Lincolnshire COUNTY COUNCIL

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Ground Investigation Report for a Proposed Residential Development off Chapelgate, Sutton St James

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UKAS TESTING 0699

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Ground Investigation Report for a Proposed Residential Development off Chapelgate, Sutton St James

Reporter:



Huw Davey
Senior Technician

Reviewer:



Steve Betteridge
Materials Engineer

Distribution:

Copy 1 (PDF) – Kirk Homes Limited, James Kirk
Copy - File

All technical matters within this report have been undertaken under the guidance of **Sam Wells.** Any enquiry relating to this report should be addressed to **Huw Davey** at Lincs Laboratory.

The samples will be stored for one month after publication of the report. Please inform **Huw Davey** if you wish to have these stored for a longer period.

GROUND INVESTIGATION REPORT FOR A PROPOSED RESIDENTIAL DEVELOPMENT OFF CHAPELGATE, SUTTON ST JAMES

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GROUND INVESTIGATION REPORT FOR A PROPOSED RESIDENTIAL DEVELOPMENT OFF CHAPELGATE, SUTTON ST JAMES

1.0 INTRODUCTION

1.1 At the request of Kirk Homes Limited, Lincs Laboratory has undertaken a ground investigation in accordance with the general principles of BS5930 [1] at a proposed residential development site off Chapelgate, Sutton St James, Lincolnshire. The purpose of the investigation was to determine the nature of the underlying soils to enable recommendations to be made to aid the design and construction of the proposed access road.

1.2 The proposed development consists of 28 plots of single storey residential houses with associated driveways, landscaping and access roads.

1.3 This report is based on data from test results and site records obtained during the ground investigation. There is the possibility of variations in ground conditions that have not been revealed during the ground investigation. It should also be noted that changes in groundwater levels are likely to occur from season to season and that higher groundwater levels may be encountered.

The report is also based on the information given to Lincs Laboratory by the client. Should there be any subsequent alterations to the project's design it will be necessary to check with Lincs Laboratory that the geotechnical assessments and recommendations are still valid.

2.0 SITE DESCRIPTION AND GEOLOGY

2.1 The site is situated in the west of the village of Sutton St James, which is approximately 7.5 kilometres south-east of the town of Holbeach and 10 kilometres north-west of the town of Wisbech (Drawing Number 1, Appendix (i)). It consists of a large (approximately 4.5 acres), irregular shaped site, which at the time of the ground investigation was occupied by various farm buildings associated with a piggery and open grassed land used for grazing (Drawing Number 2, Appendix (i)). The site is bound by Chapelgate to the north, farmland to the east and south and Taylor's Drove to the west. Access to the site was off Chapelgate, through the existing farm entrance.

A small pond was present in the eastern field portion of the site at the time of the ground investigation. A black liner was visible within the pond.

2.2 The British Geological Survey 1:50,000 geological sheet for the Spalding area [2] indicates the site to be situated on superficial Tidal Flat Deposits of the Terrington Beds. These are underlain by bedrock geology of the West Walton Formation.

3.0 SITE WORK

3.1 On Thursday 26th October 2017, three trial pits (TPs 1 to 3) were excavated using a mechanical backhoe loader to between 1.90 m and 2.00 m below ground level (BGL) in positions selected by Lincs Laboratory. The trial pits were extended below groundwater levels.

Bulk (B) bag samples were taken from all TPs out of the 0.50m margin below the anticipated sub-grade level.

4.0 LABORATORY WORK

4.1 Lincs Laboratory is registered with the United Kingdom Accreditation Service, UKAS registration No. 0699. Achieving accreditation means that the testing laboratory has demonstrated that it tests to a high standard, through external audits.

4.2 The following tests were completed at the laboratory:
Particle Size Distribution (wet sieve analysis)
California Bearing Ratio (CBR)

The following tests were subcontracted to another UKAS accredited laboratory:
pH
Sulphate

Details of the standards used [3] and the test results are presented in the Laboratory Test Result Report in Appendix (iii).

Lincs Laboratory is accredited for all of the tests undertaken in-house.

5.0 ENGINEERING ASSESSMENT AND RECOMMENDATIONS

5.1 Ground Conditions

The ground investigation confirmed that the anticipated Tidal Flat Deposits are present across the site.

The revealed geology was found beneath a thin layer of firm, brown, clayey and silty topsoil. Topsoil was encountered to a maximum depth of 0.30 m BGL.

In TP1, underlying the topsoil was soft, light brown, slightly clayey silt to a depth of 0.60 m BGL. Underlying this was medium dense, orange-brown and grey, fine grained sand. The trial pit was terminated in this horizon at 1.90 m BGL.

In TP2, underlying the topsoil was soft to firm, grey-brown clay with rootlets to a depth of 0.80 m BGL. Underlying this was medium dense, orange-brown, fine grained sand that became wetter with depth. The trial pit was terminated at 2.00 m BGL in this horizon.

In TP3, underlying the topsoil was soft, brown silty clay to a depth of 0.80 m BGL. Beneath this was stiff, grey-blue clay to a depth of 2.00 m BGL. The trial pit terminated at 2.00 m BGL.

Groundwater was encountered at 2.00 m BGL within TP2 only. The trial pit logs, in Appendix (ii), give the specific details of the encountered soils at each location.

5.2 Sulphate Classification for Concrete

Laboratory sulphate content test result of 0.2 g/l

This indicates a Design Sulphate Classification of DS-1 in accordance with BRE Special Digest 1 [4]. In order to assess an Aggressive Chemical Environment for Concrete (ACEC), the site has been assumed to be brownfield and the groundwater has been assumed to be mobile in the absence of extensive groundwater monitoring. The corresponding slightly alkaline pH value test result of 7.6,

together with the sulphate content values and previous site usage, represents an ACEC classification of AC-1.
The client is advised to refer to the BRE Special Digest 1[4] for construction guidelines for in-situ and pre-cast concrete elements of the construction.

5.3 Road Construction

The ground investigation revealed a weak, cohesive sub-grade. Laboratory CBR test results are presented in the table below.

TP No.	Depth (mBGL)	Moisture Content (%)	Minimum CBR (%)
1	0.50-0.60	28	5.2
2	0.50-0.60	33	4.5
3	0.50-0.60	30	3.0

As the sub-grade is considered to be moisture susceptible, for design purposes it is recommended that a CBR of 3% is used.

The client is advised to refer to the relevant chart in the Lincolnshire County Council Development Road Specification [5] and for construction guidelines and requirements.

5.4 Environmental Risk Assessment

The soils encountered in the trial pits did not show any visual or odorous signs of contamination. Additionally, the surrounding land shows good healthy grass cover and mature trees. Considering all these factors, along with the rural history of the area and the present surrounding land uses, it is not considered that the site is chemically contaminated. Consequently, the risk of contamination associated with constructing and using the site for its intended use as a residential estate is considered to be low. However, as with all developments, the workforce should wear overalls, gloves and boots to minimise contact with soils and water. For example, the presence of water contaminated with Weil's disease (caused by rats) is a small probability and working on many developments increases the overall risk of infection to an individual. Care should be taken if any heavily discoloured or pungent smelling materials are encountered as this could indicate that small amounts of chemicals have been discarded. In the unlikely event of encountering suspicious materials, appropriate advice should be sought.

6.0 REFERENCES

(1) BS 5930: 2015. “Code of Practice for Site Investigation”. British Standards Institution.

(2) BGS 1:50,000 Geological Solid and Drift map for the Spalding Area. Sheet 144. Published 1992.

(3) BS 1377: 1990. "Methods of Test for Soils for Civil Engineering Purposes". British Standards Institution.

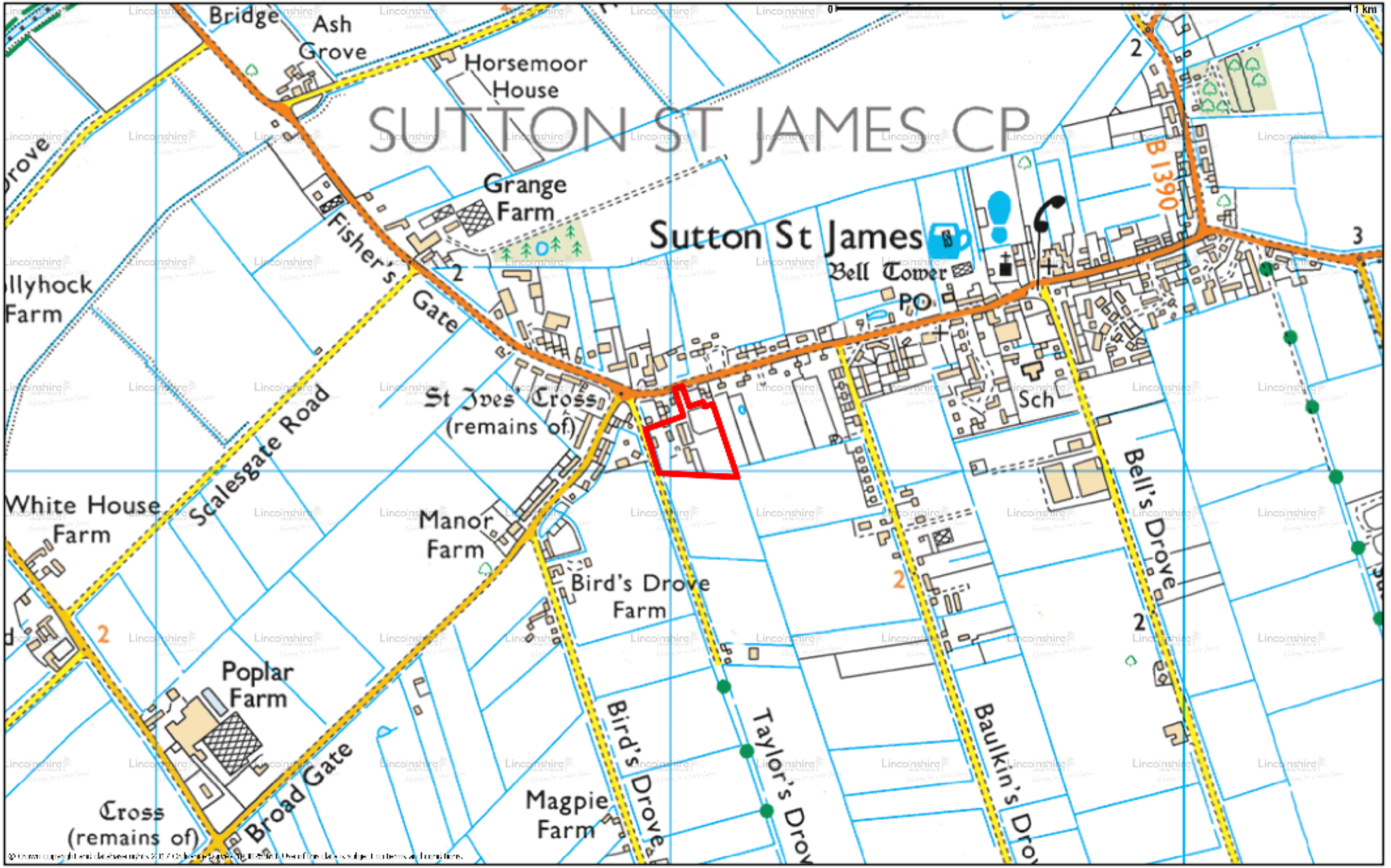
(4) BRE Special Digest 1: “Concrete in Aggressive Ground”. Third Edition. Published 2005. BRE Construction Division.

(5) "Development Road and Sustainable Drainage Specification and Construction". Lincolnshire County Council. March 2017. (Version 4.1)

7.0 APPENDICES

APPENDIX (i)

DRAWINGS



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Scale 1:10000

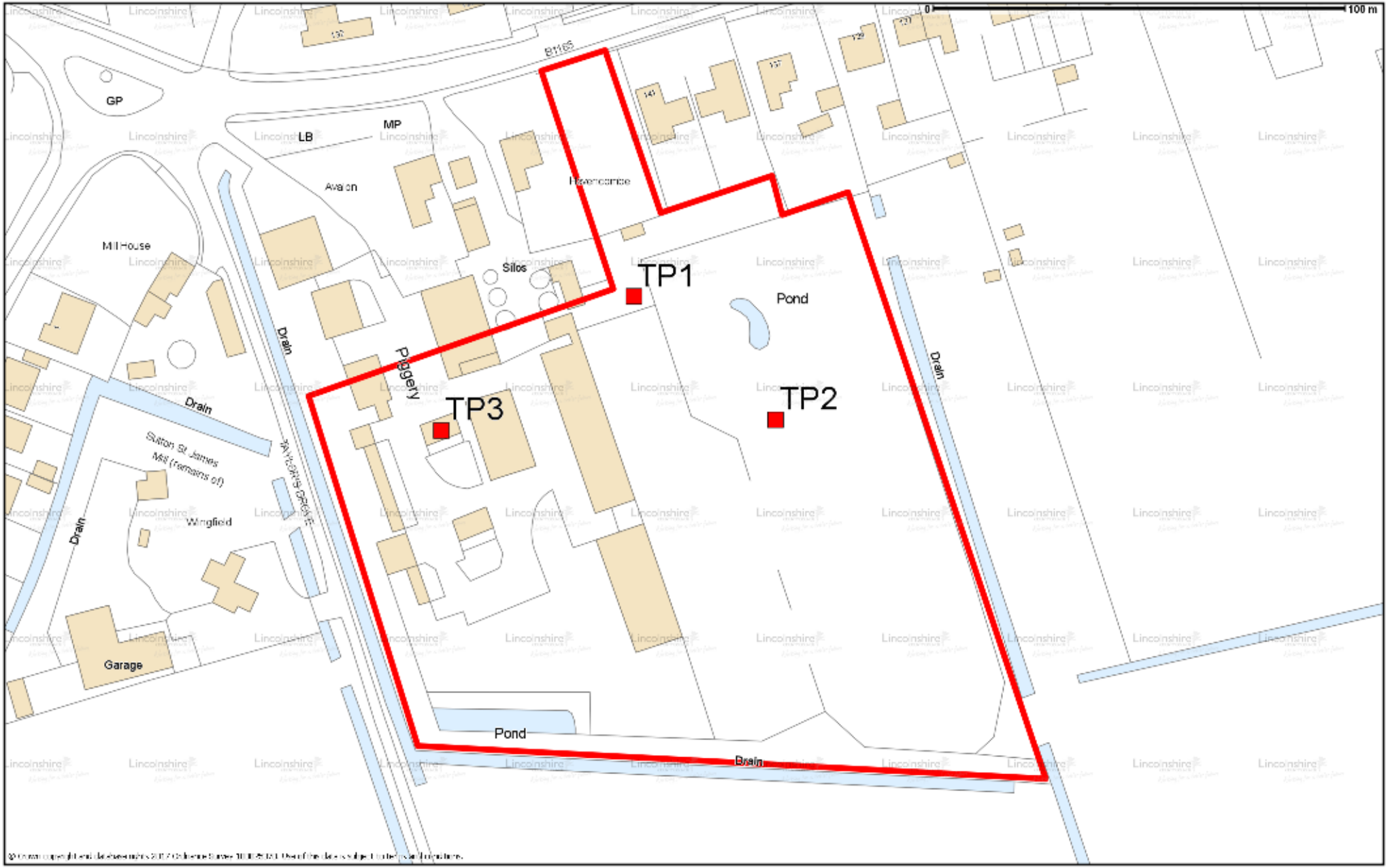
N

Development off Chapelgate, Sutton St James

Site Location Plan

Lincolnshire COUNTY COUNCIL
Working for a better future

Created by Huw Davey on 17 November 2017



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Development off Chapelgate, Sutton St James

Trial Pit Location Plan

Lincolnshire County Council
Working for a better future

Created by Huw Davey on 17 November 2017

APPENDIX (ii)

TRIAL PIT LOGS

TPs 1 to 3

Job Number: 40654	Site: Chapelgate, Sutton St James	Trial Pit.: TP1	Sheet 1 of 1
Remarks : Located on flat grassed area adjacent to existing farm buildings. No groundwater encountered.	**Location:** 539032E - 318104N	**Orientation:**	**Dimensions:** - - Depth : 1.90 m
	Client: Kirk Homes Ltd.	**Face Logged :**	
	Excavation Method: JCB 3CX	**Logged By:** HD	**Log Scale:** 2.50 m/page **Ground Level:** - m AOD

Date (2017)	Depth of Water (m)	Sample/Test No	Sample/Test Type	Sample/Test Depth (m)	Change of Strata Legend	Depth below GL (m)	Reduced Level m AOD (m)	Thickness of Stratum (m)	Description of Strata	MPT Test Result	NMC %	Atterberg Limits LL %	Atterberg Limits PL %	Atterberg Limits PI %	CBR %	Density Bulk Mg/m^3	Density Dry Mg/m^3	Shear Strength Cu kPa	Shear Strength Øu°	Shear Strength Type of Shear Test	Chemical SO_4 g/l	Chemical pH	Other Tests
26/10								0.25	Firm, brown silty TOPSOIL														
						0.25		0.35	Soft, light brown, slightly clayey SILT. (TFD)														
		001	B	0.50-0.60											(T)5.20 (B)5.20								
						0.60		1.30	Medium dense, orange-brown and grey, fine grained SAND. (TFD)														
						1.90			End of Trial Pit at 1.90 m														

Scale as Shown

Disturbed Samples
W Water Sample
D Small Bag
B Large Bag
T Tin J Jar

Undisturbed Samples
U100 105mm Diameter
U38 U100

Groundwater:
▼ Struck ▽ Rose to

Symbols
PT Penetration Tests
P Probe CBR
(i) Other Tests Undertaken

Type of Shear Test
V Shear Vane
SB Shear Box
TX Triaxial (Undrained)
Cu Undrained Cohesive Strength
Øu° Internal Friction Angle

Notes : Geology and Other Tests :
See "Sample Descriptions & Symbols" at end of logs
Soil strengths (in brackets) are assessed from on-site observations

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Telephone (01522) 530355

Job Number: 40654	Site: Chapelgate, Sutton St James	Trial Pit.: TP2	Sheet 1 of 1
Remarks : Located on flat grassed area at rear of the site, in large open field. Groundwater encountered at 2.00 m BGL.	**Location:** 539067E - 318075N	**Orientation:**	**Dimensions:** - - Depth : 2.00 m
	Client: Kirk Homes Ltd.	**Face Logged :**	
	Excavation Method: JCB 3CX	**Logged By:** HD	**Log Scale:** 2.50 m/page **Ground Level:** - m AOD

Date (2017)	Depth of Water (m)	Sample/Test No	Sample/Test Type	Sample/Test Depth (m)	Change of Strata Legend	Depth below GL (m)	Reduced Level m AOD (m)	Thickness of Stratum (m)	Description of Strata	MPT Test Result	NMC %	Atterberg Limits LL %	Atterberg Limits PL %	Atterberg Limits PI %	CBR %	Density Bulk Mg/m3	Density Dry Mg/m3	Shear Strength Cu kPa	Shear Strength Øu°	Shear Strength Type of Shear Test	Chemical SO_4 g/l	Chemical pH	Other Tests
26/10								0.25	Firm, brown clayey TOPSOIL														
		001	B	0.50-0.60		0.25		0.55	Soft to firm, grey-brown CLAY with rootlets (TFD)						(T)4.50 (B)5.50						0.2	7.6	
						0.80		1.20	Medium dense, orange-brown, fine grained SAND. Becoming wetter with depth. (TFD)														
	▼ 2.00					2.00			End of Trial Pit at 2.00 m														

Scale as Shown

Disturbed Samples
W Water Sample
D Small Bag
B Large Bag
T Tin J Jar

Undisturbed Samples
U100 105mm Diameter
U38 U100

Groundwater:
▼ Struck ▽ Rose to

Symbols
PT Penetration Tests
P Probe CBR
(i) Other Tests Undertaken

Type of Shear Test
V Shear Vane
SB Shear Box
TX Triaxial (Undrained)
Cu Undrained Cohesive Strength
Øu° Internal Friction Angle

Notes : Geology and Other Tests :
See "Sample Descriptions & Symbols" at end of logs
Soil strengths (in brackets) are assessed from on-site observations

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Job Number: 40654	Site: Chapelgate, Sutton St James	Trial Pit.: TP3	Sheet 1 of 1
Remarks : Located on small area of grass in between existing farm buildings on west of site. No groundwater encountered.	**Location:** 538986E - 318072N	**Orientation:**	**Dimensions:** - - Depth : 2.00 m
	Client: Kirk Homes Ltd.	**Face Logged :**	
	Excavation Method: JCB 3CX	**Logged By:** HD	**Log Scale:** 2.50 m/page **Ground Level:** - m AOD

Date (2017)	Depth of Water (m)	Sample/Test No	Sample/Test Type	Sample/Test Depth (m)	Change of Strata Legend	Depth below GL (m)	Reduced Level m AOD (m)	Thickness of Stratum (m)	Description of Strata	MPT Test Result	NMC %	Atterberg Limits LL %	PL %	PI %	CBR %	Density Bulk Mg/m^3	Density Dry Mg/m^3	Shear Strength Cu kPa	Øu°	Type of Shear Test	Chemical SO_4 g/l	pH	Other Tests
26/10								0.30	Soft, brown clayey TOPSOIL														
		001	B	0.50-0.60		0.30			Soft, brown silty CLAY. (TFD)						(T)3.20 (B)3.00						<0.1	7.6	
						0.50																	
						0.80			Stiff, grey-blue CLAY. (TFD)														
								1.20															
						2.00			End of Trial Pit at 2.00 m														

Scale as Shown

Disturbed Samples
W Water Sample
D Small Bag
B Large Bag
T Tin J Jar

Undisturbed Samples
U100 105mm Diameter
U38 U100

Groundwater:
▼ Struck ▽ Rose to

Symbols
PT Penetration Tests
P Probe CBR
(i) Other Tests Undertaken

Type of Shear Test
V Shear Vane
SB Shear Box
TX Triaxial (Undrained)
Cu Undrained Cohesive Strength
Øu° Internal Friction Angle

Notes : Geology and Other Tests :
See "Sample Descriptions & Symbols" at end of logs
Soil strengths (in brackets) are assessed from on-site observations

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GROUND INVESTIGATION REPORT FOR A PROPOSED RESIDENTIAL DEVELOPMENT OFF CHAPELGATE, SUTTON ST JAMES

NOTES ON SAMPLE DESCRIPTIONS AND SYMBOLS

1. Sample Descriptions

Sample descriptions are in accordance with BS 5930: 2015 Code of Practice for Site Investigations[1] but with the following additional terms also being used.

rare	intermittent appearance less than 2%
occasional	intermittent appearance 2% to 5%
with a trace	less than 10%
with a little or with frequent	10% to 25%
with some or with numerous	25% to 40%
and	about equal

2. Geology

(TFD)	Tidal Flat Deposits

3. Test Results

Where a result of 0.09g/l is reported for SO_4, the laboratory test result report gave a result of less than 0.1g/l.

APPENDIX (iii)

LABORATORY TEST REPORT

Lincs Laboratory

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UKAS TESTING
0699

TO:

James Kirk
Kirk Homes Ltd
C/O South Lincs Plant Hire
Enterprise Way
Spalding
Lincs
PE11 3YR

REPORT NO: 72091
JOB NO: 40654
DATE: 16 November 2017

PROJECT TITLE: CHAPELGATE, SUTTON ST JAMES
WORK UNDERTAKEN: ANALYSIS OF GROUND INVESTIGATION SAMPLES

Authorising Signature:  (G Johnson; Supervisor – Laboratory Testing)

Notes:

1. This report is factual and only relates to the items tested.
2. Advice on the interpretation of these results is available from Lincs Laboratory Consultancy Staff. Opinions and interpretations are outside the scope of our UKAS/ISO 17025 accreditation.
3. Any samples or their residues will normally be kept for four weeks after the publication of this report.
4. Tests marked 'UKAS accredited' in this report are listed in our UKAS accreditation schedule bearing No. 0699.
5. This report shall not be reproduced except in full, without written approval of Lincs Laboratory.

Distribution:

√1 - Client (Via Huw Davey)
1 - Lab File

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REPORT: 72091
JOB NO: 40654
DATE: 16 November 2017

PROJECT TITLE: CHAPELGATE, SUTTON ST JAMES
WORK UNDERTAKEN: CALIFORNIA BEARING RATIO TEST RESULTS

Lab Sample No:	TP (No:)	Sample (type)	Depth (m)	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)	Moisture Content Top (%)	Moisture Content Base (%)	CBR Value Top (%)	CBR Value Base (%)	CBR Value Mean (%)	Retained 20 mm (%)
S1315-17	1	B	0.50-0.60	1.89	1.48	28	27	5.2	5.2	5.2	0
S1316-17	2	B	0.50-0.60	1.85	1.40	32	33	4.5	5.5	Not Appropriate	0
S1317-17	3	B	0.50-0.60	1.90	1.46	30	30	3.2	3.0	3.1	0

Notes:

i) Sampler : Lincs Lab (HD)
ii) Sampling Procedure : BS 5930:2015 (Not UKAS Accredited)
iii) Date Received : 30.10.17
iv) Date Tested : 30.10 – 02.11.17
v) Test Procedure : BS 1377:Pt 4:1990 Cl 7.4, Surcharge Mass: 13 kg (UKAS Accredited)
Method of Compaction : Dynamic (2.5 kg rammer) BS1377:Part 4:1990 CL 7.2.4.4 Method 5 (UKAS Accredited)
vi) The samples were prepared in accordance with BS 1377:Part 1:1990 (UKAS Accredited)
vii) U = Undisturbed, d = Disturbed, B = Bulk
viii) The samples were tested in an unsoaked condition.
ix) Copies of the force penetration curves are available on request.

Lincs Laboratory

Tel: (01522) 530355 Fax: (01522) 510573

www.Lincolnshire.gov.uk/Lincslab

St Georges Lane
Riseholme
Lincoln LN2 2LQ

REPORT: 72091
JOB NO: 40654
DATE: 16 November 2017

PROJECT TITLE: CHAPELGATE, SUTTON ST JAMES
WORK UNDERTAKEN: ANALYSIS OF GROUND INVESTIGATION SAMPLES

Lab Sample No:	TP No:	Sample Type	Depth (m)
S1315-17	1	B	0.50 – 0.60
S1316-17	2	B	0.50 – 0.60
S1317-17	3	B	0.50 – 0.60

SAMPLE DETAILS:

Sample Type:	U = Undisturbed, d = Disturbed, B = Bulk	Date Received:	30.10.107
Sampler:	Lincs Lab (HD)	Date Tested:	02.11.17
Sampling Procedure:	BS 5930:2015 (Not UKAS Accredited)		

REMARKS:

The above samples were sub-contracted to a UKAS accredited laboratory which are accredited for the tests as detailed in their report. A copy of their report can be found on pages 4 of this report.

UKAS TESTING
0320

NICHOLLS COLTON GROUP

Nicholls Colton Group
7-11 Harding Street, Leicester, LE1 4DH
E-mail: info@nicholls-colton.co.uk
Website: www.nicholls-colton.co.uk
Tel: 0116 253 6333.

TEST REPORT

BS 1377 WATER SOLUBLE SULFATE CONTENT AND pH OF SOIL

40654 – Chapelgate, Sutton St. James

Report no. L17/2446/LIL/001			
Order reference: 80128711	Date of receipt: 03/11/2017	Date of testing: 07 to 13/11/2017	Date of issue: 13/11/2017

NC sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Material passing a 2mm BS test sieve (% dry mass of original sample)	Sulfate content as SO_3 of 2:1 soil/water extract (g/l):	Sulfate content as SO_4 of 2:1 soil/water extract (g/l):	pH value
17-36166	S1316-17, TP2	Disturbed	0.5-0.6	Brown clay.	100	0.2	0.2	7.6
17-36167	S1317-17, TP3	Disturbed	0.5-0.6	Brown silty clay.	100	< 0.1	< 0.1	7.6

NOTES
1. Sample preparation was in accordance with BS 1377 : Part 1 : 2016.
2. Sulphate testing was in accordance with BS 1377 : Part 3 : 1990 Clause 5.5.
3. pH testing was in accordance with BS 1377 : Part 3 : 1990 Clause 9.5.
4. Sulphate content as SO_4 has been calculated by multiplying the sulphate content as SO_3 by 1.2. BS 1377 : Part 3 : 1990 does not require SO_4 figures to be reported.
5. Some information required by BS 1377 has not been reported. This information is available on request.

.....
James Gane
Commercial Manager
Nicholls Colton Group

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