

Norfolk Boreas Offshore Wind Farm TerraConsult Ground Investigations Report Part 1 of 6

Applicant: Norfolk Boreas Limited Document Reference: Exa.AS-3.D2.V1 Deadline 2

Date: December 2019 Revision: Version 1 Author: TerraConsult

Crossing 1

Photo: Ormonde Offshore Wind Farm





Norfolk Vanguard Offshore Wind Farm

The Applicant Responses to First Written Questions

Appendix 16.2 – TerraConsult 2017 Ground Investigations Report: Crossing 1 (Q16.8)

Applicant: Norfolk Vanguard Limited
Document Reference: ExA;WQApp16.2;10.D1.3
Deadline 1

Date: January 2019

Photo: Kentish Flats Offshore Wind Farm











DRAINAGE STONE

ipping Area

November 2017 Report No 3318-R001-2

East Anglia (North) Offshore Wind Farm Crossing 1 Site Investigation

Carried out for:

Gutteridge, Haskins and Davey Ltd (GHD)

TerraConsult

East Anglia (North) Offshore Wind Farm

Crossing 1 Site Investigation

Date: November 2017

Report No 3318-R001-2

Prepared for:



Gutteridge, Haskins & Davey Ltd The Studio, 51 Brookfield Road, Cheadle, SK8 1ES **Engineer:**



Gutteridge, Haskins & Davey Ltd The Studio, 51 Brookfield Road, Cheadle, SK8 1ES By:

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DOCUMENT INFORMATION AND CONTROL SHEET

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3318-R001-2	East Anglia (North) Offshore Wind Farm
	Crossing 1 Site Investigation

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Approved by:	D Daniels		Operations Manager
Date:	03/11/17		

Issue:	Date:	Description:	Prepared by:
1	11/10/17	Draft for Approval	VS
2	03/11/17	Final	DD
		-	

DISCLAIMER

This site investigation contract was completed by TerraConsult Ltd on the basis of a specification and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget, the degree of manpower and resources allocated to the project as agreed.

TerraConsult Ltd cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outwith the agreed scope of works.

This report is issued solely to the client and TerraConsult cannot accept any responsibility to any third parties to whom this report may be circulated, in part or in full, and any such parties rely on the contents at their own risk.





October 2017 3318-R001-2

East Anglia (North) Offshore Wind Farm

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East Anglia (North) Offshore Wind Farm

Crossing 1

1 INTRODUCTION

TerraConsult Limited (TCL) was commissioned by Gutteridge, Haskins and Davey Ltd (GHD) to carry out a ground investigation for the proposed cable route crossing the A47 near Dereham, Norfolk.

This report presents the factual records of the fieldwork and laboratory testing. The data is also presented separately in digital format following AGS4 (2011).

The scope of the investigation, which was specified by GHD, comprised:

- o Boreholes formed by cable percussive techniques;
- o In situ testing comprising of;
 - Standard penetration tests in boreholes;
 - Variable head permeability testing;
- Post fieldwork monitoring and sampling;
- Geotechnical laboratory testing;
- o Geoenvironmental laboratory testing;
- Factual report (GIR) and AGS data.

The investigation was carried out in accordance with the contract specification and relevant standards (see References). The fieldwork was carried out between 28/07/17 and 03/08/17.

Whilst every attempt is made to record full details of the strata encountered in the exploratory holes, techniques of exploratory hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

All information given in this report is based on the ground conditions encountered during the site work and on the results of laboratory and field tests performed during the investigation. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations and water conditions between or below exploratory holes. It should be noted that groundwater levels, gas concentrations and gas flows usually vary due to seasonal, atmospheric and/or other effects and may at times differ to those measured during the investigation.

2 SITE DESCRIPTION

2.1 Location and Topography

The site is located approximately 3.9 km west of the centre of Dereham, Norfolk. The approximate location of Crossing 1 is located between Ordnance Survey National Grid References TF 946 129 and TF 946 127. A site location plan is presented as drawing 3318(C1)D001-1.

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2.2 **Published Geology**

The online British Geological Survey (BGS) 1:50,000 scale map shows the site to be underlain by glacial till of the Lowestoft Formation below which lies the White Chalk Subgroup.

3 **FIELDWORK**

3.1 General

Fieldwork was undertaken between 28/07/17 and 03/08/17. The scope of the works, as provided by GHD comprised:

Table 1: Scope of Intrusive Works and In Situ Testing											
Exploratory Hole/In Situ Test Type	Proposed number										
Cable percussion, SPTs, install	BH17-C1-01										
Cable percussion, SPTs, variable head perm test	BH17-C1-02										
Cable percussion, SPTs, variable head perm test, install	BH17-C1-03										
Cable percussion, SPTs	BH17-C1-04										

The exploratory hole locations were selected by GHD. The locations were set out by the GHD site representative prior to commencement.

3.2 **Exploratory Holes**

The exploratory holes were logged by an engineer in accordance with the recommendations of BS5930:2015, which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1. Methods of formation and geological descriptions, together with sample records, in situ test results and observations made during formation of the exploratory hole are given in the logs presented in Appendix A and should be read in conjunction with the Key included therein. Sample photographs are presented in Appendix B.

A summary of the exploratory holes formed is listed in the following table.

Table 2: Summary of Exploratory Positions												
Exploratory position:	Type:	Final depth (m):	Easting (mE):	Northing (mN):	Level (mAOD):	Start date:	End date:					
BH17-C1-01	CP	9.60	594695.52	312868.66	45.00	28/07/2017	28/07/2017					
BH17-C1-02	CP	15.00	594670.58	312839.54	45.20	31/07/2017	31/07/2017					
BH17-C1-03	CP	9.80	594667.09	312794.73	46.06	01/08/2017	02/08/2017					
BH17-C1-04	CP	15.45	594636.58	312774.60	46.31	02/08/2017	03/08/2017					

Type: CP - cable percussion

Prior to commencement, all exploratory positions were checked for services by reference to available plans, visual inspection and CAT/Genny survey. Inspection pits were excavated by hand and rechecked with a CAT at all borehole locations.

An exploratory hole location plan is presented as drawing 3318(C1)D002-1.

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3.3 Sampling

Samples for geotechnical and geoenvironmental testing and strata description were taken during the formation of the exploratory holes in general accordance with the specification, BS5930:2015, BS10175:2011 and BS EN ISO 22475-1:2006. Soil and water samples for geochemical analysis were taken in accordance with the specification and stored in cool boxes for despatch directly to Concept Life Sciences (Formerly Scientific Analysis Laboratories, SAL) in Braintree, Essex.

A summary of water samples taken from monitoring installations is presented in Appendix D.

3.4 In Situ Testing

In situ testing was carried out in accordance with BS 5930:2015, BS 1377-9 (1990), BS EN ISO 22282-1:2012 and BS EN ISO 22282-2:2012 unless otherwise stated. SPT results are presented on individual exploratory hole logs. Information relating to the identification and calibration of SPT hammers can also be found on the individual borehole logs. Hammer calibration certificates are presented in Appendix G.

Falling head tests were carried out in suitable strata in the boreholes upon instruction from GHD. Results are presented in Appendix C.

3.5 Instrumentation and Monitoring

Details of instrumentation installed is presented on the exploratory hole logs. A summary of the installed instrumentation is listed in the following table.

Table 3: Summary of Instrumentation												
Exploratory position:	Instrument type:	Instrument reference:	Internal diameter (mm):	Installed depth (m bgl):	Depth (m AOD):	Top of response zone (m bgl):	Base of response zone (m bgl):					
BH17-C1-04	Standpipe	BH17-C1-04	50	15.45	32.5	9.50	12.50					

Under instruction from GHD, BH17-C1-01 was not installed as proposed.

Records of monitoring and gas/groundwater sampling carried out by TerraConsult during and after the fieldwork period to the date of issue of this report are presented in Appendix D. Calibration certificates are presented in Appendix G.

3.6 Surveying

On completion of the fieldworks, all exploratory positions were surveyed by use of a dGPS. Coordinates and reduced levels to Ordnance Survey are provided on the exploratory hole logs.

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4 LABORATORY TESTING

4.1 **Geotechnical Testing**

The testing was scheduled by GHD and was carried out by GEO Site Testing Services Ltd (GSTL), Llanelli, Camarthenshire, in accordance with BS 1377 (1990) and BRE SD1 unless otherwise stated. The testing is summarised below and the results are presented in Appendix E.

Table 4: Summary of Geotechnical Laboratory Testing												
Lab test:	Number undertaken:	Method:	Remarks:									
Atterburg Limit 4 Point	1	BS1377: Part 2: 4.3 & 5.3										
Method												
Particle size distribution	2	BS1377: Part 2: 9.2										
BRE SD1 suite	1	BRE SD1										
One dimensional	1	BS1377: Part 5: 3										
consolidation												
Triaxial 100mm single stage	2	BS1377: Part 7: 8										

4.2 **Geoenvironmental Testing**

The testing was scheduled by GHD and carried out by Concept Life Sciences. The results are presented in Appendix F.

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5 REFERENCES

AGS: 2010: Electronic transfer of geotechnical and geoenvironmental data (Edition 4 including addendum 3, 2011). Association of Geotechnical and Geoenvironmental Specialists.

BRE Special Digest 1: 2005 Concrete in aggressive ground.

BS 1377: 1990: Methods of test for soils for civil engineering purposes. Published in nine parts. British Standards Institution.

BS 5930: 2015: Code of practice for site investigation. British Standards Institution.

BS 10175: 2011: Investigation of potentially contaminated sites - Code of Practice. British Standards Institution

BS EN 1997-1: 2004 : Eurocode 7 – Geotechnical Design – Part 1: General rules. Including UK National Appendix of November 2007.

British Standards Institution.

BS EN ISO 14688-1 : 2002 : Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description. British Standards Institution.

BS EN ISO 14688-2 : 2004 : Geotechnical investigation and testing – Identification and classification of soil – Part 2: Principles for a classification. British Standards Institution.

BS EN ISO 14689-1 : 2003 : Geotechnical investigation and testing – Identification and classification of rock – Part 1: Identification and description. British Standards Institution.

BS EN ISO 22282-1: 2012 Geotechnical investigation and testing. Geohydraulic testing Part1: General Rules

BS EN ISO 22282-2 : 2012 Geotechnical investigation and testing. Geohydraulic testing Part 2: Water Permeability Tests in a borehole using open systems

BS EN ISO 22475-1 : 2006 : Geotechnical investigation and testing – Sampling methods and groundwater measurements – Part 1: Technical principals for execution (July 2011 reprint). British Standards Institution.

BS EN ISO 22476-3: 2005: Geotechnical investigation and testing - Field Testing - Part 3: Standard penetration test

6 LICENCES

British Geological Survey Reproduction Licence Number: IPR/187-68CF CO8/053-CSL

Ordnance Survey Reproduction Licence Number. 100035365

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DRAWINGS

3318(C1)D001-1 Site Location Plan 3318(C1)D002-1 Exploratory Hole Location Plan

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Site Location Plan

TerraConsult



Address: East Anglia

AGS Issue: FINAL Scale: 1:25000

East Anglia (North) Offshore Wind Farm Project:

Project No: 3318 GHD Ltd Client:

Drawing No:

3318(C1)D001-1

Exploratory Hole Location Plan

TerraConsult







AGS Issue:

Scale:

FINAL 1:3000 Project: East Anglia (North) Offshore Wind Farm

Project No: 3318 Client: GHD Ltd Drawing No:

3318(C1)D002-1

APPENDICES

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APPENDIX A Exploratory Hole Records

Key sheet

Boreholes

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Exploratory Hole Key Sheet

TerraConsult

SAMPLES:

Undisturbed:

U Driven tube sample
UT Thin wall driven tube sample
TW Pushed thin wall tube sample
P Pushed piston sample

Liner sample (from windowless or similar sampler), full recovery unless otherwise stated

CBR CBR mould sample BLK Block sample

C Core sample (from rotary core) taken for laboratory testing

Disturbed:

D Small sample
B Bulk sample
AMAL Amalgamated sample

Environmental:

ES Environmental soil sample
EW Environmental water sample

Comments: Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that an attempt was made

to take a tube sample; however, there was no recovery. Sample recovery is given as a percentage.

TESTS:

SPT S or SPT C Standard Penetration Test, open shoe (S) or solid cone (C)

The Standard Penetration Test is defined in BS EN ISO 22476-3 (2005). The incremental blow counts are given in the Field Records column; each increment is 75mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 (either in total or for a single

increment) the total blow count beyond the seating drive is given (without the N = prefix).

ICBR In situ CBR

IV In situ vane shear strength, peak (p) and remoulded (r), kPa
HV Hand vane shear strength, peak (p) and remoulded (r), kPa
PP Pocket penetrometer test, converted to shear strength, kPa

KFH, KRH, KPI Variable head permeability tests (KFH = falling head test, KRH = rising head test, KPI = packer test), permeability value

PID/FID Photo-ionisation detector/Flame-ionisation detector

Test results provided in Field Records column

DRILLING RECORDS:

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930: 2015 and BS EN ISO 22575-1 (2006)

TCR Total Core Recovery, % SCR Solid Core Recovery, % RQD Rock Quality Designation, %

If Fracture spacing, mm. Minimum, typical and maximum spacings are presented.

NI Non intact is used where the core is fragmented.

CRF Core recovered (length in m) in the following run

AZCL Assessed zone of core loss

NR Not recovered

GROUNDWATER:	DEPTH REMARKS:

Groundwate

Groundwater strike

EoS End of Shift
SoS Start of Shift
EoBH End of Borehole

Groundwater level after standing period

INSTRUMENTATION:

Details of installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill. The type of instrument installed is indicated by a code adjacent to the Legend column at the base of the instrument.

dicated by a code adjacent to the Legend column at the base of the instrument.

Hydraulic piezometer

SP Standpipe
SPIE Standpipe piezometer
PPIE Pneumatic piezometer
EPIE Electronic piezometer

GMP Gas monitoring standpipe (xx) Internal diameter

. ,

ICE Biaxial inclinometer

ICM Inclinometer tubing for use with probe

SLIP Slip indicator

HPIE

ESET Electronic settlement cell/gauge
ETM Magnetic extensometer settlement point

ETR Rod extensometer

EXPLORATORY HOLE TYPE: CP Cable percussion

DP Dynamic probe
DCP Dynamic cone penetrometer

HA Hand auger
IP Inspection pit

OP Observation pit/trench
PC Pavement core
RC Rotary core
RO Rotary open hole

SH Shaft

Reference

SNC Sonic (resonance)
TP Trial pit/trench
TRAV Traverse

WLS Windowless (dynamic) sample WS Window (dynamic) sample

Project: East Anglia (North) Offshore Wind Farm

Project No: **3318**Client: **GHD Ltd**

KEY SHEET

Sheet 1 of 1



Bore	Borehole formation details:															
Туре	: F	rom:	To:	Start da	ate: End date:	Crew:	Plant:	Barrel type:	Drill Bit:	Logged:	Logg		Remarks	S :		mE: 594695.52
IP CP		0.00 0.00	1.20 9.60	28-07- 28-07-		TM TM	Hand tools Dando 2000	n/a n/a	n/a n/a	28-07-17 28-07-17	FN FN		SPT har	nmer ID: SI 4 E(r)% 74	mN: 312868.66
															•	mAOD: 45.00
																Grid: OSGB
Backfill/ Instal'n	ke r	Legend	Lavel	Depth			Stratum	Description						Samples	& In Situ Te	esting
Bac	Water- strike	Leg	Level	(thick- ness)			Stratum	Description			١	Water	Casing	Depth	Type & No	Results/Remarks
				(0.30)			slightly gravelly inded fine to co				to -			0.05	ES1	
		X	44.70	0.30	(TOPŠOIL)					•						
	▼	<u>×_</u>					slightly gravelly inded fine to co		LAY. Grave	el is	3			0.50 0.50	D1 ES1	
		×		-	(LOWESTOF	T FORM	MATION)							0.50 - 1.00	B1	
		×	44.00	1.00 —			rown mottled gr	ey slightly sar	ndy silty CL	-AY.	-			1.00 1.00	D2 ES2	
		<u>×–</u>			(LOWESTOF	ESTOFT FORMATION)										
		×		-										1.50 1.50	C D3	N=17 (2,2/4,4,4,5)
		<u>×_</u>		(1.50)										1.50	ES3	
		<u>×_</u>		-							-			2.00 2.00	D4 ES4	
		<u>×_</u>		=							-			2.00	201	
		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	42.50	2.50	Firm light gre	yish bro	wn slightly grav	elly slightly s	andy CLAY	. Gravel of				2.50 - 2.95	D5	
				-		subrou	ınded fine to co				-					
				(0.95)	(LOWL5101	i i Oikii	WATION)				-			3.00 - 3.45	U1	50 (80%)
		× -		=												
			41.55	3.45	Firm to stiff lig	ght grey	ish brown sligh	tly silty gravel	ly CLAY. G	ravel of	=			3.45	D6	
		×			subangular to siltstones.	subrou	inded fine to co	arse chalk an	d flint. Occ	asional						
		×			(LOWESTOF	T FORM	MATION)				=					
		×]					
		^	40.50	4.50 -	Finns limbs and	حدما مامان	1:-1-41	d	t. CL AV. C			Dry	3.00	4.50	s	30 (4,4/30 for 75mm)
		×			subangular to	subrou	wn slightly sand unded fine to co	arse chalk an	d flint.	ravel of	1			4.50 - 4.95	B2	
		×		_	(LOWESTOF	T FORM	MATION)				_					
		×—-		(1.50)							1					
		×—·		` _]					
		×		=							1					
		×	39.00	6.00 -										6.00 - 6.45	B3	40 (0%)
		× - 3	00.00	-			y sandy gravelly parse chalk and		Gravel of su	ubangular to	0 -			6.00 - 6.45	UNR	10 (070)
		×		-	(LOWESTOF						1					
		\$ -3		(1.50)							-					
		\$ 3		(1.00)												
		\$ -3		-							-					
		× ->	37.50	7.50 -							-	Dn.	5.50	7.50	s	N=22 (2,2/4,5,6,7)
		<u> </u>	37.30	-	Stiff to very st subrounded f		grey slightly gra	avelly CLAY. (Gravel of su	ubangular to) -	Dry	3.50	7.50 7.50 - 7.95	D7	N-22 (2,2/4,5,0,7)
				-	(LOWESTOF						-					
]					
				(0.00)							-					
				(2.00) –							-					
				-							-					
		<u> </u>		_							_			9.00 - 9.45	U3	
											=					
		100	35.50 35.40	9.50 <u> </u>	Stiff light grey	slightly	sandy gravelly parse chalk and	silty CLAY. G	Gravel is su	bangular to	7			9.50	D8	
				-	(LOWESTOF	T FORM	MATION)		at\		_/					
C=-	Inst		mania -	_	Diament		rehole ends at 9	`			٧	Water		Depth	Type & No	Results
			entries: o: Casin	ıg: Seal	Diameter ed: Dia (mm			Prom: To		Rema	arks:			Chiselling deta From: to:	Duratio	on: Tool:
9.6		0.63		•	150 9.00 9.00											
		s: For exp	lanation of sym	bols and	Project:	Fast	Anglia (North)	Offshore Wing	d Farm				F	Exploratory pos	sition refere	ence.
AGS	All de	eviations s epths and	ee Key Sheet. reduced levels a	are in metres.	Project N			CHORDIC VVIII	. I WIIII							C1-01
Log i		•	FINAL 1:50		Client:	GHD								וט		Sheet 1 of 1



Bor	prehole formation details:															
Typ IP CF	·	From: 0.00 0.00	To: 1.20 15.00	Start da 31-07- 31-07-	17 31-07-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 31-07-17 31-07-17	Logger: FN FN	Remarks SPT har	s: mmer ID: SI 8 E(r)% 73	mE: 594670.58 mN: 312839.54 mAOD: 45.20 Grid: OSGB	
Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick-			Stratum	Description					Samples & In Situ Testing			
& ⊆ X//X	≥ ∞	_ <u>_</u>		ness)	Soft orangish	hrown	slightly gravelly	v sandy silty C	I AV Grave	al of	Wate	er Casing	Depth	Type & No	Results/Remarks	
		× - : × - : ×	44.80	0.40	subangular to (TOPSOIL) Firm orangish	brown subrou	slightly gravelly	parse chalk an	d flint. Fred	quent rootlet	s.		0.50 0.50 0.50 - 1.00	D1 ES1 B1		
	_	×		(1.10)					1.00 - 1.50	m: Becomes firm	n -		1.00 1.00	D2 ES2		
	Ď	× ×	43.70 43.50	1.50 -		ĂY. Gra	rown mottled d avel of subangu MATION)				t. /		1.50 1.50 1.50 - 1.95	D3 ES3 UNR	37 (0%)	
	T			(1.30)	Firm light grey	mottle to sub	ed dark grey slig rounded fine to					,	2.00 2.00 2.00 2.00 - 2.45	C D4 ES4 B2	N=13 (2,2/3,3,3,4)	
		× × × × × × × × × × × × × × × × × × ×	42.20 41.80		lenses of dark (LOWESTOF	orangi ΓFOR	mottled dark g ish brown fine t MATION) ish grey slightly	o coarse SAN	ID.	J		3.00	3.00 3.00 - 3.45	S D5	N=22 (1,3/4,6,6,6)	
			40.00	(0.90)		to sub brown	rounded fine to staining.						4.00	D6		
			40.90			fine to	ey slightly sand o medium chalk MATION)		AY. Gravel	of subangu	lar Dry	4.50	4.50 4.50 - 4.95	S D7	N=14 (1,2/3,3,4,4)	
				(3.20)				6. <u>45 - 7.</u>	50 m: Become	s stiff to very sti			6.00 - 6.45 6.00 - 6.45	D8 U2	45 (80%)	
			37.70	7.50 -		ne to m	y slightly grave nedium chalk ar MATION)			ngular to	Dry	7.50	7.50 7.50 - 7.95	S D9	N=21 (1,3/4,5,5,7)	
			35.75	(1.95)	Stiff light grey fine to mediun (LOWESTOF	n chalk		'. Gravel of sui	bangular to	subrounde	d -		9.00 - 9.45 9.00 - 9.45	D10 U3	42 (80%)	
Y//)	Inst				1						Wate		Depth	Type & No	Results	
Stru 1.					Diameter ed: Dia (mm) 15	: Dept		Pepth relate From: To		: Rema	rks:		Chiselling deta From: to:	ails: Duratio	on: Tool:	
AG Log Sca	Project No: 3318 Client: GHD Ltd Project No: 3318 Client: GHD Ltd															



Bor	Sorehole formation details: Location details:																
Type IP CP	- 1	From: 0.00 0.00	To: 1.20 15.00	Start da 31-07- 31-07-	17 31-07-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 31-07-17 31-07-17	Logger: FN FN	Remarks	s: mmer ID: SI 8 E(r)% 73	mE: 594670.58 mN: 312839.54 mAOD: 45.20 Grid: OSGB		
Backfill/ Instal'n	ter- ike	Legend	Lovel	Depth (thick			Stratum	Description					Samples & In Situ Testing				
Bacl	Water- strike	Leg	Level	(thick- ness)							Wate	er Casing	Depth	Type & No	Results/Remarks		
				(3.00)	Stiff light grey fine to mediur (LOWESTOF	n chalk		. Gravel of su	ıbangular to	subrounde	d - Dry	7.50	10.50 10.50 - 10.95	S D11	N=27 (3,5/5,6,8,8)		
			32.75	12.45	Stiff to very st subrounded fi (LOWESTOF	ne to c		avelly CLAY.	Gravel of su	ubangular to			12.00 - 12.45	U4	66 (80%)		
				(2.55)	(LOWESTO)	i i Oid	vicinoly)				- Dry	7.50	13.50 13.50 - 13.95	S D13	N=27 (3,4/5,6,8,8)		
			30.20	15.00		Da	prehole ends at 1			omes soft to firn	<u>n</u>		14.50 - 14.95 14.50 - 14.95	B3 UNR	100 (0%)		
	Inst						Jenore enus at 1	3.00III (Targe	i depui)		Wate	er Casing	Depth	Type & No	Results		
	undw		entries:	a: C'	Diameter			Depth relate				(Chiselling deta	ails:			
AG	Note	es. For exp	o: Casin	nois and	Project:	East	: Anglia (North)		o: nd Farm	Rema	iks:		From: to:		ence:		
1	issue		FINAL 1:50		Project No Client:	3318 GHE							BH	ı17 -	C1-02 Sheet 2 of 2		



Boreh	nole	forr	nation	details):								_			Location details:
Гуре: IP CP	0	rom: 0.00 0.00	To: 1.20 9.80	Start da 01-08- 01-08-	17 01-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 01-08-17 02-08-17	Logger FN FN		marks T han	: nmer ID: SI 8 E(r)% 73	mE: 594667.0 mN: 312794.7 mAOD: 46.06 Grid: OSGB
Instal'n Water-	strike	Legend	Level	Depth (thick-			Stratum	Description						Samples	& In Situ Te	esting
8 ≝ ≥ ///	st			ness)	Soft dark brow	wn sliah	tly gravelly san	•	vel of suba	angular to	Wa	nter C	asing	Depth	Type & No	Results/Remarks
			45.66	(0.40) 0.40 (0.50)	subrounded f (TOPSOIL) Soft dark brow	ine to co wn mott angular	parse flint. Occilled dark orangi to subrounded	asional rootlet sh brown sligh	s ntly gravelly		ĀY			0.50 0.50 0.60 - 0.80	D1 ES1 B1	
			45.16	0.90	Stiff dark grey slightly sandy	yish brov CLAY.	wn mottled dar Gravel of suba sional cobbles (ngular to subr	ounded fin	e to coarse				1.00 1.00	D2 ES2	
				-	pockets of da (LOWESTOF		gish brown clay MATION)	ey SAND.	J		- D	ry 1	1.50	1.50 1.50 1.50 - 1.95	C ES3 B2	N=51 (3,4/5,6,11,29
			44.16	1.90	Gravel of sub	angular of dark	brownish grey to subrounded orangish brow MATION)	I fine to coarse	chalk. Ra					2.00 2.00	D3 ES4	
, , , ,	▼			(1.60)										3.00 - 3.45	U1	70 (90%)
	Y		42.56	3.50 -		ine to co	v sandy gravelly parse chalk and MATION)			gular to				3.50	D4	
				- - - - -		4.50 -	- 6.50 m: Occasiona	l gravel size <u>d pock</u>	ets of dark bro	own sandy CLA	<u>y</u> D	ry 3	3.00	4.50 4.50 - 4.95	S D5	N=18 (2,3/3,4,5,6)
				(6.00) -				6. 50 - 7. 3	50 m: Become	s stiff to very st				6.00 - 6.45 6.50	U2 D6	85 (100%)
	∇										D	ry 3	3.00	7.50 7.50 - 7.95	S D7	N=31 (2,4/5,7,9,10)
	abla		36.56	9.50 - (0.30)			ty sandy GRAN			ar to				9.00 - 9.45	U3	80 (90%)
		X . T.	36.26	9.80	subrounded f (LOWESTOF	T FORM					_1					
	Inst	ater o	ntries:		Diameter		rehole ends at 9	Depth relate			Wa	iter C	asing	Depth hiselling det	Type & No	Results
	: R		o: Casin 3.00	0): Deptl		From: To		: Rema	rks:		_	From: to: 9.80 9.80	Duratio	
AGS og iss	abbrev All dep	viations se pths and re	enation of symble Key Sheet. educed levels a FINAL 1:50	ools and re in metres.	Project: Project No			Offshore Wind	d Farm				E	exploratory pos		ence: C1-03 Sheet 1 of

TerraConsult

Borehole formation details:															
Type IP CP	ı	From: 0.00 0.00	To: 1.20 15.45	Start da 02-08- 02-08-	17 02-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 02-08-17 03-08-17	Logger: FN FN	Remark SPT ha	s: nmmer ID: SI 8 E(r)% 73	mE: 594636.58 mN: 312774.60 mAOD: 46.31 Grid: OSGB
Julia 1.la	- d	pue		Depth			0, ,	5					Samples	& In Situ Te	esting
Backfill/ Instal'n	Water-	Legend	Level	(thick- ness)			Stratum	Description			Water	r Casing	Depth	Type & No	Results/Remarks
			45.91	0.40	sandy CLAY. (rare chalk. (TOPSOIL)	Gravel o	sh brown mottl of subangular to on slightly grave medium flint.	subrounded	fine to coa	rse flint and	À		0.50 0.50 0.60 - 0.80	D1 ES1 B1	
				(1.10)	(LOWESTOF	Γ FORM	(ATION)						1.00 1.00	D2 ES2	
			44.81 44.51	1.80	sandy CLAY. ((LOWESTOF Medium dens	Gravel of FORM of the second of the second of FORM of Suba	orangish brown angular to subr	slightly grave	fine to coa	rse flint.	Dry	1.50	1.50 1.50 1.50 - 1.95 2.00 2.00	S ES3 D3 D4 ES4	N=12 (1,1/2,3,3,4)
		* * * * * * * * * * * * * * * * * * *		(1.90)				3.00 - 3 <u>.70 m:</u>	Becomes light	orangish brow	Dry	3.00	3.00 3.00 - 3.45	S D5	N=24 (1,2/4,6,7,7)
			42.61	3.70	Firm to stiff lig (LOWESTOF	ht grey Γ FORM	slightly sandy (IATION)	CLAY.			-		4.00	D6	
				- - - -							-		4.50 - 4.95	U1	100 (70%)
				- - - - - - - - -					5.00 - 8.00 r	m: Becomes sti			5.00	D7	
				(5.90)							Dry	4.00	6.00 6.00 - 6.45	S D8	N=16 (3,3/3,4,4,5)
				- - - - - - - - - -				8.0	00 - 9.60 m: Be	ecomes very sti			7.50 - 7.95 8.00	U2 D9	100 (60%)
			36.71	9.60							- Dry	4.00	9.00 9.00 - 9.45	S D10	N=21 (3,4/4,5,6,6)
		× × ×	JU.7 1	-	Medium dense to coarse flint	e light g and cha	rey slightly silty alk GRAVEL. G	sandy subar ravel sized po	ngular to su ockets of lig	brounded f ht grey	ine-				
Gro	Inst	water e	ntrioe:		Diameter	& raci	ua.	Depth related	d remarke:		Water		Depth Chiselling deta	Type & No	Results
	ck:		o: Casing	12.	ed: Dia (mm)	Depth: Depth		From: To		Rema	arks:		From: to:	Duratio	on: Tool:
AG Log Scal	ab All issu	breviations se I depths and re	anation of symbole Key Sheet. educed levels are FINAL 1:50	ols and e in metres.	Project: Project No Client:			Offshore Wind	d Farm				Exploratory pos BH		C1-04 Sheet 1 of 2



Borehole formation details:															
Type IP CP	ı	From: 0.00 0.00	To: 1.20 15.45	Start da 02-08-1 02-08-1	7 02-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 02-08-17 03-08-17	Logger: FN FN	Remarks: SPT hammer ID: SI 8 E(r)% 73		% 73	mE: 594636.58 mN: 312774.60 mAOD: 46.31 Grid: OSGB
kfill/ al'n	rer-	Legend	Lavel	Depth			Ctrotum	Description					Samples 8	& In Situ Te	esting
Backfill/ Instal'n	Water-	Lege	Level	(thick- ness)			Stratum	Description			Wate	r Casing	Depth	Type & No	Results/Remarks
		********		(2.40)	slightly sandy (LOWESTOF	CLAY. ΓFORM	ATION)				- Dry	10.50	10.50 10.50 - 10.95	C B2	N=22 (1,2/4,5,6,7)
	SP			12.50	subrounded fi (LOWESTOF Stiff dark grey	ne to con FORM slightly ne to con	sandy gravelly arse chalk and	halk GRAVEL			Dry	12.00	12.00 12.00 - 12.45	C B3	N=45 (2,5/8,10,12,15)
				(2.95)									13.50 - 13.95 14.00	U3 D11	100 (80%)
			30.86	15.45		Bor	ehole ends at 1		15.00 m: Beca	omes firm to st	Dry	12.80	15.00 15.00 - 15.45	S D12	N=36 (2,4/7,8,10,11)
		water e	entries:		Diameter			Depth relate			Wate	C	Depth Chiselling deta		Results
	ck:	Rose to	o: Casino		ed: Dia (mm)	Depth	: Casing:	From: To):	Rema	arks:		From: to:	Duratio	
AG Log Scal	issu	breviations se depths and r	anation of symbole Key Sheet. educed levels an FINAL 1:50	ols and e in metres.	Project: Project No Client:		Anglia (North)	Offshore Wind	d Farm			E	Exploratory pos BH		C1-04 Sheet 2 of 2

APPENDIX B Photographs

November 2017 Report No 3318-R001-2

BH17-C1-01



1.50 m



2.50 m



6.00 m



9.50 m

BH17-C1-02



1.50 m



2.00 m



4.00 m



9.45 m



14.50 m

BH17-C1-03



0.50 m



2.00 m



4.50 m



7.50 m



9.50 m

BH17-C1-04



2.00 m



5.00 m



9.00 m



14.00 m

APPENDIX C In Situ Testing Results

Variable head permeability test

November 2017 Report No 3318-R001-2

Variable Head Permeability Test Results

TerraConsult

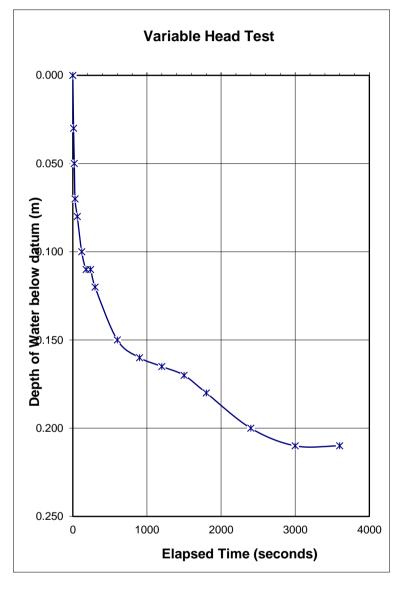
2.40 Static water level (m) Internal Diameter (D) 0.15 Length of Standpipe below Ground Level (m) 0.00 Height of Water above Ground Level (m) 0.00 Length of Standpipe above Ground Level (m) 0.00 Water level at start of test (m) 0.00 Top of Response Zone 3.00 Bottom of Response Zone 3.50

	Test 1
Time (t0)	0
Time (t)	3600
Head of Water	
Initial Head (h0) at (t0)	3.50
Final Head (h(t)) at (t)	3.29
Length of Response Zone (L)	0.50
Cross Sectional Area (S)	0.0177

Description

Clayey GRAVEL

Description		
Elapsed	Water	Head of
Time	below	
(seconds)	Datum	Water
0	0.000	3.50
10	0.030	3.47
20	0.050	3.45
30	0.070	3.43
60	0.080	3.42
120	0.100	3.40
180	0.110	3.39
240	0.110	3.39
300	0.120	3.38
600	0.150	3.35
900	0.160	3.34
1200	0.165	3.34
1500	0.170	3.33
1800	0.180	3.32
2400	0.200	3.30
3000	0.210	3.29
3600	0.210	3.29



Shape Factor (F) calculated according to ISO 22282-1:2012

Equation for borehole permeability tests after BS EN ISO 22282-2:2012

$$F = \frac{2\pi L}{\ln\left\{ \left(\frac{L}{D}\right) + \sqrt{\left(\left(\frac{L}{D}\right)^2 + 1\right)}\right\}}$$

$$k = \frac{S \ln \left(h_0 / h(t) \right)}{F(t - t_0)}$$

1.90 = 1.66 k = 1.83E-07 m/s

_	1.00

Calculated by:

Project:	East Anglia (North) Offshore Wind Farm
Droiget No:	2210

Exploratory position reference:

Checked by: DD Clie

JMT

Client: GHD

BH17-C1-02

Variable Head Permeability Test Results

Bottom of Response Zone

TerraConsult

Static water level (m)
Internal Diameter (D)
Length of Standpipe below Ground Level (m)
Height of Water above Ground Level (m)
Length of Standpipe above Ground Level (m)
Water level at start of test (m)
Top of Response Zone

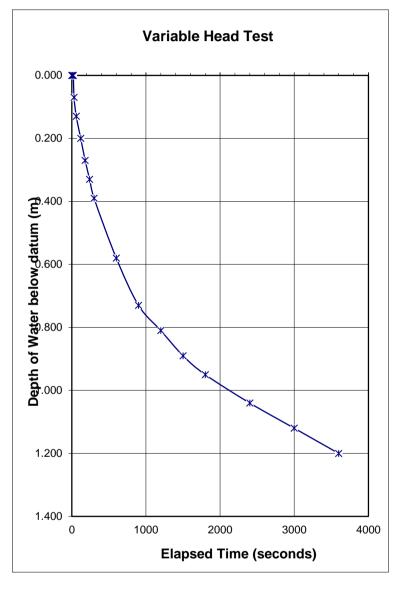
1.96	
0.15	
0.00	
0.00	
0.00	
0.00	
3.00	
8.20	

	Test 1
Time (t0)	0
Time (t)	3600
Head of Water	
Initial Head (h0) at (t0)	8.20
Final Head (h(t)) at (t)	7.00
Length of Response Zone (L)	5.20
Cross Sectional Area (S)	0.0177

Description

Grey CLAY and chalk GRAVEL

_ 000p		
Elapsed	Water	Head of
Time	below	Water
(seconds)	Datum	vvalei
0	0.000	8.20
10	0.000	8.20
20	0.000	8.20
30	0.070	8.13
60	0.130	8.07
120	0.200	8.00
180	0.270	7.93
240	0.330	7.87
300	0.390	7.81
600	0.580	7.62
900	0.730	7.47
1200	0.810	7.39
1500	0.890	7.31
1800	0.950	7.25
2400	1.040	7.16
3000	1.120	7.08
3600	1.200	7.00



Shape Factor (F) calculated according to ISO 22282-1:2012

Equation for borehole permeability tests after BS EN ISO 22282-2:2012

$$F = \frac{2\pi L}{\ln\left\{ \binom{L}{D} + \sqrt{\left(\binom{L}{D}^2 + 1\right)} \right\}}$$

$$= \frac{32.67}{4.24}$$

7.71

$$k = \frac{S \ln \left(\frac{h_0}{h(t)} \right)}{F(t - t_0)}$$

k = 1.01E-07 m/s

Calculated by: JMT

Checked by: DD

Calculated by:	JMT	Project:	East Anglia (North) Offshore Wind Farm	Exploratory position reference:
		Project No:	3318	BH17-C1-03
Checked by:	DD	Client:	GHD	Biii7-01-00

APPENDIX D Instrumentation Sampling and Monitoring Records

November 2017 Report No 3318-R001-2

GROUNDWATER AND GROUND GAS MONITORING

TerraConsult

Site: East Anglia OWF

3318

No:

GROUND GAS AND GROUNDWATER MONITORING DATA

			Well D	etails .		G	Groundwate	r			Gas					Weather							
Location	Date	Monitored by	Standpipe diameter (mm)	Depth to Base (m bgl)	Water Depth (m bgl)	Water Sample Taken?	Water Temp oC	Odour	Colour	Atmospher ic Pressure (mbar)			Flow (I/h)	CH ₄ (% v/v)	GSV CH ₄ (l/hr)	CO ₂ (% v/v)	GSV CO ₂ (I/hr)	O ₂ (% v/v)	CO (ppm)	H2S (ppm)	VOC (ppm)	Conditions	Ambient Temp °C
	22/08/17	VS	51	12.54	1.54	Υ				1016	NM	0.0	0.0	0.0	0.0000	0.8	0.0000	81.9	0	0	NM	Sunny, dry	22
BH17-C1-04	31/08/17	VS	51	12.51	1.59	N				1010	NM	0.0	0.0	0.0	0.0000	0.9	0.0000	20.7	0	0	NM	Sunny, dry	19
	15/09/17	VS	51	12.52	1.52	N				1006	NM	0.0	0.0	0.0	0.0000	0.0	0.0000	20.1	0	0	NM	Sunny spells	16

APPENDIX E Geotechnical Laboratory Test Results

Report References: GSTL 35625

CLS 684646

November 2017 Report No 3318-R001-2

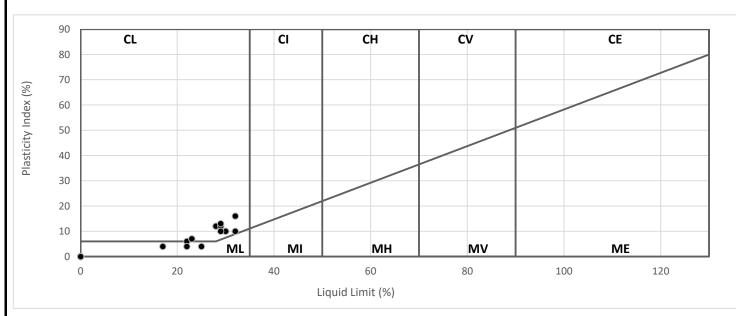
CSTI	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX	
GOIL	(BS 1377 : Part 2 : 1990 Method 5)	
Contract Number	36525	
Site Name	E Anglia Wind Farm - Cable Route	

Hole Reference	Sample Number	Sample Type	D	epth (r	m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing .425mm %	Remarks
BH17-C1-03	5	D	4.50	-	4.95	25	30	20	10	75	CL Low Plasticity
											·
				-							
				-							
				-							
				-							
				-							
				-							
				-							

Symbols: NP: Non Plastic #: Liqu

: Liquid Limit and Plastic Limit Wet Sieved

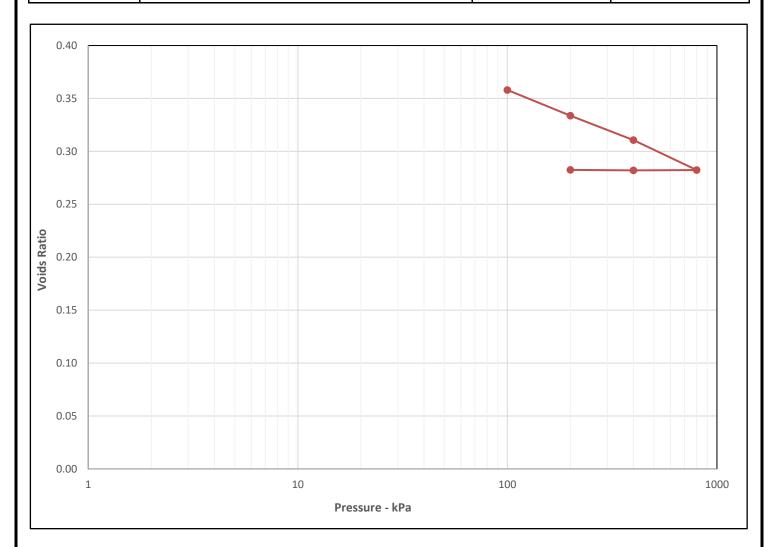
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION BS 5930:1999+A2:2010



Operators	Checked	20/09/2017	Sean Penn	
DB	Approved	21/09/2017	Ben Sharp	



CCTI	ONE DIMENSIONAL CONSOLIDATION TEST	Contract Number	36525
GOIL	BS1377:Part 5:1990, clause 3	Borehole/Trialpit No.	BH17-C1-02
Site Name	E Anglia Wind Farm - Cable Route	Sample No.	2
Soil Description	Grey/brown slightly sandy fine gravelly silty CLAY	Depth Top (m)	6.00
	Grey/brown siightiy sandy fille gravelly siity CEAT	Depth Base (m)	6.45
Lab Temperature	20°c	Sample Location	Middle
Remarks	Cv Calculated Using T90	Sample Type	U

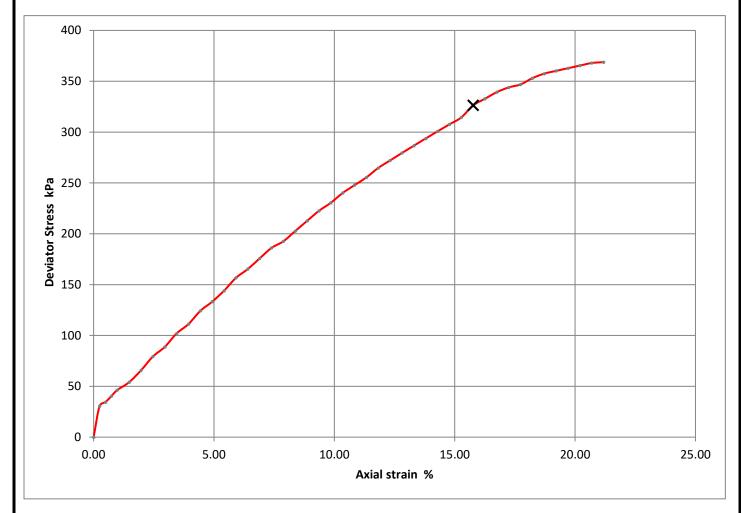


Initial Sample Condit	Initial Sample Conditions		Pressure Range			Cv m2/yr	Pressure Range			Mv m2/MN	Cv m2/yr
Moisture Content (%)	15	0	-	100	0.33	9		-			
Bulk Density (Mg/m3)	2.17	100	-	200	0.18	12		-			
Dry Density (Mg/m3)	1.89	200	-	400	0.086	14		-			
Voids Ratio	0.4039	400	-	800	0.1	11		-			
Degree of saturation	98.0	800	-	400	-0.00055	12		-			
Height (mm)	19.75	400	-	200	0.0019	7.8		-			
Diameter (mm)	74.84		-					-			
Particle Density (Mg/m3)	2.65		-					-			

Operators	Checked	20/09/2017	Sean Penn	
LG	Approved	21/09/2017	Ben Sharp	



CCTI	Single Stage Unconsolidated-Undrained Triaxial Test	Contract Number	36525
GOIL	BS 1377 : 1990 Part 7 : 8	Borehole/Pit No.	BH17-C1-04
Site Name	E Anglia Wind Farm - Cable Route	Sample No.	1
Soil Description	Light grov sity CLAV	Depth Top (m)	4.50
	Light grey silty CLAY	Depth Base (m)	4.95
		Sample Type	U



Moisture Content (%)	15			
Bulk Density (Mg/m ³)	2.29			
Dry Density (Mg/m ³)	1.99			
Specimen Length (mm)	203			
Specimen Diameter (mm)	102			
Cell Pressure (kPa)	90			
Deviator Stress (kPa)	326			
Undrained Shear Strength (kPa)	163			
Failure Strain (%)	15.8			
Mode Of Failure	Plastic			
Membrane Used/Thickness	Rubber/0.3mm			
Rate of Strain (%/min)	3.00			

Specimen Post Test	Sample Split
PICTURE NOT AVAILABLE	PICTURE NOT AVAILABLE

Checked	20/09/2017	Sean Penn	
Approved	21/09/2017	Paul Evans	





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Concept Life Sciences Certificate of Analysis

3 Crittall Drive Springwood Industrial Estate Braintree Essex CM7 2RT

Tel: 01376 560120 Fax: 01376 552923

Report Number: Supplement 1A to Report Number

684646-1

Date of Report: 23-Oct-2017

Customer: TerraConsult (South) Limited

Suite F17 Dugard House

Peartree Road Colchester Essex CO3 0UL

Customer Contact: Victoria Smith

Customer Job Reference:

Customer Site Reference: Happisburgh/East Anglia

Date Job Received at Concept: 05-Sep-2017
Date Analysis Started: 26-Sep-2017
Date Analysis Completed: 29-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs
All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical
Services Quality Manual





Report checked and authorised by : Chelsea Entwistle Senior Customer Service Advisor Issued by : Aislinn Arthey Customer Service Advis



Project Site: Happisburgh/East Anglia

Customer Reference:

Soil Analysed as Soil

BRE SD1 (SE)

	684646 003				
	17-C1-01 D6 @ 3.45m				
	28-JUL-2017				
	Clay				
Determinand	Method	Test Sample	LOD	Units	
(Water soluble) Ammonia expressed as NH4	T710	AR	0.01	g/l	<0.01
(Water soluble) CI-	T710	A40	0.01	g/l	<0.01
Magnesium	T112	A40	1	mg/l	<1
(Water soluble) NO3	T710	A40	0.01	g/l	<0.01
рН	T7	A40			8.2
(Water Soluble) SO4 expressed as SO4	T242	A40	0.01	g/l	0.01
SO4(Total)	T102	A40	0.02	%	0.03
Sulphur (total)	T6	A40	0.01	%	0.02
Moisture @105C	T162	AR	0.1	%	15
Retained on 2mm	T2	A40	0.1	%	19.2

Index to symbols used in Supplement 1A to Report Number 684646-1

Value	Description							
AR	As Received							
A40	Assisted dried < 40C							
M	Analysis is MCERTS accredited							
N	Analysis is not UKAS accredited							

Notes

Retained on 2mm is removed before analysis

Supplement 1A Report reissued to include only sample 003

Method Index

Value	Description
T102	ICP/OES (HCI extract)
T710	2:1 Extraction / Discrete Analyser
T2	Grav
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T7	Probe
T112	ICP/OES (SIM)(Water Extract)
T162	Grav (1 Dec) (105 C)
T6	ICP/OES

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
(Water soluble) Ammonia expressed as NH4	T710	AR	0.01	g/l	N	003
(Water soluble) CI-	T710	A40	0.01	g/l	N	003
Magnesium	T112	A40	1	mg/l	N	003
(Water soluble) NO3	T710	A40	0.01	g/l	N	003
рН	T7	A40			М	003
(Water Soluble) SO4 expressed as SO4	T242	A40	0.01	g/l	М	003
SO4(Total)	T102	A40	0.02	%	М	003
Sulphur (total)	T6	A40	0.01	%	М	003
Moisture @105C	T162	AR	0.1	%	N	003
Retained on 2mm	T2	A40	0.1	%	N	003



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Concept Life Sciences Certificate of Analysis

3 Crittall Drive Springwood Industrial Estate Braintree Essex CM7 2RT

Tel: 01376 560120 Fax: 01376 552923

Report Number: Supplement 1A to Report Number

684646-1

Date of Report: 23-Oct-2017

Customer: TerraConsult (South) Limited

Suite F17 Dugard House

Peartree Road Colchester Essex CO3 0UL

Customer Contact: Victoria Smith

Customer Job Reference:

Customer Site Reference: Happisburgh/East Anglia

Date Job Received at Concept: 05-Sep-2017
Date Analysis Started: 26-Sep-2017
Date Analysis Completed: 29-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs
All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical
Services Quality Manual





Report checked and authorised by : Chelsea Entwistle Senior Customer Service Advisor Issued by : Aislinn Arthey Customer Service Advis



Project Site: Happisburgh/East Anglia

Customer Reference:

Soil Analysed as Soil

BRE SD1 (SE)

	684646 003				
	17-C1-01 D6 @ 3.45m				
	28-JUL-2017				
	Clay				
Determinand	Method	Test Sample	LOD	Units	
(Water soluble) Ammonia expressed as NH4	T710	AR	0.01	g/l	<0.01
(Water soluble) CI-	T710	A40	0.01	g/l	<0.01
Magnesium	T112	A40	1	mg/l	<1
(Water soluble) NO3	T710	A40	0.01	g/l	<0.01
рН	T7	A40			8.2
(Water Soluble) SO4 expressed as SO4	T242	A40	0.01	g/l	0.01
SO4(Total)	T102	A40	0.02	%	0.03
Sulphur (total)	T6	A40	0.01	%	0.02
Moisture @105C	T162	AR	0.1	%	15
Retained on 2mm	T2	A40	0.1	%	19.2

Index to symbols used in Supplement 1A to Report Number 684646-1

Value	Description							
AR	As Received							
A40	Assisted dried < 40C							
M	Analysis is MCERTS accredited							
N	Analysis is not UKAS accredited							

Notes

Retained on 2mm is removed before analysis

Supplement 1A Report reissued to include only sample 003

Method Index

Value	Description
T102	ICP/OES (HCI extract)
T710	2:1 Extraction / Discrete Analyser
T2	Grav
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T7	Probe
T112	ICP/OES (SIM)(Water Extract)
T162	Grav (1 Dec) (105 C)
T6	ICP/OES

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
(Water soluble) Ammonia expressed as NH4	T710	AR	0.01	g/l	N	003
(Water soluble) CI-	T710	A40	0.01	g/l	N	003
Magnesium	T112	A40	1	mg/l	N	003
(Water soluble) NO3	T710	A40	0.01	g/l	N	003
рН	T7	A40			М	003
(Water Soluble) SO4 expressed as SO4	T242	A40	0.01	g/l	М	003
SO4(Total)	T102	A40	0.02	%	М	003
Sulphur (total)	T6	A40	0.01	%	М	003
Moisture @105C	T162	AR	0.1	%	N	003
Retained on 2mm	T2	A40	0.1	%	N	003

APPENDIX F Geoenvironmental Laboratory Test Results

Report References: CLS674086

CLS675010

CLS677583

November 2017 Report No 3318-R001-2



Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences Certificate of Analysis

3 Crittall Drive Springwood Industrial Estate Braintree Essex CM7 2RT

Tel: 01376 560120 Fax: 01376 552923

Report Number: Supplement 2 to Report Number 674086-

1

Date of Report: 03-Nov-2017

Customer: TerraConsult Limited

Unit 34

Bold Business Centre

Bold Lane Sutton St Helens WA9 4TX

Customer Contact: Mr Derek Daniels

Customer Job Reference: 3318

Customer Purchase Order: PO-001839

Customer Site Reference: Norfolk Vanguard Cable Route

Date Job Received at Concept: 08-Aug-2017
Date Analysis Started: 09-Aug-2017
Date Analysis Completed: 22-Aug-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

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Report checked and authorised by : Claire Brown Crociquia Customer Service Manager Issued by : Aislinn Arthey Customer Service Advi



Project Site: Norfolk Vanguard Cable Route

Analysed as Soil

Customer Reference: 3318

Soil

CLEA metals, Braintree

			Conce	ot Reference	674086 002				
	BH17-C1-04 ES2 @ 1.00m								
	02-AUG-2017								
	Matrix Class								
Determinand	Method	Test Sample	LOD	Units					
Arsenic	T257	A40	2	mg/kg	8				
Barium	T257	A40	2	mg/kg	72				
Beryllium	T245	A40	0.5	mg/kg	0.7				
Boron (water-soluble)	T82	A40	1	mg/kg	<1				
Cadmium	T257	A40	0.1	mg/kg	<0.1				
Chromium	T257	A40	0.5	mg/kg	22				
Copper	T257	A40	2	mg/kg	8				
Lead	T257	A40	2	mg/kg	12				
Mercury	T245	A40	1.0	mg/kg	<1.0				
Nickel	T257	A40	0.5	mg/kg	15				
Selenium	T257	A40	3	mg/kg	<3				
Vanadium	T257	A40	0.1	mg/kg	30				
Zinc	T257	A40	2	mg/kg	29				
Moisture @105C	T162	AR	0.1	%	12				
Retained on 2mm	T2	A40	0.1	%	13.4				

Index to symbols used in Supplement 2 to Report Number 674086-1

Value	Description						
A40	Assisted dried < 40C						
AR	As Received						
64	Analysis was performed by an alternative technique						
100	LOD determined by sample aliquot used for analysis						
131	Result is outside of the scope of accreditation due to a QC Failure						
М	Analysis is MCERTS accredited						
U	Analysis is UKAS accredited						
N	Analysis is not UKAS accredited						

Notes

Supplement 2 Report reissued to include only sample 002

Retained on 2mm is removed before analysis

Method Index

Value	Description
T287	Calc TOC/0.58
T85	Calc
T17	HPLC
T2	Grav
T54	GC/MS (Headspace)
T245	ICP/OES (Aqua Regia Extraction)
T257	ICP/OES (SIM) (Aqua Regia Extraction)
T16	GC/MS
T1	GC/MS (HR)
T219	GC/FID (SE)
T162	Grav (1 Dec) (105 C)
T82	ICP/OES (Sim)
T310	LC/MS/MS
T27	PLM
T209	GC/MS (Head Space)(MCERTS)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Arsenic	T257	A40	2	mg/kg	М	002
Barium	T257	A40	2	mg/kg	U	002
Beryllium	T245	A40	0.5	mg/kg	U	002
Boron (water-soluble)	T82	A40	1	mg/kg	N	002
Cadmium	T257	A40	0.1	mg/kg	М	002
Chromium	T257	A40	0.5	mg/kg	М	002
Copper	T257	A40	2	mg/kg	М	002
Lead	T257	A40	2	mg/kg	М	002
Mercury	T245	A40	1.0	mg/kg	U	002
Nickel	T257	A40	0.5	mg/kg	М	002
Selenium	T257	A40	3	mg/kg	U	002
Vanadium	T257	A40	0.1	mg/kg	U	002
Zinc	T257	A40	2	mg/kg	М	002
Moisture @105C	T162	AR	0.1	%	N	002
Retained on 2mm	T2	A40	0.1	%	N	002





Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences Certificate of Analysis

3 Crittall Drive Springwood Industrial Estate Braintree Essex CM7 2RT

Tel: 01376 560120 Fax: 01376 552923

Report Number: Supplement 1C to Report Number

675010-1

Date of Report: 17-Oct-2017

Customer: TerraConsult Limited

Unit 34

Bold Business Centre

Bold Lane Sutton St Helens WA9 4TX

Customer Contact: Mr Jimmy Thorburn

Customer Job Reference: 3318

Customer Purchase Order: PO-001839

Customer Site Reference: Norfolk Vanguard Cable Route

Date Job Received at Concept: 03-Aug-2017
Date Analysis Started: 15-Aug-2017
Date Analysis Completed: 06-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs
All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical
Services Quality Manual





Report checked and authorised by : Aislinn Arthey Customer Service Advisor Issued by : Aislinn Arthey Customer Service Advi



Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

CLEA metals, Braintree

		675010 006	675010 014 BH17-C1-03 ES2 @ 1.00m			
		BH17-C1-01 ES2 @ 1.00m				
			D	ate Sampled	01-AUG-2017	02-AUG-2017
		Clay	Clay			
Determinand	Method	Test Sample	LOD	Units		
Arsenic	T257	A40	2	mg/kg	51	20
Barium	T257	A40	2	mg/kg	100	120
Beryllium	T245	A40	0.5	mg/kg	0.5	1.4
Boron (water-soluble)	T82	A40	1	mg/kg	<1	<1
Cadmium	T257	A40	0.1	mg/kg	0.2	0.4
Chromium	T257	A40	0.5	mg/kg	16	30
Copper	T257	A40	2	mg/kg	7	20
Lead	T257	A40	2	mg/kg	11	19
Mercury	T245	A40	1.0	mg/kg	<1.0	<1.0
Nickel	T257	A40	0.5	mg/kg	11	43
Selenium	T257	A40	3	mg/kg	<3	<3
Vanadium	T257	A40	0.1	mg/kg	26	48
Zinc	T257	A40	2	mg/kg	33	70
Moisture @105C	T162	AR	0.1	%	16	14
Retained on 2mm	T2	A40	0.1	%	9.5	3.2

Concept Reference: 675010

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

Asbestos

	675010 013				
	BH17-C1-03 ES1 @ 0.50m				
			D	ate Sampled	02-AUG-2017
Determinand	Method	Test Sample	LOD	Units	
Asbestos ID	T27	A40			Asbestos not detected

Concept Reference: 675010

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

Miscellaneous

	Concept Reference						
	BH17-C1-03 ES2 @ 1.00m						
	02-AUG-2017						
			l	Matrix Class	Clay		
Determinand	Method	Test Sample	LOD	Units			
Soil Organic Matter	T287	A40	0.1	%	0.3		

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil
Total and Speciated USEPA16 PAH (SE) (MCERTS)

				pt Reference	
			675010 014		
		Custon	BH17-C1-03 ES2 @ 1.00m		
			D	ate Sampled	02-AUG-2017
				Matrix Class	Clay
Determinand	Method	Test Sample	LOD	Units	
Naphthalene	T16	AR	0.1	mg/kg	<0.1
Acenaphthylene	T16	AR	0.1	mg/kg	<0.1
Acenaphthene	T16	AR	0.1	mg/kg	<0.1
Fluorene	T16	AR	0.1	mg/kg	<0.1
Phenanthrene	T16	AR	0.1	mg/kg	<0.1
Anthracene	T16	AR	0.1	mg/kg	<0.1
Fluoranthene	T16	AR	0.1	mg/kg	<0.1
Pyrene	T16	AR	0.1	mg/kg	<0.1
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	<0.1
Chrysene	T16	AR	0.1	mg/kg	<0.1
Benzo(b)fluoranthene	T16	AR	0.1	mg/kg	<0.1
Benzo(k)fluoranthene	T16	AR	0.1	mg/kg	<0.1
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	<0.1
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	<0.1
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	<0.1
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	<0.1
PAH(total)	T16	AR	0.1	mg/kg	<0.1

Concept Reference: 675010

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analys	ed as Soil				
TPH CWG					
			Concer	ot Reference	675010 014
		Custor	ner Sampl	e Reference	BH17-C1-03 ES2 @ 1.00m
		- 4	D	ate Sampled	02-AUG-2017
				Matrix Class	Clay
Determinand	Method	Test Sample	LOD	Units	
Benzene	T209	AR	10	μg/kg	<10
Toluene	T209	AR	10	μg/kg	<10
EthylBenzene	T209	AR	10	μg/kg	<10
M/P Xylene	T209	AR	10	μg/kg	<10
O Xylene	T209	AR	10	μg/kg	<10
Methyl tert-Butyl Ether	T54	AR	1	μg/kg	<1
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010
TPH (C10-C12 aliphatic)	T219	AR	2	mg/kg	<2
TPH (C10-C12 aromatic)	T219	AR	2	mg/kg	<2
TPH (C12-C16 aliphatic)	T219	AR	2	mg/kg	<2
TPH (C12-C16 aromatic)	T219	AR	2	mg/kg	<2
TPH (C16-C21 aliphatic)	T219	AR	2	mg/kg	<2
TPH (C16-C21 aromatic)	T219	AR	2	mg/kg	<2
TPH (C21-C35 aliphatic)	T219	AR	2	mg/kg	<2
TPH (C21-C35 aromatic)	T219	AR	2	mg/kg	<2
TPH (C35-C40 aliphatic)	T219	AR	2	mg/kg	<2
TPH (C35-C40 aromatic)	T219	AR	2	mg/kg	<2
TPH (Aliphatic+Aromatic) C10-C25 (Sum)	T85	AR	4	mg/kg	<4
TPH (Aliphatic+Aromatic) C25-C40 (Sum)	T85	AR	4	mg/kg	<4

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

Organochlorine insecticides

	675010 014						
	BH17-C1-03 ES2 @ 1.00m						
	Date Sampled						
	Clay						
Determinand	Method	Test Sample	LOD	Units			
Hexachlorocyclohexane	T16	AR	0.01	mg/kg	(162) < 0.02		
Hexachlorobenzene	T1	AR	0.01	mg/kg	<0.01		
Heptachlor	T16	AR	0.01	mg/kg	(162) < 0.02		
Aldrin	T16	AR	0.01	mg/kg	(162) < 0.02		
Heptachlor epoxide	T16	AR	0.01	mg/kg	<0.01		
Chlordane	T16	AR	0.01	mg/kg	<0.01		
Endosulphan	T16	AR	0.01	mg/kg	<0.01		
DDE	T16	AR	0.01	mg/kg	<0.01		
Dieldrin	T16	AR	0.01	mg/kg	<0.01		
Endrin	T16	AR	0.01	mg/kg	<0.01		
DDD	T16	AR	0.01	mg/kg	<0.01		
DDT	T16	۸Þ	0.01	ma/ka	(162,131) -0.02		

Concept Reference: 675010

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

Organophosphorous insecticides

	675010 014				
	BH17-C1-03 ES2 @ 1.00m				
			D	ate Sampled	02-AUG-2017
				Matrix Class	Clay
Determinand	Method	Test Sample	LOD	Units	1436.8
Dichlorvos	T16	AR	0.01	mg/kg	<0.01
Mevinphos	T16	AR	0.01	mg/kg	<0.01
Dimethoate	T16	AR	0.01	mg/kg	<0.01
Diazinon	T16	AR	0.01	mg/kg	<0.01
Pirimiphos methyl	T16	AR	0.01	mg/kg	<0.01
Malathion	T16	AR	0.01	mg/kg	<0.01
Fenitrothion	T16	AR	0.01	mg/kg	<0.01
Parathion	T16	AR	0.01	mg/kg	<0.01
Azinphos methyl	T16	AR	0.01	ma/ka	<0.01

Concept Reference: 675010

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

Triazines Suite

	675010 014				
	BH17-C1-03 ES2 @ 1.00m				
	02-AUG-2017				
	Clay				
Determinand	Method	Test Sample	LOD	Units	
Simazine	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ < 0.01
Atrazine	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ < 0.01
Propazine	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ < 0.01
Trietazine	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ < 0.01
Prometryn	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ < 0.01
Terbutryn	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ < 0.01

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

Phenoxy Acetic acid herbicides

	675010 014				
	BH17-C1-03 ES2 @ 1.00m				
	02-AUG-2017				
	Clay				
Determinand	Method	Test Sample	LOD	Units	
Mecoprop	T16	AR	0.01	mg/kg	<0.01
Phenoxy Acetic acid herbicide: MCPA	T16	AR	0.01	mg/kg	<0.01
Dichlorprop	T16	AR	0.01	mg/kg	<0.01
Phenoxy Acetic acid herbicide: 2,4-D	T16	AR	0.01	mg/kg	<0.01
Fenoprop	T16	AR	0.01	mg/kg	<0.01
Phenoxy Acetic acid herbicide: 2,4,5-T	T16	AR	0.01	mg/kg	<0.01

Concept Reference: 675010

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

Phenols (Speciated)

	675010 014				
	BH17-C1-03 ES2 @ 1.00m				
	02-AUG-2017				
	Matrix Class	Clay			
Determinand	Method	Test Sample	LOD	Units	1. P. C. 1. T.
Resorcinol	T17	AR	0.05	mg/kg	<0.05
Catechol	T17	AR	0.05	mg/kg	<0.05
Phenol	T17	AR	0.1	mg/kg	<0.1
Cresols	T17	AR	0.05	mg/kg	<0.05
Xylenols	T17	AR	0.05	mg/kg	<0.05
Naphthols	T17	AR	0.05	mg/kg	<0.05
Trimethyl phenol	T17	AR	0.05	mg/kg	<0.05
Total Phenols	T17	AR	0.1	ma/ka	<0.1

Concept Reference: 675010

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil

Analysed as Soil

Urons								
	675010 014							
	BH17-C1-03 ES2 @ 1.00m							
	02-AUG-2017							
	Matrix Class							
Determinand	Method	Test Sample	LOD	Units				
Chlorotoluron	T310	AR	0.01	mg/kg	<0.01			
Diuron	T310	AR	0.01	mg/kg	<0.01			
Isoproturon	T310	AR	0.01	mg/kg	<0.01			
Linuron	T310	AR	0.01	mg/kg	<0.01			
Monuron	T310	AR	0.01	mg/kg	<0.01			

Index to symbols used in Supplement 1C to Report Number 675010-1

Value	Description					
A40	Assisted dried < 40C					
AR	As Received					
131	Result is outside of the scope of accreditation due to a QC Failure					
64	Analysis was performed by an alternative technique					

162	LOD determined by matrix spike recovery
36	LOD Raised due to low Matrix spike recovery
S	Analysis was subcontracted
М	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Supplement 1C report reissued to include only samples 006, 013 and 014								
Triazines and Urons transferred to Concept life Sciences Cambridge								
014 - BTEX, PAH, OCP, OPP, Speciated Phenols: Due to lab error, These samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.								
Reported results on as received samples are corrected to a 105 degree centigrade dry weight basis except TPH c5-c40 aro/ali split, OCP/OPP and PAAH								
Asbestos subcontracted to REC Limited								
OCP, OPP and PAAH transferred to Concept Life Sciences Cambridge								
Retained on 2mm is removed before analysis								
BTEX: Samples submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised.								

Method Index

Value	Description
T2	Grav
T16	GC/MS
T162	Grav (1 Dec) (105 C)
T310	LC/MS/MS
T1	GC/MS (HR)
T209	GC/MS (Head Space)(MCERTS)
T219	GC/FID (SE)
T17	HPLC
T287	Calc TOC/0.58
T82	ICP/OES (Sim)
T54	GC/MS (Headspace)
T85	Calc
T245	ICP/OES (Aqua Regia Extraction)
T27	PLM
T257	ICP/OES (SIM) (Aqua Regia Extraction)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Arsenic	T257	A40	2	mg/kg	М	006,014
Barium	T257	A40	2	mg/kg	U	006,014
Beryllium	T245	A40	0.5	mg/kg	U	006,014
Boron (water-soluble)	T82	A40	1	mg/kg	N	006,014
Cadmium	T257	A40	0.1	mg/kg	М	006,014
Chromium	T257	A40	0.5	mg/kg	М	006,014
Copper	T257	A40	2	mg/kg	М	006,014
Lead	T257	A40	2	mg/kg	М	006,014
Mercury	T245	A40	1.0	mg/kg	U	006,014
Nickel	T257	A40	0.5	mg/kg	М	006,014
Selenium	T257	A40	3	mg/kg	U	006,014
Vanadium	T257	A40	0.1	mg/kg	U	006,014
Zinc	T257	A40	2	mg/kg	М	006,014
Moisture @105C	T162	AR	0.1	%	N	006,014
Retained on 2mm	T2	A40	0.1	%	N	006,014
Asbestos ID	T27	A40			SU	013
Soil Organic Matter	T287	A40	0.1	%	N	014
Naphthalene	T16	AR	0.1	mg/kg	U	014
Acenaphthylene	T16	AR	0.1	mg/kg	U	014
Acenaphthene	T16	AR	0.1	mg/kg	М	014
Fluorene	T16	AR	0.1	mg/kg	М	014
Phenanthrene	T16	AR	0.1	mg/kg	U	014
Anthracene	T16	AR	0.1	mg/kg	М	014
Fluoranthene	T16	AR	0.1	mg/kg	N	014
Pyrene	T16	AR	0.1	mg/kg	N	014
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	М	014
Chrysene	T16	AR	0.1	mg/kg	М	014
Benzo(b)fluoranthene	T16	AR	0.1	mg/kg	U	014

Determinand	Method	Test	LOD	Units	Symbol	Concept References
Benzo(k)fluoranthene	T16	Sample AR	0.1	mg/kg	N	014
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	М	014
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	М	014
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	M	014
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	M	014
PAH(total)	T16	AR	0.1	mg/kg	U	014 014
Benzene Toluene	T209 T209	AR AR	10 10	μg/kg μg/kg	M M	014
EthylBenzene	T209	AR	10	μg/kg	M	014
M/P Xylene	T209	AR	10	μg/kg	М	014
O Xylene	T209	AR	10	μg/kg	М	014
Methyl tert-Butyl Ether	T54	AR	1	μg/kg	U	014
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	N	014
TPH (C6-C7 aromatic) TPH (C6-C8 aliphatic)	T54 T54	AR AR	0.010	mg/kg	N N	014
TPH (C6-C8 aiipnatic) TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg mg/kg	N	014
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	N	014
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	N	014
TPH (C10-C12 aliphatic)	T219	AR	2	mg/kg	N	014
TPH (C10-C12 aromatic)	T219	AR	2	mg/kg	N	014
TPH (C12-C16 aliphatic)	T219	AR	2	mg/kg	N	014
TPH (C15 C21 cliphetic)	T219	AR	2	mg/kg	N	014
TPH (C16-C21 aliphatic) TPH (C16-C21 aromatic)	T219 T219	AR AR	2	mg/kg mg/kg	N N	014 014
TPH (C21-C35 aliphatic)	T219	AR	2	mg/kg	N	014
TPH (C21-C35 aromatic)	T219	AR	2	mg/kg	N	014
TPH (C35-C40 aliphatic)	T219	AR	2	mg/kg	N	014
TPH (C35-C40 aromatic)	T219	AR	2	mg/kg	N	014
TPH (Aliphatic+Aromatic) C10-C25 (Sum)	T85	AR	4	mg/kg	N	014
TPH (Aliphatic+Aromatic) C25-C40 (Sum)	T85	AR	4	mg/kg	N	014 014
Hexachlorocyclohexane Hexachlorobenzene	T16	AR AR	0.01	mg/kg mg/kg	U	014
Heptachlor	T16	AR	0.01	mg/kg	U	014
Aldrin	T16	AR	0.01	mg/kg	U	014
Heptachlor epoxide	T16	AR	0.01	mg/kg	U	014
Chlordane	T16	AR	0.01	mg/kg	U	014
Endosulphan	T16	AR	0.01	mg/kg	U	014
DDE Dieldrin	T16	AR	0.01	mg/kg	U	014 014
Endrin	T16 T16	AR AR	0.01	mg/kg mg/kg	U	014
DDD	T16	AR	0.01	mg/kg	U	014
DDT	T16	AR	0.01	mg/kg	U	014
Dichlorvos	T16	AR	0.01	mg/kg	U	014
Mevinphos	T16	AR	0.01	mg/kg	U	014
Dimethoate	T16	AR	0.01	mg/kg	U	014
Diazinon Diaziniah a gasabad	T16	AR	0.01	mg/kg	U	014
Pirimiphos methyl Malathion	T16 T16	AR AR	0.01	mg/kg mg/kg	U	014 014
Fenitrothion	T16	AR	0.01	mg/kg	U	014
Parathion	T16	AR	0.01	mg/kg	U	014
Azinphos methyl	T16	AR	0.01	mg/kg	U	014
Simazine	T16	AR	0.01	mg/kg	N	014
Atrazine	T16	AR	0.01	mg/kg	N	014
Propazine	T16	AR	0.01	mg/kg	N N	014
Trietazine Prometryn	T16 T16	AR AR	0.01	mg/kg mg/kg	N N	014 014
Terbutryn	T16	AR	0.01	mg/kg	N	014
Mecoprop	T16	AR	0.01	mg/kg	N	014
Phenoxy Acetic acid herbicide: MCPA	T16	AR	0.01	mg/kg	N	014
Dichlorprop	T16	AR	0.01	mg/kg	N	014
Phenoxy Acetic acid herbicide: 2,4-D	T16	AR	0.01	mg/kg	N	014
Phonorus Acetic poid borbisides 2.4.5.T	T16	AR	0.01	mg/kg	N	014
Phenoxy Acetic acid herbicide: 2,4,5-T Resorcinol	T16 T17	AR AR	0.01	mg/kg mg/kg	N M	014 014
Catechol	T17	AR	0.05	mg/kg	N	014
Phenol	T17	AR	0.1	mg/kg	M	014
Cresols	T17	AR	0.05	mg/kg	М	014
Xylenols	T17	AR	0.05	mg/kg	М	014
Naphthols	T17	AR	0.05	mg/kg	N	014
Trimethyl phenol	T17	AR	0.05	mg/kg	M	014

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Total Phenols	T17	AR	0.1	mg/kg	N	014
Chlorotoluron	T310	AR	0.01	mg/kg	N	014
Diuron	T310	AR	0.01	mg/kg	N	014
Isoproturon	T310	AR	0.01	mg/kg	N	014
Linuron	T310	AR	0.01	mg/kg	N	014
Monuron	T310	AR	0.01	mg/kg	N	014





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Concept Life Sciences Certificate of Analysis

3 Crittall Drive Springwood Industrial Estate Braintree Essex CM7 2RT

Tel: 01376 560120 Fax: 01376 552923

Report Number: Supplement 1A to Report Number

675010-1

Date of Report: 17-Oct-2017

Customer: TerraConsult Limited

Unit 34

Bold Business Centre

Bold Lane Sutton St Helens WA9 4TX

Customer Contact: Mr Jimmy Thorburn

Customer Job Reference: 3318

Customer Purchase Order: PO-001839

Customer Site Reference: Norfolk Vanguard Cable Route

Date Job Received at Concept: 03-Aug-2017 Date Analysis Started: 15-Aug-2017 Date Analysis Completed: 06-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs
All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical
Services Quality Manual





Report checked and authorised by : Aislinn Arthey Customer Service Advisor Issued by : Aislinn Arthey Customer Service



Waste Acceptance Criteria

Customer Sample Reference: BH17-C1-03 ES2 @ 1.00m

SAL Sample Reference: 675010 014

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Test Portion Mass (g): 87.5

Date Sampled: 02-AUG-2017

Matrix Class: Clay

	Soil Summary	Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill			
Determinand	Technique	LOD	Units	Symbol				
рН	Probe			М	8.1		>6.0	
Loss on Ignition @450C	Ign @450C/Grav	0.1	%	М	3.3			10.0
Total Organic Carbon	OX/IR	0.1	%	N	0.2	3.0	5.0	6.0
Acid Neutralising Capacity (pH 7)	Titration	2.0	Mol/kg	N	<2.0			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
TPH (C10-C40)	GC/FID (SE)	10	mg/kg	М	<10	500.0		
Coronene	GC/MS (MCERTS)	0.1	mg/kg	N	<0.1			
PCB EC7 (Sum)	Calc	0.00035	mg/kg	N	<0.14	1.0		
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	14			
Retained on 2mm	Grav	0.1	%	N	3.2			

	Result	Inert Waste	Stable non reactive	Hazardous Waste Landfill				
Determinand	Technique		Lailuiii	Teactive	Traste Landini			
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0020	mg/kg	N	<0.0020	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.036	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chloride	Calc / Discrete Analyser	10	mg/kg	N	12	800.0	15000.0	25000.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.027	2.0	50.0	100.0
Dissolved Organic Carbon	Calc / OX/IR	10	mg/kg	N	90	500.0	800.0	1000.0
Fluoride	Calc / Discrete Analyser	0.50	mg/kg	N	6.2	10.0	150.0	500.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0030	mg/kg	N	<0.0030	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.012	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols(Mono)	Calc / Colorimetry (CF)	0.20	mg/kg	N	<0.20	1.0		
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	<0.0050	0.1	0.5	7.0
SO4	Calc / Discrete Analyser	5.0	mg/kg	N	22	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	100	mg/kg	N	560	4000.0	60000.0	100000.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.020	mg/kg	N	0.032	4.0	50.0	200.0

From: EC Directive 99/31/EC and Landfill Regulations 2002 (as ammended)

Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Analysed as Soil Total and Speciated USEPA16 PAH (SE) (MCERTS)

	675010 014				
	BH17-C1-03 ES2 @ 1.00m				
	AR				
	02-AUG-2017				
	Clay				
Determinand					
Naphthalene	GC/MS	0.1	mg/kg	U	<0.1
Acenaphthylene	GC/MS	0.1	mg/kg	U	<0.1
Acenaphthene	GC/MS	0.1	mg/kg	М	<0.1
Fluorene	GC/MS	0.1	mg/kg	М	<0.1
Phenanthrene	GC/MS	0.1	mg/kg	U	<0.1
Anthracene	GC/MS	0.1	mg/kg	М	<0.1
Fluoranthene	GC/MS	0.1	mg/kg	N	<0.1
Pyrene	GC/MS	0.1	mg/kg	Ν	<0.1
Benzo(a)Anthracene	GC/MS	0.1	mg/kg	М	<0.1
Chrysene	GC/MS	0.1	mg/kg	М	<0.1
Benzo(b)fluoranthene	GC/MS	0.1	mg/kg	U	<0.1
Benzo(k)fluoranthene	GC/MS	0.1	mg/kg	N	<0.1
Benzo(a)Pyrene	GC/MS	0.1	mg/kg	М	<0.1
Indeno(123-cd)Pyrene	GC/MS	0.1	mg/kg	М	<0.1
Dibenzo(ah)Anthracene	GC/MS	0.1	mg/kg	М	<0.1
Benzo(ghi)Perylene	GC/MS	0.1	mg/kg	М	<0.1
Polyaromatic Hydrocarbons (Total)	GC/MS	0.1	mg/kg	U	<0.1

Concept Reference: 675010

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil Analysed as Soil

BTEX					
			Concep	t Reference	675010 014
		Custo	mer Sample	e Reference	BH17-C1-03 ES2 @ 1.00m
				est Sample	AR
			Da	te Sampled	02-AUG-2017
			ı	Matrix Class	Clay
Determinand	Method	LOD	Units	Symbol	
Benzene	GC/MS (Head Space)(MCERTS)	10	μg/kg	М	<10
Toluene	GC/MS (Head Space)(MCERTS)	10	μg/kg	М	<10
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	μg/kg	M	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	μg/kg	М	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	μg/kg	M	<10

Project Site: Norfolk Vanguard Cable Route

Customer Reference: 3318

Soil

Analysed as Soil

PCBs E	C7 (SE)
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	675010 014						
	Customer Sample Reference						
			1	est Sample	AR		
			Da	te Sampled	02-AUG-2017		
			N	Matrix Class	Clay		
Determinand	Method	LOD	Units	Symbol			
Polychlorinated biphenyl BZ#28	GC/MS	20	μg/kg	М	<20		
Polychlorinated biphenyl BZ#52	GC/MS	20	μg/kg	М	<20		
Polychlorinated biphenyl BZ#101	GC/MS	20	μg/kg	М	<20		
Polychlorinated biphenyl BZ#118	GC/MS	20	μg/kg	М	<20		
Polychlorinated biphenyl BZ#153	GC/MS	20	μg/kg	М	<20		
Polychlorinated biphenyl BZ#138	GC/MS	20	μg/kg	М	<20		
Polychlorinated biphenyl BZ#180	GC/MS	20	μg/kg	М	<20		

Index to symbols used in Supplement 1A to Report Number 675010-1

Value	Description
8:1	Leachate to BS EN 12457-3 (8:1)
AR	As Received
2:1	Leachate to BS EN 12457-3 (2:1)
A40	Assisted dried < 40C
М	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Supplement 1A report reissued to include only sample 014			
pH, LOI & TOC were performed on assisted dried samples (<40 degree centigrade). All other results relate to samples as received.			
Reported results on as received samples are corrected to a 105 degree centigrade dry weight basis except ANC			
BTEX: Samples submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised.			
Detained as 2mm is removed before analysis			



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Concept Life Sciences Certificate of Analysis

3 Crittall Drive Springwood Industrial Estate Braintree Essex CM7 2RT

Tel: 01376 560120 Fax: 01376 552923

Report Number: Supplement 1A to Report Number

677853-1

Date of Report: 18-Oct-2017

Customer: TerraConsult (South) Limited

Suite F17 Dugard House

Peartree Road Colchester Essex CO3 0UL

Customer Contact: Victoria Smith

Customer Job Reference: 3318

Customer Site Reference: East Anglia OWF
Date Job Received at Concept: 24-Aug-2017
Date Analysis Started: 25-Aug-2017
Date Analysis Completed: 04-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs
All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical
Services Quality Manual



Report checked and authorised by : Aislinn Arthey Customer Service Advisor Issued by : Aislinn Arthey Customer Service Adv



Project Site: East Anglia OWF

Customer Reference: 3318

Water Analysed as Water

Heavy Metals (9)

	Concept Reference						
	C1-04						
	Date Sampled						
Determinand	Method	Test Sample	LOD	Units			
As (Dissolved)	T281	F	0.0002	mg/l	0.0003		
Cd (Dissolved)	T281	F	0.00002	mg/l	<0.00002		
Cr (Dissolved)	T281	F	0.001	mg/l	<0.001		
Cu (Dissolved)	T281	F	0.0005	mg/l	0.0011		
Pb (Dissolved)	T281	F	0.0003	mg/l	<0.0003		
Hg (Dissolved)	T281	F	0.00005	mg/l	<0.00005		
Ni (Dissolved)	T281	F	0.001	mg/l	<0.001		
Se (Dissolved)	T281	F	0.0005	mg/l	0.0029		
Zn (Dissolved)	T281	F	0.002	ma/l	0.006		

Concept Reference: 677853

Project Site: East Anglia OWF

Customer Reference: 3318

Water Analysed as Water

Total and Speciated USEPA16 PAH (SE)

		Concept Reference Customer Sample Reference					
	Date Sampled						
Determinand	Method	Test Sample	LOD	Units	23750		
Naphthalene	T149	AR	0.01	μg/l	<0.01		
Acenaphthylene	T149	AR	0.01	μg/l	<0.01		
Acenaphthene	T149	AR	0.01	μg/l	<0.01		
Fluorene	T149	AR	0.01	μg/l	<0.01		
Phenanthrene	T149	AR	0.01	μg/l	<0.01		
Anthracene	T149	AR	0.01	μg/l	<0.01		
Fluoranthene	T149	AR	0.01	μg/l	<0.01		
Pyrene	T149	AR	0.01	μg/l	<0.01		
Benzo(a)Anthracene	T149	AR	0.01	μg/l	<0.01		
Chrysene	T149	AR	0.01	μg/l	<0.01		
Benzo(b)fluoranthene	T149	AR	0.01	μg/l	<0.01		
Benzo(k)fluoranthene	T149	AR	0.01	μg/l	<0.01		
Benzo(a)Pyrene	T149	AR	0.01	μg/l	<0.01		
Indeno(123-cd)Pyrene	T149	AR	0.01	μg/l	<0.01		
Dibenzo(ah)Anthracene	T149	AR	0.01	μg/l	<0.01		
Benzo(ghi)Perylene	T149	AR	0.01	μg/l	<0.01		
PAH(total)	T149	AR	0.01	μg/l	<0.01		

Concept Reference: 677853
Project Site: East Anglia OWF

Customer Reference: 3318

Analysed as Water

TPH (CWG) with MTBE & BTEX SE

Water

			Conce	t Reference	677853 001
	C1-04				
			D	ate Sampled	22-AUG-2017
Determinand	Method	Test Sample	LOD	Units	
Benzene	T54	AR	1	μg/l	<1
Toluene	T54	AR	1	μg/l	<1
EthylBenzene	T54	AR	1	μg/l	<1
M/P Xylene	T54	AR	1	μg/l	<1
O Xylene	T54	AR	1	μg/l	<1
Methyl tert-Butyl Ether	T54	AR	1	μg/l	<1
TPH (C5-C6 aliphatic)	T54	AR	0.020	mg/l	<0.020
TPH (C6-C7 aromatic)	T54	AR	0.020	mg/l	<0.020
TPH (C6-C8 aliphatic)	T54	AR	0.020	mg/l	<0.020
TPH (C7-C8 aromatic)	T54	AR	0.020	mg/l	<0.020
TPH (C8-C10 aliphatic)	T54	AR	0.020	mg/l	<0.020
TPH (C8-C10 aromatic)	T54	AR	0.020	mg/l	<0.020
TPH (C10-C12 aliphatic)	T219	AR	0.01	mg/l	<0.01
TPH (C10-C12 aromatic)	T219	AR	0.01	mg/l	<0.01
TPH (C12-C16 aliphatic)	T219	AR	0.01	mg/l	<0.01
TPH (C12-C16 aromatic)	T219	AR	0.01	mg/l	<0.01
TPH (C16-C21 aliphatic)	T219	AR	0.01	mg/l	<0.01
TPH (C16-C21 aromatic)	T219	AR	0.01	mg/l	0.02
TPH (C21-C35 aliphatic)	T219	AR	0.01	mg/l	0.02
TPH (C21-C35 aromatic)	T219	AR	0.01	mg/l	0.02

Concept Reference: 677853

Project Site: East Anglia OWF

Customer Reference: 3318

Water Analysed as Water

Organochlorine insecticides

			Conce	ot Reference	677853 001	
	Customer Sample Reference					
			D	ate Sampled	22-AUG-2017	
Determinand	Method	Test Sample	LOD	Units		
Hexachlorocyclohexane	T16	AR	0.01	μg/l	<0.01	
Hexachlorobenzene	T16	AR	0.01	μg/l	<0.01	
Heptachlor	T16	AR	0.01	μg/l	<0.01	
Aldrin	T16	AR	0.01	μg/l	<0.01	
Heptachlor epoxide	T16	AR	0.01	μg/l	<0.01	
Chlordane	T16	AR	0.01	μg/l	<0.01	
Endosulphan	T16	AR	0.01	μg/l	<0.01	
DDE	T16	AR	0.01	μg/l	<0.01	
Dieldrin	T16	AR	0.01	μg/l	<0.01	
Endrin	T16	AR	0.01	μg/l	<0.01	
DDD	T16	AR	0.01	μg/l	<0.01	
DDT	T16	AR	0.01	na/l	(36) < 0.02	

Concept	Reference:	677853					
Project Site:		East Angl	East Anglia OWF				
Customer	Reference:	3318					
Water Organophosphorous in	secticides	Analysed	as Water				
			Concep	t Reference	677853 001		
		Custon	ner Sampl	e Reference	C1-04		
			Da	ate Sampled	22-AUG-2017		
Determinand	Method	Test Sample	LOD	Units			
Dichlorvos	T16	AR	0.01	μg/l	<0.01		
Mevinphos	T16	AR	0.01	μg/l	<0.01		
Dimethoate	T16	AR	0.01	μg/l	<0.01		
Diazinon	T16	AR	0.01	μg/l	<0.01		
Pirimiphos methyl	T16	AR	0.01	μg/l	<0.01		
Malathion	T16	AR	0.01	μg/l	<0.01		
Fenitrothion	T16	AR	0.01	μg/l	<0.01		
Parathion	T16	AR	0.01	μg/l	<0.01		
Azinphos methyl	T16	AR	0.01	μg/l	<0.01		

Index to symbols used in Supplement 1A to Report Number 677853-1

Value	Description
F	Filtered
AR	As Received
149	LOD raised due to high dissolved solids
36	LOD Raised due to low Matrix spike recovery
100	LOD determined by sample aliquot used for analysis
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Supplement 1A Report Reissued to include only sample 001 OCP and OPP analysis transferred to Concept Life Sciences Manchester

Method Index

Description
GC/FID (SE)
ICP/MS (Filtered)
GC/MS (SIR)
GC/MS
GC/MS (Headspace)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
As (Dissolved)	T281	F	0.0002	mg/l	U	001
Cd (Dissolved)	T281	F	0.00002	mg/l	U	001
Cr (Dissolved)	T281	F	0.001	mg/l	U	001
Cu (Dissolved)	T281	F	0.0005	mg/l	U	001
Pb (Dissolved)	T281	F	0.0003	mg/l	U	001
Hg (Dissolved)	T281	F	0.00005	mg/l	U	001
Ni (Dissolved)	T281	F	0.001	mg/l	U	001
Se (Dissolved)	T281	F	0.0005	mg/l	U	001
Zn (Dissolved)	T281	F	0.002	mg/l	U	001
Naphthalene	T149	AR	0.01	μg/l	U	001
Acenaphthylene	T149	AR	0.01	μg/l	U	001
Acenaphthene	T149	AR	0.01	μg/l	U	001
Fluorene	T149	AR	0.01	μg/l	U	001
Phenanthrene	T149	AR	0.01	μg/l	U	001
Anthracene	T149	AR	0.01	μg/l	U	001
Fluoranthene	T149	AR	0.01	μg/l	U	001
Pyrene	T149	AR	0.01	μg/l	U	001

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Benzo(a)Anthracene	T149	AR	0.01	μg/l	U	001
Chrysene	T149	AR	0.01	μg/l	U	001
Benzo(b)fluoranthene	T149	AR	0.01	μg/l	N	001
Benzo(k)fluoranthene	T149	AR	0.01	μg/l	U	001
Benzo(a)Pyrene	T149	AR	0.01	μg/l	U	001
Indeno(123-cd)Pyrene	T149	AR	0.01	μg/l	U	001
Dibenzo(ah)Anthracene	T149	AR	0.01	μg/l	U	001
Benzo(ghi)Perylene	T149	AR	0.01	μg/l	U	001
PAH(total)	T149	AR	0.01	μg/l	N	001
Benzene	T54	AR	1	μg/l	U	001
Toluene	T54	AR	1	μg/l	U	001
EthylBenzene	T54	AR	1	μg/l	U	001
M/P Xylene	T54	AR	1	μg/l	U	001
O Xylene	T54	AR	1	μg/l	U	001
Methyl tert-Butyl Ether	T54	AR	1	μg/l	U	001
TPH (C5-C6 aliphatic)	T54	AR	0.020	mg/l	N	001
TPH (C6-C7 aromatic)	T54	AR	0.020	mg/l	N	001
TPH (C6-C8 aliphatic)	T54	AR	0.020	mg/l	N	001
TPH (C7-C8 aromatic)	T54	AR	0.020	mg/l	N	001
TPH (C8-C10 aliphatic)	T54	AR	0.020	mg/l	N	001
TPH (C8-C10 aromatic)	T54	AR	0.020	mg/l	N	001
TPH (C10-C12 aliphatic)	T219	AR	0.01	mg/l	N	001
TPH (C10-C12 aromatic)	T219	AR	0.01	mg/l	N	001
TPH (C12-C16 aliphatic)	T219	AR	0.01	mg/l	N	001
TPH (C12-C16 aromatic)	T219	AR	0.01	mg/l	N	001
TPH (C16-C21 aliphatic)	T219	AR	0.01	mg/l	N	001
TPH (C16-C21 aromatic)	T219	AR	0.01	mg/l	N	001
TPH (C21-C35 aliphatic)	T219	AR	0.01	mg/l	N	001
TPH (C21-C35 aromatic)	T219	AR	0.01	mg/l	N	001
Hexachlorocyclohexane	T16	AR	0.01	μg/l	N	001
Hexachlorobenzene	T16	AR	0.01	μg/l	N	001
Heptachlor	T16	AR	0.01	μg/l	N	001
Aldrin	T16	AR	0.01	μg/l	N	001
Heptachlor epoxide	T16	AR	0.01	μg/l	N	001
Chlordane	T16	AR	0.01	μg/l	N	001
Endosulphan	T16	AR	0.01	μg/l	N	001
DDE	T16	AR	0.01	μg/l	N	001
Dieldrin	T16	AR	0.01		N	001
Endrin	T16	AR	0.01	μg/l μg/l	N	001
DDD	T16	AR			N	001
			0.01	μg/l		
DDT	T16	AR AR	0.01	μg/l	N N	001
Dichlorvos	T16		0.01	μg/l		
Mevinphos	T16	AR	0.01	μg/l	N	001
Dimethoate	T16	AR	0.01	μg/l	N	001
Diazinon	T16	AR	0.01	μg/l	N	001
Pirimiphos methyl	T16	AR	0.01	μg/l	N	001
Malathion	T16	AR	0.01	μg/l	N	001
Fenitrothion	T16	AR	0.01	μg/l	N	001
Parathion	T16	AR	0.01	μg/l	N	001
Azinphos methyl	T16	AR	0.01	μg/l	N	001

APPENDIX G Calibration Certificates

SPT hammer(s) SI 3, SI 4, SI 5

Gas monitor(s) GFM 435 s/n 11378

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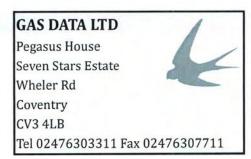
SPT Calibration Report www.equipegroup.com Hammer Energy Measurement Report Type of Hammer SPT HAMMER Client Key SI DRILLING EQU1695 Test No 2 Part of instrumented rod 3 Drive Rod Test Depth (m) 8.70 Strain Gauge Accelerometer 29 December 2016 Date of Test Valid until 29 December 2017 F Force d_r Diameter of rod SI 3 Hammer ID ød, m = 63.5 kgMass of the hammer h = 0.76m Falling height $m \times g \times h = 473$ Characteristics of the instrumented rod $d_r = 0.052 \,\mathrm{m}$ Length of the instrumented rod 0.558 m $A = 11.61 \text{ cm}^2$ Area Modulus $E_a = 206843 \text{ MPa}$ Fig. B.1 and B.2 BS EN ISO 22476-3: 2005 + A1: 2011 **Particle Velocity** Force Velocity v (m/s) Time t (µs) Time t (µs) Acceleration **Energy Ratio per Blow** 100.000 95.000 90.000 Blow 2 Blow 3 80,000 Blow 4 75.000 Blow 5 70.000 Blow 6 Blow 7 Biow 8 Blow 9 Blow 10 50.000 Maximum Force (Fmax) Time t (µs) Observations: E meas = 0.355 kN-m 75.14% Energy Ratio = Etheor E theor = 0.473 kN-m (E_r) Equipe SPT Analyzer Operators: KS Prepared by: Checked by Date 10/01/2017

SPT Calibration Report www.equipegroup.com F **Hammer Energy Measurement Report** Type of Hammer SPT HAMMER Key Client SI DRILLING EQU1694 Test No Part of instrumented rod 8.70 Drive Rod Test Depth (m) 4 Strain Gauge 29 December 2016 Date of Test 6 Ground 29 December 2017 Valid until F Force d, Diameter of rod 4 CUT DOWN Hammer ID ød, m = 63.5 kgMass of the hammer h = 0.76m Falling height $m \times g \times h = 473$ /// Characteristics of the instrumented rod $d_r = 0.052 \,\mathrm{m}$ Length of the instrumented rod 0.558 m $A = 11.61 \text{ cm}^2$ Area Modulus $E_a = 206843 \text{ MPa}$ Fig. B.1 and B.2 BS EN ISO 22476-3: 2005 + A1: 2011 **Particle Velocity** Force Time t (µs) Time t (µs) **Energy Ratio per Blow** Acceleration 100.000 95.000 90.000 85.000 Blow 2 Blow 3 80.000 Blow 4 75.000 Blow 5 70.000 Blow 6 • Blow 7 65.000 Blow 8 Blow 9 55.000 Blow 10 50,000 Maximum Force (Fmax) Time t (µs) Observations: E meas = 0.351 kN-m **Energy Ratio** 74.14% Etheor E theor = 0.473 kN-m (E_r) **Equipe SPT Analyzer Operators:** KS Prepared by: Checked 10/01/2017 Date

SPT Calibration Report www.equipegroup.com **Hammer Energy Measurement Report** Type of Hammer SPT HAMMER Client Key SI DRILLING Test No EQU1690 Part of instrumented rod Test Depth (m) 8.70 3 Drive Rod 4 Strain Gauge Date of Test 29 December 2016 5 Accelerometer 6 Ground Valid until 29 December 2017 F Force d_r Diameter of rod Hammer ID SI 05 ød, Mass of the hammer m = 63.5 kgFalling height h = 0.76m $E_{\text{theor}} =$ $m \times g \times h = 473$ /// Characteristics of the instrumented rod $d_r = 0.052 \,\mathrm{m}$ Length of the instrumented rod 0.558 m Area $A = 11.61 \text{ cm}^2$ Modulus $E_a = 206843 \text{ MPa}$ Fig. B.1 and B.2 BS EN ISO 22476-3: 2005 + A1: 2011 Force **Particle Velocity** Time t (µs) Time t (µs) Acceleration **Energy Ratio per Blow** 100.000 95.000 90,000 Blow 1 85.000 Blow 2 Blow 3 80.000 Blow 4 75.000 70,000 Blow 6 ♦ Blow 7 65.000 Blow 8 Blow 9 55.000 * Blow 10 170 220 Maximum Force (Fmax) Time t (µs) Observations: E meas = 0.343 kN-m Emeas **Energy Ratio** 72.53% E theor = 0.473 kN-m **Equipe SPT Analyzer Operators:** Prepared by: Checked by: Date 10/01/2017

TEST DATE	AND CONDI	TIONS			
Date	21/06/2017				
Atmospheric Press	sure	997	mB		
Ambient Temperat	23.0	°C			
Environics Serial N	508	9			

GFM435 Final Inspection & Calibration Check Certificate



Customer	Terraconsult (South) Ltd				
Certificate Number	119385				
Order Number	317112				

Serial Number	11378	Recalibration DUE Date
Software Version	G435-00.0024/0004	21/06/2018

		Instrum	ent Checks			
Keyboard		1	Display Contrast	1		
Pump Flow In	400	Accept > 200 cc/min	Pump Flow @ -200mB	200	Accept > 200 cc/min	
Clock Set / Running		Labels Fitted	1			

Gas Checks									
Sensor	CH	14	C	O_2	0)2			
	Instrument Gas Readings %	True Gas Value	Instrument Gas Readings %	True Gas Value %	Instrument Gas Readings %	True Gas Value			
	59.7	60	39.7	40	20.8	20.9			
	Accept +/- 3.0	00	Accept +/- 3.0	TO	Accept +/- 0.5	20.7			
1	5.0	5	4.8	5	6.0	6			
	Accept +/- 0.3	J	Accept +/- 0.3	9	Accept +/- 0.3				
Zero Reading	0.0	0.0	0.0		0.0	0.0			
100% N ₂	Accept +/- 0.0	0.0	Accept +/- 0.0	0.0	Accept + 0.1	0.0			

		Option	al Gas Check	CS			
Applied Gas 8	Range of GFM	Concentration		Instrument Re	eadings (ppm)		
Gas Type Range (ppm)		Range (ppm) Tested @ (ppm)		o Reading	Instrument Gas Reading		
H2S	5000	1500	0	Accept +/-0.0	1500	Accept +/-5.0	
CO	2000	1000	0	Accept +/-0.0	1000	Accept +/-5.0	
				Accept +/-0.0		Accept +/-5.0	
				Accept +/-0.0		Accept +/-5.0	
Hexane	2.0%	2.0%	0	Accept +/-0.0	1.99	Accept +/-10.0	

			Cross C	as Effects					
Applied Gas (ppm)			Instrument Readings (ppm)						
Gas Type	Concentration	Toxic 1:	H2S	Toxic 2:	CO	Toxic 3:	Hex	Toxic 4:	
H2S	1500	150	1500		0		0		
СО	1000	60		100	0	0			
Hexane	2.0%	0		0		1.9	9		

	Pressure Checks					
Atr	nospheric Pressure [A	P] (mB)				
Current Atmospheric Pressure (mB)	Instrument Atmospheric Pressure Reading (mB)					
All Ports Open to Atmosphere	Open Ports	997	Accept +/- 2.0			
AP Port (Internal)	+800 mB	801	Accept +/- 5.0			
AP Port (Internal)	+1200mb	1199	Accept +/- 5.0			

Flow Checks									
Borehole Flow	Latara and Fi	D U (1/L)	Differential Pressure						
Applied Flow Reading (l/h)	instrument Fi	ow Reading (l/h)	Instrument	DP Reading (Pa)	Applied DP Pressure (Pa) -276				
-30.0	-29.8	Accept +/-3.0	-272	Accept +/-50					
-3.0	-3.1	Accept +/-1.0	-15	Accept +/-6.0	-14				
0.0	0.0	Accept +/-0.0	0.0	Accept +/-0.5	0.0				
+3.0	3.0	Accept +/-0.5	13	Accept +/-3.0	14				
+30.0	30.0	Accept +/-3.0	294	Accept +/-50	295				
+60.0	58.5	Accept +/-6.0	843	Accept +/-130	876				
+90.0	85.9	Accept +/-9.0	1616	Accept +/-250	1717				















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