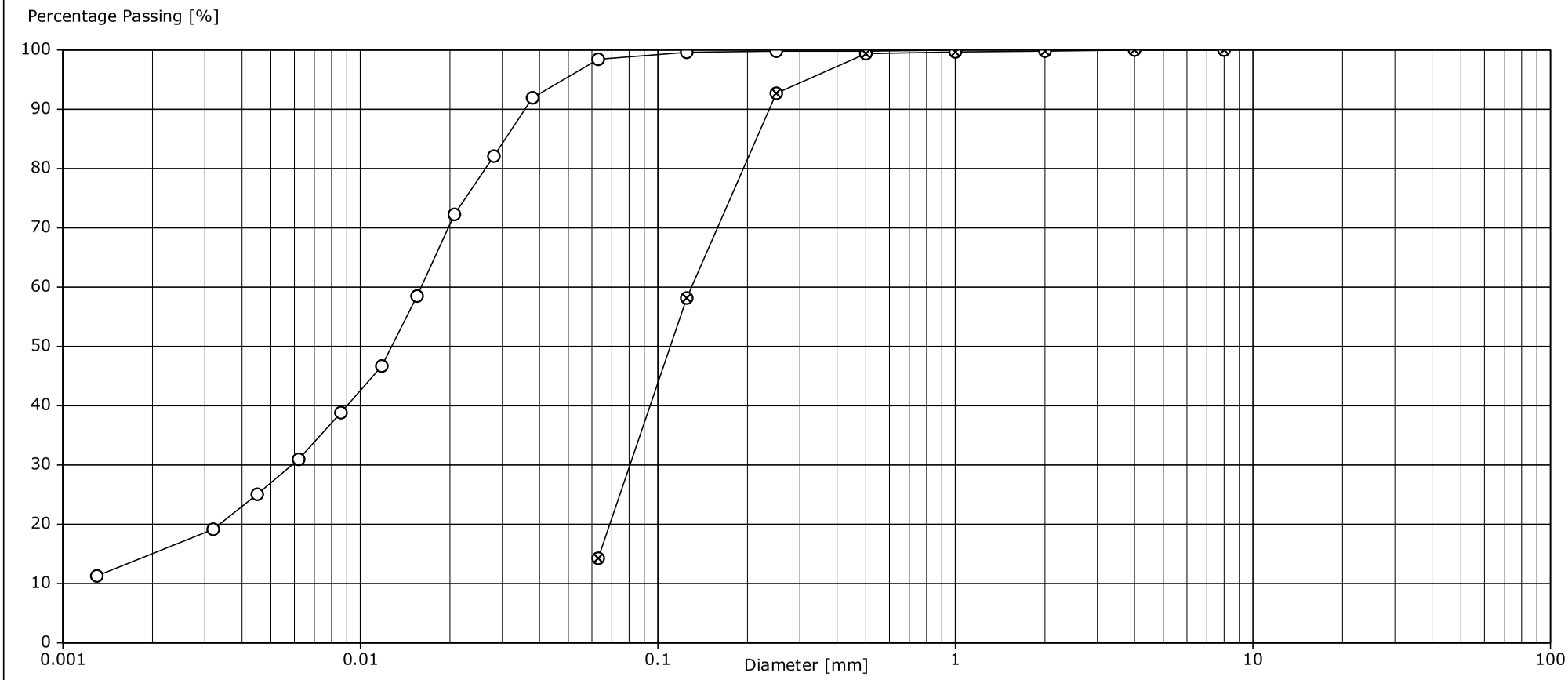
COWI

Grain Size

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Test: HJT Check: HRMO Approved: HRMO Date: 2021.04.08 Encl. No.: G 1.8

P. 1/1



	Fine	Medium	Course	Fine	Medium	Course	Fine	Medium	Course	
CLAY	SILT			SAND			GRAVEL			STONE

Borehole / Sample No.:	○ B/CPT4 / 22A	⊗ B/CPT4 / 43A			
Depth / Level [m]:	10,30 / -7,64	20,30 / -17,64			
Geology:					
Medium grain size, d50 [mm]	0.0127	0.11			
Uniformity coeff., d60 [mm] / d10 [mm] = U	0.016 / =	0.13 / 0.0621 = 2,1			
Plasticity Index, WL - WP = IP [%]	- =	- =			
Aktivity, IP [%] / Clay [%] = IA	/ 15.1 =	/ =			
CaCO3 [%]					
Density of Solids, dS					
Sand Equivalent, SE					

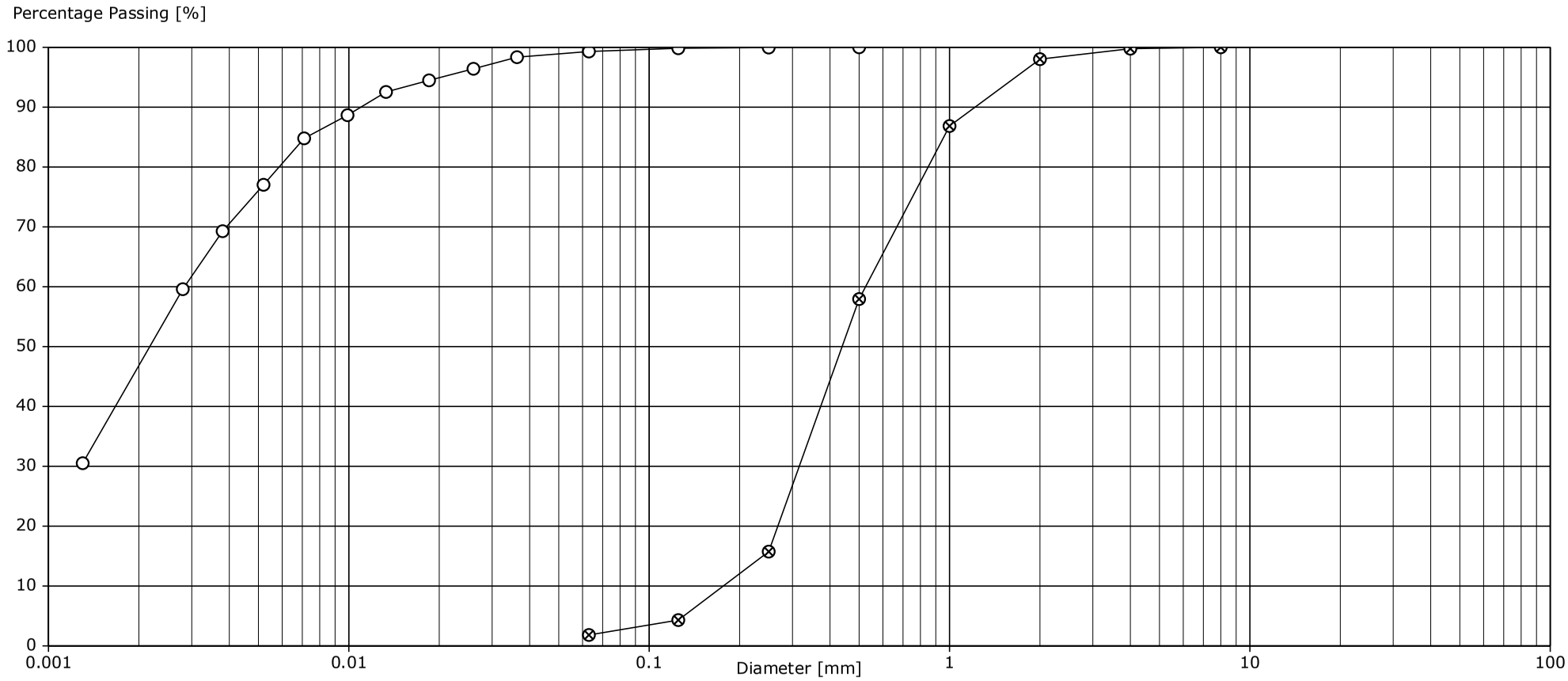
COWI

Project: A224691-001 Thor offshore wind farm. Landfall site investigations

Test: HJT Check: HRMO Approved: HRMO Date: 2021.04.08 Encl. No.: G 1.9

P. 1/1

Grain Size



	Fine	Medium	Course	Fine	Medium	Course	Fine	Medium	Course	
CLAY	SILT			SAND			GRAVEL			STONE

Borehole / Sample No.:	○ B/CPT5 / 26A	⊗ B/CPT5 / 44A			
Depth / Level [m]:	13,22 / -8,09	22,30 / -17,17			
Geology:					
Medium grain size, d50 [mm]	0.0022	0.439			
Uniformity coeff., d60 [mm] / d10 [mm] = U	0.0028 / =	0.525 / 0.176 = 3,0			
Plasticity Index, WL - WP = IP [%]	- =	- =			
Aktivity, IP [%] / Clay [%] = IA	/ 46.8 =	/ =			
CaCO3 [%]					
Density of Solids, dS					
Sand Equivalent, SE					

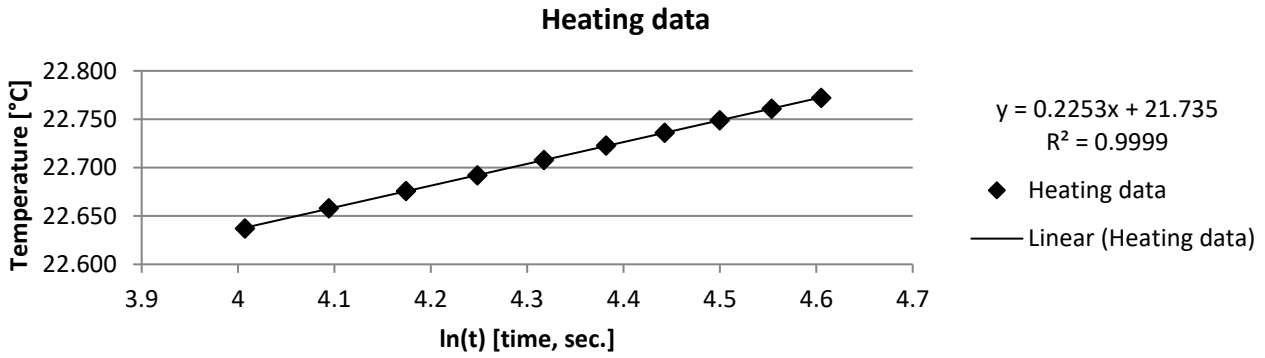
Sample parameters

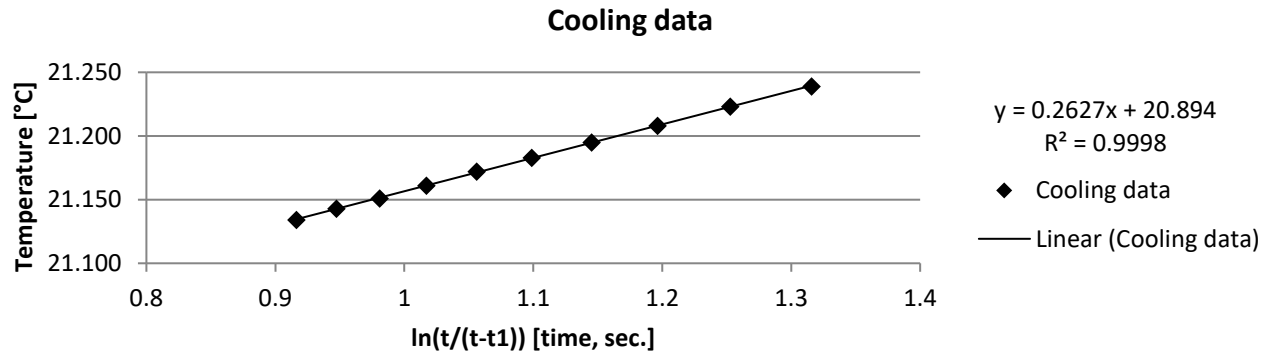
Geological classification	CLAY, very high plasticity, micaceous				
Sample Preparation:	Undisturbed soil sample, Thin-Walled steel tube, ø72mm				
Sample diameter, D	[mm]	72	Bulk Density, ρ_m	[Mg/m^3]	1.84
Sample height, H	[mm]	26	Dry Density, ρ_d	[Mg/m^3]	1.39
Moisture content, w	[%]	32.1	Moist unit weight, γ_m	[kN/m^3]	18.1
Particle density, ρ_s (assumed)	[Mg/m^3]	2.65	Dry Unit weight, γ_d	[kN/m^3]	13.7
Initial Degree of Saturation	[%]	94	Void Ratio, e	[-]	0.90

Apparatus

Product and model no.:	Decagon KD2 Pro		Sensor:	Decagon TR-1 (100 mm)	
Calibration constant, C	[-]	1.003	Heat input, Q	[W/m]	4.650
	Pushed	Pre-drilled	Read time	[min.]	5
Needle insertion method:	x		Current, I	[A]	0.095

Test data





Test results

Thermal Conductivity, K	[W m^{-1} K^{-1}]	1.549	Thermal Resistivity, ρ	[(m K W^{-1}]	0.645

Notes:

COWI

Thermal Conductivity

Test standard:
ASTM D 5334 (2008)

Lab. tech.:	SNHS	**Date:**	14-04-2021	**Project:**	Thor offshore wind farm Landfall site			**Encl. no.:**	
Checked:	MATP	**Date:**	16-04-2021	**Job no.:**	A224691	**Sample no.:**	40A		1.10
Approved:	HRMO	**Date:**	16-04-2021	**Boring no.:**	B/CPT1	**Depth [m]:**	20.0-20.6	**Revision**	1.0

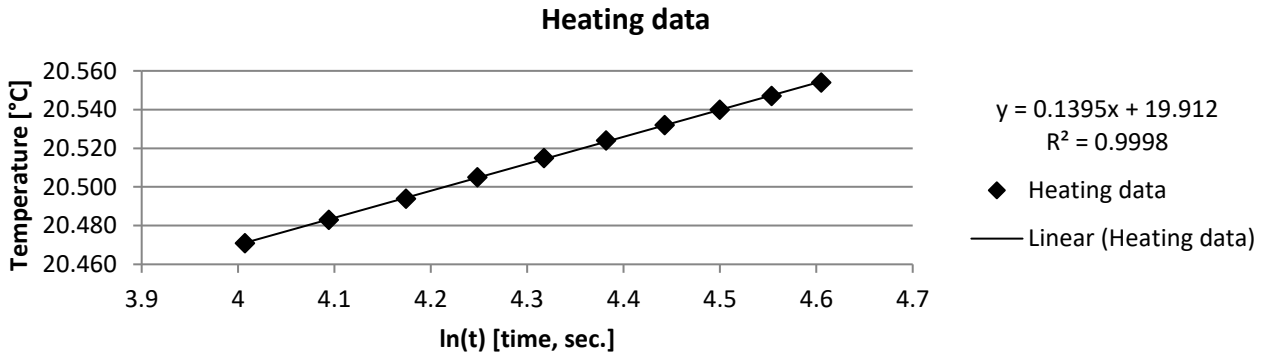
Sample parameters

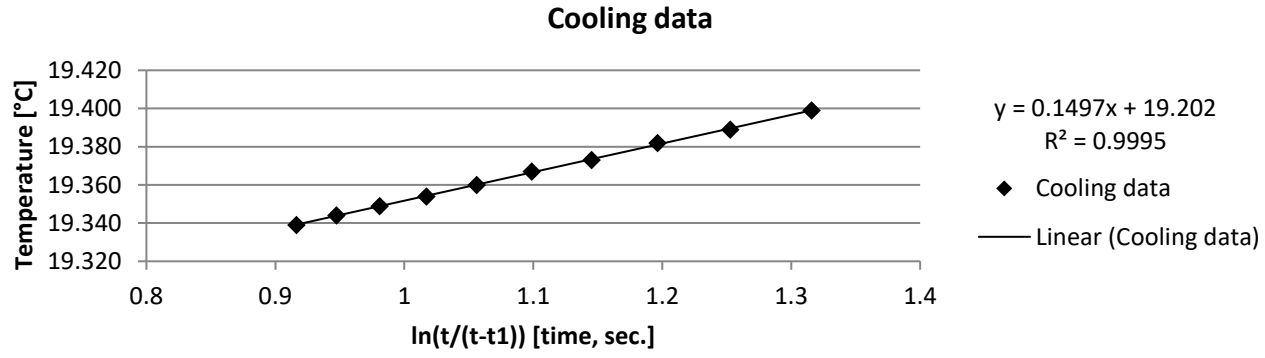
Geological classification	SAND, fine, micaceous, with small fragments of lignite, sorted				
Sample Preparation:	Large bag (LB) sample compacted in 208 mm high Standard Proctor Mold				
Sample diameter, D	[mm]	102	Bulk Density, ρ_m	[Mg/m^3]	1.86
Sample height, H	[mm]	208	Dry Density, ρ_d	[Mg/m^3]	1.53
Moisture content, w	[%]	21.6	Moist unit weight, γ_m	[kN/m^3]	18.2
Particle density, ρ_s (assumed)	[Mg/m^3]	2.65	Dry Unit weight, γ_d	[kN/m^3]	15.0
Initial Degree of Saturation	[%]	78	Void Ratio, e	[-]	0.73

Apparatus

Product and model no.:	Decagon KD2 Pro		Sensor:	Decagon TR-1 (100 mm)	
Calibration constant, C	[-]	1.003	Heat input, Q	[W/m]	3.920
	Pushed	Pre-drilled	Read time	[min.]	5
Needle insertion method:		x	Current, I	[A]	0.087

Test data





Test results

Thermal Conductivity, K	[W m^{-1} K^{-1}]	2.207	Thermal Resistivity, ρ	[(m K W^{-1}]	0.453

Notes: Measurements have been performed on saturated sample.

COWI

Thermal Conductivity

Test standard:
ASTM D 5334 (2008)

Lab. tech.:	SNHS	**Date:**	15-04-2021	**Project:**	Thor offshore wind farm Landfall site		**Encl. no.:**	
Checked:	MATP	**Date:**	16-04-2021	**Job no.:**	A224691-001	**Sample no.:**	43A	1.11
Approved:	HRMO	**Date:**	16-04-2021	**Boring no.:**	B/CPT4	**Depth [m]:**	13.0-13.4	**Revision** 1.0

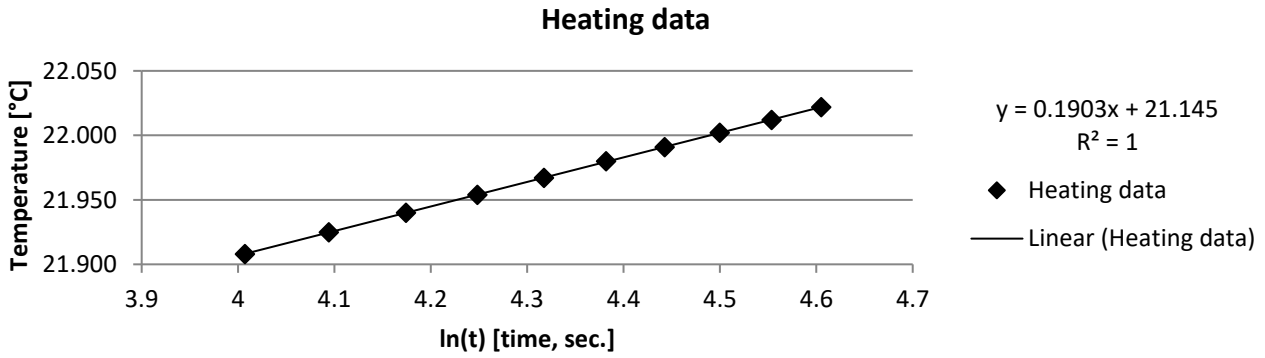
Sample parameters

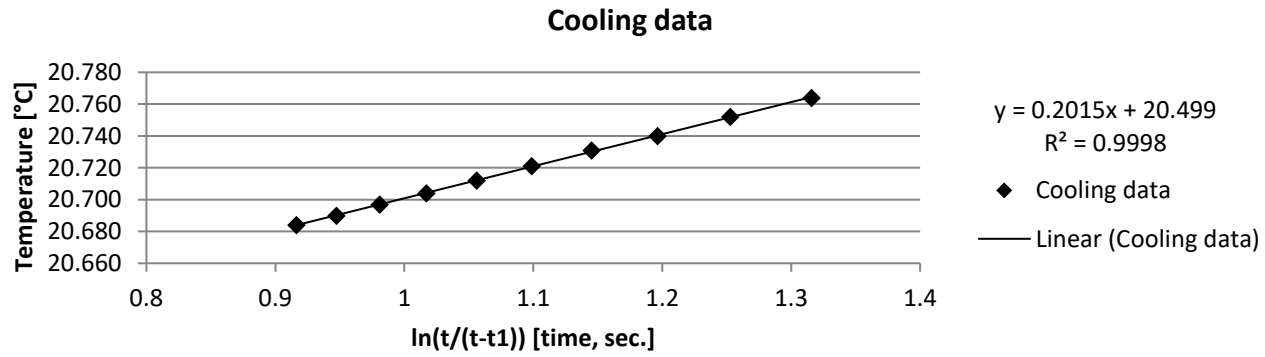
Geological classification	CLAY, very high plasticity, with many thin layers of silt				
Sample Preparation:	Undisturbed soil sample, Thin-Walled steel tube, ø72mm				
Sample diameter, D	[mm]	72	Bulk Density, ρ_m	[Mg/m^3]	1.82
Sample height, H	[mm]	27	Dry Density, ρ_d	[Mg/m^3]	1.38
Moisture content, w	[%]	32.4	Moist unit weight, γ_m	[kN/m^3]	17.9
Particle density, ρ_s (assumed)	[Mg/m^3]	2.65	Dry Unit weight, γ_d	[kN/m^3]	13.5
Initial Degree of Saturation	[%]	93	Void Ratio, e	[-]	0.92

Apparatus

Product and model no.:	Decagon KD2 Pro		Sensor:	Decagon TR-1 (100 mm)	
Calibration constant, C	[-]	1.003	Heat input, Q	[W/m]	4.080
	Pushed	Pre-drilled	Read time	[min.]	5
Needle insertion method:	x		Current, I	[A]	0.089

Test data





Test results

Thermal Conductivity, K	[W m^{-1} K^{-1}]	1.669	Thermal Resistivity, ρ	[(m K W^{-1}]	0.599

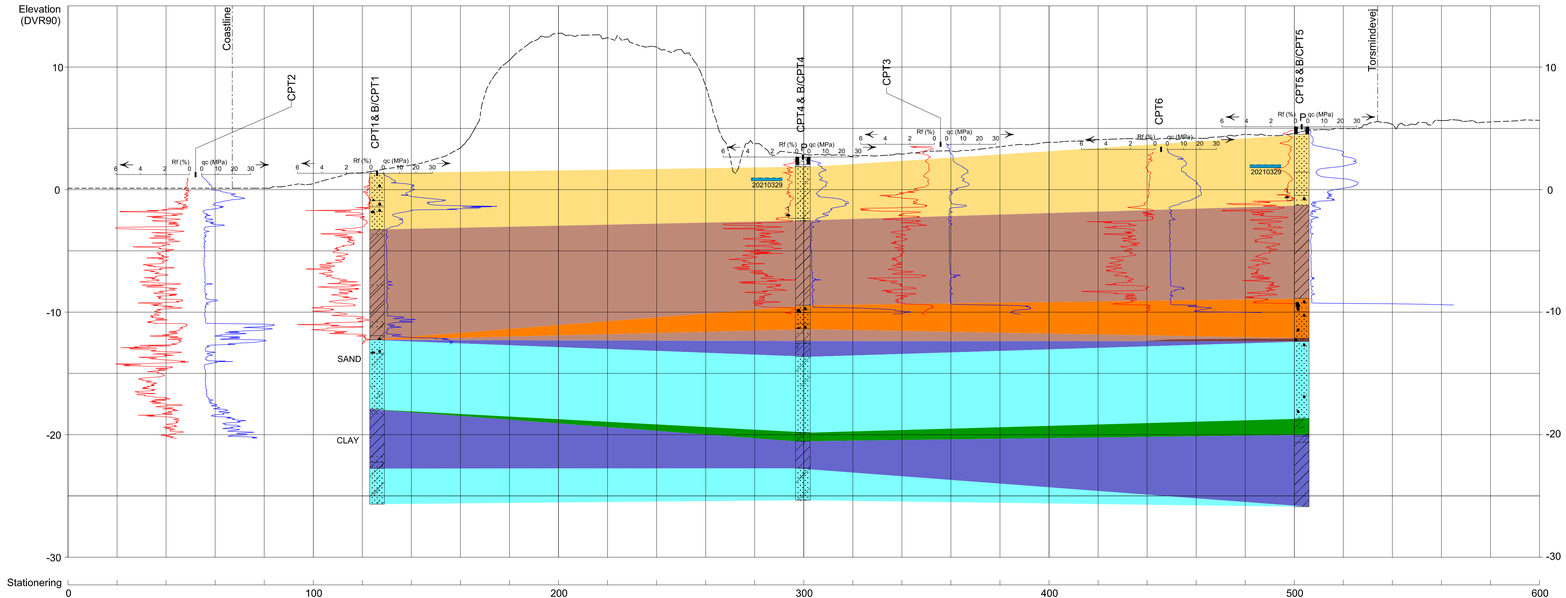
Notes:

COWI

Thermal Conductivity

Test standard:
ASTM D 5334 (2008)

Lab. tech.:	SNHS	**Date:**	14-04-2021	**Project:**	Thor offshore wind farm Landfall site	**Encl. no.:**	
Checked:	MATP	**Date:**	16-04-2021	**Job no.:**	A224691-001	**Sample no.:** 26A	1.12
Approved:	HRMO	**Date:**	16-04-2021	**Boring no.:**	B/CPT5	**Depth [m]:** 13.0-13.4	**Revision** 1.0



Legend

Enclosure 1.13 1.0

TOPSOIL

Postglacial deposits
- SAND and GRAVEL (S1)

Lateglacial/Glacial deposits
- CLAY (C1)
- CLAY TILL (C2)
- SAND and GRAVEL (S2)

Miocene deposits
- CLAY (C3)
- SAND (S3)
- GYTTJA (G1)

Terrain along the centerline (DHM/Terrain (0.4 m), Styrelsen for Dataforsyning og Effektivisering.

Borehole
B/CPT5
Borehole no.
Water level in stand pipe and date for measurement 20210329
Layer boundary
Soil signature (see enclosure)

CPT
CPT1
CPT no.
Rf (%) qc (MPa)

Coordinates on this drawing refer to UTM32 ETRS89
Vetical heights refer to DVR90

VER.	DATE	REMARKS	DRAW.	CHECKED	APPROVED

Energinet Eltransmission A/S

Thor offshore wind farms. Landfall site investigations

Geotechnical Investigations
Geotechnical longitudinal section

PROJECT NO.	A224691
DRAW.	LNJE
CHECKED	HRMO
APPROVED	HRMO
SCALE	1:200 / 1:1000
DATE	2021.04.16

REMARKS

ENCLOSURE NO. 1.13 VERSION 1.0

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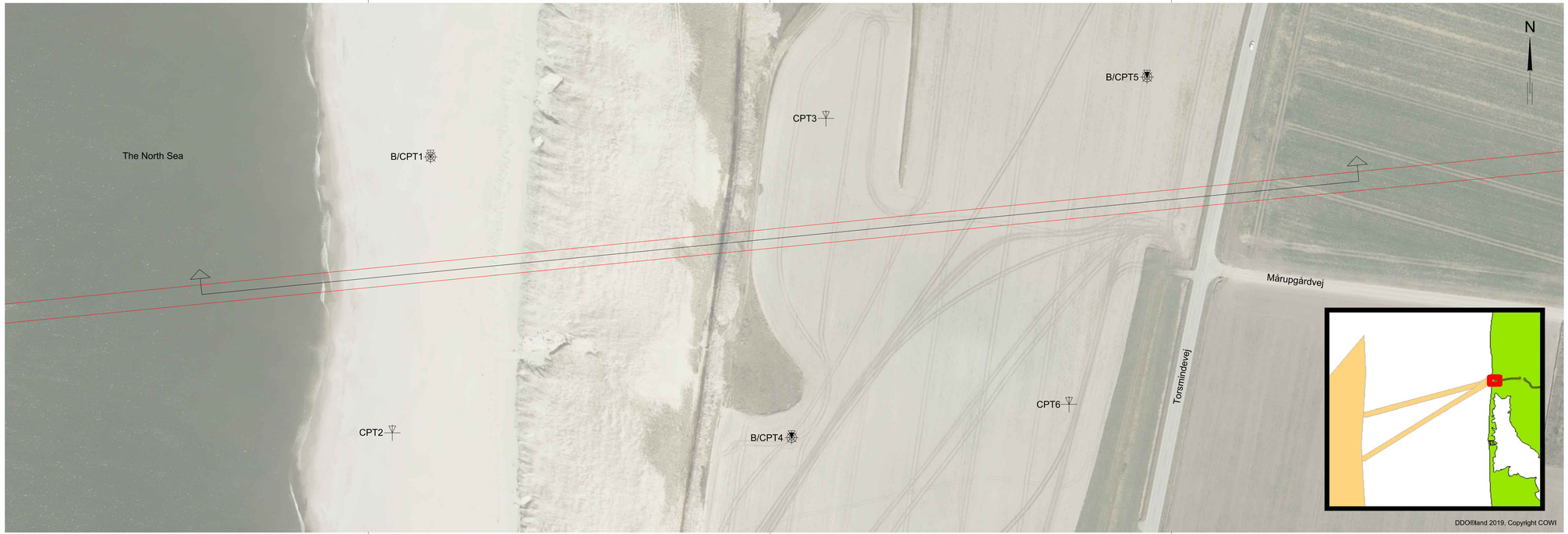
LNJE Q:\A220000\A224691\10-BIM\02_Wip\C10_SoilMech\Sheet\A224691-Profile_enclosure_1.13.dgn 21-04-2021 12:07:09

Enclosure 1.14 1.0



Legend

- Borehole with CPT and SPT
- Borehole with CPT
- CPT

Coordinates on this drawing refer to UTM32 ETRS89
Vetical heights refer to DVR90

VER.	DATE	REMARKS	DRAW.	CHECKED	APPROVED

Energinet Eltransmission A/S

Thor offshore wind farms. Landfall site investigations

Geotechnical Investigations
Location plan

PROJECT NO.	A224691
DRAW.	LNJE
CHECKED	HRMO
APPROVED	HRMO
SCALE	1:1000
DATE	2021.04.16

REMARKS

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Fax +45 56 40 99 99
www.cowi.dk

ENCLOSURE NO.	VERSION
1.14	1.0

LNJE Q:\A220000\A224691\10-BIM\02_Wip\C10_SoilMech\Sheet\A224691-SitePlan_enclosure_1.14.dgn 21-04-2021 12:10:34