Soil Environment Services Ltd

GEOTECHNICAL SOIL SURVEY

Oxford Estates Construction Ltd

21 Salford Road
Oxford

Soil Environment Services Ltd
May 2017

Our Ref: SES/OEC/SR/1#1 **Date: 5th May 2017**

Client:

Oxford Estates Construction Ltd
2 Inott Furze
Headington
Oxford
OX3 7ES

GEOTECHNICAL SOIL SURVEY

21 Salford Road
Oxford

A report prepared on behalf of ***Soil Environment Services*** by:

[redacted]

Lorna Johnson BSc
Environmental Consultant

Checked by:

[redacted]

Dr Robin S Davies BSc PhD MISoilSci PGC *Contaminated Land Management*
Managing Director

Soil Environment Services
Agricultural Land Classification, Contaminated Land
Risk Assessment, Mineral Extraction Soil Planning
Unit 8, Stocksfield Hall, Stocksfield, Northumberland, NE43 7TN
Tel: 01661 844 827 Email: rd@soilenvironmentservices.co.uk
www.soilenvironmentservices.co.uk

CONTENTS

1. SCOPE OF WORKS

Soil Environment Services Ltd was instructed to conduct a factual ground investigation at:

21 Salford Road
Marston
Oxford
OX3 0RX

OS Grid Ref: 452465,207977. (Drawing SS/1)

…to determine the ground conditions for proposed erection of sixteen flats on three floors and associated parking.

The planned works include soil survey and testing to provide a factual geotechnical assessment of soil conditions for the required ground-works and/or building construction in general accordance with EC7, BS5930 and BS1377.

The site investigation was carried out on the 20th April 2017.

The planned scope of works detailed and specified within the agreed quotation comprised:

- 3 x boreholes to a maximum depth of 5 m or as dictated by ground conditions
- 3 x Dynamic probing or SPT and/ or Shear vane reading
- pH and sulphate analysis
- Atterberg limits analysis (plastic index)
- 1 x Factual report in general accordance with EC7 and BS5930

Variation to the above scope of works may be needed and beneficial given the ground conditions encountered during the site investigation. This will be detailed in **Section 3.1 – Completed Works.**

The accuracy of the geotechnical report is restricted to the initial scope of works and then the completed works. Also, variation in soil strength and composition may subsequently be encountered across the site during site works operations and/or ground preparation.

2. SITE SETTING

The site assessed for this investigation (Drawing 1) comprised an asphalt car park area and the derelict Jack Russell public house. Salford Road bounds the site to the north with retail units to the east, residential properties to the south and The Link road to the west. Mature trees were located off site within a significant distance of the northern and western boundaries.

Topographically, the site and surrounding land is relatively level.

2.1 Surface conditions

At the time of the investigation the majority of the site surface apart from the former public house, comprised asphalt with some concrete paving at the north eastern boundary. The surfaces were level.

2.2 BGS/Soil survey mapped Geology and drift

The site is mapped by the BGS (1:50 000) as being located on:

Superficial geology
1:50 000 scale superficial deposits description: *Northmoor Sand and Gravel Member - Sand and Gravel. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by rivers.*

Bedrock geology
1:50 000 scale bedrock geology description: *Oxford Clay Formation and West Walton Formation (undifferentiated) - Mudstone. Sedimentary Bedrock formed approximately 156 to 165 million years ago in the Jurassic Period. Local environment previously dominated by shallow seas.*

BGS borehole logs located south of the site in the same mapped strata indicate stiff CLAY to ~4 m bgl.

2.3 Drainage and hydrogeology

Surface water would be considered to runoff site towards Salford Road in the north east.

The ground conditions encountered during the investigation was predominantly shallow made ground over clay in all boreholes.

Groundwater was not detected within the boreholes. Perched water was evident in BH1 at 1.0 m bgl and in BH3 at 1.2 m bgl.

3. GEOTECHNICAL SOIL SURVEY

3.1 Completed works

Site works

BHs with shear vane readings were located as in Drawing 1.

All boreholes were drilled to 5 m bgl.

3.2 General strata descriptions (full borehole log/s in Appendix A)

The ground investigation encountered shallow made ground to a maximum depth of 0.65 m bgl overlying stiff clay to 5.0 m bgl in all boreholes.

3.3 In-situ testing

Shear Vane readings

Shear vane readings were undertaken to 5 m in all boreholes at 1 m intervals.

Standard Penetration Test (SPT)

SPTs were not undertaken as part of the investigation

3.3.1 Ground bearing

The allowable bearing capacities are as detailed in Tables 2 and 3.

Table 1. Ground shear strength

Depth (m bgl)	BH1		BH2		BH3	
	Vane reading	Shear (kN/m2)	Vane reading	Shear (kN/m2)	Vane reading	Shear (kN/m2)
2.0	102	161	115	181	138	217
3.0	140	221	140	221	140	221
4.0	140	221	140	221	140	221
5.0	140	221	140	221	140	221

Table 2. Ground bearing for (0.6 m) strip footings at depth

Depth (m bgl)	BH1		BH2		BH3	
	N value	Bearing (kN/m2)*	N value	Bearing (kN/m2)*	N value	Bearing (kN/m2)*
2.0	8	205	10	230	13	256
3.0	14	269	14	269	14	269
4.0	14	294	14	294	14	294
5.0	14	307	14	307	14	307

* Method: – – Bowles after Meyerhof 1976 for 25 m settlement - -0.6 m width

** The N-value has been derived from the shear vane via y=0.1x-8.5908

Table 3. Ground bearing for piles

Depth (m bgl)	BH1		BH2		BH3	
	N value	Bearing (kN/m2)*	N value	Bearing (kN/m2)*	N value	Bearing (kN/m2)*
2.0	8	383	10	479	8	622
3.0	14	670	14	670	14	670
4.0	14	710	14	710	14	710
5.0	14	769	14	769	14	769

* Method: – Bearing capacity for piles, Reece and Wright 1977

** The N-value has been derived from the shear vane via y=0.1x-8.5908

Notes on bearing capacity calculations

The bearing value information constitutes an element of interpretation of the factual data as recorded on site. This requires choice of methods and formulae which are open to interpretation.

Soil Environment Services uses NovoSPT, a widely accepted software package, using typical formulae for these calculations. Appropriate formulae have been used given the soil type/s and data input into the software adjusted to site specific conditions.

Shear Failure safety factor	3 or 25 mm settlement
Soil type/s	CLAY
Unit weight	18 kN/m^3
Groundwater depth	None
Shallow footing width	0.6 m
Preferred depth	n/a
Pile diameter	0.4 m
Borehole diameter	65 mm
Overburden correction	Liao & Whitman 1986

A number of interpretations of the factual data may be selected within the software and results offered for comparison. This will typically be either shallow and deep foundation options and different formulae for each of these options.

NovoSPT is a computer program for interpretation of Standard Penetration Test (SPT/ DCPT) and correlating blow counts (N) to soil properties based on more than 270 formulas. Novo Tech Software Ltd. #4188 Hoskins Road, North Vancouver, British Columbia, Canada. Soil Environment Services accept no responsibility for errors within NovoSPT software.

3.4 Groundwater

Groundwater was not encountered within the boreholes. Perched water was evident in BH1 at 1.0 m bgl and in BH3 at 1.2 m bgl.

4. LABORATORY TESTING

4.1 Chemical testing

Samples obtained at depth in BH2 indicated some concern with regards to sulphates and pH (Appendix B) and it is therefore recommended in accordance with BRE Special Digest 1 (2005) that the on site Design Sulphate Class is classified as DS-3. Subsequently all concrete specification should be of DS-3 ACEC class AC-2s with respect to the chemical environment for concrete.

4.2 Mechanical testing

The soils are classified as low to high plasticity (Appendix B) and low to medium volume change potential. With reference to NHBC Chapter 4.2, Building near trees, foundation depths will need to consider the proximity of trees due to the medium volume change potential soils.

Table 4. Foundation depth in relation to trees

BH/ location	Volume change potential	Tree type	Tree water demand	Potential distance from foundations (m)	Max tree height (m)	DH	Foundation depth (m)*
2	Medium	Willow	High	12	24	0.5	2.15
3	Medium	Lime	Moderate	12	22	0.55	1.2

*-The foundation depths are based on the soil volume change potential noted in the borehole, the estimated distance between the nearest foundation and specific tree in relation to that borehole and the status of the trees in terms of removal, maximum growth allowed or limited height with respect to some hedge types. Hence, apart from soil volume change potential and tree type identification (although some estimation may occur during the winter) other factors may be subject to some variation if information is not supplied by the client or not obvious from site observations.

5. SUMMARY AND CONCLUSIONS

5.1 General ground conditions

- Made ground was encountered to a maximum depth of 0.65 m bgl overlying stiff clay to 5.0 m bgl in all boreholes.

- Ground conditions on site indicated drainage to depth is likely to be restricted. No groundwater was evident in the boreholes. Perched water was evident in BH1 at 1.0 m bgl and in BH3 at 1.2 m bgl

- Chemical testing indicates some concern with regards to soil pH and sulphates (Appendix B).

- Allowable bearing capacity ranged upwards from 383 kN/m^2 at 2.0 m depth for 0.4 m diameter piles.

- Foundation depths will need to consider the proximity of the Willow tree on the opposite side of Salford Road at the north eastern boundary and hence a depth of 2.15 m will be needed for foundations on this side of the property.

Drawing 1

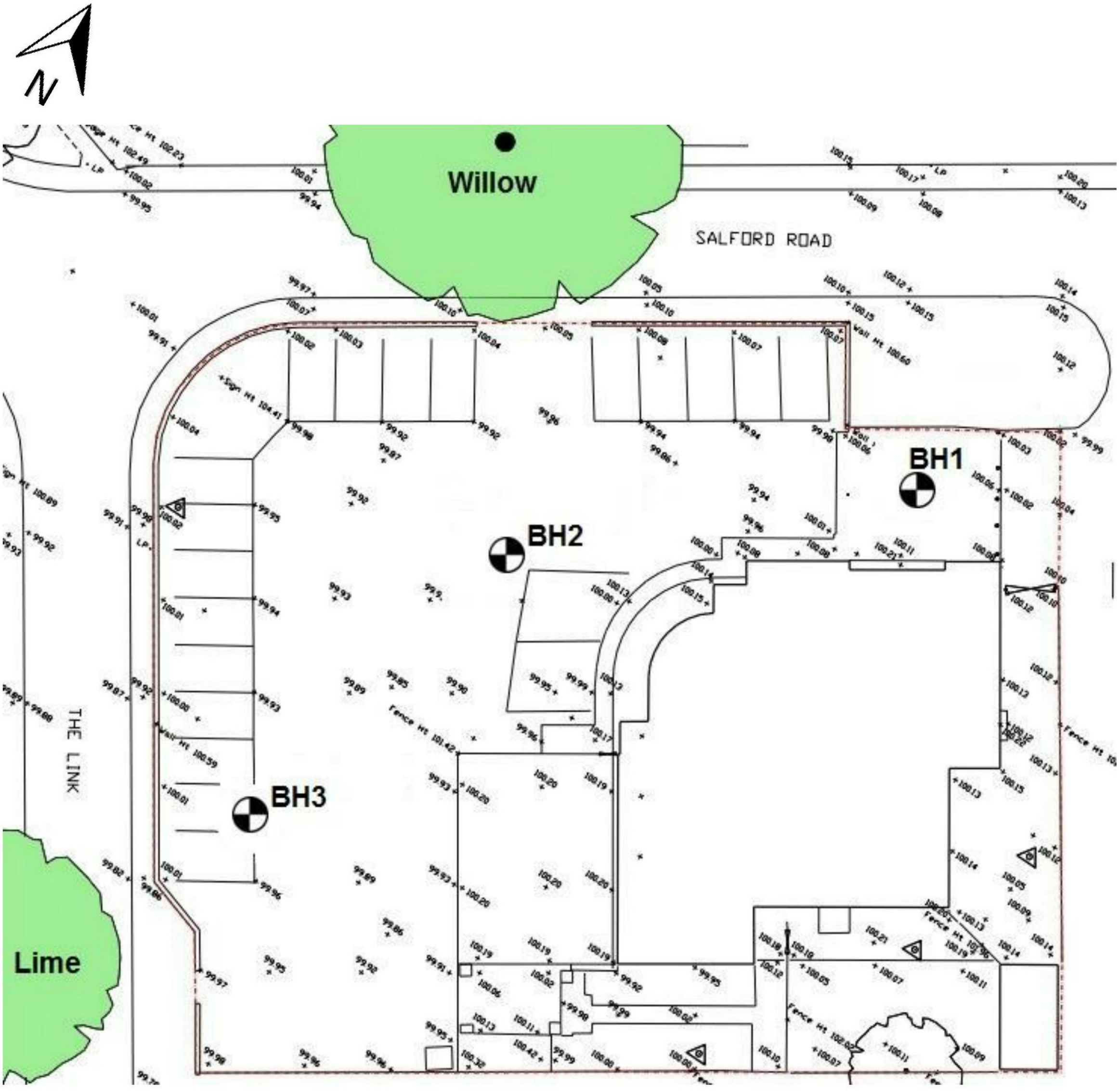
Borehole Locations

NOTES:

Borehole and Shear Vane

Soil Environment Services

Project: 21 Salford Road	Client: Oxford Estates Construction Ltd
Drawing Title: Borehole locations	Drawing No.:1
Scale: NA	Date: 5th May 2017



APPENDIX A

Engineer's Borehole Logs

Borehole/ Testpit Log	Excavation type and method:	Date
BH/Pit Ref. BH1	Borehole/Window Sampler	20/04/2017

Depth (m BGL)	Symbol	Description	Notes
		MADE GROUND concrete paving and sub base	
		Dark greyish brown soft silty CLAY	
1.0		Light yellowish grey loose sandy GRAVEL	Perched water evident at 1.0 m bgl
2.0		Yellowish grey firm to stiff mottled CLAY	
3.0			
4.0			

Borehole/ Testpit Log	Excavation type and method:	Date
BH/Pit Ref. BH 2	Borehole/Window Sampler	20/04/2017

Depth (m BGL)	Symbol	Description	Notes
		MADE GROUND asphalt and sub base	
		MADE GROUND broken bricks and fill material	
		MADE GROUND dark brown silty clay with broken bricks	
		Dark greyish brown soft silty CLAY	
1.0		Light yellowish grey loose sandy GRAVEL	
2.0		Greyish yellow firm to stiff mottled CLAY	
3.0			
4.0		Dark grey stiff CLAY	No water encountered

Borehole/ Testpit Log	Excavation type and method:	Date
BH/Pit Ref. BH3	Borehole/Window Sampler	20/04/2017

Depth (m BGL)	Symbol	Description	Notes
		MADE GROUND asphalt and sub base	
		MADE GROUND very dark brown silty clay with broken bricks and rubble	
		Dark greyish brown soft silty CLAY	
1.0		Light greyish brown medium dense sandy GRAVEL	Perched water evident at 1.2 m bgl
		Light orange brown firm sandy CLAY with flints	
2.0		Light greyish brown loose SAND	
3.0		Dark greyish brown stiff mottled CLAY	
4.0			

APPENDIX B

Laboratory Results

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
1			0.30	0.90	31			50	22	28	92	Intermediate plasticity CI.
1			1.20	4.00	26			57	23	34	100	High plasticity CH.
2			0.65	0.90	20			32	15	17	90	Low plasticity CL.
2			1.30	5.00	26			56	23	33	100	High plasticity CH.
3			0.50	0.90	23			38	17	21	100	Intermediate plasticity CI.
3			1.50	1.90	12			28	14	14	82	Low plasticity CL.
3			2.40	5.00	29			57	24	33	100	High plasticity CH.

SYMBOLS : NP : Non Plastic * : Liquid Limit and Plastic Limit Wet Sieved.

UKAS TESTING 4043

PSL Professional Soils Laboratory

Salford Road

Contract No:

PSL17/1888

Client Ref:

Chemtech Environmental Limited

SOILS

Lab number			64492-1	64492-2	64492-3	64492-4	64492-5	64492-6
Sample id			BH1	BH1	BH1	BH2	BH2	BH2
Depth (m)			0.30-0.90	0.90-1.20	1.20-4.00	0.65-0.90	0.90-1.30	1.30-5.00
Date sampled			20/04/2017	20/04/2017	20/04/2017	20/04/2017	20/04/2017	20/04/2017
Test	**Method**	**Units**						
pH	CE004 M	units	7.6	8.3	8.0	7.8	8.3	7.7
Sulphate (2:1 water soluble)	CE061 M	mg/l SO_4	27	25	54	31	23	1821

Lab number			64492-7	64492-8	64492-9	64492-10	64492-11
Sample id			BH3	BH3	BH3	BH3	BH3
Depth (m)			0.50-0.90	0.90-1.50	1.50-1.90	1.90-2.40	2.40-5.00
Date sampled			20/04/2017	20/04/2017	20/04/2017	20/04/2017	20/04/2017
Test	**Method**	**Units**					
pH	CE004 M	units	7.8	8.1	8.3	8.5	8.1
Sulphate (2:1 water soluble)	CE061 M	mg/l SO_4	426	55	26	20	100