

GROUND INVESTIGATION REPORT

Ashton Keynes
Prepared for: Acorn Bioenergy

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CONTENTS

1.0 INTRODUCTION	1
1.1 Appointment.....	1
1.2 Proposed Development	1
1.3 Background and Objectives.....	1
1.4 Scope of Works	2
1.5 Previous Work.....	2
2.0 SITE DETAILS	3
2.1 Site Details	3
2.2 Previous Assessment.....	4
2.2.1 Preliminary Land Quality Risk Assessment (PLQRA) Findings	5
3.0 GROUND INVESTIGATION	6
3.1 Rationale	6
3.2 Fieldwork Summary	6
3.3 Utility Mapping and Exploratory Location Clearance.....	7
3.4 Ground Conditions.....	7
3.4.1 Site Geology	7
3.5 Field / Visual Observations of Contamination.....	8
3.6 Groundwater and Ground Gas monitoring visit.....	8
3.7 In-situ testing	10
3.7.1 Standard Penetration Tests (SPTs)	10
3.7.2 Plate Bearing Tests	13
3.7.3 Dynamic Probe Testing (DPT)	14
4.0 CHEMICAL LABORATORY RESULTS.....	15
4.1 Soil Analysis.....	15
4.1.1 Soil Analysis Schedule.....	15
4.1.2 Soil Analytical Results	15
4.2 Summary of Laboratory Results	16
5.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)	17
5.1 Human Health Risk Assessment	17
5.1.1 Assessment Methodology	17
5.1.2 Risks to Human Health – Soil	17
5.1.3 Risks to Human Health – Groundwater & Ground Gas	18

5.1.4	Summary – Risks to Human Health	18
5.2	Controlled Waters Risk Assessment.....	18
5.2.1	Assessment Methodology.....	18
5.2.2	Risks to Controlled Waters.....	19
5.2.3	Summary of Risks to Controlled Waters.....	19
6.0	REVISED CONCEPTUAL SITE MODEL.....	20
7.0	OUTLINE GEOTECHNICAL ASSESSMENT	21
7.1	Geotechnical Laboratory Data	21
8.0	DISCUSSION OF GEOTECHNICAL RESULTS	25
8.1	Classification testing	25
8.2	Strength Testing.....	27
8.1	Settlement	27
8.2	Moisture Content / Dry Density Relationship	28
8.3	Chemical Testing	28
9.0	GEOTECHNICAL CONCLUSIONS & RECOMMENDATIONS	29
9.1	Geotechnical Parameters.....	29
9.2	Hardstanding Design	30
9.3	Earthworks	30
9.4	Foundation Options	31
9.4.1	Shrink Swell Potential.....	31
9.4.2	Bearing Capacity and Settlement Performance.....	31
9.4.3	Groundwater.....	32
9.4.4	General.....	32
9.4.5	Floor Slabs.....	32
9.5	General	32
10.0	LAND QUALITY CONCLUSIONS & RECOMMENDATIONS	33
10.1	Conclusions	33
10.1.1	Ground Conditions	33
10.1.2	Visual / Olfactory Indications of Contamination.....	33
10.1.3	Groundwater and Ground Gas	33
10.1.4	Revised Conceptual Site Model	33
10.2	Recommendations	33

DOCUMENT REFERENCES

TABLES

Table 2-1: Site Details	3
Table 3-1: Summary of Strata Encountered.....	7
Table 3-2: Groundwater Levels.....	8
Table 3-3: Ground Gas Concentrations.....	9
Table 3-4: Equivalent CBR Values (%)	13
Table 4-1: Soil Chemical Analysis Schedule.....	15
Table 4-2: Total Organic Carbon Results.....	16
Table 7-1: Geotechnical Laboratory Test Results; Classification Testing	21
Table 7-2: Geotechnical Laboratory Test Results; Particle Size Distribution.....	22
Table 7-3: Geotechnical Laboratory Test Results; Compaction Test.....	23
Table 7-4: Geotechnical Laboratory Test Results; Oedometer Consolidation	23
Table 7-5: Geotechnical Laboratory Test Results; Strength and Density Tests	24
Table 9-1 Geotechnical Parameters.....	29

FIGURES

Figure 3-1: SPT N value with Depth	11
Figure 3-2: Undrained Shear Strength with Depth	12
Figure 3-3: Dynamic Probe Blows with Depth	14
Figure 8-1: Water Content with Depth	26
Figure 8-2: Atterberg Limits.....	27

DRAWINGS

Drawing 01: Site Location Plan	
Drawing 02a: Exploratory Hole Location Plan- Current Layout	
Drawing 02b: Exploratory Hole Location Plan- Proposed Layout	

APPENDICES

Appendix 01: Development Proposal	
Appendix 02: Exploratory Location Borehole and Trial Pit Logs	
Appendix 03: Gas and Groundwater Monitoring Data	
Appendix 04: Plate Bearing Test Results	
Appendix 05: Dynamic Probe Test Results	
Appendix 06: Chemical Laboratory Certificates	
Appendix 07: Assessment Criteria Screening	
Appendix 08: Geotechnical Laboratory Certificates	

1.0 Introduction

1.1 Appointment

SLR Consulting Limited (SLR) was commissioned by Acorn Bioenergy to undertake a ground investigation to support the construction of a proposed new anaerobic digestion facility located at Ashton Keynes, on land west of Ashton Road, Ashton Keynes, Wiltshire, GL7 6DD (the Site). The Site boundary and location plan is provided as Drawing 01.

This report documents the factual results from the ground investigation and consideration of the ground conditions to inform an outline geotechnical assessment, alongside an assessment of the land quality risks prior to development.

1.2 Proposed Development

The proposed development comprises the construction of a new anaerobic digestion facility which will comprise:

- A new hard surfaced access road from the adjacent Ashton Road;
- 5no. fermentor tanks 34m in diameter and 9m in height;
- 6no. slurry, pre-water and dirty water tanks 8m in diameter and 8m in height;
- Ancillary equipment and plant area that includes propane tanks, carbon dioxide tanks, chiller, biogas upgrading unit, grid entry unit, heat exchangers, compressors, CHP units and gas flare;
- 2No. covered lagoons to each hold 10,000m³ of process water;
- 1No. rainwater lagoon;
- 3no. large bays for raw silage feedstock clamps;
- A separator building, straw bunker, straw building and chicken shed;
- Areas for admin block and welfare, car parking, trailer bays and weighbridge; and,
- Hard surfaced road and pavement access within the main central site area.

The biogas generated at the Site will be road tankered to an off-site hub location where it will be injected directly into the grid network. The development proposals are presented in Appendix 01.

Due to the Site being located on a slope it is understood that an earthworks cut and fill exercise will be required across the Site to create a level platform for the development.

1.3 Background and Objectives

The objective of the report is to characterise the ground conditions beneath the Site and allow preliminary design advice for the proposed development. Analysis of field observations and laboratory test results will determine the ground conditions and geotechnical parameters to inform the design.

The secondary objective of the investigation was also to collect appropriate data on the geo-environmental conditions at the Site to allow further assessment of potential contaminant linkages identified within the PLQRA and associated potential development risks associated with the Site.

1.4 Scope of Works

The scope of works required to meet the objectives above are detailed further within Section 3.0, but in summary comprised the following as outlined below:

- review of the current and historic uses of the Site and surrounding area;
- assessment of sensitivity and environmental setting through a review of geological and hydrogeological data and records regarding the quality of nearby surface waters and underlying groundwater;
- preparation of relevant health and safety documentation including a detailed Health & Safety Plan, Risk Assessments and Method Statements for the proposed works;
- clearance of all exploratory locations by an on-site survey utilising a Ground Penetrating Radar (GPR), and Cable Avoidance Tool (C.A.T) and Genny;
- excavate 6no. trial pits to enable characterisation of the shallow ground conditions;
- advance 6no. window sample locations to a target depth of 6m below ground level (bgl) or refusal to enable characterisation of shallow soil deposits;
- the drilling of 2No. cable percussion boreholes to enable characterisation of soils to a target depth of 10m bgl or refusal;
- undertake a dynamic probing investigation;
- undertake in-situ plate load bearing tests;
- installation of gas and groundwater monitoring wells;
- collection of soil samples for geotechnical and geo-environmental laboratory analysis;
- carry out preliminary groundwater and ground gas monitoring at installed monitoring wells;
- carry out geochemical and geotechnical laboratory testing to support the Land Quality Risk Assessments and Geotechnical Assessment; and,
- produce a factual and interpretive report detailing the findings of the investigation with recommendations for further work.

1.5 Previous Work

This Ground Investigation Report follows on from a desk-based Phase 1 Preliminary Land Quality Risk Assessment (PLQRA) for the Site undertaken by SLR:

- Preliminary Land Quality Risk Assessment (PLQRA) Ashton Keynes - Anaerobic Digestion Facility. SLR Ref: 404.11923.00004 Version No: 2.0 SLR Consulting Ltd, February 2023.

The PLQRA should be referred to for more detailed site walkover and desk study review information.

2.0 Site Details

2.1 Site Details

The Site details taken from the PLQRA are summarised in Table 2-1 and presented within the Site Location Plan provided in Drawing 01.

**Table 2-1:
Site Details**

Site Details		
Location	Land west of Ashton Road, Ashton Keynes, Wiltshire, GL7 6DD. Grid Reference 403985 196141 identifies the approximate location (Drawing 01).	
Current Site Use	The Site is in use as arable cropland, which at the time of the investigation had crops growing in.	
Existing Buildings & Hardstanding	There have been no previous developments within the site boundary and there is no evidence of any previous structures being present.	
Utilities	No utilities present on site. A shallow drainage ditch runs through the site, east to west.	
Drainage System	The Site is arable cropland and therefore surface water drainage is direct to ground.	
Surrounding Land Use	North	Arable fields.
	East	Ashton Road then arable fields - a closed landfill which has been restored to sheep pasture. Commercial/residential properties are located beyond.
	South	Arable fields. Aggregate Industries depot and lakes beyond to the southeast.
	West	Arable fields with lakes beyond.
Site History	From first available maps dated 1875 onwards the Site comprises undeveloped land, with a public footpath running along the western boundary and Ashton Road running off-site adjacent to the eastern boundary. Mapping from 1956 onwards shows a rectangular structure approximately 10m west of the northwest corner of site which remains present, corresponding with a derelict barn. The wider surrounding area has been subject to progressive sand and gravel extraction which appears to have occurred from the 1950s. The extracted areas do not appear to have been infilled, resulting in the formation of many lakes. To the southeast an Aggregate Industries depot is present. By the late 1980s a gravel pit was present approximately 20m east and southeast of the site. By 1994 the gravel pit is shown as disused and partially infilled. Aerial imagery shows landfilling operations were occurring across much of the land east of Ashton Road in 1999 but	

Site Details		
		the landfill appears to have been restored and closed by 2006 and has remained relatively unchanged since.
Geography	Topography, gradient and elevation	The topography of the site generally slopes from west to east, towards Ashton Road, from approximately 102m aOD in the northwest to 92m aOD at the southeast boundary.
	Surface waters	There are no surface water features on-site other than a shallow field drain crossing the site east-west in the southern area creating a field boundary. The risk of surface water flooding is largely designated as negligible. The nearest recorded surface water feature is a small unnamed inland drain 150m north which drains to the northeast, to the Cerney Wick Brook (350m northeast), a poor-quality watercourse. A lake is present 350m southeast, formed by former sand and gravel extraction. Several additional lakes are present within 1km to the west, east and south.
Geology and Hydrogeology	Superficial	Superficial deposits are not recorded on-site, however the Northmoor Sand and Gravel Member is recorded immediately east and may intrude into the eastern site boundary.
	Solid	The bedrock geology is recorded as the Kellaways Clay Member – Mudstone. The Cornbrash Limestone Formation is understood to underly the Kellaways Clay Member.
	Aquifer status	The adjacent superficial deposits are designated a secondary A aquifer of high vulnerability. The Kellaways Clay bedrock deposits are designated as unproductive. The Cornbrash Limestone Formation is designated as a principal aquifer.
	SPZ / Groundwater abstractions	The Site is located within a source protection zone 2 (SPZ2)

2.2 Previous Assessment

The previous Phase 1 Preliminary Land Quality Risk Assessment (PLQRA) qualitatively assessed potential land contamination risks associated with the Site for a commercial/light industrial use.

The assessment indicated that there was no evidence of potentially significant sources of contamination identified on site during the walkover or from published information. However, potentially significant off-site sources of contamination were identified at the closed landfill, comprising the landfill itself and an assumed (to be confirmed) above ground leachate storage tank located on the landfill site.

A summary of the findings from the PLQRA are provided in the following section.

2.2.1 Preliminary Land Quality Risk Assessment (PLQRA) Findings

UK contaminated land statutory guidance and associated supporting guidance documents including LCRM¹ and R&D66² recommend that a qualitative assessment of risk should be provided for each identified PPL to determine any risk management actions.

Qualitative risk assessment indicated that the off-site closed landfill represents a moderate/low risk of contamination impacts to on-site human health and buildings associated with the proposed development due to the potential migration and accumulation of ground gases (PPL1). It also indicated the off-site assumed leachate storage tank associated with the landfill represents a low risk to human health and buildings (PPL2).

The findings of the PLQRA concluded that that to address PPL1 the on-site geology needed to be confirmed and potential gas risk monitored. No further action was deemed necessary to address PPL2.

¹ Land Contamination Risk Management (LCRM), EA 2020

² Guidance for the Safe Development of Housing, R&D66, DEFRA, EA, CIEH 2008

3.0 Ground Investigation

3.1 Rationale

A ground investigation scope was developed by Acorn Bioenergy's consulting engineers GGP Consult to provide geotechnical information for the proposed development design and to baseline the land quality contamination status of the Site.

The rationale for the investigation was therefore to:

- confirm the nature of the ground and collect soil samples for both chemical and geotechnical analysis;
- undertake in-situ testing for both land quality and geotechnical purposes;
- install groundwater and ground gas monitoring wells across the Site;
- confirm the depth and elevation of groundwater;
- complete a round of groundwater and gas monitoring;
- develop an updated understanding of the Ground Model and subsequently the Conceptual Site Model (CSM) to inform site characterisation; and
- obtain sufficient data to provide preliminary geotechnical and land quality recommendations for development design.

3.2 Fieldwork Summary

SLR conducted an intrusive ground investigation at the Site in February 2023. The scope of the investigation specified by GGP Consult included the following:

- excavation of 6No. trial pits (TP101 – TP106) to depths of between 2.60m and 3.00m bgl³;
- advancement of 6No shallow boreholes (SBH1 to SBH6) between 3.50m to 4.50m bgl utilising a terrier rig;
- drilling of 2No. deep borehole (DBH1 and DBH2) to a depth of 10m bgl utilising a cable percussion rig;
- in-situ testing including Standard Penetration Tests (SPTs);
- intrusive dynamic probing investigation (DP1 – DP10) to 6m bgl utilising a terrier rig;
- in-situ plate load tests using a 14 tonne excavator (PBT 1, 2, 3, 4 and 5);
- field screening of soil samples for volatile organic compounds (VOC's) utilising a photo-ionisation detector (PID);
- supervision and logging of all exploratory locations in accordance with BS5930:2015 +A1:2020⁴ by a suitability qualified engineer;
- recovery of soil samples for geotechnical and chemical laboratory analysis;
- dual installation of 50mm and 19mm monitoring wells in 8No. locations for gas and groundwater monitoring.

³ Metres below ground level (m bgl)

⁴ British Standards Institution (2020). BS 5930:2015+A1: 2020 BSI Standards Publication Code of Practice for Ground Investigations

The locations of all exploratory locations are shown on Drawing 02a, which shows the Site in its current layout. Drawing 02b shows the exploratory hole locations in relation to the proposed development.

Chemical laboratory analysis was undertaken by Element Laboratories, Deeside.

Geotechnical laboratory analysis was undertaken by Geolabs Limited.

3.3 Utility Mapping and Exploratory Location Clearance

Prior to intrusive works, SLR procured buried service plans and also carried out a survey utilising a CAT and Genny, and a Ground Penetrating Radar (GPR) to identify any buried objects at all proposed exploratory locations.

The service survey and clearance was undertaken by CC Ground Investigation Ltd on 20th February 2023.

3.4 Ground Conditions

Detailed descriptions of the underlying geology are provided within the borehole and trial pit logs in Appendix 02. A summary of site observations are provided within Table 3-1.

A total of 6No. window samples (SBH1-SBH6) were advanced to a maximum depth of 4.50m bgl, 2No. cable percussion boreholes (DBH1 and DBH2) were drilled to a depth of 10m bgl and 6No. trial pits (TP101-TP106) were excavated to depths between 2.60m and 3.00m between 20th and 24th February 2023.

3.4.1 Site Geology

Table 3-1 below shows a summary of the encountered geology during the intrusive investigation.

Table 3-1:
Summary of Strata Encountered

Ground Type	Strata	Description	Depth Range (m bgl)
Topsoil	Topsoil	Very soft to soft dark brown sandy silty clay.	0.0 – 0.30
Superficial	Alluvium – Northmoor Sand and Gravel Member	Very soft to soft yellowish brown sandy clay.	0.08 – 2.50
Bedrock	Kellaways Clay Member – Mudstone	Soft mottled orange, brown and grey sandy silty clay and stiff blueish grey clay.	0.76 – 10
Bedrock	Cornbrash Limestone Formation	Not encountered.	-

No Made Ground was identified on-site, all encountered soils were deemed to be of natural origin.

Topsoil was found in all exploratory locations, to a maximum depth of 0.3m bgl (in DBH1, SBH3 and TP106). The topsoil was generally consistent across the site comprising of very soft to soft dark brown silty sandy clay, with occasional rootlets.

Although Alluvium is not mapped on-site, it is mapped very nearby as the Northmoor Sand and Gravel Member and was encountered in all exploratory hole locations. It comprised very soft to soft yellowish brown sandy clay and was encountered to a maximum depth of 2.50m bgl (SBH2).

The Kellaways Clay Member was encountered in all of the exploratory locations. It can be separated into two distinct strata's. At shallower depths the encountered soils comprised of soft mottled orange, brown and grey slightly sandy silty clay. At greater depths the encountered soils comprised of stiff blueish grey/grey clay, with occasional mudstone nodules. This was found to extend beneath the final depths of all exploratory holes.

The Cornbrash Limestone Formation was not encountered in any of the exploratory hole locations.

3.5 Field / Visual Observations of Contamination

Topsoil was identified within each exploratory location and no Made Ground was observed to be present. No evidence of any visual contamination, staining and/ or olfactory indications of possible contamination was encountered within any of the exploratory hole locations.

Field screening of soil samples from all the exploratory hole locations was undertaken using a Photo Ionisation Detector (PID) with no organic vapour concentrations recorded throughout (<0.1ppm). Results are presented on the borehole logs in Appendix 02.

3.6 Groundwater and Ground Gas monitoring visit

SLR returned to site on the 17th March 2023 to undertake 1No. round of groundwater and ground gas monitoring of the installed monitoring wells (SBH1 – SBH6 and DBH1 – DBH2) so as to ascertain water and ground gas levels post investigation. The encountered groundwater levels are provided in Table 3-2. The encountered gas concentrations are provided in Table 3-3. All data is presented in Appendix 03.

Table 3-2: Groundwater Levels

Monitoring Well	Screened Interval (m)	Groundwater Level (m bgl)	Screened Interval Flooded (✕ / ✓)	Ground Level (mAOD)
SBH1 (19mm)	0.50 – 1.20	1.07	✕	92.36
SBH1 (50mm)	3.00 – 4.00	0.64	✓	92.36
SBH2 (19mm)	0.50 – 1.20	0.56	✕	100.00
SBH2 (50mm)	3.00 – 4.00	0.52	✓	100.00
SBH3 (19mm)	0.50 -1.20	0.54	✕	92.16
SBH3 (50mm)	3.00 – 4.00	0.55	✓	92.16
SBH4 (19mm)	0.50 – 1.20	0.43	✓	99.82
SBH4 (50mm)	2.00 – 3.00	0.51	✓	99.82
SBH5 (19mm)	0.50 – 1.20	1.03	✕	90.80
SBH5 (50mm)	2.00 – 3.00	1.02	✓	90.80
SBH6 (19mm)	0.50 – 1.20	1.32	✕	90.47

Monitoring Well	Screened Interval (m)	Groundwater Level (m bgl)	Screened Interval Flooded (✗ / ✓)	Ground Level (mAOD)
SBH6 (50mm)	2.00 – 3.00	1.35	✓	90.47
DBH1 (19mm)	0.00 – 1.50	0.99	✗	92.36
DBH1 (50mm)	7.00 – 10.00	0.88	✓	92.36
DBH2 (19mm)	0.00 – 1.50	1.20	✗	91.63
DBH2 (50mm)	7.00 – 10.00	0.87	✓	91.63

Water strikes were observed in only SBH2 and SBH3 during the advancement of the boreholes, with the strikes being encountered at 1.50m and 3.40m respectively. As shown in Table 3-2 groundwater was recorded during the return monitoring visit in all of the boreholes. The minimum groundwater depth was recorded in SBH4 (19mm) at 0.43m bgl and the maximum groundwater depth was recorded in SBH6 (50mm) at 1.35m bgl. Water depths recorded in SBH1 – SBH4 were generally similar, as were depths recorded in SBH5 and SBH6 and both deep boreholes.

Table 3-3: Ground Gas Concentrations

Monitoring Well	Barometric Pressure (mbar)	Methane Steady State (% v/v)	Carbon Dioxide Steady State (% v/v)	Oxygen Steady State (% v/v)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Flow (l/hr)	Gas Pressure (mbar)
SBH1 (19mm)	994	<0.1	1.8	20.8	2	<0.1	0.1	0.02
SBH2 (19mm)	994	<0.1	0.1	21.0	<0.1	<0.1	<0.1	0.04
SBH3 (19mm)	994	<0.1	0.1	21.0	1	<0.1	0.1	0.02
SBH4 (19mm)	994	<0.1	0.1	20.8	<0.1	<0.1	0.2	0.02
SBH5 (19mm)	994	<0.1	1.4	20.8	<0.1	<0.1	0.1	0.11
SBH6 (19mm)	994	<0.1	1.0	20.8	<0.1	<0.1	0.1	0.04
DBH1 (19mm)	994	<0.1	0.1	20.8	<0.1	<0.1	<0.1	0.03
DBH2 (19mm)	994	<0.1	0.1	21.3	<0.1	<0.1	0.1	0.02

As shown in Table 3-3 ground gas concentrations across the site were generally found to be low. Methane was not recorded in any of the locations. The maximum concentration of carbon dioxide detected was 1.8% v/v in SBH1 (19mm). Oxygen concentrations were generally consistent across the site. Low levels of Carbon Monoxide were detected in SBH1, SBH3, DBH1 and DBH2, with a maximum concentration detected of 6ppm in DBH2 (50mm). Low flows were detected in the majority of the boreholes but none are deemed to be significant. DBH2 (50mm) recorded the highest flow of 1.2l/hr and also recorded the highest gas pressure of 17.4mbar.

3.7 In-situ testing

3.7.1 Standard Penetration Tests (SPTs)

A total of thirty-one in-situ SPTs were conducted in all borehole locations (DBH1, DBH2 and SHB1 – SBH6) from 1.2m to a maximum depth of 10.0m bgl. Results are presented on the borehole logs in Appendix 02 and presented in **Error! Reference source not found.**

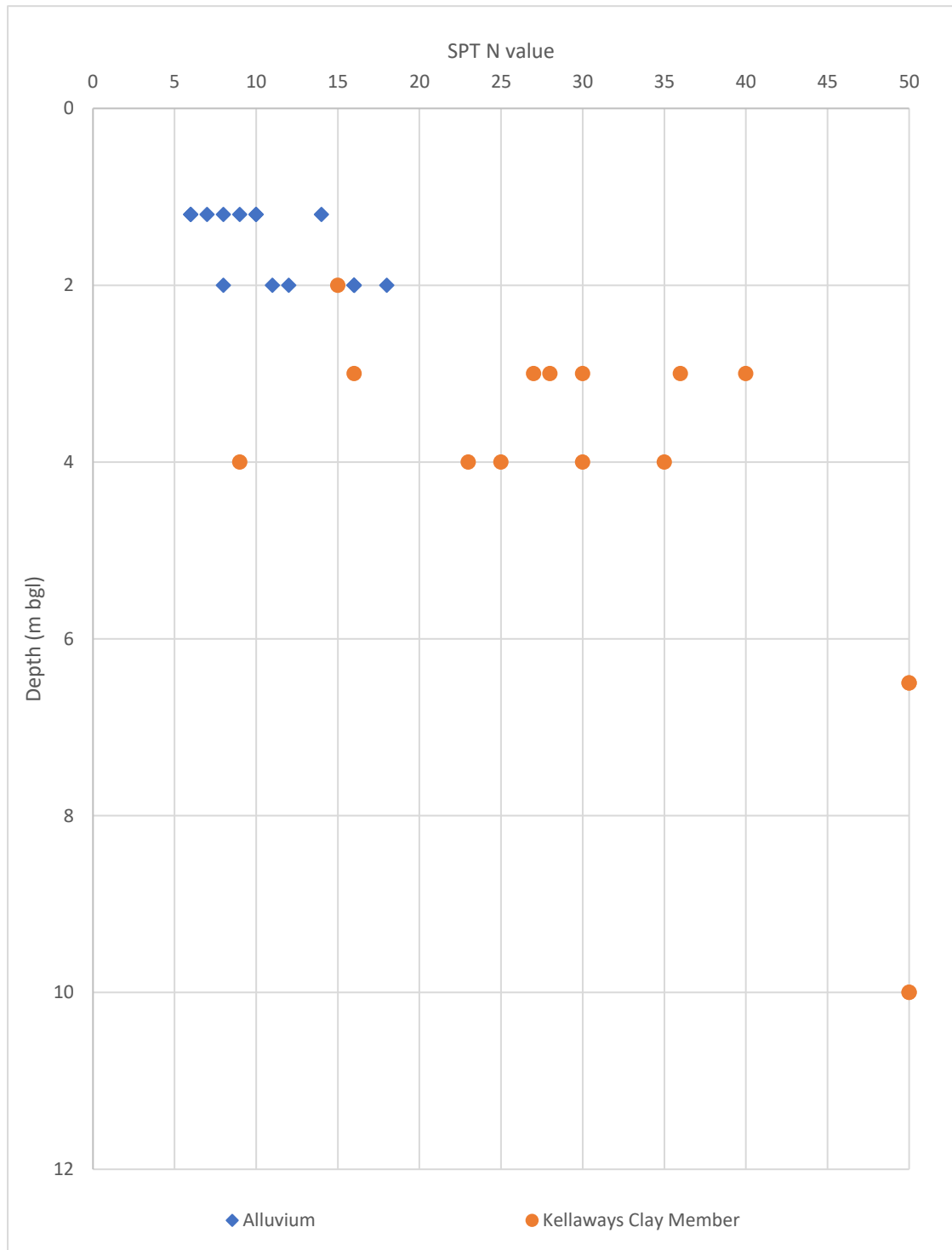
Fifteen tests were conducted within Alluvium, comprising sandy clay. SPT N values of between 6 and 18, with an average of 11, were recorded at depths of 1.2m and 2.0m bgl. This is indicative of low to high strength material.

SPT N values within the Kellaways Clay Member comprising silty sandy clay ranged between 9 and refusal (>50 blows) with an average of 32. This is indicative of medium to very high strength material. As shown in Figure 3-1, the N value increases with depth.

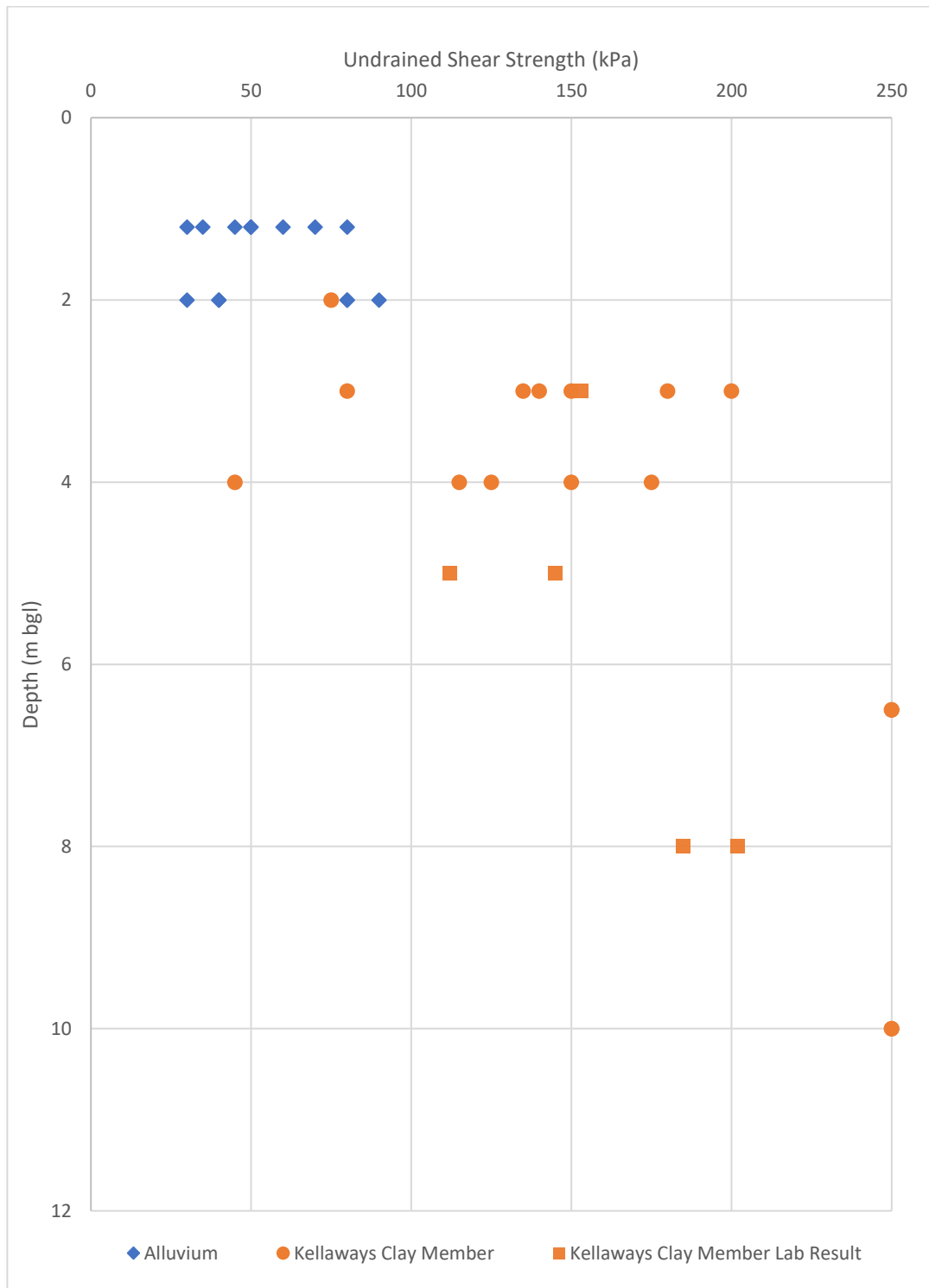
A correlation between undrained strength in clay and SPT N-value is proposed by Stroud⁵ (1989) with values against depth presented in **Error! Reference source not found.**; which indicates the Alluvium as a low to high strength material with undrained shear strengths of between 30kPa and 90kPa and show a high variability with no correlation with depth. The Kellaways Clay Member is interpreted as a medium to high strength material with undrained shear strengths of between 45kPa and 250kPa. This is comparable with the field descriptions that identified the clay as firm to stiff and show an increase with depth. However, the relationship is not considered to be as reliable as laboratory testing and alternative in-situ test methods.

⁵ Stroud, M.A. (1989). *The Standard Penetration Test – its application and interpretation. Penetration testing in the UK*, Thomas Telford.

Figure 3-1:
SPT N value with Depth



**Figure 3-2:
Undrained Shear Strength with Depth**



3.7.2 Plate Bearing Tests

In-situ plate bearing tests were undertaken at five locations, PBT1 - PBT5, across the Site using a 455mm diameter plate and an 8-tonne excavator as the kentledge.

Equivalent CBR values are summarised in Table 3-3 with full results presented in Appendix 04. Testing was conducted beneath the Topsoil within Alluvium comprising sandy clay. CBR values ranged between 0.89% and 4.4%.

A maximum applied pressure of 249kPa was applied at all test locations and resulted in settlement of between 6.8mm and 19.4mm.

Table 3-3: Equivalent CBR Values (%)

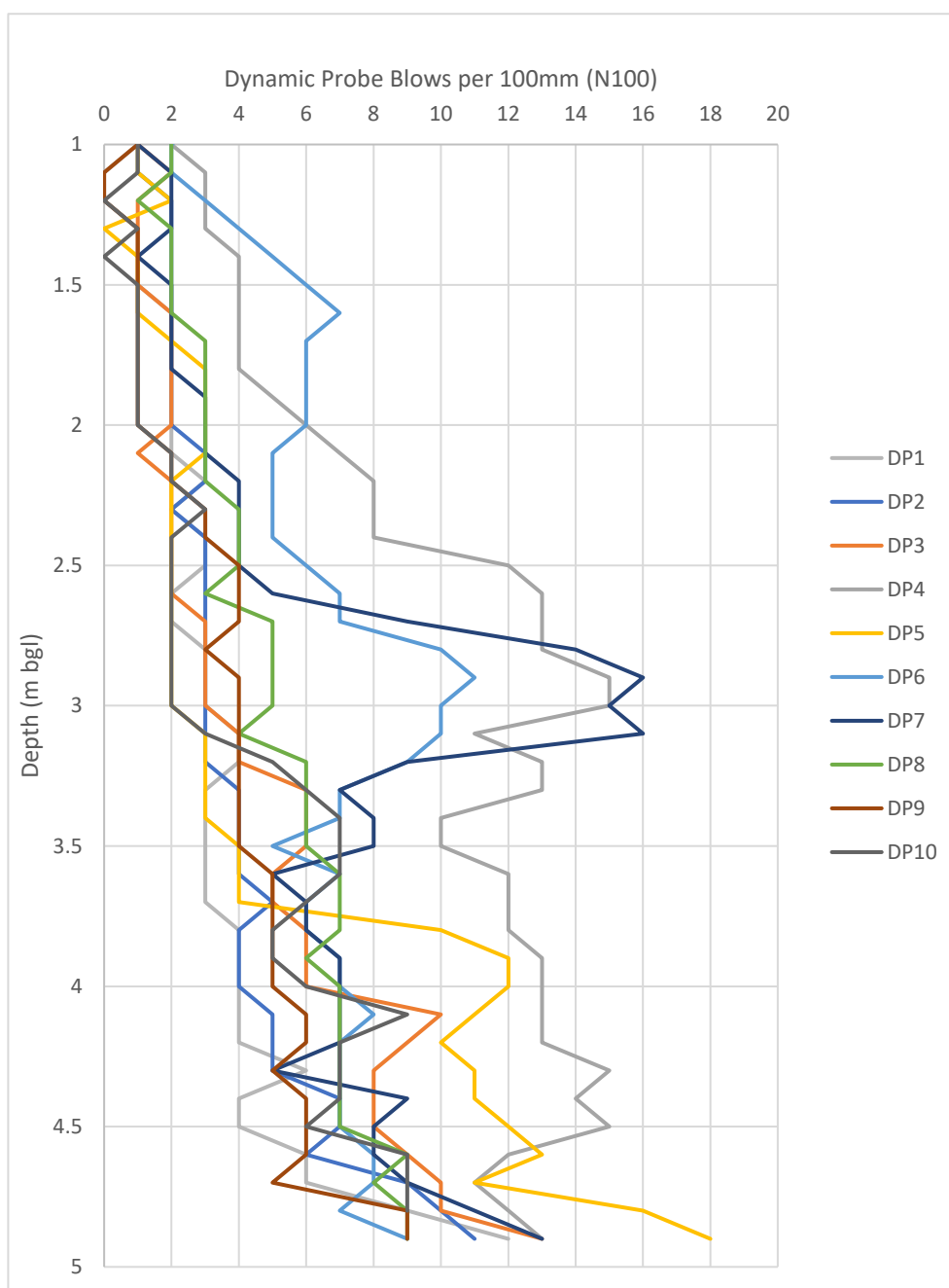
Exploratory Location	Depth (m bgl)	Equivalent CBR (%)
PBT1	0.2	0.89
PBT2	0.2	4.4
PBT3	0.2	1.1
PBT4	0.2	2.6
PBT5	0.2	1.8

3.7.3 Dynamic Probe Testing (DPT)

Dynamic Probe Testing was conducted utilising a Terrier Rig from ground level to a maximum depth of 5.0m bgl in ten locations across the Site (DP1 – DP10).

The results of the DPTs are presented in Appendix 05 and **Error! Reference source not found.** presents the N100 (number of blows per 100mm increment) with depth. The figure shows that the N100 across the Site is relatively consistent at each test location. The figure also presents the increase in strength from the Alluvium to the Kellaways Clay Formation between 1.5m and 2.0m bgl and the gradual increase with depth within the Kellaways Clay, comparable with the field descriptions and SPT testing.

Figure 3-4:
Dynamic Probe Blows with Depth



4.0 Chemical Laboratory Results

4.1 Soil Analysis

4.1.1 Soil Analysis Schedule

Table 4-1 summarises the soil chemical analysis scheduled during SLR's ground investigation. A total of 48No. soil samples were submitted for laboratory analysis and 8No. were scheduled for analysis.

Table 4-1:
Soil Chemical Analysis Schedule.

Contaminants	Number of Samples		
	Topsoil	Northmoor Sand and Gravel Member	Kellaway Clay Member
pH	4	2	2
Metals	4	2	2
Speciated PAHs (Poly-aromatic Hydrocarbons)	4	2	2
Speciated TPH (TPH-CWG inc BTEX)	4	2	2
Total Cyanide	4	2	2
Total Organic Carbon (TOC)	4	2	2
Asbestos Screening	4	0	0

All soil samples were stored in cool boxes and transported by courier under chain of custody protocol to Element Materials Technology.

4.1.2 Soil Analytical Results

Laboratory certificates are presented in Appendix 06. The data trends and key points are summarised below:

- the concentration of metals across the site are generally low and consistent with background concentrations for the area where available, as indicated by BGS Geoindex mapping. However, there were greater concentrations noted in the samples for arsenic, barium, beryllium, chromium, lead, mercury, nickel, vanadium and zinc. The highest total metal concentration was recorded in DBH1, SBH6 and TP105.
- PAH concentrations were below the laboratory limits of detection (LOD) in samples from SBH3, 4, 6 and TP103. In the remaining samples the PAH concentrations were only slightly above the LOD.
- petroleum hydrocarbons (TPH) were not detected in any of the samples tested, with one exception (SBH5 at 0.15m – Aliphatics >C21-C35). All other concentrations recorded were below the LOD and indicative of natural humic soils;
- PCBs and cyanide were recorded below the LOD in all instances; and,
- asbestos fibres were not detected within any of the 4 samples tested.

4.2 Summary of Laboratory Results

Based on the laboratory results, the following qualitative conclusions have been made with respect to assessment of contaminants:

- concentrations of contaminants in soils are low and metal concentrations are consistent with background concentrations for the area;
- no visible asbestos or asbestos fibres have been recorded within any of the samples or investigation locations;
- PAHs and TPH were recorded slightly above the LOD in a few of the samples, with the majority being recorded as below the LOD; and
- PCBs and cyanide were recorded below the LOD across the site.

Table 4-2 shows the recorded levels of Total Organic Carbon (TOC). TOC can be an indicator of the potential for a degradable fraction to be present in the soil which could result in decomposition to generate ground gases such as carbon dioxide and methane.

Table 4-2: Total Organic Carbon Results

Sample	Total Organic Carbon (%)
DBH1 @ 0-0.30m	1.2
SBH3 @ 3.45m	0.46
SBH4 @ 1.50m	0.14
SBH5 @ 0.15m	1.2
SBH6 @ 1.25m	0.59
TP102 @ 0.10m	1.4
TP103 @ 1.20m	0.16
TP105 @ 0-0.20m	1.7

Concentrations of TOC are generally low (<2 %) in all samples, the highest being recorded in TP105 at 0-0.20m with a concentration of 1.7% which is a topsoil sample. During construction all topsoil will be excavated and stockpiled. The recorded concentrations of TOC across the site do not indicate a potential gas risk to human health or property from carbon dioxide or methane, there were no indications of significant organic material being observed in natural material during the ground investigation and no hydrocarbon/organic made ground contamination has been observed and on this basis the risks from ground gas are not considered to require further assessment.

5.0 Generic Quantitative Risk Assessment (GQRA)

5.1 Human Health Risk Assessment

5.1.1 Assessment Methodology

Generic Assessment Criteria (GAC) have been used to assess the significance of soil contaminant concentrations recorded. The generic assessment criteria are drawn from several sources of guidance, some from non-statutory guidance and some informal. SLR uses a combination of assessment criteria that are currently available to assist in the screening of soil data prior to determining whether further action is required. The following assessment criteria (known as generic assessment criteria or GAC) have been used for the assessment of contaminant levels in soil:

- Category 4 Screening Levels (C4SLs) (DEFRA) where available. In 2014 DEFRA commissioned CL:AIRE to produce screening values that would allow an assessment land within Category 4 under Part 2A of the Environmental Protection Act (1990), under the planning regime and the DCLG's Planning Practice Guidance on Land Affected by Contamination, which includes a reference to the use of C4SLs under planning. C4SL's are available for the following contaminants: arsenic, benzene, benzo(a)pyrene (BaP), cadmium, chromium VI and lead; and,
- LQM/CIEH Suitable for Use Levels (S4ULs) – in 2015 Land Quality Management and the Chartered Institute of Environmental Health published S4ULs derived following CLEA technical guidance and using the Environment Agency's CLEA UK model, with updated toxicological and exposure parameters and land uses following the publication of the C4SLs. Whilst S4ULs utilise the same exposure parameters as C4SLs, the toxicological data utilised comprises the use of benchmark doses (BMDs) whereas the C4SLs utilise low levels of toxicological concern (LLTCs).

If the concentrations recorded on site are lower than the GAC it is generally accepted that the contaminants in question are present at acceptable concentrations which are not capable of putting human health at significant risk - as long as the humans make use of the site in a relatively standard and normal way. An exceedance of these values indicates to an assessor that soil contaminant concentrations need to be considered further. Generic assessment criteria combine both authoritative science and policy judgements.

The S4ULs / C4SLs used have been derived using the CLEA model according to several typical land uses:

- residential (with and without vegetable growth);
- allotments;
- commercial/industrial;
- Public Open Space residential (POS1); and,
- Public Open space park (POS2).

The proposed development at the site is considered a commercial/industrial land use. Therefore GAC for commercial land use was selected.

A soil organic matter (SOM) content of 1% has been used in the assessment, to be suitably conservative.

5.1.2 Risks to Human Health – Soil

General Contaminants

The laboratory analysis recorded no exceedances relating to commercial/industrial GACs protective of human health. Screening sheets are attached as Appendix 07.

Asbestos

In summary of the field and laboratory results SLR would comment that:

- ACMs have not been visually identified at the locations investigated; and
- No asbestos fibres have been detected within any of the 4 soil samples tested.

The results indicate that the short-term and long-term risks from asbestos in soils are likely to be very low.

5.1.3 Risks to Human Health – Groundwater & Ground Gas

No groundwater was sampled as part of these works, however given the greenfield nature of the Site and the absence of any identified contamination during the site investigation or within the subsequent soil laboratory analysis results it is considered that risks to human health from groundwater are negligible.

A preliminary round of ground gas monitoring has indicated gas screening values in line with CIRIA (C665)⁶ Characteristic Situation 1 (CS1) – very low risk. However, this should be noted is from only one round of monitoring.

5.1.4 Summary – Risks to Human Health

No exceedances of the screening criteria protective of human health were recorded in the soils sampled at the site in relation to a commercial land use. The concentrations of contaminants in soil on-site are not considered to present an unacceptable risk to human health for the proposed land.

No visual and/ or olfactory indications of contamination were recorded in soils or groundwater.

As indicated, asbestos has not been recorded at the Site.

Potential risk from ground gas is considered very low.

Potential short-term risks to human health during construction and longer-term risks under the proposed future commercial use of the site are considered to be low due to the background levels of contamination recorded and the absence of any asbestos being detected. However, future site construction and maintenance workers should ensure that appropriate personal protective equipment (PPE) is worn and that risk assessments ensure the protection against exposure to potential contamination. The future commercial/industrial development is likely to comprise hard cover that will further mitigate any risks.

5.2 Controlled Waters Risk Assessment

5.2.1 Assessment Methodology

In order to assess the potential significance of dissolved phase concentrations of contamination in groundwater, results would be screened against the SoBRA groundwater Generic Assessment Criteria⁷ protective of human health under a commercial/industrial end use which are considered appropriate based on the proposed development.

The Site is in a location which has a high risk to groundwater, due to the bedrock being a principal aquifer and a moderate risk to surface water due to the stream/drainage channel along the northern site boundary. Screening would be undertaken using the most conservative environmental quality standard (EQS) or drinking water standard (DWS) value for any particular contaminant to ensure that a protective approach to the water environment has been undertaken.

⁶ CIRIA (C665) Assessing risks posed by hazardous ground gases to buildings, December 2007

⁷ SoBRA, Development of Generic Assessment Criteria for assessing vapour risks to human health from volatile contaminants in groundwater, Version 1.0, February 2017.

5.2.2 Risks to Controlled Waters

No groundwater was sampled as part of these works, and therefore such a water quality screening assessment cannot be completed. Given the greenfield nature of the site and the absence of any identified contamination during the site investigation or within the subsequent soil laboratory analysis results it is considered that risks to groundwater or surface water receptors are negligible. It is considered that should contaminant concentrations be detected within groundwater present beneath the site that it would likely be representative of background water quality.

5.2.3 Summary of Risks to Controlled Waters

No visual and / or olfactory indications of contamination were recorded during the ground investigation. Whilst no groundwater samples were collected as part of these works, given the background concentrations detected in soils and the absence of any known potential sources given the greenfield nature of the Site it is not considered that controlled waters receptors are at risk from potential site derived contamination.

It is considered that concentrations that could be detected in groundwater are likely to be representative of background water quality.

As such, risks to groundwater and surface water receptors are therefore not considered to be significant.

6.0 Revised Conceptual Site Model

As discussed in Section 2.0, the Phase 1 PLQRA identified one potential contaminant source-pathway-receptor linkage. This was the off-site closed landfill which was concluded to potentially represent a moderate/low risk to on-site human health and buildings due to the potential migration and accumulation of ground gases.

This report refutes this conclusion. During the site investigation no visual or olfactory evidence of contamination was observed. Laboratory analysis was carried out on selected soil samples, in which the majority of the recorded concentrations for most contaminants were found to be below the laboratory limit of detection. The recorded concentrations have been screened against conservative generic assessment criteria (GACs) for a commercial land use and no exceedances were found. The ground gas assessment and monitoring has indicated a preliminary CS1 classification (very low risk) (note that this has been based on one round of monitoring). The concentrations recorded during the gas monitoring were found to be low, with no significant flows, this report suggests the off-site closed landfill presents a very low risk to on-site human health and buildings.

7.0 Outline Geotechnical Assessment

7.1 Geotechnical Laboratory Data

On completion of the fieldwork, recovered samples were submitted to an accredited Geotechnical Laboratory for the following testing:

- water content;
- Atterberg (plasticity) limits;
- particle size distribution;
- undrained triaxial compression;
- oedometer consolidation;
- direct shear by shear box;
- moisture content/dry density relationship; and,
- pH and sulphate content by 2:1 aqueous.

The results are summarised in Table 7-1 to Table 7-5 and the laboratory certificates are included in Appendix 08.

Table 7-1:
Geotechnical Laboratory Test Results; Classification Testing

Location ID	Depth (m)	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	% passing <425µm sieve	Chemical	
							pH	2:1 WS SO ₄ (g/l)
DBH1	1.20	19.2	33	16	17	100	-	-
DBH1	2.00	-	-	-	-	-	8.1	0.55
DBH1	4.00	18.7	49	20	29	100	-	-
DBH1	6.50	-	-	-	-	-	8.6	0.10
DBH1	10.00	14.7	39	16	23	99	-	-
DBH2	2.30	14.9	33	14	19	100	-	-
DBH2	4.00	-	-	-	-	-	8.4	0.79
DBH2	5.45	13.0	35	16	19	100	-	-
DBH2	8.45	15.1	40	17	23	100	-	-
PBT10	0.40	-	-	-	-	-	7.6	<0.010
PBT6	0.20	-	-	-	-	-	7.7	0.018
PBT8	0.30	-	-	-	-	-	6.7	0.013
SHB1	0.20	-	-	-	-	-	6.0	<0.010
SBH1	0.50	20.2	-	-	-	-	-	-

Location ID	Depth (m)	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	% passing <425µm sieve	Chemical	
							pH	2:1 WS SO ₄ (g/l)
SBH1	2.00	19.5	34	18	16	100	-	-
SBH2	1.00	22.1	-	-	-	-	7.7	0.019
SBH2	3.00	13.2	32	14	18	100	-	-
SBH2	4.00	13.3	32	14	18	100	-	-
SBH3	0.50	-	-	-	-	-	7.3	<0.010
SBH3	1.20	20.8	37	16	21	100	-	-
SBH3	2.00	-	-	-	-	-	6.5	0.092
SBH4	1.20	-	-	-	-	-	7.8	0.020
SBH4	2.00	16.4	-	NP	-	100	-	-
SBH5	0.50	16.0	-	-	-	-	6.9	<0.010
SBH5	2.00	19.6	35	18	17	100	7.7	0.012
SBH6	1.00	-	-	-	-	-	8.1	<0.010
SBH6	3.00	19.8	48	19	29	100	-	-
TP101	1.20	20.0	42	16	26	100	-	-
TP101	2.00	-	-	-	-	-	8.0	<0.010
TP102	0.32	23.5	-	-	-	-	7.5	0.024
TP202	1.00	-	-	--	-	-	7.6	<0.010
TP102	2.00	17.3	37	14	23	100	-	-
TP103	1.20	21.3	28	17	11	100	-	-
TP104	1.30	-	-	-	-	-	7.8	<0.010
TP104	3.00	15.6	29	13	16	100	-	-
TP106	2.60	16.5	33	14	19	100	8.	0.15

NP = Non-Plastic

Table 7-2:
Geotechnical Laboratory Test Results; Particle Size Distribution

Location ID	Depth (m)	Particle Size Distribution (%)				Lithology
		Clay	Silt	Sand	Gravel	
DBH1	0.3 - 0.9	18.2	22.7	58.0	1.1	Alluvium - Silty sandy CLAY.

Location ID	Depth (m)	Particle Size Distribution (%)				Lithology
		Clay	Silt	Sand	Gravel	
DBH2	0.9 - 1.2	22.1	22.0	55.3	0.6	Alluvium - Silty sandy CLAY
TP104	2.5	21.8	57.8	19.1	1.3	Kellaways Clay Member - Slightly sandy clayey SILT

Table 7-3:
Geotechnical Laboratory Test Results; Compaction Test

Location ID	Depth (m bgl)	Natural Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (Mg/m ³)	Degree of Compaction at NMC (%)
DBH1	2.0 – 3.0	15.5	12.4	1.87	97
TP103	0.9	21.3	14.6	1.81	88
TP105	2.3	16.8	15.5	1.80	98
TP106	2.7	16.8	14.1	1.86	96

Table 7-4:
Geotechnical Laboratory Test Results; Oedometer Consolidation

Location ID	Depth (m)	Water Content (%)	Bulk Density (Mg/m ³)	Pressure Range (kPa)	M _v (m ² /MN)	C _v (m ² /year)
DBH1	5.00 – 5.45	18.8	2.15	0 – 25	-	Specimen Swelled
				25 – 50	-	Specimen Swelled
				50 – 100	0.11	0.71
				100 – 200	0.14	0.21
				200 – 400	0.10	0.19
				400 – 800	0.060	0.21
				800 – 1600	0.031	0.29

Location ID	Depth (m)	Water Content (%)	Bulk Density (Mg/m ³)	Pressure Range (kPa)	M _v (m ² /MN)	C _v (m ² /year)
DBH2	3.00 – 3.45	14.5	2.18	0 – 15	-	Specimen Swelled
				15 – 30	0.16	6.4
				30 – 60	0.17	3.0
				60 – 120	0.18	2.7
				120 – 240	0.12	2.5
				240 – 480	0.032	2.5

Table 7-5:
Geotechnical Laboratory Test Results; Strength and Density Tests

Location ID	Depth (m bgl)	Moisture Content (%)	Density Tests		Undrained Triaxial Compression	Direct Shear	
			Bulk (Mg/m ³)	Dry (Mg/m ³)	Shear Stress C _u (kPa)	Apparent Cohesion (kPa)	Angle of Shearing Resistance (°)
DBH1	5.00 – 5.45	19.2	2.16	1.81	145	-	
DBH1	8.00 – 8.45	15.9	2.20	1.90	202	-	
DBH2	3.00 – 3.45	15.1	2.22	1.93	153	-	
DBH2	5.00 – 5.45	20.6	2.16	1.79	112	-	
DBH2	8.00 – 8.45	19.6	2.17	1.82	185	-	
DBH1	0.90 – 1.20	20.9	2.02	1.67	-	10	24.5

8.0 Discussion of Geotechnical Results

The ground investigation encountered Alluvium comprising sandy silty clay to a maximum depth of 3.0m bgl, overlying the Kellaways Clay Member comprising stiff silty clay.

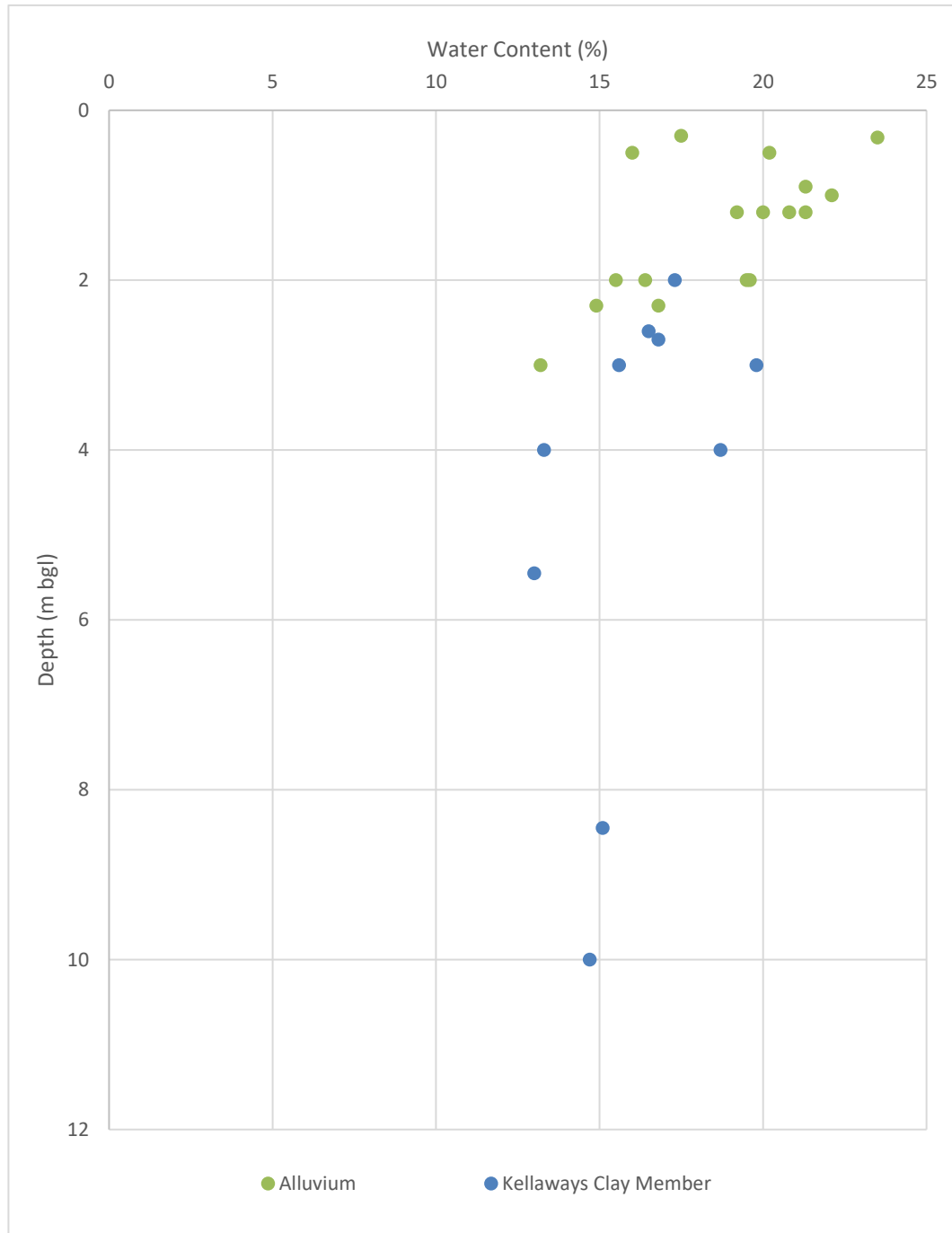
8.1 Classification testing

Three samples were submitted for Particle Size Distribution analysis. Two samples were recovered from the Alluvium at depths of 0.3m and 0.9m bgl within DBH1 and DBH2, respectively, which identified the deposits as a silty sandy clay. One sample was recovered from the Kellaways Clay Member at 2.5m bgl in TP104 which identified the deposit as a slightly sandy very clayey silt.

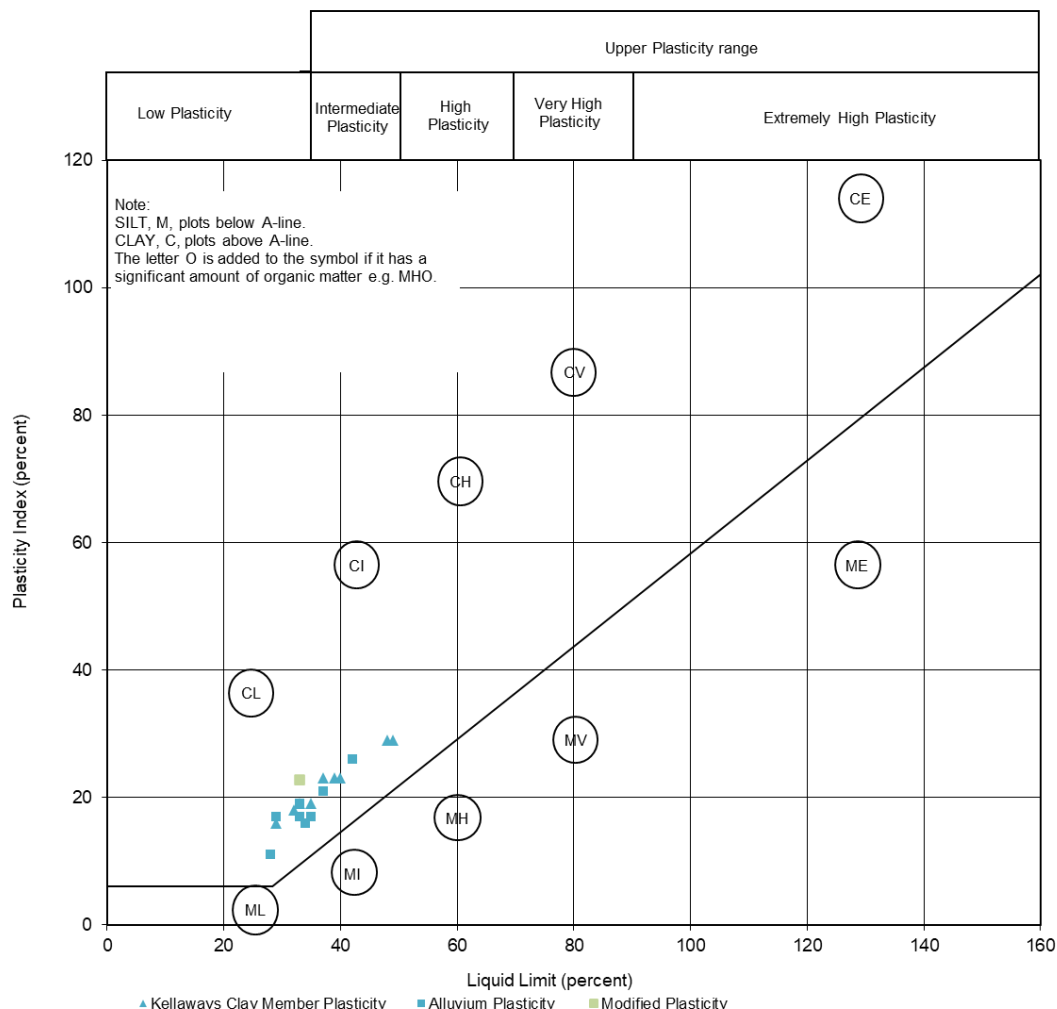
Twenty-seven samples were submitted for water content testing. Analysis returned values of between 13.2% and 23.5% at depths of between 0.3m and 3.0m bgl within the Alluvium. Within the Kellaways Clay Member, analysis returned values of between 13% and 19.8% at depths of between 2.0m and 10.0m bgl. Figure 8-1 shows a decrease in water content with depth within the Alluvium, and a slight decrease within the Kellaways Clay Member at shallow depths before becoming consistent from 4.0m bgl.

Eighteen samples were submitted for plasticity testing to determine Atterberg Limits. All of the samples plot above the 'A-line' and display clay like behaviour as shown in Figure 8-2. The clay from both the Alluvium and Kellaways Clay Member display a low to intermediate plasticity with a low to medium volume change potential.

Figure 8-1:
Water Content with Depth



**Figure 8-2:
Atterberg Limits**



8.2 Strength Testing

Five undisturbed samples of the Kellaways Clay Member were submitted for unconsolidated undrained triaxial testing; from DBH1 at depths of 5.0m and 8.0m bgl and from DBH2 at 3.0m, 5.0 and 8.0m bgl. Testing returned undrained shear strength values of between 112kPa and 202kPa. The results indicate a high to very high strength material, comparable with the observations determined in the field that identified the clay as stiff.

One sample was submitted for direct shear testing using a small shear box. The sample of Alluvium recovered from DBH1 at 0.9 to 1.2m bgl resulted in an apparent cohesion of 10kPa and an angle of shearing resistance of 24.5°.

Bulk density within the Kellaways Clay were similar and recorded between 2.16 and 2.22 Mg/m³, whilst the bulk density of the Alluvium was slightly lower at 2.02 Mg/m³.

8.1 Settlement

Two undisturbed samples were submitted for oedometer consolidation analysis from DBH1 at 5.0m bgl, and DBH2 at 3.0m bgl. The sample submitted from DBH1 resulted in a coefficient of volume compressibility (M_v) of 0.10 m²/MN at a pressure range of 200-400 kPa and is indicative of a medium compressibility. Coefficient of consolidation (C_v) at the applied test pressure of 200-400 kPa was recorded as 0.19m²/yr, indicative of a low rate

of consolidation. The sample submitted from DBH2 resulted in a maximum coefficient of volume compressibility (M_v) of $0.12 \text{ m}^2/\text{MN}$ at a pressure range of 120-240 kPa and is indicative of a medium compressibility. Coefficient of consolidation (C_v) at the applied test pressure of 120-240 kPa was recorded as $2.5 \text{ m}^2/\text{yr}$, indicative of a medium rate of consolidation. The sample recovered from DBH1 was recorded as a stiff extremely fissured slightly sandy silty clay, whereas the sample from DBH2 was described as a firm to stiff very sandy silty clay, explaining the slight difference in C_v between the two samples.

8.2 Moisture Content / Dry Density Relationship

Compaction testing was undertaken on two samples of the Alluvium and two samples of the Kellaways Clay Member to determine the Optimum Moisture Content (OMC) and maximum dry density relationship. The samples of Alluvium submitted from TP103 and TP105 at depths of 0.9m and 2.3m bgl resulted in a natural moisture content of 21.3% and 16.8% which are wet of the OMC of 14.6% and 15.5%. The samples of Kellaways Clay submitted from DBH1 and TP106 at depths of 3.0m and 2.7m bgl respectively, resulted in a natural moisture content of 15% and 16.8% which are wet of the OMC of 12.4% and 14.1%. A degree of compaction of 90-100% is achievable at NMC in three of the samples (DBH1, TP105 and TP106).

8.3 Chemical Testing

Fourteen samples were submitted for chemical testing at depths ranging from 0.2m to 2.0m bgl within the Alluvium and five samples of the Kellaways Clay Member at depths of between 2.0m and 6.5m bgl. The pH testing recorded slightly acidic to slightly alkaline values of between 6 and 8.1 in the Alluvium, and between 6.5 and 8.6 within the Kellaways Clay Member.

Testing to determine the soluble sulphate content returned values below the limit of detection of $<0.010 \text{ g/l}$ and 0.55 g/l 2:1 WS SO_4 within the Alluvium, and between $<0.010 \text{ g/l}$ and 0.79 g/l 2:1 WS SO_4 within the Kellaways Clay Member.

This needs to be taken into account when selecting the concrete qualities for construction. Based on BRE guidelines⁸ the Site is classified as Design Sulphate class DS-1 and DS-2 and as ACEC (aggressive chemical environment for concrete) AC-1s.

⁸ BRE Construction Division. Special Digest 1: Concrete in Aggressive Ground. Third edition 2005

9.0 Geotechnical Conclusions & Recommendations

The proposed development comprises the construction of a new anaerobic digestion facility as detailed in Section 1.2.

The biogas generated at the Site will be road tankered to an off-site hub location where it will be injected directly into the grid network. The development proposals are presented in Appendix 01.

The Site is on a slope, decreasing in topography from 101m AOD to 90m AOD towards the east. Therefore, it is understood that an earthworks cut and fill exercise will be required across the site to create a level platform for the development. However, at the time of writing this report an engineering drawing has not been provided detailing the proposed earthworks.

9.1 Geotechnical Parameters

Table 9-1 details the geotechnical parameters for the Alluvium and Kellaways Clay Member encountered onsite, comprising silty sandy clay, and silty clay respectively. Values are derived from laboratory and in-situ test results, relevant published literature, and adapted from similar work undertaken by SLR.

Table 9-1:
Summary of Geotechnical Parameters

Structure	Material Parameter	Alluvium Value	Kellaways Clay Member Value
Shallow Foundations	Unit Weight (γ)	20 kN/m ³	22 kN/m ³
	Undrained Shear Strength (S_u)	35 kPa	100 kPa
Retaining Wall	Unit Weight (γ)	20 kN/m ³	22 kN/m ³
	Effective Cohesion (c')	1 kPa	1 kPa
	Angle of Internal Friction (ϕ')	24.5°	27°
	Undrained Shear Strength (S_u)	50 kPa	100 kPa
Slope Stability	Unit Weight (γ)	20 kN/m ³	22 kN/m ³
	Undrained Shear Strength (S_u)	30 kPa	Top of Layer: 100 kPa Maximum: 200 kPa Rate of change: ((10 kPa)/m
	Effective Cohesion (c')	1 kPa	1 kPa
	Angle of Internal Friction (ϕ')	24.5°	27°

9.2 Hardstanding Design

The proposed development includes the construction of new hardstanding across the Site, therefore, equivalent CBR values were derived from five plate bearing tests across the development. Three tests were conducted within the Alluvium comprising sandy clay which resulted in CBR values of between 0.89% and 4.4%.

National Highways withdrew the Design Guidance for Road and Pavement Foundations⁹, which estimates a CBR value of up to 8% for a sandy clay. Whilst this document has been withdrawn, the recommendations on CBR values are considered to remain appropriate. The client has recommended a design CBR value of 3.5% for the Site. Four of the five resulted do not comply with this recommendation. In addition to this, the minimum permitted design CBR is 2.5% CBR. Where a subgrade has a lower CBR it is considered an unsuitable support for a pavement foundation. The material at the surface can be removed and replaced by a more suitable material; however, due to the size of the proposed hardstanding, this option seems unviable. As the material is fine-grained, a lime (or similar) treatment may be appropriate. Alternatively, a geosynthetic material could be added into the sub-base.

Notwithstanding this, in-situ plate bearing or CBR tests should be conducted at formation level in areas of hardstanding structures immediately prior to construction.

9.3 Earthworks

The topography across the Site varies between 101m and 90m AOD, decreasing in topography towards the east of the Site. Across the Site, to ensure a level topography for the development, an earthworks cut and fill exercise is required. However, engineering drawings or earthworks details have not been provided at the time of preparing this report.

Two covered lagoons have been proposed in the south of the Site to hold 10,000m³ of processed water, and a rainwater in the southeast of the Site. Material will need to be removed for the construction of the lagoons, which will be approximately 3m deep. Fine-grained clay material will be used to create the bunds around the lagoons and the clamps.

The ground investigation encountered two geological strata, Alluvium comprising sandy silty clay and the Kellaways Clay Member comprising silty clay. The clay is likely to be classified as Class 2, fine-grained fill, in accordance with Series 600 of MCHW¹⁰.

Laboratory testing on the clay included water content and plasticity, with the results indicating the material can be classified as a Class 2A material (water content was greater than -4% of Plastic Limit).

PSD testing was conducted on three samples of clay which classifies the material as Class 2A material with between 80-100% passing 2mm, and between 15-100% passing 63 microns.

Compaction testing was carried out on five samples using a 2.5kg rammer. The results show that samples recovered were wet of OMC. Therefore, prior to placement, the material should be subjected to moisture conditioning.

Testing will need to be conducted during the earthworks to ensure the material is classified in accordance with Series 600. Compliance testing should be conducted at an approved UKAS accredited laboratory in addition to in-situ testing onsite. Adoption of the Method Compaction specification detailed in Series 600 will ensure a minimum of 90% compaction (10% air voids). Results presented in Table 7-3 show that four of the five samples comply with this. One sample from TP103 and 0.9m bgl does not comply with this, with an 88% compaction and would need to be subjected to moisture conditioning and subsequent testing to confirm its suitability.

⁹ Interim Advice Note (IAN) 73/06 Revision 1 (2009) Design Guidance for Road Pavement Foundations

¹⁰ Specification for Highways Works, Series 600, Earthworks, February 2016.

9.4 Foundation Options

The ground investigation encountered topsoil overlying Alluvium to a maximum depth of 3.0m bgl, which was underlain by the Kellaways Clay Member in all locations to a maximum depth of 10.0m bgl. Groundwater was encountered in two boreholes, SBH2 and SBH3, during the drilling. A subsequent groundwater monitoring visit recorded water in all boreholes at depths of between 0.43m to 1.35m bgl.

During foundation assessment a worst-case scenario is considered. This uses the lowest bearing ground conditions with the highest load. This allows for the variation across the site as well as considering a maximum load. Design parameters selected are based on field observations, laboratory results and published guidance where relevant.

9.4.1 Shrink Swell Potential

The volume change potential of the shrinkable soils is critical to the foundation design. Although not necessarily required, reference should be made to NHBC Guidelines, Section 4.2¹¹. In the context of building near trees, this is considered to provide a best practice approach.

Eighteen samples were submitted for plasticity testing which classified the clay onsite as low to intermediate plasticity with a low to medium volume change potential.

The type, moisture demand and size of surroundings trees will need to be taken into considering during detailed foundation design. Notwithstanding this, the structures would likely be situated outside the zone of influence. The minimum foundation depth for foundations outside the zone of influence for low and medium potential soils is 0.7m and 0.9m bgl respectively for traditional strip foundations. Raft foundations are able to accommodate larger magnitude differential settlements and therefore shallower foundation depths can be applied.

9.4.2 Bearing Capacity and Settlement Performance

Based on the ground conditions encountered on site, the provided loadings and current knowledge of vegetation around the site, shallow foundations are considered appropriate.

Structures such as the grid entry unit, propane tanks, compressor, and gas flare have anticipated loads of 50kPa and will be founded on raft foundations. The underlying ground conditions have been modelled in undrained conditions applying strengths obtained from field observations, in-situ testing and inferred from laboratory analysis. Dimensions for the proposed structures have not been provided at this time, therefore calculations have assumed a raft foundation with an area of approximately 20m² and 0.4m thick, will achieve a bearing capacity in excess of 150kPa in undrained conditions. Calculated settlement of <20mm is anticipated, which is within acceptable limits for the design of the structure.

Five tanks are proposed to be constructed on circular foundations in the east of the Site. The tanks will be constructed on individual foundations with loadings of 150kN/m² 2.5m bgl. Dimensions of the structures have been provided; with the tanks at 34m in diameter, a circular spread footing foundation will achieve a bearing capacity in excess of 300kPa within the Alluvium and Kellaways Clay Member.

Direct parameters for settlement were obtained during the ground investigation. Two undisturbed samples of the Kellaways Clay Member, one from DBH1 at 5.0m bgl, and one sample from DBH2 at 3.0m bgl was submitted for oedometer consolidation testing. Calculations based on the results from DBH1 resulted in anticipated settlement 50mm, and in DBH2 at 8.0m the anticipated settlement is 60mm. Samples were not obtained from the Alluvium. However, if the foundations are constructed within the soft Alluvium, settlement is anticipated to be significantly higher at >150mm.

¹¹ NHBC Standards 2020, Part 4: Foundations

9.4.3 Groundwater

Groundwater strikes were observed in SBH2 and SBH3 during the advancement of the boreholes, encountered at 1.5m and 3.4m bgl. Following a return groundwater visit, water was recorded in all boreholes at depths of between 0.43m to 1.35m bgl as presented in Table 3-2.

Therefore, the presence of shallow groundwater will impact the construction of shallow foundations. Measures will be required to manage groundwater flows during construction, with shallow sumps required to allow pumping of groundwater. Although this may be avoided with careful excavation planning to provide falls for any water to discharge from the area. Provided contamination testing is carried out to document that water generated from the Site is clean without sediment loading and discharge occurs for not more than 6 months, water pumped from the construction works can be discharged to local surface water features without the need for a discharge consent.

9.4.4 General

Within the clay, there is potential for areas of softer material, with a reduced allowable bearing capacity, to be present within the development area. Prior to construction foundation excavations should be proof rolled with a Wacker plate to highlight any soft areas. These should then be removed and backfilled with suitable granular material to ensure the structure remains stable.

9.4.5 Floor Slabs

Based on the currently development proposals no floor slabs will be required.

9.5 General

In addition to the above recommendations, it is recommended that all design and construction works, including temporary works, be carried out on site in accordance with recognised engineering codes of practice including BS8004 (2015: Code of Practice for Foundations) and BS6031 (2009: Code of Practice for Earthworks).

10.0 Land Quality Conclusions & Recommendations

The findings from the ground investigation and subsequent land quality assessments are as follows.

10.1 Conclusions

10.1.1 Ground Conditions

Ground conditions across the site comprised of topsoil, which was found across the whole site. Alluvium was found in all locations across the site, to a maximum depth of 2.50m bgl. The Kellaways Clay Member was encountered across the whole site and was found to extend beneath the final depths of the exploratory locations.

10.1.2 Visual / Olfactory Indications of Contamination

No visual or olfactory evidence of contamination was noted in any of the exploratory hole locations. Headspace readings were undertaken using a photo-ionisation detector (PID) and all results were <1ppm.

10.1.3 Groundwater and Ground Gas

Groundwater monitoring wells were installed in each of the 8no. boreholes on the Site. Groundwater depths were found to vary from 0.43m and 3.40m bgl during the return visit on 17th March 2023.

Ground gas concentrations were found to be low and no significant flows were recorded in any of the monitoring wells, although it should be noted this was only from one round of monitoring. Total organic carbon concentrations across the Site were also found to be low, therefore SLR do not consider there to be a potentially significant development risk to human health or property from ground gas, although this could be confirmed through additional rounds of monitoring.

10.1.4 Revised Conceptual Site Model

No exceedances of the screening criteria protective of human health were recorded in the soils sampled at the site in relation to a commercial land use. The concentrations of contaminants in soil on-site are not considered to present an unacceptable risk to human health for the proposed land use.

The Phase 1 PLQRA identified the nearby closed landfill as a potential source of contamination, this report concludes that it does not pose an unacceptable risk to human health or controlled waters as all contaminant concentrations were found to be below the screening criteria for commercial land use.

10.2 Recommendations

No further investigation or remediation is considered necessary for the proposed development. A watching brief should be maintained for potentially unexpected contamination during development.

Soils are to be stripped and stockpiled separately in accordance with the Code of Practice¹² and a Soil Management Plan prepared. Given the site investigation has not identified any sources of potential contamination, it is likely that on-site soils can be excavated and reused as part of the proposed development. It is the responsibility of a holder of material to form their own view on whether that material is waste or not. Given the proposed reuse of natural occurring material within the site boundary and lack of any identified contamination sources it is likely that excavated soils reused as part of the proposed development would not be considered waste. However, we would recommend that any soil reuse is covered by a Materials Management Plan (MMP) in accordance with the CLAIRE Definition of Waste Code of Practice (DoWCoP).

¹² Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. DEFRA (2009)

Any material brought on to Site will need to be suitable from a chemical perspective and will require chemical test certificates to be provided. Any material removed off-site will need to follow a MMP or Duty of Care procedures. All such records are to be retained by the contractor.

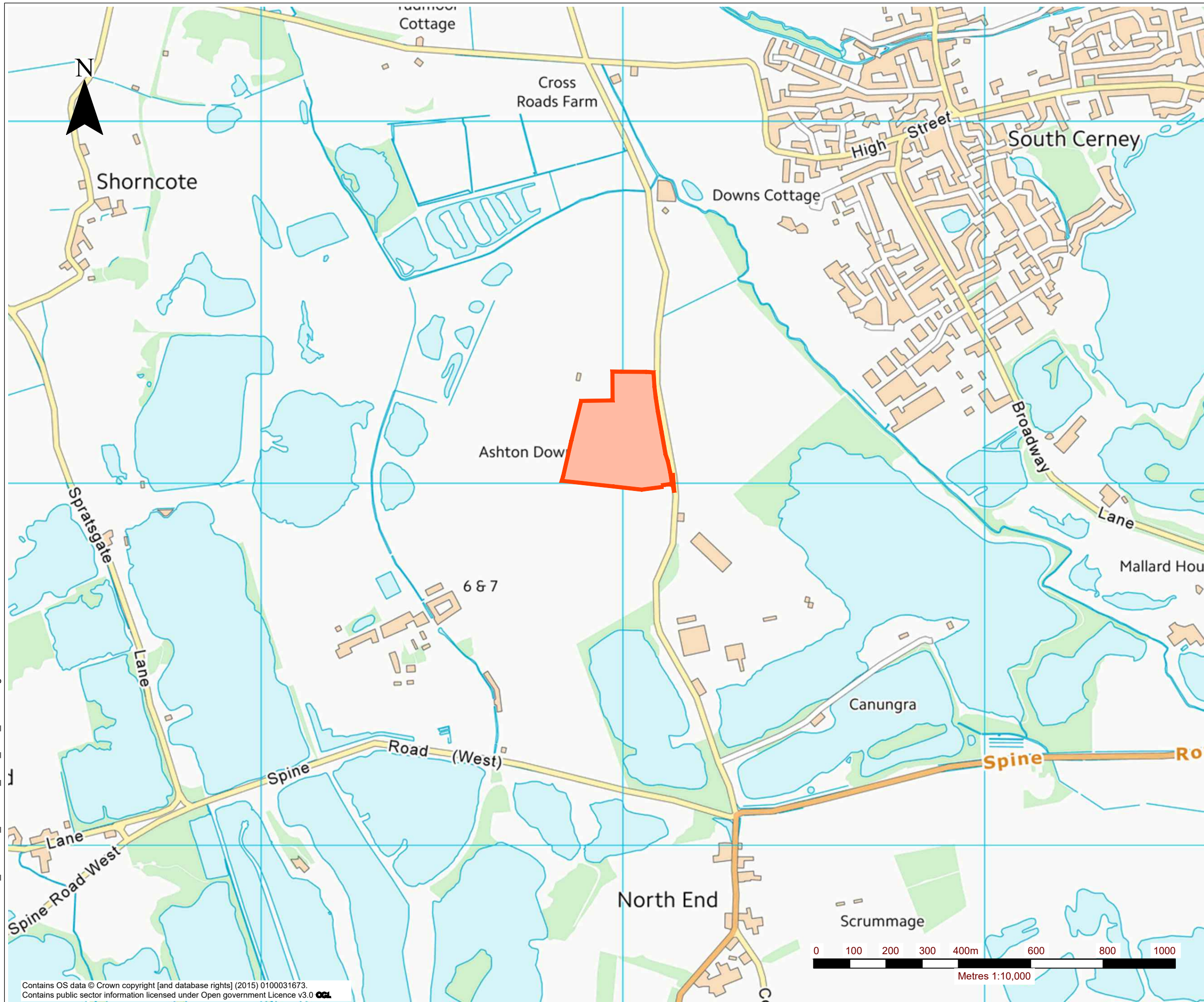
Given the presence of the adjacent landfill, further rounds of ground gas monitoring could be undertaken to confirm preliminary assumptions and conclusions provided in this report.

The contractor will be required to avoid any work that may result in silting of the off-site stream located adjacent to the northwest site boundary.

The contractor is to follow good practice measures during the operation of plant and machinery to ensure that there are no releases of hydrocarbons, lubricants or oils to ground during site preparation.

DRAWINGS

404.11923.00002:19.001.1_ASHTON_KEYNES_SITE_LOC_PLAN.dwg



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LEGEND



SITE LOCATION



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T: +44 (0)1905 751310
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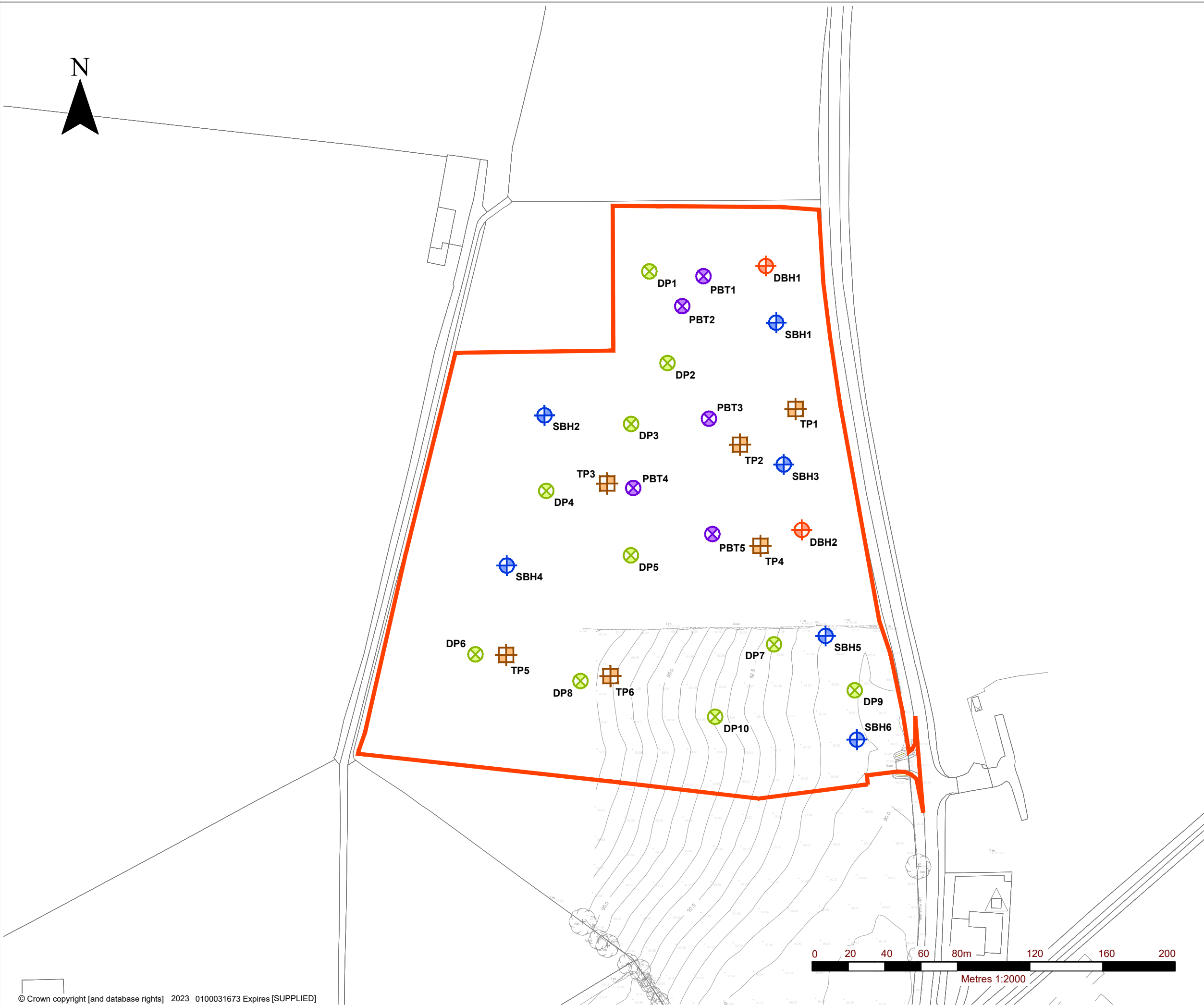
ASHTON KEYNES
GROUND INVESTIGATION REPORT
SITE LOCATION PLAN

DRAWING 01

Scale
1:10,000 @ A3

Date
MARCH 2023

404.11923.00002.19.002a.1_ASHTON_KEYNES_EXP_HOLES-CURRENT.dwg



NOTES

1. DRAWING IS BASED ON GGP CONSULT SITE LAYOUT PLAN, REF: 29419/P/1010 REV E, DATED: 8TH DECEMBER 2022.

LEGEND

	SITE BOUNDARY
	BOREHOLE 10m (DEEP)
	BOREHOLE 6m (SHALLOW)
	TRIAL PIT
	DYNAMIC PROBE
	PLATE BEARING TEST

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ASHTON KEYNES

GROUND INVESTIGATION REPORT

EXPLORATORY HOLE PLAN
- CURRENT LAYOUT

DRAWING 02a

Scale 1:2000 @ A3	Date MARCH 2023
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404.11923.00002:19.002b.1_ASHTON_KEYNES_EXP_HOLES-PROPOSED.dwg



NOTES

1. DRAWING IS BASED ON GGP CONSULT SITE LAYOUT PLAN, REF: 29419/P/1010 REV E, DATED: 8TH DECEMBER 2022.

LEGEND

	SITE BOUNDARY
	BOREHOLE 10m (DEEP)
	BOREHOLE 6m (SHALLOW)
	TRIAL PIT
	DYNAMIC PROBE
	PLATE BEARING TEST

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ASHTON KEYNES
GROUND INVESTIGATION REPORT
EXPLORATORY HOLE PLAN
- PROPOSED LAYOUT
DRAWING 02b

Scale 1:2000 @ A3	Date MARCH 2023
----------------------	--------------------

APPENDIX 01

Proposed Development Plan

0 10m 20m 30m 40m 50m
Scale 1:1000 @ A1

0 50m 100m 150m 200m 250m
Scale 1:5000 @ A1



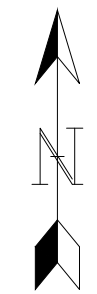
Site Location Plan.
Scale: 1:5000 @ A1.



Site Plan.
Scale: 1:1000 @ A1.

- NOTES:-
1. All dimensions must be checked on site and not scaled from this drawing.
 2. The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
 3. All levels shown on this drawing are relative to Agreed Topographic survey
 4. This drawing is to be read in conjunction with 29419/100 Series Drawings.
 5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.

Site Red Line Boundary (6.99Ha)



E	08/12/22	Hatched Plan	JHC	JHC
D	30/11/22	Layout update	JHC	JHC
C	02/11/22	Redline & Entrance Update	JHC	JHC
B	28/10/22	Redline Update	JHC	JHC
A	04/10/22	Concept Layout	JHC	JHC
Rev	Date	Description	DR	CH

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Client



Job Title
AD Plant.
Ashton Keynes

Drawing Title
Site Layout Plan.

Status
Planning

Scale As Noted @ A1 Date Oct '22

Drawn By J. Collins Checked JHC Approved JHC

Dwg. No. 29419/P/101 Rev E

NOT FOR CONSTRUCTION

APPENDIX 02

Exploratory Location Borehole and Trial Pit Logs

BOREHOLE LOG										BOREHOLE No DBH1	
Client: Acorn BioEnergy											
Project No: 404.11923.00004.0027		Date: 20/02/2023		Ground Level: 92.36m		Co-ordinates: E404054 N196274					
Project: Ashton Keynes										Sheet 1 of 1	
SAMPLES & TESTS					Water	STRATA				Instrument Backfill	
Depth	Type No	Test Type	Test Result	SPT N Value		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00 - 0.30	B	SPT		N=10 (1,2/2,2,3,3)			0.30	Very soft dark brown silty sandy CLAY. Sand is medium to coarse. Occasional rootlets.			
0.00 - 0.30	ES										
0.30 - 0.90	B										
0.30 - 0.90	B										
0.90 - 1.20	B										
0.90 - 1.20	B										
1.00	ES										
1.20 - 1.65	B										
1.20 - 1.65	D										
1.20 - 2.00	SPTLS										
2.00 - 2.45	B	SPT		N=16 (3,2/4,4,4,4)		1.20	Soft yellowish brown silty sandy CLAY. Sand is fine to medium.				
2.00 - 2.45	B										
2.00 - 2.45	B										
2.00 - 3.00	D										
2.00 - 3.00	SPTLS										
2.80	ES										
3.00 - 3.45	B										
3.00 - 4.00	UT										
3.45 - 3.55	D										
4.00 - 4.45	B					SPT		N=23 (3,4/5,6,6,6)		2.45	Firm orangish brown mottled grey slightly sandy silty CLAY. Sand is fine.
4.00 - 4.45	D										
4.00 - 5.00	SPTLS										
5.00 - 5.45	B										
5.00 - 5.45	U										
5.00 - 6.50	UT										
5.45 - 5.55	D										
6.50	B										
6.50 - 6.95	D										
6.50 - 6.95	ES	SPT		N=50 (8,8/50 for 275mm)						3.00	Stiff blueish grey slightly sandy silty CLAY. Sand is fine to medium.
6.50 - 8.00	SPTLS										
8.00 - 10.00	B										
8.00 - 8.45	U										
8.00 - 8.45	UT										
8.45 - 8.55	D										
9.80	ES										
10.00 - 10.45	D										
10.00 - 10.45	SPTLS										
10.00 - 10.45											
Boring Progress and Water Observations						Chiselling			Water Added		General Remarks
Date	Time	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To	
											Service traced and CAT scanned. Hand dug pit to 1.2m. Installed with dual 19mm and 50mm monitoring well. No visual or olfactory evidence of contamination. No water strike during drilling. Resting groundwater was 0.88m bgl on 17/03/2023.
All dimensions in metres Scale 1:71		Contractor: CCGI Plant: Dando D3000		Method: Cable percussion (shell and auger) Hole Size: 150mm		Logged By: EH		Approved By: ML			

LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015

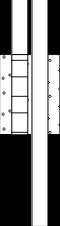
BOREHOLE LOG										BOREHOLE No DBH2	
Client: Acorn BioEnergy											
Project No: 404.11923.00004.0027		Date: 21/02/2023		Ground Level: 91.63m		Co-ordinates: E404074 N196129					
Project: Ashton Keynes										Sheet 1 of 1	
SAMPLES & TESTS					Water	STRATA				Instrument Backfill	
Depth	Type No	Test Type	Test Result	SPT N Value		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.00 - 0.15	B	SPT		N=10 (1,2/2,2,3,3)			0.20	Very soft dark brown silty sandy CLAY. Sand is medium to coarse. Occasional rootlets.			
0.00 - 0.20	ES										
0.20 - 0.90	B										
0.90 - 1.20	B										
0.90 - 1.20	B										
1.20 - 1.65	SPTLS						1.30	Soft to firm, yellowish brown silty sandy CLAY. Sand is fine to medium.			
2.00	2	SPT		N=18 (2,3/4,4,4,6)			1.70	Stiff yellowish brown mottled grey sandy CLAY. Sand is fine to medium.			
2.30	D										
2.30	D										
3.00 - 3.45	3	UT					3.00	Firm blueish grey silty CLAY.			
3.00 - 3.45	UT										
4.00	4	SPT		N=9 (1,0/1,1,3,4)			3.00	KELLAWAYS CLAY MEMBER			
4.00	D										
4.00	ES										
4.00 - 4.45	SPTLS										
5.00	5										
5.00 - 5.45	U						6.00	Very stiff dark grey silty CLAY. Occasional fossils and mudstone nodules.			
5.00 - 5.45	UT										
5.45 - 5.55	D										
5.45 - 5.55	D										
5.45 - 5.55	D										
6.00	6	SPT		N=50 (8,8/50 for 285mm)			6.00	KELLAWAYS CLAY MEMBER			
6.50 - 6.95	SPTLS										
7.00	7										
7.50	ES										
8.00 - 8.45	8										
8.00 - 8.45	UT						10.00	Borehole Complete at 10.00m			
8.45 - 8.55	D										
8.45 - 8.55	D										
9.00	9										
10.00	10										
10.00	D	SPT		N=50 (8,12/50 for 245mm)			10.00				
10.00 - 10.45	SPTLS										
Boring Progress and Water Observations						Chiselling			Water Added		General Remarks
Date	Time	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To	
											Service traced and CAT scanned. Hand dug pit to 1.2m. Installed with dual 19mm and 50mm monitoring well. No visual or olfactory evidence of contamination. No water strike during drilling. Resting groundwater was 0.87m bgl on 17/03/2023.
All dimensions in metres Scale 1:71		Contractor: CCGI Plant: Dando D3000		Method: Cable percussion (shell and auger) Hole Size: 150mm		Logged By: EH		Approved By: ML			

LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015

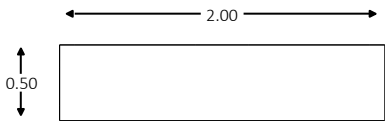
BOREHOLE LOG										BOREHOLE No SBH1	
Client: Acorn BioEnergy											
Project No: 404.11923.00004.0027		Date: 22/02/2023		Ground Level: 92.36m		Co-ordinates: E404060 N196243					
Project: Ashton Keynes										Sheet 1 of 1	
SAMPLES & TESTS				Water	STRATA				Instrument Backfill		
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
0.00 - 0.20 0.20 - 0.50 0.20 - 0.50 0.50 0.50	ES D D D D	HS	0ppm		92.16		0.20	Very soft dark brown silty sandy CLAY. Sand is medium to coarse. Occasional rootlets.			
							(1.00)	TOPSOIL Soft yellowish brown silty sandy CLAY. Sand is fine to medium. ALLUVIUM			
1		SPT	N=9		91.16		1.20	Firm orangish brown mottled grey slightly sandy silty CLAY. Sand is fine. KELLAWAYS CLAY MEMBER 1.50 - 1.55 Water seepage observed within core and casing.			
2.00 2.00 2.00 2.00	D D ES ES	SPT	N=8		90.36		2.00	Firm bluish grey slightly sandy silty CLAY. Sand is fine to medium. KELLAWAYS CLAY MEMBER			
					89.76		2.60	Stiff bluish grey silty CLAY. KELLAWAYS CLAY MEMBER			
3		SPT	N=16			(1.40)					
4		SPT	N=25		88.36		4.00				
								Borehole Complete at 4.00m			
5											
6											
7											
8											
9											
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
										Service traced and CAT scanned. Hand dug pit to 1.2m. Installed with dual 19mm and 50mm monitoring well. No visual or olfactory evidence of contamination. No water strike during drilling. Resting groundwater was 0.64m bgl on 17/03/2023.	
All dimensions in metres Scale 1:66		Contractor: CCGI Plant: Terrier			Method: Window Sampler Hole Size: 100mm			Logged By: EH		Approved By: ML	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

[illegible]

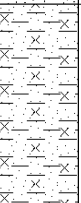
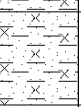
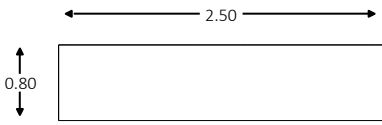
[illegible]

BOREHOLE LOG										BOREHOLE No SBH6	
Client: Acorn BioEnergy											
Project No: 404.11923.00004.0027		Date: 24/02/2023		Ground Level: 90.47m		Co-ordinates: E404104 N196014					
Project: Ashton Keynes										Sheet 1 of 1	
SAMPLES & TESTS				Water	STRATA				Instrument	Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
0.10	D	SPT	N=6		90.27		0.20	Very soft dark brown silty sandy CLAY. Sand is medium to coarse. Occasional rootlets.			
0.50	D										TOPSOIL
1.00	1 D									(1.20)	Soft yellowish brown silty sandy CLAY. Sand is fine to medium.
1.00	D										ALLUVIUM
1.25	ES	SPT	N=11		89.07		1.40	Firm orange brown grey mottled slightly sandy silty CLAY. Sand is fine.			
1.90	2 ES									(0.70)	KELLAWAYS CLAY MEMBER
2.40	ES									2.10	Very stiff bluish grey slightly sandy silty CLAY. Sand is fine to medium.
										(0.90)	KELLAWAYS CLAY MEMBER
3.00 - 3.45	3 D	SPT	N=36		87.47		3.00	Borehole Complete at 3.00m			
Boring Progress and Water Observations					Chiselling			Water Added		General Remarks	
Date	Depth	Casing Dpt	Casing Dia	Water Dpt	From	To	Hours	From	To		
All dimensions in metres Scale 1:66					Contractor: CCGI Plant: Terrier			Method: Window Sampler Hole Size: 100mm		Logged By: EH	Approved By: ML
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020											

LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020

TRIAL PIT LOG							TRIAL PIT No TP103		
Client: Acorn BioEnergy									
Project: Ashton Keynes									
Project No: 404.11923.00004.00 27		Date: 22/02/2023		Ground Level: 98.44m		Co-ordinates: E403967 N196155		Sheet 1 of 1	
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Sample	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.12	ES	HS	1ppm			(0.12)	Very soft dark brown silty sandy CLAY. Sand is medium to coarse. Occasional rootlets.		
		HS	0ppm			(0.22)	TOPSOIL		
				98.10		0.34	Soft yellowish brown silty sandy CLAY. Sand is fine to medium.		
							ALLUVIUM		
						(0.77)	Stiff orangish brown grey mottled slightly sandy silty CLAY. Sand is fine. KELLAWAYS CLAY MEMBER		
0.90	B								
1.00	B			97.33		1.11	0.96 remnants of old red pipe encountered. Slight seepage.		
1.20	D	HS	2ppm				Stiff brownish grey mottled orangish yellow sandy CLAY. Sand is fine to coarse. KELLAWAYS CLAY MEMBER		
1.30	D					(0.45)			
1.30	ES			96.88		1.56	Very stiff bluish grey silty CLAY. KELLAWAYS CLAY MEMBER		
						(1.04)			
2.20	ES	HS	0ppm						
2.60	ES	HS	0ppm			95.84	2.60		
Trial Pit Complete at 2.60m									
GENERAL REMARKS:								Trial Pit Dimensions:  Shoring/Support: None Stability: Stable	
Service traced and CAT scanned. No visual or olfactory evidence of contamination. No water strike.									
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement									
All dimensions in metres Scale 1:33		Contractor: CCGI Plant: JCB 3CX		Method: Trial pit/trench		Logged By: NR		Approved By: ML	
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020									

TRIAL PIT LOG								TRIAL PIT No TP104	
Client: Acorn BioEnergy								SLR	
Project: Ashton Keynes									
Project No: 404.11923.00004.00 27		Date: 22/02/2023		Ground Level: 93.19m		Co-ordinates: E404051 N196120		Sheet 1 of 1	
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Sample	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
0.10	ES	HS	0ppm			(0.10)0.10	Very soft dark brown silty sandy CLAY. Sand is medium to coarse. Occasional rootlets.		
0.67	B					(0.68)	Soft yellowish brown silty sandy CLAY. Sand is fine to coarse.		
1.00	ES	HS	0ppm			0.78	Stiff orangish brown grey mottled slightly sandy silty CLAY. Sand is fine to medium.		
1.30	D	HS	0ppm			(1.14)	KELLAWAYS CLAY MEMBER		
2.00	ES	HS	0ppm			1.92	Stiff bluish grey silty CLAY.		
2.50	B					(1.08)	KELLAWAYS CLAY MEMBER		
3.00	D	HS	0ppm			3.00	Trial Pit Complete at 3.00m		
3.00	ES								
</									

TRIAL PIT LOG							TRIAL PIT No TP105			
Client: Acorn BioEnergy										
Project: Ashton Keynes										
Project No: 404.11923.00004.00 27		Date: 23/02/2023		Ground Level: 99.09m		Co-ordinates: E403911 N196060		Sheet 1 of 1		
SAMPLES & TESTS				Water	STRATA				Instrument Backfill	
Depth	Sample	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.00 - 0.20	ES	HS	1ppm	98.89		(0.20) 0.20	Very soft dark brown silty sandy CLAY. Sand is medium to coarse. Occasional rootlets.			
										TOPSOIL
										Soft yellowish brown silty sandy CLAY. Sand is fine to medium.
										ALLUVIUM
1.45 1.50	ES B			97.39		1.70	Stiff orangish brown mottled grey slightly sandy silty CLAY. Sand is fine.			
2.30	B			96.49		2.60	KELLAWAYS CLAY MEMBER			
2.70	B			96.09		3.00	Very stiff bluish grey slightly sandy silty CLAY. Sand is fine to medium.			
							KELLAWAYS CLAY MEMBER			
							Trial Pit Complete at 3.00m			
GENERAL REMARKS:				Trial Pit Dimensions:  Shoring/Support: None Stability: Stable						
Service traced and CAT scanned. No visual or olfactory evidence of contamination. Water seepage observed at 2.4m bgl.										
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement										
All dimensions in metres Scale 1:33		Contractor: CCGI Plant: JCB 3CX		Method: Trial pit/trench		Logged By: EH		Approved By: ML		
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020										

TRIAL PIT LOG				TRIAL PIT No TP106	
Client: Acorn BioEnergy					
Project: Ashton Keynes					
Project No: 404.11923.00004.00 27	Date: 24/02/2023	Ground Level: 96.67m	Co-ordinates: E403969 N196049	Sheet 1 of 1	

SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Sample	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.25	ES	HS	1ppm		96.37		(0.30) 0.30	Very soft, dark brown silty sandy CLAY. Sand is medium to coarse. Occasional rootlets. TOPSOIL	
0.70	B						(0.65)	Soft yellowish brown silty sandy CLAY. Sand is fine to medium. ALLUVIUM	
0.90	ES				95.72		0.95	Stiff orangish brown mottled grey slightly sandy silty CLAY. Sand is fine. KELLAWAYS CLAY MEMBER	
1.85	ES				94.87		1.80	Very stiff bluish grey silty CLAY. KELLAWAYS CLAY MEMBER	
2.50	B						(1.20)		
2.60	D								
2.60	D								
2.70	B				93.67		3.00		
								Trial Pit Complete at 3.00m	

GENERAL REMARKS: Service traced and CAT scanned. No visual or olfactory evidence of contamination. Water seepage observed at 2.1m bgl. KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement		Trial Pit Dimensions: Shoring/Support: None Stability: Stable	
All dimensions in metres Scale 1:33	Contractor: CCGI Plant: JCB 3CX	Method: Trial pit/trench	Logged By: EH Approved By: ML
LOGGING HAS BEEN CARRIED OUT IN ACCORDANCE WITH BS5930:2015+A2:2020			

APPENDIX 03

Gas and Groundwater Monitoring Data

Soil Gas Monitoring Record Sheet 2.10.1: Soil Gas Sheet



Site Name : Ashton Keynes

Job Number: 404.11923.002

Address: Ashton Road

Date: 17/03/2023

Ashton Keynes

Weather Conditions: Intermittent rain and sunshine

GL7 6DD

Air Temperature (Deg C)

Wind Speed (mph)

Ground Surface Conditions Boggy/muddy

Operator: NR

Equipment: GA5000, IP

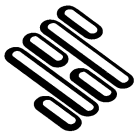
Next Calibration Due:

	Sample Point Ref	Barometric Pressure (mbar)	Depth of Water (m)	Depth of well (m)	Methane (CH4)		Carbon Dioxide (CO2)		Oxygen (O2)		Carbon Monoxide (CO) (ppm)	Hydrogen Sulphide (H2S) (ppm)	Gas Balance (%)	Flow (l/hr)	Gas Pressure (mbar)	Sample Collected?	Sample Type
					Peak (%v/v)	Steady State (%v/v)	Peak (%v/v)	Steady State (%v/v)	Min (%v/v)	Steady State (%v/v)							
50mm	SBH6	994	1.351	3.361	0.0	0.0	1.0	1.0	19.5	20.1	0	0	-	0.2	0.02		
19mm	SBH6	994	1.321	1.520	0.0	0.0	1.0	1.0	18.2	20.8	0	0	-	0.1	0.04		
50mm	SBH5	994	1.019	3.371	0.0	0.0	1.3	1.3	19.5	20.4	0	0	-	0.1	0.04		
19mm	SBH5	994	1.030	1.561	0.0	0.0	1.8	1.4	17.7	20.8	0	0	-	0.1	0.11		
50mm	DBH2	994	0.873	10.314	0.0	0.0	0.7	0.4	18.8	20.1	6	0	-	1.2*	17.4		
19mm	DBH2	994	1.195	1.804	0.0	0.0	0.1	0.1	21.3	21.3	0	0	-	0.1	0.02		
50mm	SBH3	994	0.554	4.365	0.0	0.0	0.4	0.4	20.3	21.0	0	0	-	0.0	0.04		
19mm	SBH3	994	0.541	1.483	0.0	0.0	0.3	0.1	21.0	21.0	1	0	-	0.1	0.02		
50mm	SBH1	994	0.642	4.329	0.0	0.0	1.2	1.1	18.7	20.8	4	0	-	0	0.04		
19mm	SBH1	994	1.065	1.595	0.0	0.0	1.8	1.8	15.4	20.8	2	0	-	0.1	0.02		
50mm	DBH1	994	0.879	1.595	0.0	0.0	0.3	0.3	20.9	20.9	4	0	-	0.3	0.04		
19mm	DBH1	994	0.991	2.764	0.0	0.0	0.2	0.1	20.8	20.8	0	0	-	0	0.03		
50mm	SBH2	994	0.521	2.889	0.0	0.0	0.1	0.1	20.9	21	0	0	-	0.1	-0.09		
19mm	SBH2	994	0.561	1.435	0.0	0.0	0.1	0.1	21	21	0	0	-	0	0.04		
50mm	SBH4	994	0.513	3.03	0.0	0.0	0.9	0.1	20.7	20.8	0	0	-	0.2	0.02		
19mm	SBH4	994	0.429	1.494	0.0	0.0	0.6	0.3	20.8	21	0	0	-	0.1	-0.03		

Comments: *DBH2 50mm Jumped from 2.3 then gradually fell to 1.2 over 5 minutes. DBH2 19mm, SBH3 50mm, SBH1 50mm Valves open on cap removal.

APPENDIX 04

Plate Bearing Test Results



STRUCTURAL SOILS LTD
INSITU TESTING REPORT



1774

Report No. 751236R.01(00)

Date	24-February-2023	Contract	C7898 South Cerney
Client	CC Ground Investigations		
Address	Unit A2 Innsworth Technology Park Innsworth Lane Gloucester GL3 1DL		
For the Attention of	Sarah Bennett		

Order received	13-February-2023	Client Reference	None
Testing Started	23-February-2023	Client Order No.	CCEng07019
Testing Completed	23-February-2023	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

5no. Plate load tests carried out at locations specified by the client.

Not UKAS Accredited Tests

The results represent the ground conditions at the specified locations and depths at the time of testing.

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of.
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd 1a Princess Street Bedminster Bristol BS3 4AG Tel.0117 9471000. e-mail dimitris.xirouchakis@soils.co.uk

TESTING VERIFICATION CERTIFICATE



1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **24/02/2023 10:21:58**.

Testing reported after this date is not covered by this Verification Certificate.

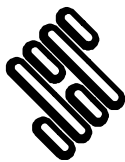
Approved Signatory
Tim Fay (Deputy Site Testing Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU



**STRUCTURAL
SOILS LTD**

Contract:

C7898 Soth Cerney

Job No:

751236



GINT_LIBRARY_V10_01.GLB LibVersion: v8_07 | Graph 1 - PLATE LOADING [R1] - A4P | 751236-GINT.GPJ - v10_01.
Structural Soils Ltd. Branch Office - Bristol Lab: 1a Princess Street, Bedminster, Bristol, BS3 4AG. Tel: 0117-947-1000, Fax: 0117-947-1004, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 24/02/23 - 09:59 | DR1 |

PLATE LOADING TEST - INCREMENTAL

BS1377:Part 9:1990, Clause 4.1

Position ID: **PB1** Depth (m) : **0.20** Date of Test : **23/02/23**



Applied Pressure (kPa)	Average Settlement (mm)
3	0.000
52	2.553
101	6.537
151	9.160
200	14.553
249	19.447

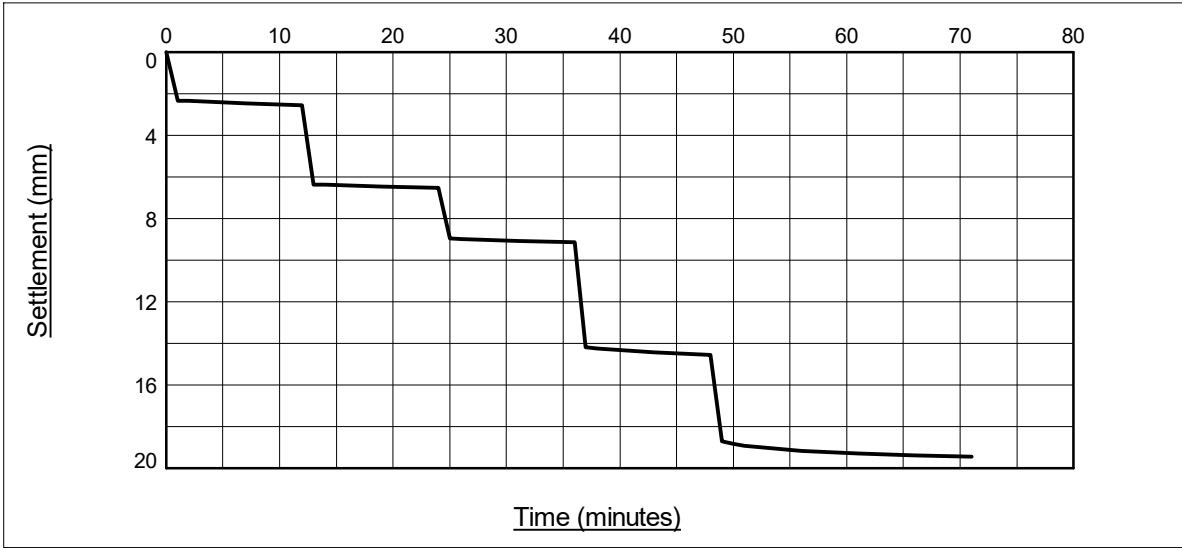
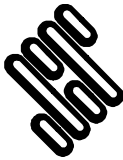
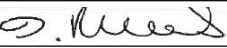


Plate Diameter (mm):	455	Reaction Load :	7 Tonne Tracked Excavator
Maximum Applied Pressure (kPa):	249	Maximum Applied Deformation (mm) :	19.447

Modulus of Subgrade Reaction at 1.25mm			
Applied Pressure:	27	kPa	Conversion to k_{762} : $k_{455} \times 0.6291$
k_{455} :	21600	kN/m ² /m	k_{762} : 13589 kN/m ² /m
Approximate Equivalent CBR Value (%): 0.89			
Calculations derived from section 7.14 of Department of Transport, Interim Advice Note 73/06 (Draft HD25) February 2009 Design Guidance for Road Pavement Foundations			

Additional Information	
Environmental Conditions at Time of Test: Cloudy	
Start Temperature: 6°C	
End Temperature: 6°C	
Distance Between Plate and Wall of Pit (m): 0.5	

	Compiled By		Date
			24/02/23
	Contract		Contract Ref:
STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG		C7898 Soth Cerney	751236

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07 | Graph 1 - PLATE LOADING [R1] - A4P | 751236-GINT.GPJ - v10_01.
Structural Soils Ltd. Branch Office - Bristol Lab: 1a Princess Street, Bedminster, Bristol, BS3 4AG. Tel: 0117-947-1000, Fax: 0117-947-1004, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 24/02/23 - 09:59 | DR1 |

PLATE LOADING TEST - INCREMENTAL

BS1377:Part 9:1990, Clause 4.1

Position ID: **PB2** Depth (m) : **0.20** Date of Test : **23/02/23**



Applied Pressure (kPa)	Average Settlement (mm)
3	0.000
52	0.797
102	2.203
151	3.103
200	4.313
249	6.803

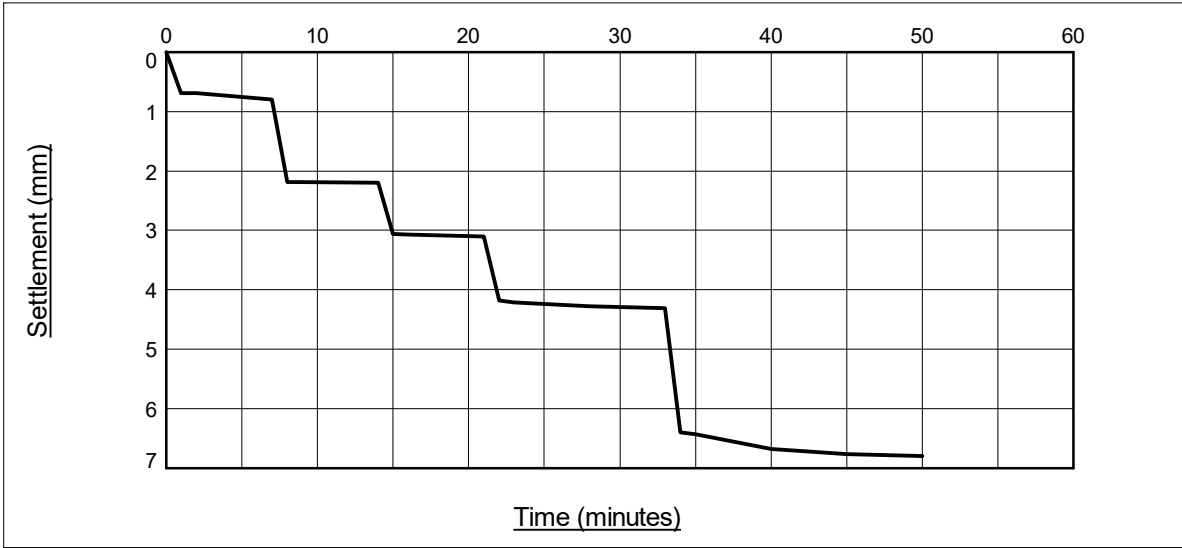
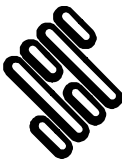


Plate Diameter (mm):	455	Reaction Load :	7 Tonne Tracked Excavator
Maximum Applied Pressure (kPa):	249	Maximum Applied Deformation (mm) :	6.803

Modulus of Subgrade Reaction at 1.25mm			
Applied Pressure:	68	kPa	Conversion to k_{762} : $k_{455} \times 0.6291$
k_{455} :	54400	kN/m ² /m	k_{762} : 34223 kN/m ² /m
Approximate Equivalent CBR Value (%): 4.4			
Calculations derived from section 7.14 of Department of Transport, Interim Advice Note 73/06 (Draft HD25) February 2009 Design Guidance for Road Pavement Foundations			

Additional Information	
Environmental Conditions at Time of Test: Cloudy	
Start Temperature: 6°C	
End Temperature: 6°C	



STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
		24/02/23
Contract		Contract Ref:
C7898 Soth Cerney		751236

PLATE LOADING TEST - INCREMENTAL

BS1377:Part 9:1990, Clause 4.1

Position ID: **PB3** Depth (m) : **0.20** Date of Test : **23/02/23**



Applied Pressure (kPa)	Average Settlement (mm)
3	0.000
52	2.197
102	4.100
151	6.653
200	10.027
249	16.023

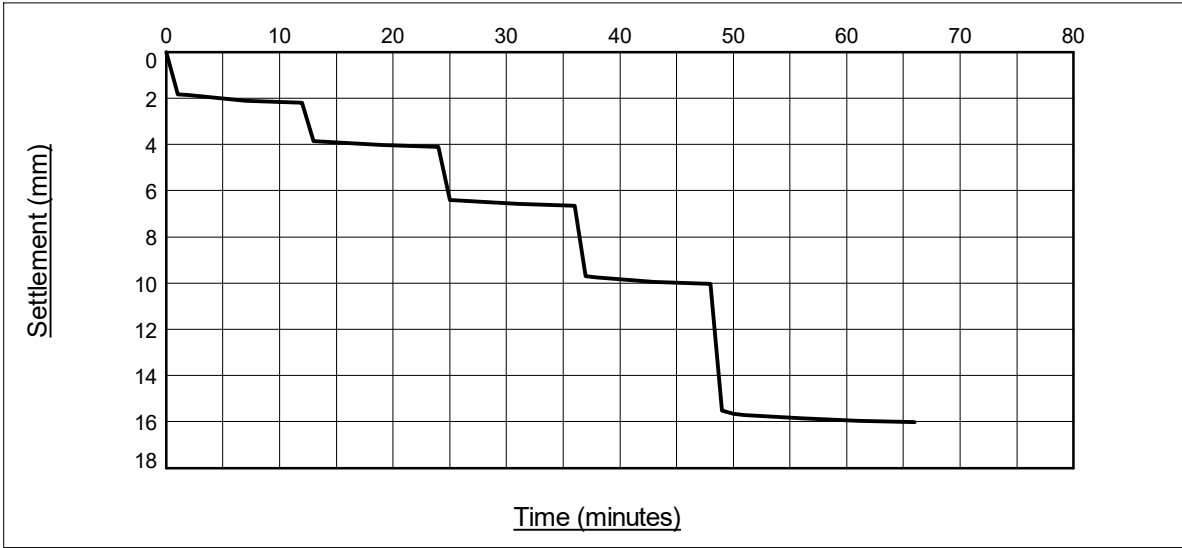
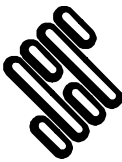


Plate Diameter (mm):	455	Reaction Load :	7 Tonne Tracked Excavator
Maximum Applied Pressure (kPa):	249	Maximum Applied Deformation (mm) :	16.023

Modulus of Subgrade Reaction at 1.25mm			
Applied Pressure:	31	kPa	Conversion to k_{762} : $k_{455} \times 0.6291$
k_{455} :	24800	kN/m ² /m	k_{762} : 15602 kN/m ² /m
Approximate Equivalent CBR Value (%): 1.1			
Calculations derived from section 7.14 of Department of Transport, Interim Advice Note 73/06 (Draft HD25) February 2009 Design Guidance for Road Pavement Foundations			

Additional Information	
Environmental Conditions at Time of Test: Cloudy	
Start Temperature: 6°C	
End Temperature: 6°C	
Distance Between Plate and Wall of Pit (m): 0.5	



STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
		24/02/23
Contract		Contract Ref:
C7898 Soth Cerney		751236

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07 | Graph 1 - PLATE LOADING [R1] - A4P | 751236-GINT.GPJ - v10_01.
Structural Soils Ltd. Branch Office - Bristol Lab: 1a Princess Street, Bedminster, Bristol, BS3 4AG. Tel: 0117-947-1000, Fax: 0117-947-1004, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 24/02/23 - 09:59 | DR1 |

PLATE LOADING TEST - INCREMENTAL

BS1377:Part 9:1990, Clause 4.1

Position ID: **PB4** Depth (m) : **0.20** Date of Test : **23/02/23**



Applied Pressure (kPa)	Average Settlement (mm)
3	0.000
52	1.293
102	3.067
151	4.787
200	6.670
249	12.200

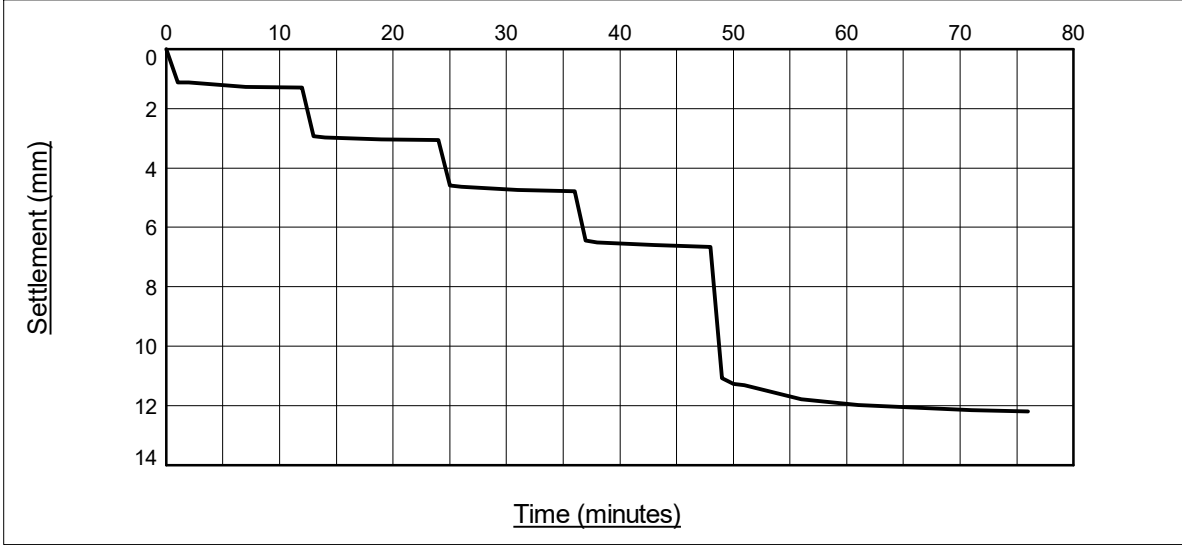


Plate Diameter (mm):	455	Reaction Load :	7 Tonne Tracked Excavator
Maximum Applied Pressure (kPa):	249	Maximum Applied Deformation (mm) :	12.200

<u>Modulus of Subgrade Reaction at 1.25mm</u>				
Applied Pressure:	50	kPa	Conversion to k_{762} :	$k_{455} \times 0.6291$
k_{455} :	40000	kN/m ² /m	k_{762} :	25164 kN/m ² /m
Approximate Equivalent CBR Value (%): 2.6				
Calculations derived from section 7.14 of Department of Transport, Interim Advice Note 73/06 (Draft HD25) February 2009 Design Guidance for Road Pavement Foundations				

Additional Information	
Environmental Conditions at Time of Test: Cloudy	
Start Temperature: 6°C	
End Temperature: 6°C	
Distance Between Plate and Wall of Pit (m): 0.5	

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By		Date
			DAISY RICHARDS
	Contract		Contract Ref:
C7898 Soth Cerney		751236	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07 | Graph 1 - PLATE LOADING [R1]- A4P | 751236-GINT.GPJ - v10_01.
Structural Soils Ltd. Branch Office - Bristol Lab: 1a Princess Street, Bedminster, Bristol, BS3 4AG. Tel: 0117-947-1000, Fax: 0117-947-1004, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 24/02/23 - 09:59 | DR1 |

PLATE LOADING TEST - INCREMENTAL

BS1377:Part 9:1990, Clause 4.1

Position ID: **PB5** Depth (m) : **0.20** Date of Test : **23/02/23**



Applied Pressure (kPa)	Average Settlement (mm)
3	0.000
52	1.643
102	3.060
151	5.220
200	7.863
250	10.890

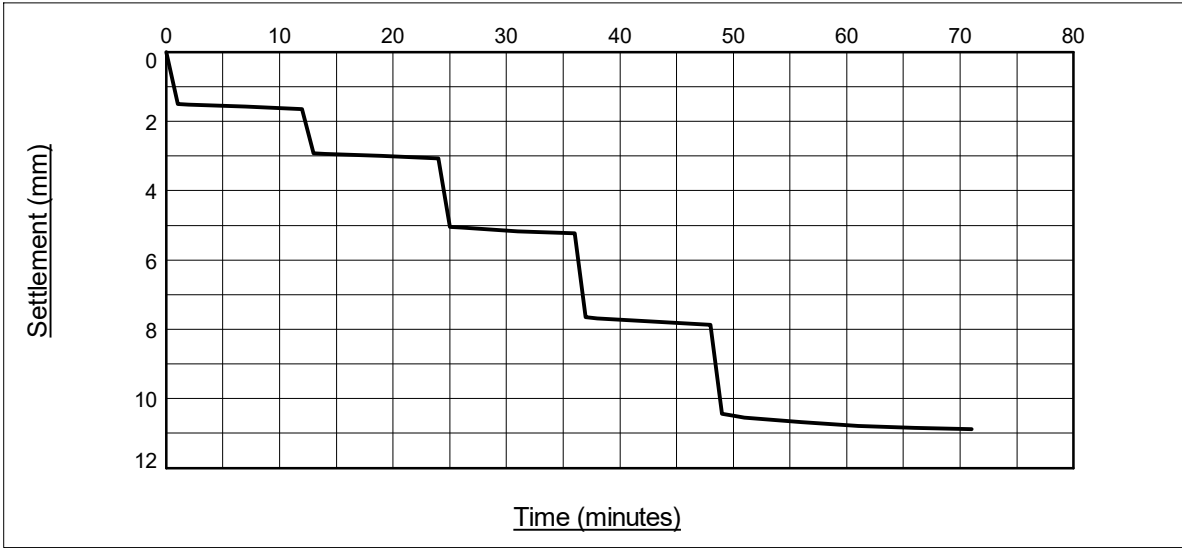
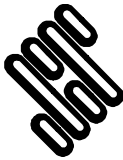


Plate Diameter (mm):	455	Reaction Load :	7 Tonne Tracked Excavator
Maximum Applied Pressure (kPa):	250	Maximum Applied Deformation (mm) :	10.890

Modulus of Subgrade Reaction at 1.25mm			
Applied Pressure:	40	kPa	Conversion to k_{762} : $k_{455} \times 0.6285$
k_{455} :	32000	kN/m ² /m	k_{762} : 20112 kN/m ² /m
Approximate Equivalent CBR Value (%): 1.8			
Calculations derived from section 7.14 of Department of Transport, Interim Advice Note 73/06 (Draft HD25) February 2009 Design Guidance for Road Pavement Foundations			

Additional Information	
Environmental Conditions at Time of Test: Cloudy	
Start Temperature: 6°C	
End Temperature: 6°C	
Distance Between Plate and Wall of Pit (m): 0.5	

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By		Date
			24/02/23
	Contract		Contract Ref:
C7898 Soth Cerney		751236	

APPENDIX 05

Dynamic Probe Results



CC Ground Investigations Ltd (T: 01452 739165 E: info@ccground.co.uk W: www.ccground.co.uk)

BOREHOLE NO.

CC Ground Investigations Ltd

CABLE PERCUSSION DRILLER DAILY REPORT

CLIENT SLR

DATE 22-2-23

CONTRACT No. C7898

SITE ASTON WORKS

RIG NUMBER

SPT NO.

WEATHER: Fine / Overcast / Drizzling / Raining / Stormy / Snowing / Freezing

SHEET: of

DRILLING RECORD

SAMPLES AND INSITU TESTING

Strata Description	Base of Strata (m)	Type No.	Depth (m)		Casing Depth (m)	Water Depth (m)	U-blows / Vane	Seating blows (mm)		SPT & CPT Test Blows (mm)			
			From	To				75	75	75	75	75	75
GR: 0.10;0.0,0/1,1,1,1,1 = DP5													
1 = 1,1,2,0,1/1,1,2,3,3 = 0 fubs													
2 = 3,3,2,2,2/2,2,2,2,2 = 20													
3 = 2,3,3,3,3/4,4,4,4,10,12 = 40													
4 = 12,11,10,11,11/12,13,11,16,18 = 60													
DP3													
GR: 0.0,0,0,1,1/1,1,1,1,1 = 0													
1 = 1,2,4,1,1/1,2,2,2,2 = 0													
2 = 2,1,2,2,2/2,2,3,3,3 = 30													
3 = 3,4,4,6,6/6,5,5,6,6 = 60													
4 = 6,10,9,8,8/8,9,10,10,13 = 60													
DP2													
GR: 0.00,1,1/1,1,1,1,1 = 0													
1 = 1,1,2,2,2/2,2,2,2,2 = 0													
2 = 2,3,3,2,3/3,3,3,3,3 = 20													
3 = 3,3,3,4,4/4,4,5,4,4 = 30													
4 = 4,5,5,5,7/7,6,9,10,11 = 60													

NR = No Recovery D = Disturbed B = Bulk UT = UT100 Undisturbed U = U4/U100 Undisturbed W = Water S = Standard Penetration Test C = Cone Penetration Test P = Piston V = Vane

CASING RECORD

GROUNDWATER DETAILS

INSTALLATION

DEPTH & DETAILS

Size (mm)	From (m)	To (m)	Date	Time	Strike / Standing Depth (m)	Rising To Depth (m)				Casing Depth (m)	Sealed Depth (m)		
						5 mins	10 mins	15 mins	20 mins				

RECORD OF STANDING TIME / CHISELING / DAYWORKS / DELAYS etc

Time (Mins)		Depth (m)		Description
From	To	From	To	

REMARKS

ONSITE TIME RECORD

Drillers Name and Signature Rob Smith	Onsite		Pipe size	110mm/50mm/40mm/19mm
			Plain (m)	
	Offsite		Slotted (m)	
			Geosock	Yes/No
	Breaks (mins)		Gas Valve	Yes/No
			Gripper Plug	Yes/No
			Cover type / size	Raised/Flush = mm



CABLE PERCUSSION DRILLER DAILY REPORT

CONTRACT No. C7989

SPT NO.

WEATHER: Fine / Overcast / Drizzling / Raining / Stormy / Snowing / Freezing

BOREHOLE NO.

DP 1,4.

SHEET: _____ of _____

DRILLING RECORD

SAMPLES AND INSITU TESTING

[illegible]

NR = No Recovery D = Disturbed B = Bulk UT = UT100 Undisturbed U = U4/U100 Undisturbed W = Water S = Standard Penetration Test C = Cone Penetration Test P = Piston V = Vane

CASING RECORD

GROUNDWATER DETAILS

INSTALLATION

DEPTH & DETAILS

[illegible]

RECORD OF STANDING TIME / CHISELING / DAYWORKS / DELAYS etc

[illegible]

REMARKS

ON-SITE TIME RECORD

Onsite		Pipe size	110mm/50mm/40mm/19mm
Onsite		Plain (m)	
		Slotted (m)	
Offsite		Geosock	Yes/No
		Gas Valve	Yes/No
Breaks (mins)		Gripper Plug	Yes/No
		Cover type / size	Raised/Flush = mm

Drillers Name and Signature

Rob Smith



CC Ground Investigations Ltd

CC Ground Investigations Ltd (T: 01452 739165 E: info@ccground.co.uk W: www.ccground.co.uk)

CABLE PERCUSSION DRILLER DAILY REPORT

BOREHOLE NO.

DP7.9

CLIENT SLR

DATE 23-2-23

CONTRACT No. C7818

SITE BARNON 167.05

RIG NUMBER

SPT NO.

WEATHER: Fine / Overcast / Drizzling / Raining / Stormy / Snowing / Freezing

SHEET: of

DRILLING RECORD

SAMPLES AND INSITU TESTING

Strata Description	Base of Strata (m)	Type No.	Depth (m)		Casing Depth (m)	Water Depth (m)	U-blows / Vane	Seating blows (mm)		SPT & CPT Test Blows (mm)			
			From	To				75	75	75	75	75	75
CL = 0.0, 0.1, 1.1 / 1.1, 1.1, 1.1 = 0													
1 = 1.2, 2.2, 1.1 / 2.2, 2.2, 3 = 0													
2 = 3.3, 4.4, 4.4 / 4.5, 9.1, 14.16 = 60													
3 = 15.16, 19.7, 8 / 35.6, 6.7 = 20													
4 = 7.7, 7.5, 9 / 8.8, 9.11, 13 = 80													
DP9													
CL = 0.0, 0.1, 1.1 / 1.1, 1.1, 1.1 = 0													
1 = 1.0, 0.1, 1.1 / 4.1, 1.1, 1.1 = 0													
2 = 1.2, 2.3, 3 / 4.4, 4.4, 3.4 = 20													
3 = 4.4, 4.4, 4.4 / 4.5, 5.5, 5 = 30													
4 = 5.6, 5.6 / 6.6, 5.9, 9 = 60													

NR = No Recovery D = Disturbed B = Bulk UT = UT100 Undisturbed U = U4/U100 Undisturbed W = Water S = Standard Penetration Test C = Cone Penetration Test P = Piston V = Vane

CASING RECORD

GROUNDWATER DETAILS

INSTALLATION

DEPTH & DETAILS

Size (mm)	From (m)	To (m)	Date	Time	Strike / Standing Depth (m)	Rising To Depth (m)				Casing Depth (m)	Sealed Depth (m)		
						5 mins	10 mins	15 mins	20 mins				

RECORD OF STANDING TIME / CHISELING / DAYWORKS / DELAYS etc

Time (Mins)		Depth (m)		Description
From	To	From	To	

REMARKS

ONSITE TIME RECORD

Drillers Name and Signature Rob Smith			Pipe size	110mm/50mm/40mm/19mm
	Onsite		Plain (m)	
			Slotted (m)	
	Offsite		Geosock	Yes/No
			Gas Valve	Yes/No
	Breaks (mins)		Gripper Plug	Yes/No
			Cover type / size	Raised/Flush = mm



CC Ground Investigations Ltd (T: 01452 739165 E: info@ccground.co.uk W: www.ccground.co.uk)

BOREHOLE NO.

DP6, 8, 10

CC Ground Investigations Ltd

CABLE PERCUSSION DRILLER DAILY REPORT

CLIENT SLR

DATE 23/2/23

CONTRACT No. C7898

SITE Ashdon 107NES

RIG NUMBER

SPT NO.

WEATHER: Fine / Overcast / Drizzling / Raining / Stormy / Snowing / Freezing

SHEET: of

DRILLING RECORD

SAMPLES AND INSITU TESTING

Strata Description	Base of Strata (m)	Type No.	Depth (m)		Casing Depth (m)	Water Depth (m)	U-blows / Vane	Seating blows (mm)		SPT & CPT Test Blows (mm)			
			From	To				75	75	75	75	75	75
GL = 1,2,2,2,2/1,0,1,1,3 = 0													
1 = 2,2,3,4,5/6,7,6,6,6 = 20													
2 = 6,5,5,5,5/6,7,7,10,11 = 60													
3 = 10,10,9,7,7/5,7,6,6,7 = 60													
4 = 7,8,7,7,7/7,8,8,7,9 = 60													
DP8													
GL = 1,2,3,3,3/2,2,1,2,2 = 0													
1 = 2,2,1,2,2/2,2,3,3,3 = 0													
2 = 3,3,3,4,4/4,3,5,5,5 = 0													
3 = 5,4,6,6,6/6,7,7,7,6 = 30													
4 = 7,7,7,7,7/7,9,8,9,9 = 60													
DP10													
GL = 1,1,1,0,1,0/1,1,1,1,1 = 0													
2 = 1,2,2,3,2/2,2,2,2,2 = 0													
3 = 2,3,5,6,7/7,7,6,5 = 20													
4 = 5,6,9,7,7/7,6,9,9,9 = 60													

NR = No Recovery D = Disturbed B = Bulk UT = UT100 Undisturbed U = U4/U100 Undisturbed W = Water S = Standard Penetration Test C = Cone Penetration Test P = Piston V = Vane

CASING RECORD

GROUNDWATER DETAILS

INSTALLATION

DEPTH & DETAILS

Size (mm)	From (m)	To (m)	Date	Time	Strike / Standing Depth (m)	Rising To Depth (m)				Casing Depth (m)	Sealed Depth (m)		
						5 mins	10 mins	15 mins	20 mins				

RECORD OF STANDING TIME / CHISELING / DAYWORKS / DELAYS etc

Time (Mins)		Depth (m)		Description
From	To	From	To	

REMARKS

ONSITE TIME RECORD

Drillers Name and Signature 			Pipe size	110mm/50mm/40mm/19mm
	Onsite		Plain (m)	
			Slotted (m)	
	Offsite		Geosock	Yes/No
			Gas Valve	Yes/No
	Breaks (mins)		Gripper Plug	Yes/No
			Cover type / size	Raised/Flush = mm

APPENDIX 06

Chemical Laboratory Certificates

SLR Consulting Ltd

28 Mill Barn

Turkey Mill

Maidstone

ME14 5PP



4225



Attention : Dominic Goodchild-James

Date : 13th March, 2023

Your reference : 404.11923.00004

Our reference : Test Report 23/3260 Batch 1 Schedule A 23/3260 Batch 1 Schedule C

Location : Ashton Keynes

Date samples received : 2nd March, 2023

Status : Final Report

Issue : 1

Fifty one samples were received for analysis on 2nd March, 2023 of which eight were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Simon Gomery BSc

Project Manager

Please include all sections of this report if it is reproduced

Client Name: SLR Consulting Ltd
Reference: 404.11923.00004
Location: Ashton Keynes
Contact: Dominic Goodchild-James
EMT Job No: 23/3260

Solids: V=60g VOC jar. J=250g glass jar. T=plastic tub

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: SLR Consulting Ltd
Reference: 404.11923.00004
Location: Ashton Keynes
Contact: Dominic Goodchild-James
EMT Job No: 23/3260

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	52-54	61-63	64-66	73-75	94-95	105-107	121-123			Please see attached notes for all abbreviations and acronyms		
Sample ID	DBH1	SBH3	SBH4	SBH5	SBH6	TP102	TP103	TP5					
Depth	0.0-0.30	3.45	1.50	0.15	1.25	0.10	1.20	0.00-0.20					
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J	V J T	V J T					
Sample Date	20/02/2023	22/02/2023	23/02/2023	24/02/2023	24/02/2023	22/02/2023	22/02/2023	23/02/2023					
Sample Type	Clayey Sand	Clay	Clayey Sand	Clayey Sand	Clay	Clay	Clayey Sand	Sandy Loam					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	02/03/2023	02/03/2023	02/03/2023	02/03/2023	02/03/2023	02/03/2023	02/03/2023	02/03/2023			LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL) ^{#M}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) ^{#M}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL) ^{#M}	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) ^{#M}	<4	<4	<4	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) ^{#M}	<7	<7	<7	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) ^{#M}	<7	<7	<7	13	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-35 (EH+HS_CU_1D_AL)	<19	<19	<19	<19	<19	<19	<19	<19			<19	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR) [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) ^{#M}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR) [#]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) [#]	<4	<4	<4	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) [#]	<7	<7	<7	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) [#]	<7	<7	<7	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-35 (EH+HS_CU_1D_AR) [#]	<19	<19	<19	<19	<19	<19	<19	<19			<19	mg/kg	TM5/PM8/PM16
Total aliphatics and aromatics (C5-35) (EH+HS_CU_1D_Total)	<38	<38	<38	<38	<38	<38	<38	<38			<38	mg/kg	TM5/PM8/PM16
Natural Moisture Content	20.4	17.1	19.9	20.1	20.7	23.6	22.1	20.4			<0.1	%	PM4/PM0
Free Cyanide	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	mg/kg	TM89/PM45
Total Cyanide ^{#M}	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	mg/kg	TM89/PM45
Sample Type	Clayey Sand	Clay	Clayey Sand	Clayey Sand	Clay	Clay	Clayey Sand	Sandy Loam			None		PM13/PM0
Sample Colour	Medium Brown	Medium Grey	Light Brown	Medium Brown	Medium Brown	Medium Brown	Light Brown	Medium Brown			None		PM13/PM0
Other Items	roots	sand	none	stones and vegetation	sand	sand	none	stones and vegetation			None		PM13/PM0
Total Organic Carbon [#]	1.2	0.46	0.14	1.2	0.59	1.4	0.16	1.7			<0.02	%	TM21/PM24
pH ^{#M}	5.7	7.7	7.5	5.5	7.4	6.0	8.0	7.3			<0.01	pH units	TM73/PM11

Client Name: SLR Consulting Ltd
Reference: 404.11923.00004
Location: Ashton Keynes
Contact: Dominic Goodchild-James

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/3260

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 23/3260

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes	Yes	AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details	Yes		AR	Yes
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	No
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO ₂ generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.	Yes		AD	Yes

EMT Job No: 23/3260

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes	Yes	AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes	Yes	AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes	Yes	AR	Yes

APPENDIX 07

Assessment Criteria Screening

Generic Risk Assessment - Soils
Lab Data Screening

SLR



Client Name	Acorn AD
Site Name	Ashton Keynes
Job Number	404.11923.00004.0027
Date	13/03/2023
Description of Data Assessment / Zoning	Zone X
Selected Screening Value and Land Use	GAC - Commercial

Sample ID	DBH1	SBH3	SBH4	SBH5	SBH6	TP102	TP103	TP5
Depth	0.0-0.30	3.45	1.50	0.15	1.25	0.1	1.2	0.00-0.20
Sample Type	Clayey Sand	Clay	Clayey Sand	Clayey Sand	Clay	Clay	Clayey Sand	Sandy Loam
Sampled Date	23/02/20	23/02/22	23/02/23	23/02/24	23/02/24	23/02/22	23/02/22	23/02/23
Sample Received Date	23/03/02	23/03/02	23/03/02	23/03/02	23/03/02	23/03/02	23/03/02	23/03/02
EMT Sample No	1-3	52-54	61-63	64-66	73-75	94-95	105-107	121-123
Batch Number	1	1	1	1	1	1	1	1
Strata / Zone	Zone X	Zone X	Zone X	Zone X	Zone X	Zone X	Zone X	Zone X

Test	Units	LOD	Selected GAC	No. Above GAC								
Arsenic	mg/kg	<0.5	640	0	11	5.8	4.9	8.6	13	10	15	17
Barium	mg/kg	<1	22000	0	39	23	24	32	53	40	20	70
Beryllium	mg/kg	<0.5	420	0	0.8	0.9	0.7	0.6	1.1	1.1	0.9	1.9
Cadmium	mg/kg	<0.1	348	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	<0.5	30400	0	87	59	74	90	75	70	78	77
Copper	mg/kg	<1	71700	0	10	10	3	7	10	10	9	22
Lead	mg/kg	<5	2330	0	78	10	5	38	14	19	5	51
Mercury	mg/kg	<0.1	3600	0	<0.1	0.1	<0.1	0.2	<0.1	0.2	<0.1	0.2
Nickel	mg/kg	<0.7	1800	0	15	21	15	13	18	24	14	18
Selenium	mg/kg	<1	13000	0	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	mg/kg	<1	3160	0	33	24	33	28	48	38	23	46
Zinc	mg/kg	<5	665000	0	52	47	43	43	58	62	27	100
PAH MS					-	-	-	-	-	-	-	-
Naphthalene	mg/kg	<0.04	200	0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Acenaphthylene	mg/kg	<0.03	84000	0	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Acenaphthene	mg/kg	<0.05	85000	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg	<0.04	64000	0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Phenanthrene	mg/kg	<0.03	22000	0	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.1
Anthracene	mg/kg	<0.04	530000	0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Fluoranthene	mg/kg	<0.03	23000	0	0.12	<0.03	<0.03	0.16	<0.03	0.07	<0.03	0.23
Pyrene	mg/kg	<0.03	54000	0	0.11	<0.03	<0.03	0.13	<0.03	0.06	<0.03	0.19
Benzo(a)anthracene	mg/kg	<0.06	90	0	0.11	<0.06	<0.06	0.24	<0.06	0.09	<0.06	0.18
Chrysene	mg/kg	<0.02	140	0	0.08	<0.02	<0.02	0.24	<0.02	0.06	<0.02	0.16
Benzo(bk)fluoranthene	mg/kg	<0.07			0.18	<0.07	<0.07	0.49	<0.07	0.12	<0.07	0.28
Benzo(a)pyrene	mg/kg	<0.04	14	0	0.08	<0.04	<0.04	0.24	<0.04	<0.04	<0.04	0.14
Indeno(123cd)pyrene	mg/kg	<0.04	60	0	0.07	<0.04	<0.04	0.19	<0.04	<0.04	<0.04	0.11
Dibenz(a,h)anthracene	mg/kg	<0.04	13	0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Benzo(ghi)perylene	mg/kg	<0.04	650	0	0.06	<0.04	<0.04	0.14	<0.04	<0.04	<0.04	0.08
PAH 16 Total	mg/kg	<0.6			0.8	<0.6	<0.6	1.8	<0.6	<0.6	<0.6	1.5
Benzo(b)fluoranthene	mg/kg	<0.05	100	0	0.13	<0.05	<0.05	0.35	<0.05	0.09	<0.05	0.2
Benzo(k)fluoranthene	mg/kg	<0.02	140	0	0.05	<0.02	<0.02	0.14	<0.02	0.03	<0.02	0.08
PAH Surrogate % Recovery	%	<0			92	89	92	97	98	100	95	94
Methyl Tertiary Butyl Ether	mg/kg	<0.005	7900	0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzene	mg/kg	<0.005	28	0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Toluene	mg/kg	<0.005	869	0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ethylbenzene	mg/kg	<0.005	518	0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
m & p Xylene	mg/kg	<0.005	576	0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
o-Xylene	mg/kg	<0.005	576	0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Xylenes	mg/kg	<0.01			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TPH CWG					-	-	-	-	-	-	-	-
Aliphatics					-	-	-	-	-	-	-	-
Aliphatics >C5-C6	mg/kg	<0.1	3400	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aliphatics >C6-C8	mg/kg	<0.1	8300	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aliphatics >C8-C10	mg/kg	<0.1	2100	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aliphatics >C10-C12	mg/kg	<0.2	10000	0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Aliphatics >C12-C16	mg/kg	<4	61000	0	<4	<4	<4	<4	<4	<4	<4	<4
Aliphatics >C16-C21	mg/kg	<7	1600000	0	<7	<7	<7	<7	<7	<7	<7	<7
Aliphatics >C21-C35	mg/kg	<7	1600000	0	<7	<7	<7	13	<7	<7	<7	<7
Total Aliphatics >C5 - C35	mg/kg	<19			<19	<19	<19	<19	<19	<19	<19	<19
Aromatics					-	-	-	-	-	-	-	-
Aromatics >EC5-EC7	mg/kg	<0.1	28000	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aromatics >EC7-EC8	mg/kg	<0.1	59000	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aromatics >EC8-EC10	mg/kg	<0.1	3700	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aromatics >EC10-EC12	mg/kg	<0.2	17000	0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Aromatics >EC12-EC16	mg/kg	<4	36000	0	<4	<4	<4	<4	<4	<4	<4	<4
Aromatics >EC16-EC21	mg/kg	<7	28000	0	<7	<7	<7	<7	<7	<7	<7	<7
Aromatics >EC21-EC35	mg/kg	<7	28000	0	<7	<7	<7	<7	<7	<7	<7	<7
Total aromatics C5-35	mg/kg	<19			<19	<19	<19	<19	<19	<19	<19	<19
Total aliphatics and aromatics(C5-35)	mg/kg	<38			<38	<38	<38	<38	<38	<38	<38	<38
Natural Moisture Content	%	<0.1			20.4	17.1	19.9	20.1	20.7	23.6	22.1	20.4
Free Cyanide	mg/kg	<0.5		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Cyanide	mg/kg	<0.5		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sample Type	None				Clayey Sand	Clay	Clayey Sand	Clayey Sand	Clay	Clay	Clayey Sand	Sandy Loam
Sample Colour	None				Medium Brown roots	Medium Grey sand	Light Brown none	Medium Brown stones and vegetation	Medium Brown sand	Medium Brown sand	Light Brown none	Medium Brown stones and vegetation
Other Items	None				-	-	-	-	-	-	-	-
Total Organic Carbon	%	<0.02			1.2	0.46	0.14	1.2	0.59	1.4	0.16	1.7
pH	pH units	<0.01			5.7	7.7	7.5	5.5	7.4	6	8	7.3
					-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-
	None				brown soil/stones	-	-	brown soil/stones	-	Brown Soil/Stones	-	loose soil
	None				NAD	-	-	NAD	-	NAD	-	NAD
	None				NAD	-	-	NAD	-	NAD	-	NAD
	None				NAD	-	-	NAD	-	NAD	-	NAD

APPENDIX 08

Geotechnical Laboratory Certificates

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27 March 2023

Report No : GEO/37551/01

Page 1 of 1

For the attention of Ms A Kenshole

Our ref **GEO / 37551**
Your Ref **404.11923.00004**

Date samples received 01/03/2023
Date written instructions received 03/03/2023
Date testing commenced 04/03/2023
Date of sample disposal 24/04/2023

Project **ASHTON KEYNES**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	~	Geotechnical Test Summary
2	~	Liquid & Plastic Limits Summary
	27	Water Content
	18	Liquid & Plastic Limits
3	~	Geochemical Test Summary
	19	pH Value & Water Soluble Sulphate Content as SO4
4	3	Particle Size Distribution
5	4	Moisture Content / Dry Density Relationship
6	2	One Dimensional Consolidation
7	5	Unconsolidated Undrained Triaxial Compression
8	1	Shear Strength by Direct Shear

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**

J Sturges
Operations Manager

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC	LL	PL	PI	<425 µm	Bulk	Dry	Condition	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					%	%	%	%	%	Mg/m³	Mg/m³		kPa	kPa	kPa		g/L	mg/L	
DBH1	0.30-0.90		B	Yellowish brown sandy silty CLAY with rare roots.	17.5														Particle Size Distribution
DBH1	0.90-1.20		B																Direct Shear
DBH1	1.20-1.65		D	Brown and grey sandy silty CLAY. Sand is fine.	19.2	33	16	17	100										
DBH1	2.00-3.00		B	Grey sandy silty CLAY. Sand is fine.	15.5														Compaction
DBH1	2.00-2.45		D													8.1	0.55		
DBH1	4.00-4.45		D	Grey mottled brown slightly sandy silty CLAY. Sand is fine.	18.7	49	20	29	100										
DBH1	5.00-5.45		U	Stiff extremely closely fissured grey slightly sandy silty CLAY with occasional shell fragments. Sand is fine.	19.2					2.16	1.81	Undisturbed	100	291	145				One Dimensional Consolidation
DBH1	6.50-6.95		D													8.6	0.10		
DBH1	8.00-8.45		U	Very stiff dark grey slightly sandy clayey SILT with rare shell fragments. Sand is fine.	15.9					2.20	1.90	Undisturbed	160	404	202				
DBH1	10.00-10.45		D	Grey slightly gravelly slightly sandy CLAY with rare shell fragments. Sand and gravel are fine.	14.7	39	16	23	99										

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

NP=Non Plastic

Checked and Approved by

J Sturges - Operations Manager
27/03/2023

Project Number:

Project Name:

GEO / 37551

ASHTON KEYNES
404.11923.00004



SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC	LL	PL	PI	<425 µm	Bulk	Dry	Condition	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					%	%	%	%	%	Mg/m³	Mg/m³		kPa	kPa	kPa		g/L	mg/L	
DBH2	0.90-1.20		B	Grey mottled yellowish brown sandy silty CLAY. Sand is fine, rare medium to coarse.															Particle Size Distribution
DBH2	2.30-2.30		D	Grey sandy silty CLAY. Sand is fine.	14.9	33	14	19	100										
DBH2	3.00-3.45		U	Firm to stiff grey very sandy silty CLAY. Sand is fine.	15.1					2.22	1.93	Undisturbed	60	305	153				One Dimensional Consolidation
DBH2	4.00		D													8.4	0.79		
DBH2	5.00-5.45		U	Very stiff dark grey clayey SILT.	20.6					2.16	1.79	Undisturbed	100	224	112				
DBH2	5.45-5.55		D	Grey sandy silty CLAY. Sand is fine.	13.0	35	16	19	100										
DBH2	8.00-8.45		U	Very stiff dark grey silty CLAY.	19.6					2.17	1.82	Undisturbed	160	371	185				
DBH2	8.45-8.55		D	Grey sandy silty CLAY. Sand is fine.	15.1	40	17	23	100										
PBT10	0.40		D													7.6	< 0.010		
PBT6	0.20		D													7.7	0.018		

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

NP=Non Plastic

Checked and Approved by



J Sturges - Operations Manager
27/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
404.11923.00004**

GEOLABS®

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC	LL	PL	PI	<425 µm	Bulk	Dry	Condition	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					%	%	%	%	%	Mg/m³	Mg/m³		kPa	kPa	kPa		g/L	mg/L	
PBT8	0.30		D													6.7	0.013		
SBH1	0.20-0.50		D													6.0	< 0.010		
SBH1	0.50-0.50		D	Brown sandy CLAY. Sand is fine.	20.2														
SBH1	2.00-2.00		D	Brown and grey sandy gravelly CLAY. Sand is fine.	19.5	34	18	16	100										
SBH2	1.00		D	Brown mottled light grey sandy silty CLAY. Sand is fine.	22.1											7.7	0.019		
SBH2	3.00-3.45		D	Grey mottled brown slightly sandy silty CLAY. Sand is fine.	13.2	29	12	17	100										
SBH2	4.00-4.45		D	Grey mottled orangish brown sandy silty CLAY. Sand is fine.	13.3	32	14	18	100										
SBH3	0.50		D													7.3	< 0.010		
SBH3	1.20-1.65		D	Brown and light grey sandy silty CLAY. Sand is fine.	20.8	37	16	21	100										
SBH3	2.00-2.45		D													6.5	0.092		

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

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27/03/2023

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**ASHTON KEYNES
404.11923.00004**

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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC	LL	PL	PI	<425 µm	Bulk	Dry	Condition	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					%	%	%	%	%	Mg/m³	Mg/m³		kPa	kPa	kPa		g/L	mg/L	
SBH4	1.20-1.65		D													7.8	0.020		
SBH4	2.00-2.45		D	Orangish brown silty sandy CLAY. Sand is fine.	16.4		NP		100										
SBH5	0.50		D	Brown silty sandy CLAY. Sand is fine.	16.0											6.9	< 0.010		
SBH5	2.00-2.45		D	Brown and orangish brown sandy silty CLAY. Sand is fine.	19.6	35	18	17	100							7.7	0.012		
SBH6	1.00		D													8.1	< 0.010		
SBH6	3.00-3.45		D	Grey slightly sandy CLAY covered in orangish brown fine sandy.	19.8	48	19	29	100										
TP101	1.20		D	Orangish brown mottled light grey sandy CLAY. Sand is fine.	20.0	42	16	26	100										
TP101	2.00		D													8.0	< 0.010		
TP102	0.32		B	Brown slightly sandy CLAY. Sand is fine.	23.5											7.5	0.024		
TP102	1.00		D													7.6	< 0.010		

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

NP=Non Plastic

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J Sturges - Operations Manager
27/03/2023

Project Number:

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Project Name:

**ASHTON KEYNES
404.11923.00004**

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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC	LL	PL	PI	<425 µm	Bulk	Dry	Condition	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					%	%	%	%	%	Mg/m³	Mg/m³		kPa	kPa	kPa		g/L	mg/L	
TP102	2.00		D	Grey mottled orangish brown slightly sandy silty CLAY. Sand is fine.	17.3	37	14	23	100										
TP103	0.90		B	Yellowish brown sandy silty CLAY.	21.3														Compaction
TP103	1.20		D	Dark brown and light grey silty sandy CLAY. Sand is fine.	21.3	28	17	11	100										
TP104	1.30		D													7.8	< 0.010		
TP104	2.50		B	Grey slightly sandy silty CLAY.															Particle Size Distribution
TP104	3.00		D	Dark grey sandy CLAY. Sand is fine.	15.6	29	13	16	100										
TP105	2.30		B	Grey mottled yellowish brown sandy silty CLAY.	16.8														Compaction
TP106	2.60-2.60		D	Grey mottled orangish brown slightly sandy silty CLAY.	16.5	33	14	19	100							8.1	0.15		
TP106	2.70		B	Grey mottled yellowish brown sandy silty CLAY.	16.8														Compaction

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

NP=Non Plastic

Checked and Approved by



J Sturges - Operations Manager
27/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
404.11923.00004**

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SUMMARY OF LIQUID AND PLASTIC LIMIT TESTS

Location	Depth m	Sample Ref	Sample Type	Description	Water Content BS EN ISO 17892-1 : 2014 %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Percentage Passing 425µm %	Atterberg Classification	Test Type	Sample Condition
DBH1	0.30-0.90		B	Yellowish brown sandy silty CLAY with rare roots.	17.5	~	~	~	~	~	~	~
DBH1	1.20-1.65		D	Brown and grey sandy silty CLAY. Sand is fine.	19.2	33	16	17	100	CL	2	1
DBH1	2.00-3.00		B	Grey sandy silty CLAY. Sand is fine.	15.5	~	~	~	~	~	~	~
DBH1	4.00-4.45		D	Grey mottled brown slightly sandy silty CLAY. Sand is fine.	18.7	49	20	29	100	CI	2	1
DBH1	10.00-10.45		D	Grey slightly gravelly slightly sandy CLAY with rare shell fragments. Sand and gravel are fine.	14.7	39	16	23	99	CI	2	1
DBH2	2.30-2.30		D	Grey sandy silty CLAY. Sand is fine.	14.9	33	14	19	100	CL	2	1
DBH2	5.45-5.55		D	Grey sandy silty CLAY. Sand is fine.	13.0	35	16	19	100	CL	2	1
DBH2	8.45-8.55		D	Grey sandy silty CLAY. Sand is fine.	15.1	40	17	23	100	CI	2	1
SBH1	0.50-0.50		D	Brown sandy CLAY. Sand is fine.	20.2	~	~	~	~	~	~	~
SBH1	2.00-2.00		D	Brown and grey sandy gravelly CLAY. Sand is fine.	19.5	34	18	16	100	CL	2	1
SBH2	1.00		D	Brown mottled light grey sandy silty CLAY. Sand is fine.	22.1	~	~	~	~	~	~	~
SBH2	3.00-3.45		D	Grey mottled brown slightly sandy silty CLAY. Sand is fine.	13.2	29	12	17	100	CL	2	1
SBH2	4.00-4.45		D	Grey mottled orangish brown sandy silty CLAY. Sand is fine.	13.3	32	14	18	100	CL	2	1
SBH3	1.20-1.65		D	Brown and light grey sandy silty CLAY. Sand is fine.	20.8	37	16	21	100	CI	2	1
SBH4	2.00-2.45		D	Orangish brown silty sandy CLAY. Sand is fine.	16.4	~	NP		100	~	3	1

Test Type:

- 1 - 1 point 80g / 30° fall cone method.
 2 - 4 point 80g / 30° fall cone method.
 3 - Non plastic determination.

Sample condition:

- 1 - As Received
 2 - Air Dried
 3 - Washed & Air Dried

Checked and Approved by:



J Sturges - Operations Manager
 27/03/2023

Project Number:

GEO / 37551

Project Name:

ASHTON KEYNES
 404.11923.00004

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SUMMARY OF LIQUID AND PLASTIC LIMIT TESTS

Location	Depth m	Sample Ref	Sample Type	Description	Water Content BS EN ISO 17892-1 : 2014 %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Percentage Passing 425µm %	Atterberg Classification	Test Type	Sample Condition
SBH5	0.50		D	Brown silty sandy CLAY. Sand is fine.	16.0	~	~	~	~	~	~	~
SBH5	2.00-2.45		D	Brown and orangish brown sandy silty CLAY. Sand is fine.	19.6	35	18	17	100	CL	2	1
SBH6	3.00-3.45		D	Grey slightly sandy CLAY covered in orangish brown fine sandy.	19.8	48	19	29	100	CI	2	1
TP101	1.20		D	Orangish brown mottled light grey sandy CLAY. Sand is fine.	20.0	42	16	26	100	CI	2	1
TP102	0.32		B	Brown slightly sandy CLAY. Sand is fine.	23.5	~	~	~	~	~	~	~
TP102	2.00		D	Grey mottled orangish brown slightly sandy silty CLAY. Sand is fine.	17.3	37	14	23	100	CI	2	1
TP103	0.90		B	Yellowish brown sandy silty CLAY.	21.3	~	~	~	~	~	~	~
TP103	1.20		D	Dark brown and light grey silty sandy CLAY. Sand is fine.	21.3	28	17	11	100	CL	2	1
TP104	3.00		D	Dark grey sandy CLAY. Sand is fine.	15.6	29	13	16	100	CL	2	1
TP105	2.30		B	Grey mottled yellowish brown sandy silty CLAY.	16.8	~	~	~	~	~	~	~
TP106	2.60-2.60		D	Grey mottled orangish brown slightly sandy silty CLAY.	16.5	33	14	19	100	CL	2	1
TP106	2.70		B	Grey mottled yellowish brown sandy silty CLAY.	16.8	~	~	~	~	~	~	~

Test Type:

- 1 - 1 point 80g / 30° fall cone method.
 2 - 4 point 80g / 30° fall cone method.
 3 - Non plastic determination.

Sample condition:

- 1 - As Received
 2 - Air Dried
 3 - Washed & Air Dried

Checked and Approved by:



J Sturges - Operations Manager
 27/03/2023

Project Number:

GEO / 37551

Project Name:

ASHTON KEYNES
 404.11923.00004

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SUMMARY OF CHEMICAL TESTS ON SOIL

Location	Depth m	Sample Ref	Sample Type	pH Value	Total Acid Soluble Sulphate as SO ₄ %	Water Soluble Sulphate as SO ₄ 2:1 Water:Soil Extract g/l	Total Sulphur %	Water Soluble Chloride g/l	Water Soluble Nitrate g/l	Magnesium g/l	Organic Content %	Mass Loss on Ignition %	Carbonate Content %
DBH1	2.00-2.45		D	8.1	-	0.55	-	-	-	-	-	-	-
DBH1	6.50-6.95		D	8.6	-	0.10	-	-	-	-	-	-	-
DBH2	4.00		D	8.4	-	0.79	-	-	-	-	-	-	-
PBT10	0.40		D	7.6	-	< 0.010	-	-	-	-	-	-	-
PBT6	0.20		D	7.7	-	0.018	-	-	-	-	-	-	-
PBT8	0.30		D	6.7	-	0.013	-	-	-	-	-	-	-
SBH1	0.20-0.50		D	6.0	-	< 0.010	-	-	-	-	-	-	-
SBH2	1.00		D	7.7	-	0.019	-	-	-	-	-	-	-
SBH3	0.50		D	7.3	-	< 0.010	-	-	-	-	-	-	-
SBH3	2.00-2.45		D	6.5	-	0.092	-	-	-	-	-	-	-
SBH4	1.20-1.65		D	7.8	-	0.020	-	-	-	-	-	-	-
SBH5	0.50		D	6.9	-	< 0.010	-	-	-	-	-	-	-
SBH5	2.00-2.45		D	7.7	-	0.012	-	-	-	-	-	-	-
SBH6	1.00		D	8.1	-	< 0.010	-	-	-	-	-	-	-
TP101	2.00		D	8.0	-	< 0.010	-	-	-	-	-	-	-
TP102	0.32		B	7.5	-	0.024	-	-	-	-	-	-	-

Tested by Chemtest Ltd : MCERTS / UKAS No 2183

Checked and Approved by:



J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
404.11923.00004**

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Tested by Chemtest Ltd : MCERTS / UKAS No 2183

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PARTICLE SIZE DISTRIBUTION

Location
Depth (m)
Sample Type

DBH1
0.30-0.90
B

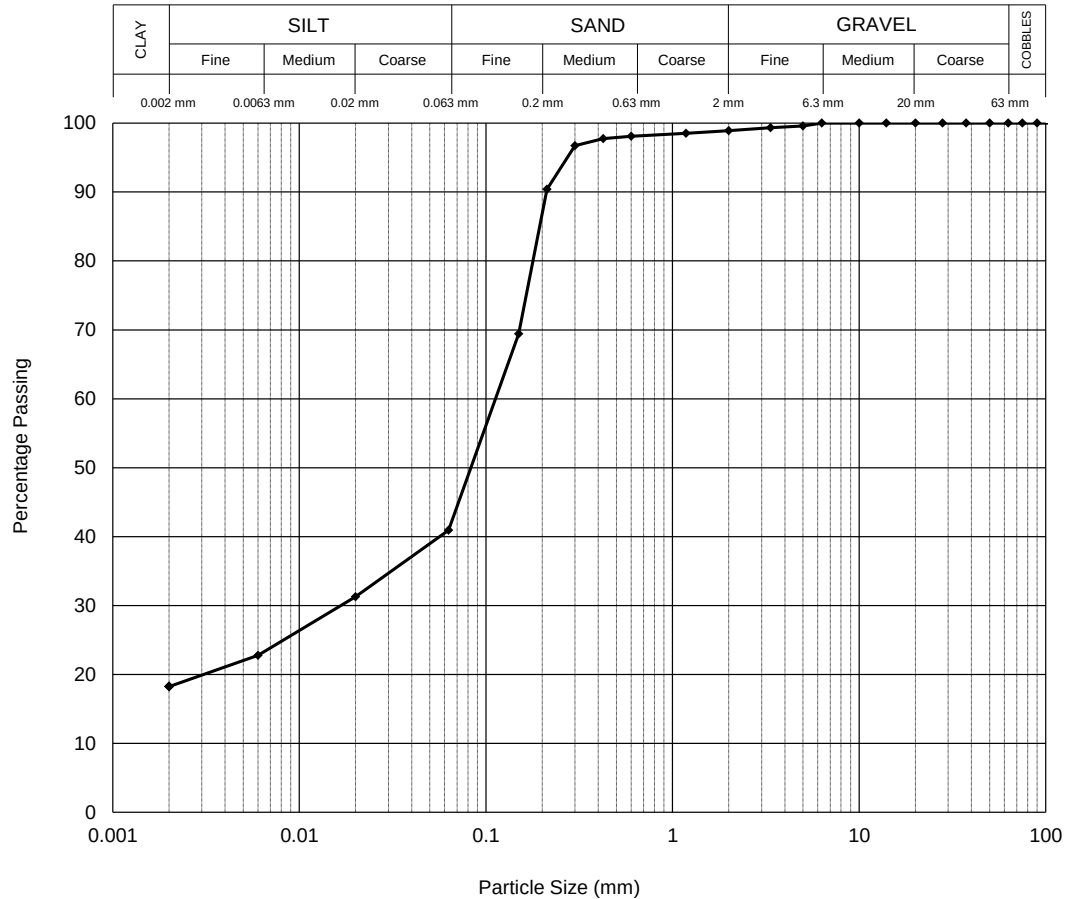
Description

Yellowish brown sandy silty CLAY with rare roots. Sand is fine, rare medium to coarse.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	99
2.00 mm	99
1.18 mm	99
600 µm	98
425 µm	98
300 µm	97
212 µm	90
150 µm	69
63 µm	41



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	31
6 µm	23
2 µm	18

Particle Proportions	
Cobbles	0.0
Gravel	1.1
Sand	58.0
Silt	22.7
Clay	18.2

Particle Density 2.70(A) Mg/m³

Tested by AW
Checked and Approved by

J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

ASHTON KEYNES
404.11923.00004



PARTICLE SIZE DISTRIBUTION

Location
Depth (m)
Sample Type

DBH2
0.90-1.20
B

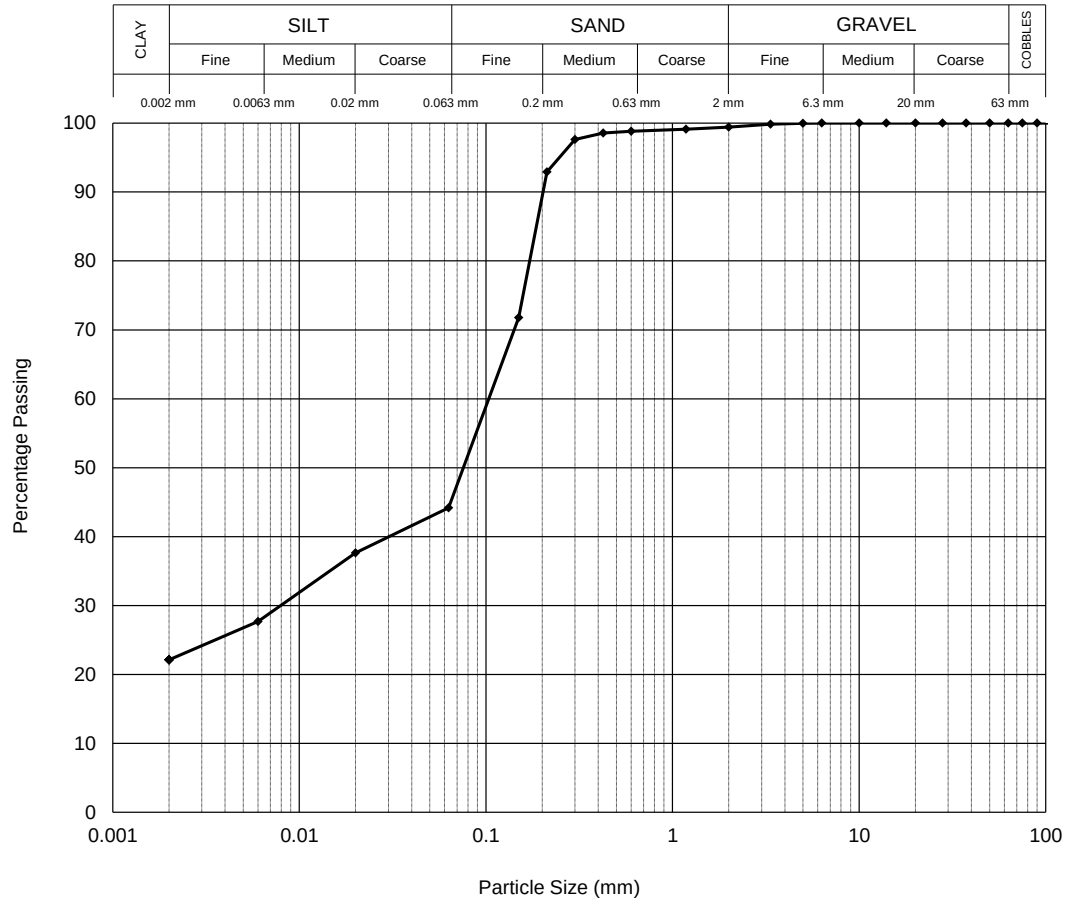
Description

Grey mottled yellowish brown sandy silty CLAY. Sand is fine, rare medium to coarse.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	99
1.18 mm	99
600 µm	99
425 µm	99
300 µm	98
212 µm	93
150 µm	72
63 µm	44



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	38
6 µm	28
2 µm	22

Particle Density 2.70(A) Mg/m³

Particle Proportions	
Cobbles	0.0
Gravel	0.6
Sand	55.3
Silt	22.0
Clay	22.1

Tested by AW
Checked and Approved by

J Sturges - Operations Manager
21/03/2023

Project Number:

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Project Name:

ASHTON KEYNES
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PARTICLE SIZE DISTRIBUTION

Location
Depth (m)
Sample Type

TP104
2.50
B

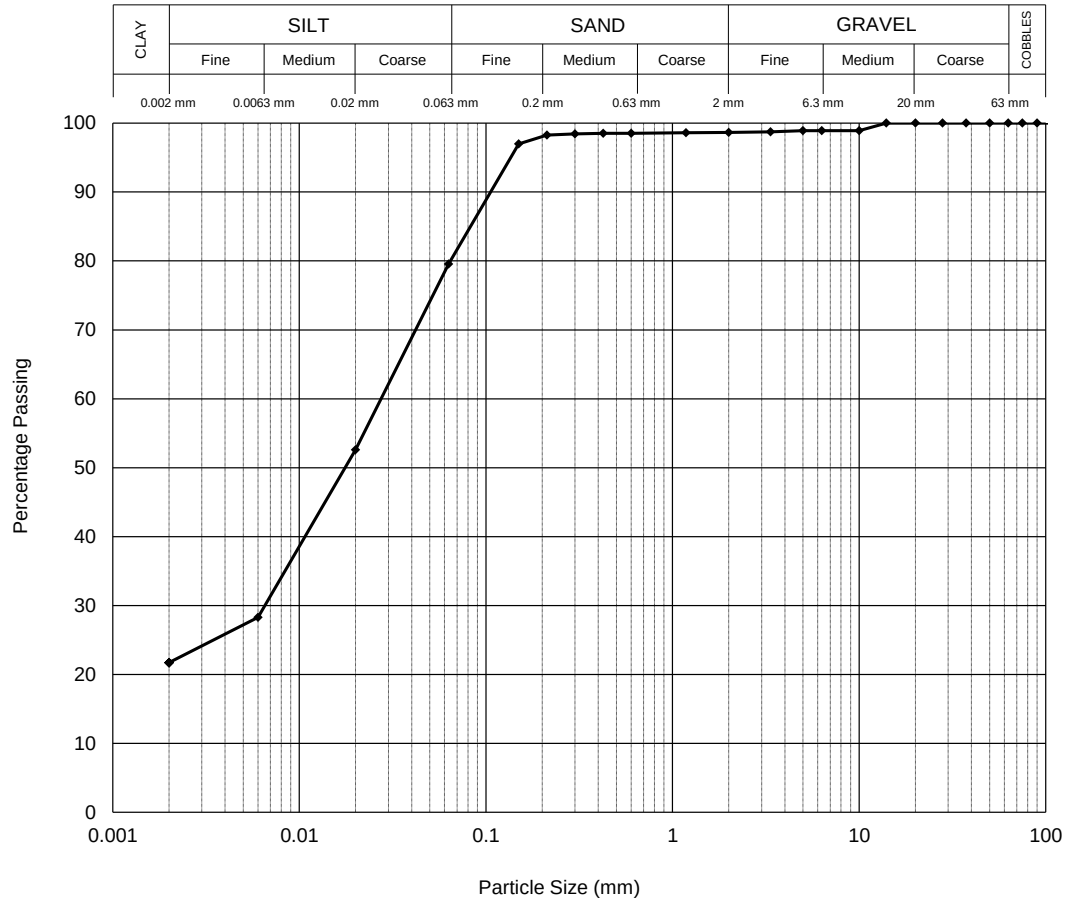
Description

Grey slightly sandy silty CLAY.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	99
6.30 mm	99
5.00 mm	99
3.35 mm	99
2.00 mm	99
1.18 mm	99
600 µm	99
425 µm	99
300 µm	98
212 µm	98
150 µm	97
63 µm	80



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	53
6 µm	28
2 µm	22

Particle Density 2.70(A) Mg/m³

Particle Proportions	
Cobbles	0.0
Gravel	1.3
Sand	19.1
Silt	57.8
Clay	21.8

Tested by AW
Checked and Approved by

J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

ASHTON KEYNES
404.11923.00004



MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

Location DBH1
Depth (m) 2.00-3.00
Sample Type B

Description:

Grey sandy silty CLAY. Sand is fine.

Preparation

Test Method

Samples Used

Mass Retained on 37.5 mm Sieve

%

Single

0

Mass Retained on 20.0 mm Sieve

%

0

Particle Density - Assumed

Mg/m³

2.65

Maximum Dry Density

Mg/m³

1.87

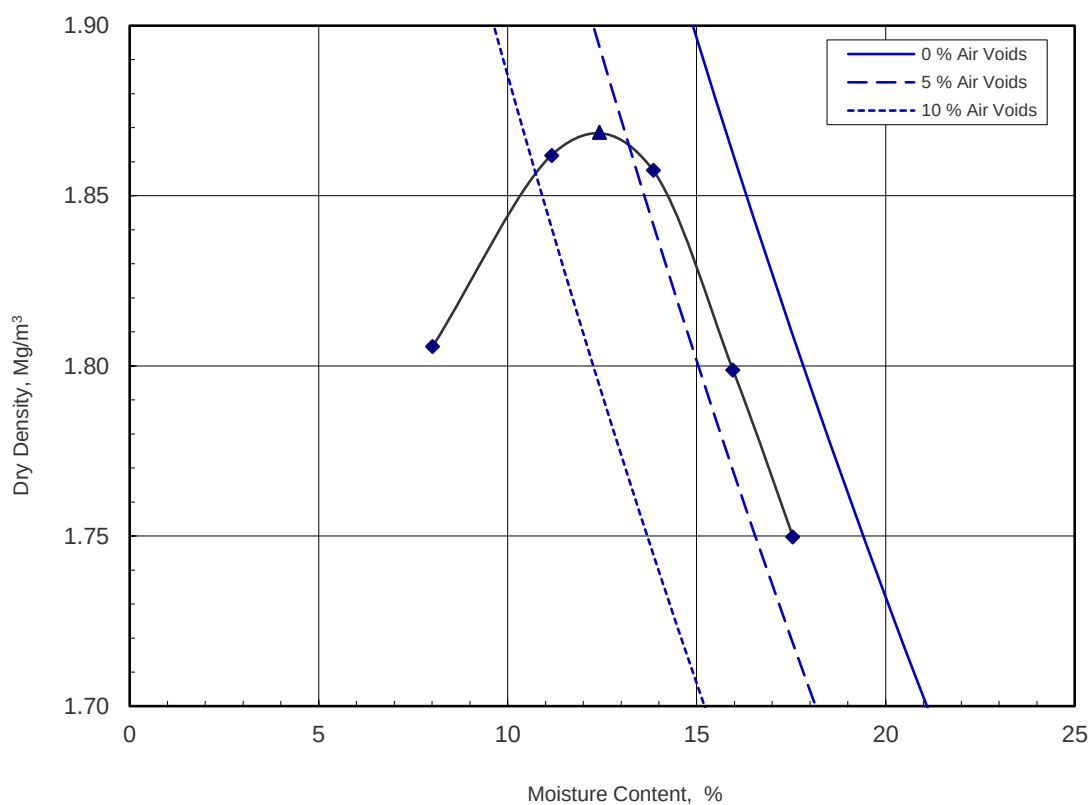
Optimum Moisture Content

%

12.4

Oven dried

2.5kg Rammer for soils with particles up to medium-gravel size



Determination	1	2	3	4	5
Moisture Content	8.0	11.2	13.9	16.0	17.5
Dry Density	1.81	1.86	1.86	1.80	1.75

Tested by ME
Checked and Approved by

J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
404.11923.00004**

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

Location TP103
Depth (m) 0.90
Sample Type B

Description:

Yellowish brown sandy silty CLAY.

Preparation

Air dried

Test Method

2.5kg Rammer for soils with particles up to medium-gravel size

Samples Used

Single

Mass Retained on 37.5 mm Sieve

%

0

Mass Retained on 20.0 mm Sieve

%

0

Particle Density - Assumed

Mg/m³

2.65

Maximum Dry Density

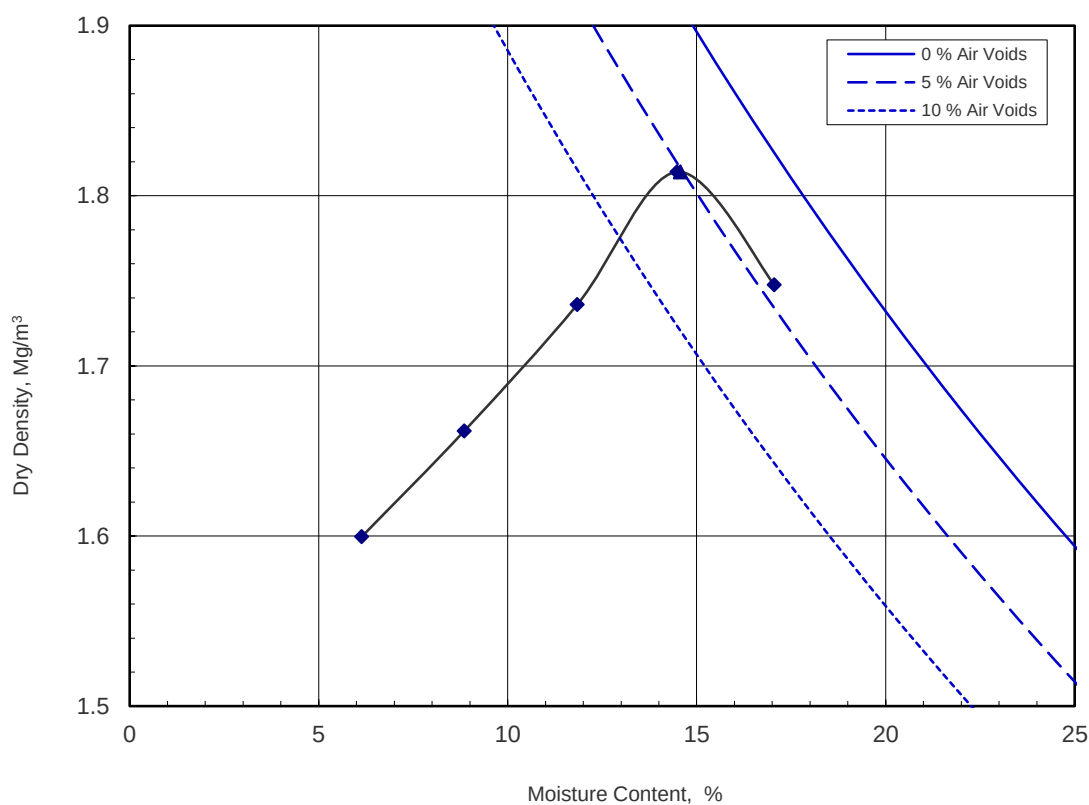
Mg/m³

1.81

Optimum Moisture Content

%

14.6



Determination	1	2	3	4	5
Moisture Content %	6.1	8.9	11.8	14.5	17.1
Dry Density Mg/m ³	1.60	1.66	1.74	1.81	1.75

Tested by DN
Checked and Approved by

J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

ASHTON KEYNES
404.11923.00004



MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

Location TP105
Depth (m) 2.30
Sample Type B

Description:

Grey mottled yellowish brown sandy silty CLAY.

Preparation

Air dried

Test Method

2.5kg Rammer for soils with particles up to medium-gravel size

Samples Used

Single

Mass Retained on 37.5 mm Sieve

%

0

Mass Retained on 20.0 mm Sieve

%

0

Particle Density - Assumed

Mg/m³

2.65

Maximum Dry Density

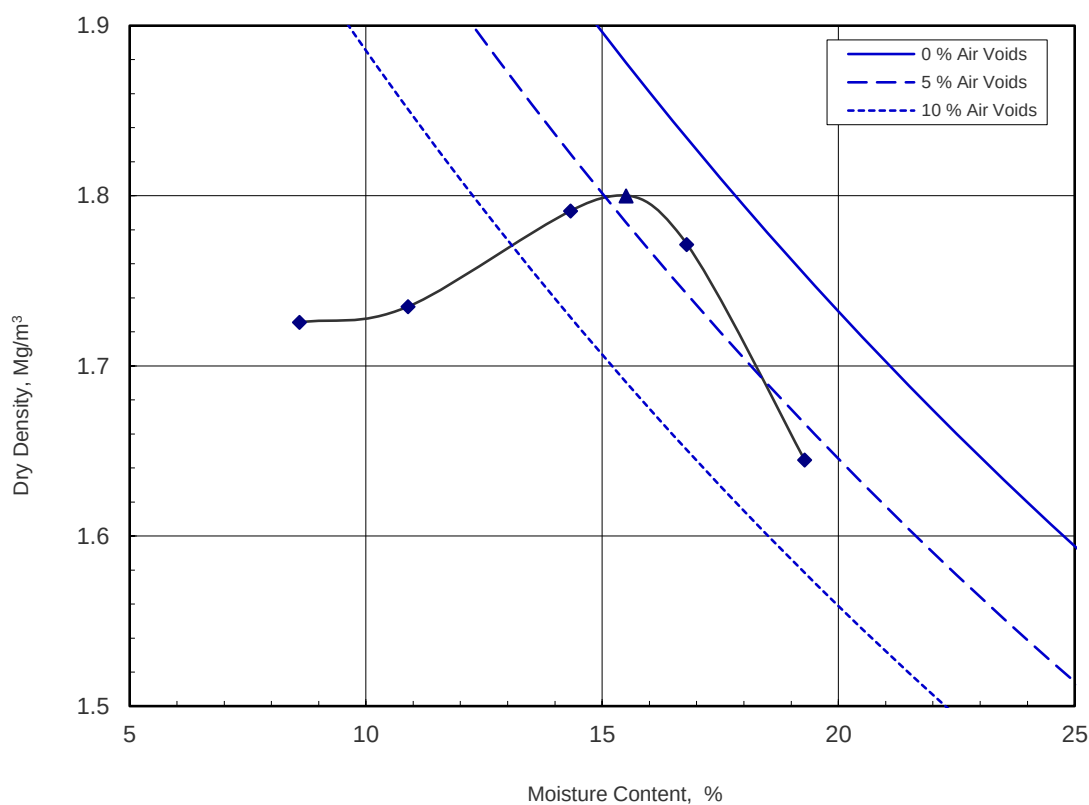
Mg/m³

1.80

Optimum Moisture Content

%

15.5



Determination	1	2	3	4	5
Moisture Content %	8.6	10.9	14.3	16.8	19.3
Dry Density Mg/m ³	1.73	1.73	1.79	1.77	1.64

Tested by DN
Checked and Approved by

J Sturges - Operations Manager
27/03/2023

Project Number:

GEO / 37551

Project Name:

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404.11923.00004



MOISTURE CONTENT / DRY DENSITY RELATIONSHIP

Location TP106
Depth (m) 2.70
Sample Type B

Description:

Grey mottled yellowish brown sandy silty CLAY.

Preparation

Test Method

Samples Used

Mass Retained on 37.5 mm Sieve

%

Single

0

Mass Retained on 20.0 mm Sieve

%

0

Particle Density - Assumed

Mg/m³

2.65

Maximum Dry Density

Mg/m³

1.86

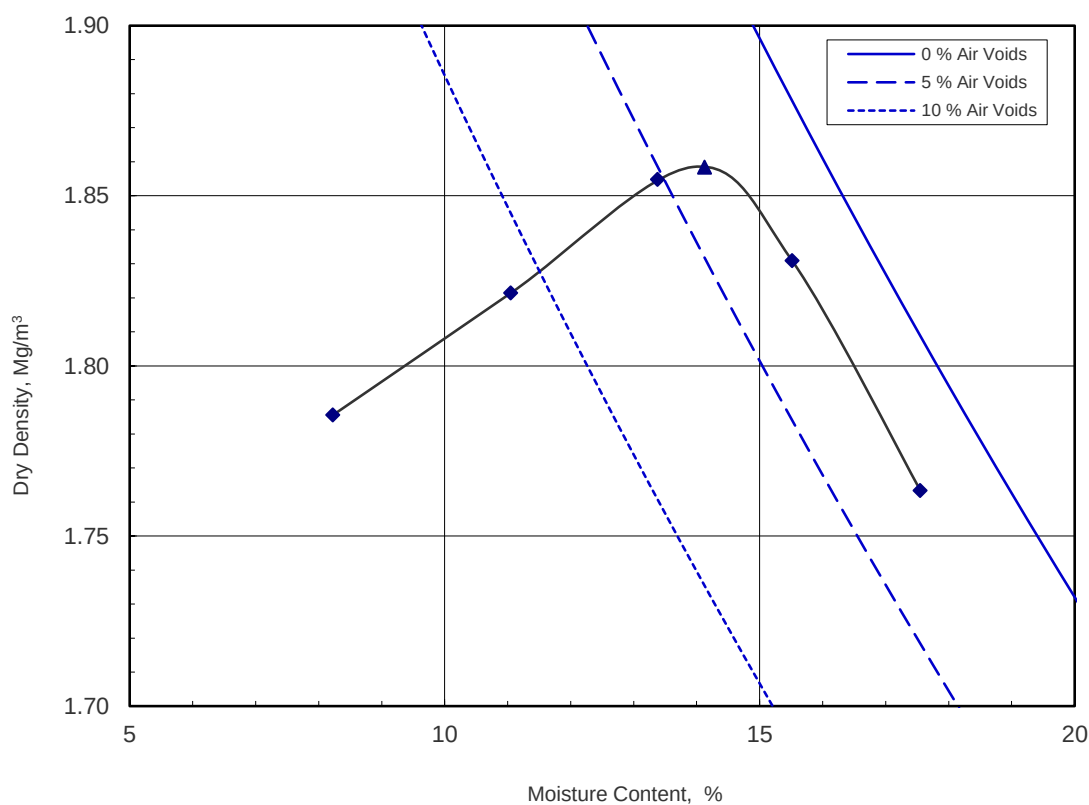
Optimum Moisture Content

%

14.1

Oven dried

2.5kg Rammer for soils with particles up to medium-gravel size



Determination	1	2	3	4	5
Moisture Content %	8.2	11.1	13.4	15.5	17.6
Dry Density Mg/m ³	1.79	1.82	1.85	1.83	1.76

Tested by ME
Checked and Approved by

J Sturges - Operations Manager
27/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
404.11923.00004**

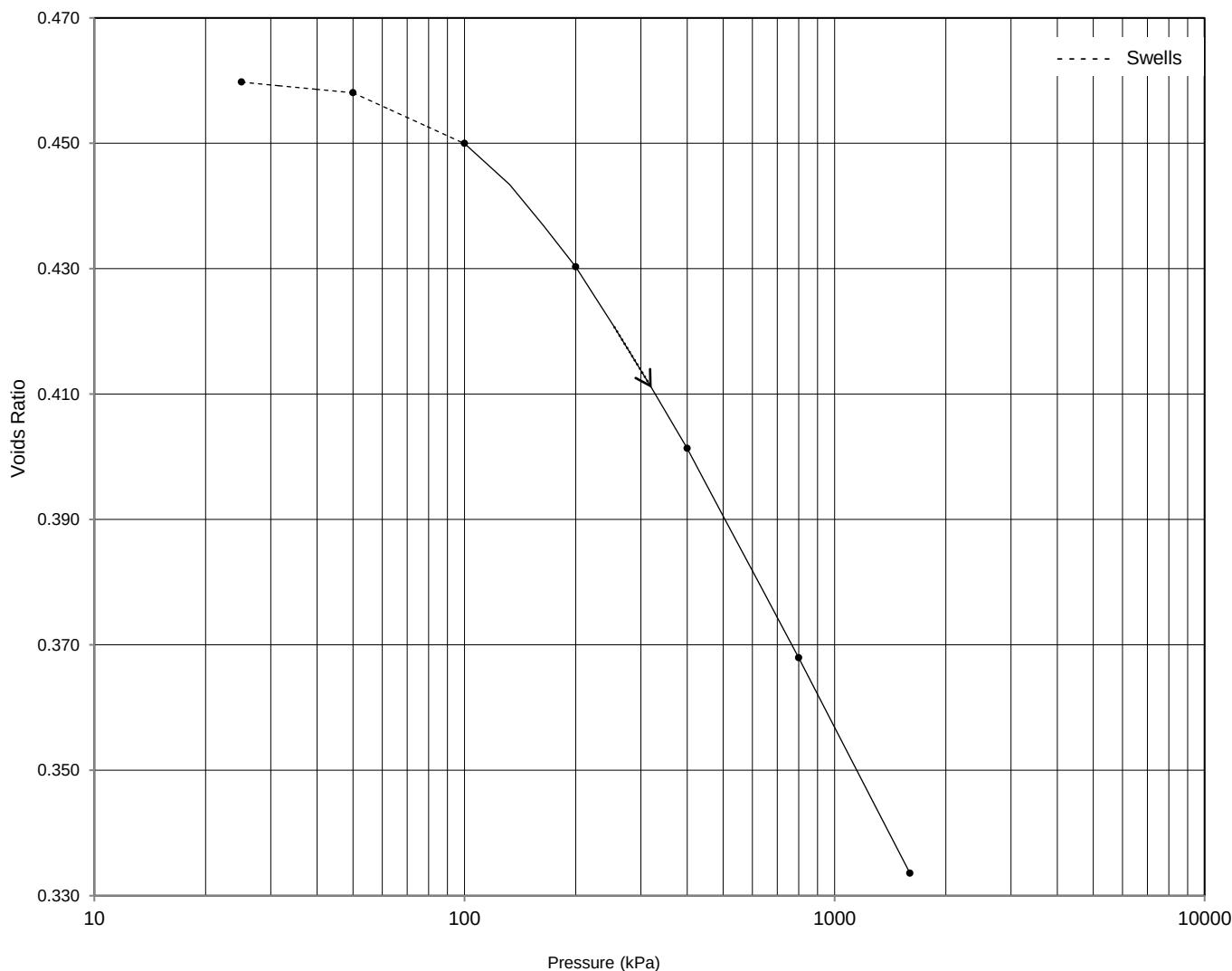


INCREMENTAL LOADING OEDOMETER TEST

Location DBH1
 Sample Ref. UT-02
 Depth (m) 5.00-5.45
 Sample Type U
 Depth within original (mm) 150
 Orientation within original Vertical
 Specimen preparation Undisturbed

Description:

Stiff extremely closely fissured grey slightly sandy silty CLAY with occasional shell fragments. Sand is fine.



Initial Conditions:

Height	(mm)	18.99	Water Content	(%)	18.8	(from trimmings)
Diameter	(mm)	74.97	Voids Ratio		0.464	
Area	(mm ²)	4414	Bulk Density	(Mg/m ³)	2.15	
Volume	(cm ³)	83.83	Dry Density	(Mg/m ³)	1.81	
Laboratory Temperature	(°C)	18.7	Particle density	(Mg/m ³)	2.65 (Assumed)	
			Degree of Saturation	(%)	100.0	

Results have been corrected for equipment deformation

Checked and Approved by

J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
404.11923.00004**

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INCREMENTAL LOADING OEDOMETER TEST

Location DBH1
 Sample Ref. UT-02
 Depth (m) 5.00-5.45
 Sample Type U
 Depth within original (mm) 150
 Orientation within original Vertical
 Specimen preparation Undisturbed

Description:

Stiff extremely closely fissured grey slightly sandy silty CLAY with occasional shell fragments. Sand is fine.

Pressure Range (kPa)	m_v (m ² /MN)	c_v (m ² /year)	Time Fitting		Voids Ratio
			Method	minutes	
0 - 25	-	Specimen swelled	-	-	0.460
25 - 50	-	Specimen swelled	-	-	0.458
50 - 100	0.11	0.71	t50	13.0	0.450
100 - 200	0.14	0.21	t50	42.3	0.430
200 - 400	0.10	0.19	t50	46.2	0.401
400 - 800	0.060	0.21	t50	39.8	0.368
800 - 1600	0.031	0.29	t50	27.9	0.334

Checked and Approved by



J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

ASHTON KEYNES
404.11923.00004

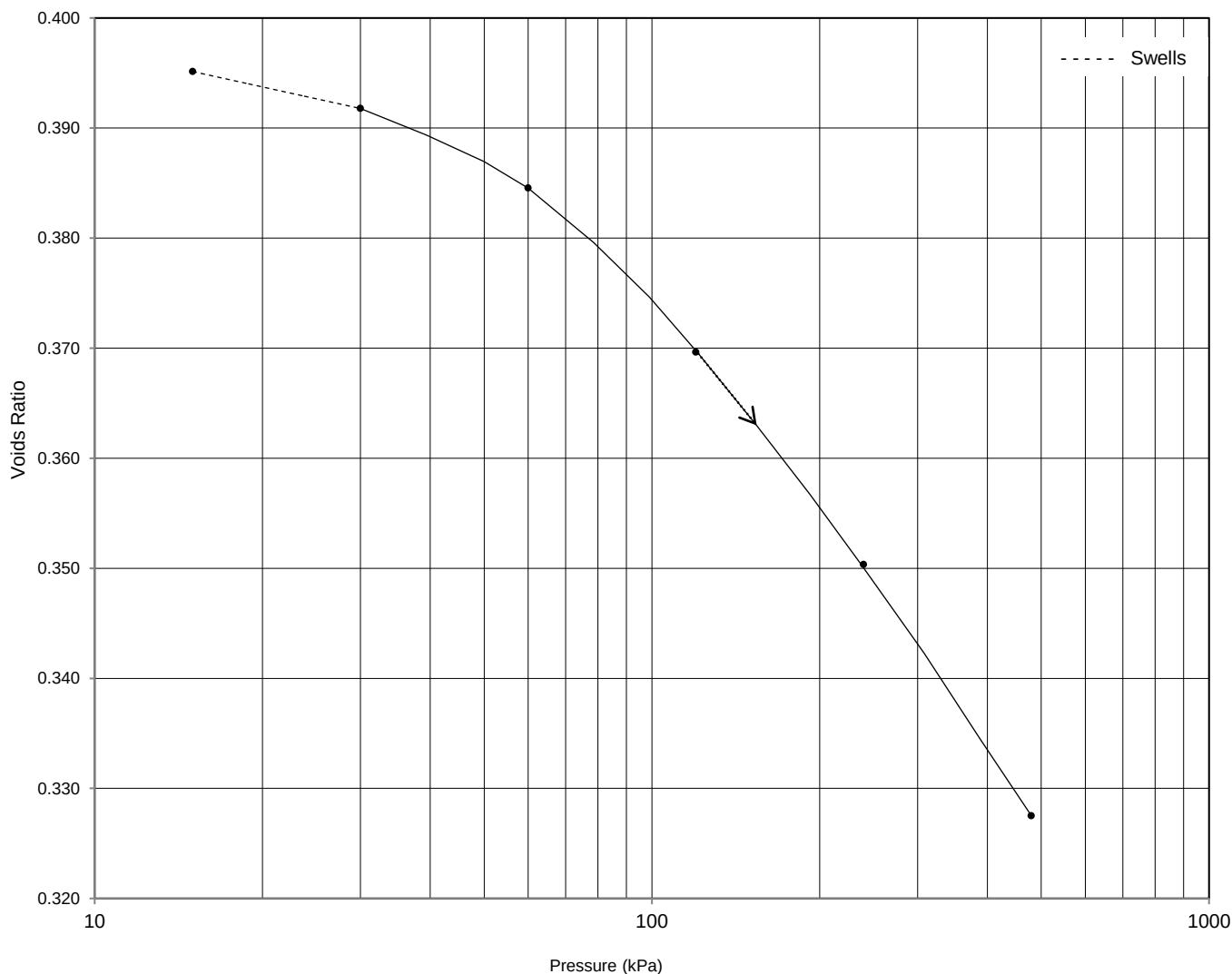
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INCREMENTAL LOADING OEDOMETER TEST

Location DBH2
 Sample Ref. UT-001
 Depth (m) 3.00-3.45
 Sample Type U
 Depth within original (mm) 100
 Orientation within original Vertical
 Specimen preparation Undisturbed

Description:

Firm to stiff grey very sandy silty CLAY. Sand is fine.



Initial Conditions:

Height	(mm)	18.99	Water Content	(%)	14.5	(from trimmings)
Diameter	(mm)	74.89	Voids Ratio		0.394	
Area	(mm ²)	4405	Bulk Density	(Mg/m ³)	2.18	
Volume	(cm ³)	83.65	Dry Density	(Mg/m ³)	1.90	
Laboratory Temperature	(°C)	18.9	Particle density	(Mg/m ³)	2.65 (Assumed)	
			Degree of Saturation	(%)	97.4	

Results have been corrected for equipment deformation

Checked and Approved by

J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
404.11923.00004**

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INCREMENTAL LOADING OEDOMETER TEST

Location DBH2
 Sample Ref. UT-001
 Depth (m) 3.00-3.45
 Sample Type U
 Depth within original (mm) 100
 Orientation within original Vertical
 Specimen preparation Undisturbed

Description:

Firm to stiff grey very sandy silty CLAY. Sand is fine.

Pressure Range (kPa)	m_v (m ² /MN)	c_v (m ² /year)	Time Fitting		Voids Ratio
			Method	minutes	
0 - 15	-	Specimen swelled	-	-	0.395
15 - 30	0.16	6.4	t50	1.46	0.392
30 - 60	0.17	3.0	t50	3.14	0.385
60 - 120	0.18	2.7	t50	3.36	0.370
120 - 240	0.12	2.5	t50	3.59	0.350
240 - 480	0.070	2.5	t50	3.45	0.328

Checked and Approved by



J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

ASHTON KEYNES
404.11923.00004




UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION

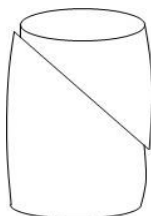
Location DBH1
Sample Ref UT-02
Depth (m) 5.00-5.45
Sample Type U

Description:

Stiff extremely closely fissured grey slightly sandy silty CLAY with occasional shell fragments. Sand is fine.

Specimen Details

Specimen conditions	Undisturbed
Length (mm)	200.3
Diameter (mm)	102.2
Moisture content (%)	19.2
Bulk density (Mg/m ³)	2.16
Dry density (Mg/m ³)	1.81
Test Details	
Latex membrane thickness (mm)	0.3
Specimen height prior to shearing (mm)	200.3
Membrane correction (kPa)	0.4
Mean rate of shear (%/min)	2.0
Cell pressure (kPa)	100
Strain at failure (%)	5.0
Maximum deviator stress (kPa)	291
Shear Stress Cu (kPa)	145

Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

10

Tested by SB
Checked and Approved by

J Sturges - Operations Manager
21/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
404.11923.00004****GEOLABS**

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION

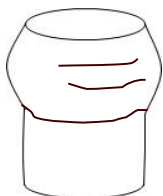
Location DBH1
 Sample Ref UT-03
 Depth (m) 8.00-8.45
 Sample Type U

Description:

Very stiff dark grey slightly sandy clayey SILT with rare shell fragments. Sand is fine.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.0
Diameter	(mm)	101.9
Moisture content	(%)	15.9
Bulk density	(Mg/m ³)	2.20
Dry density	(Mg/m ³)	1.90
Test Details		
Latex membrane thickness	(mm)	0.3
Specimen height prior to shearing	(mm)	200.9
Membrane correction	(kPa)	1.1
Mean rate of shear	(%/min)	2.0
Cell pressure	(kPa)	160
Strain at failure	(%)	19.9
Maximum deviator stress	(kPa)	404
Shear Stress Cu	(kPa)	202

Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

50

Tested by SB
 Checked and Approved by

J Sturges - Operations Manager
 21/03/2023

Project Number:

GEO / 37551

Project Name:

ASHTON KEYNES
404.11923.00004



UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION

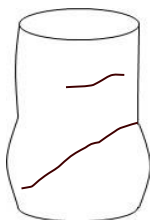
Location DBH2
 Sample Ref UT-001
 Depth (m) 3.00-3.45
 Sample Type U

Description:

Very stiff fissured dark grey sandy silty CLAY. Sand is fine.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	200.3
Diameter	(mm)	102.5
Moisture content	(%)	15.1
Bulk density	(Mg/m ³)	2.22
Dry density	(Mg/m ³)	1.93
Test Details		
Latex membrane thickness	(mm)	0.3
Specimen height prior to shearing	(mm)	200.3
Membrane correction	(kPa)	0.7
Mean rate of shear	(%/min)	2.0
Cell pressure	(kPa)	60
Strain at failure	(%)	10.5
Maximum deviator stress	(kPa)	305
Shear Stress Cu	(kPa)	153

Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

90

Tested by SB
 Checked and Approved by

J Sturges - Operations Manager
 21/03/2023

Project Number:

GEO / 37551

Project Name:

**ASHTON KEYNES
 404.11923.00004**

GEOLABS



UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION

Location DBH2
 Sample Ref UT-002
 Depth (m) 5.00-5.45
 Sample Type U

Description:

Very stiff dark grey clayey SILT.

Specimen Details

Specimen conditions	Undisturbed
Length (mm)	201.0
Diameter (mm)	102.3
Moisture content (%)	20.6
Bulk density (Mg/m ³)	2.16
Dry density (Mg/m ³)	1.79
Test Details	
Latex membrane thickness (mm)	0.3
Specimen height prior to shearing (mm)	200.9
Membrane correction (kPa)	0.8
Mean rate of shear (%/min)	2.0
Cell pressure (kPa)	100
Strain at failure (%)	13.4
Maximum deviator stress (kPa)	224
Shear Stress Cu (kPa)	112

Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

44

Tested by SB
 Checked and Approved by

J Sturges - Operations Manager
 21/03/2023

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UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION

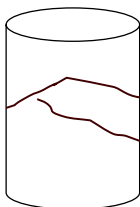
Location DBH2
Sample Ref UT-003
Depth (m) 8.00-8.45
Sample Type U

Description:

Very stiff dark grey silty CLAY.

Specimen Details

Specimen conditions	Undisturbed
Length (mm)	201.7
Diameter (mm)	102.5
Moisture content (%)	19.6
Bulk density (Mg/m ³)	2.17
Dry density (Mg/m ³)	1.82
Test Details	
Latex membrane thickness (mm)	0.3
Specimen height prior to shearing (mm)	201.6
Membrane correction (kPa)	0.5
Mean rate of shear (%/min)	2.0
Cell pressure (kPa)	160
Strain at failure (%)	6.9
Maximum deviator stress (kPa)	371
Shear Stress Cu (kPa)	185

Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

200

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DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No DBH1
 Depth (m) 0.90-1.20
 Sample Type B

Description:

Brown mottled grey sandy CLAY. Sand is fine.

Specimen Details

Depth within original sample *m* n/a
 Orientation within original sample n/a
 Test condition Submerged
 Preparation < 2 mm material remoulded at existing water content to a medium density.

Particle density *Mg/m³* 2.69 (assumed)

Specimen Number		1	2	3
Length	<i>mm</i>	59.94	60.79	61.18
Width	<i>mm</i>	60.04	60.85	61.07
Height	<i>mm</i>	20.68	20.10	19.88
Initial water content	%	20.9	20.9	20.9
Initial bulk density	<i>Mg/m³</i>	2.02	2.02	2.02
Initial dry density	<i>Mg/m³</i>	1.67	1.67	1.67
Initial voids ratio		0.614	0.612	0.611
Degree of Saturation	%	91.7	91.9	92.1

Consolidation Stage

	<i>kPa</i>	50	100	200
Normal stress				
Duration	<i>day(s)</i>	1	1	1

Shearing Stage

	<i>kPa</i>	50	100	200
Normal stress				

Peak Conditions:

	<i>mm/min</i>	0.0014	0.0019	0.0019
Rate of horizontal displacement				
Maximum shear stress	<i>kPa</i>	31.4	58.6	101.2
Horizontal displacement at MSS	<i>mm</i>	1.9	6.6	3.9
Vertical Displacement at Peak	<i>mm</i>	0.15	0.62	0.48

	%	22.6	22.7	21.7
Final water content				
Duration	<i>day(s)</i>	3	3	3

Shear Strength Parameters

	<i>kPa</i>	10
Apparent Cohesion		
Angle of Shearing Resistance	<i>degrees</i>	24.5

Notes:

Tested by JJR / IT
 Checked and Approved by

C F Wallace - Technical Director
 24/03/2023

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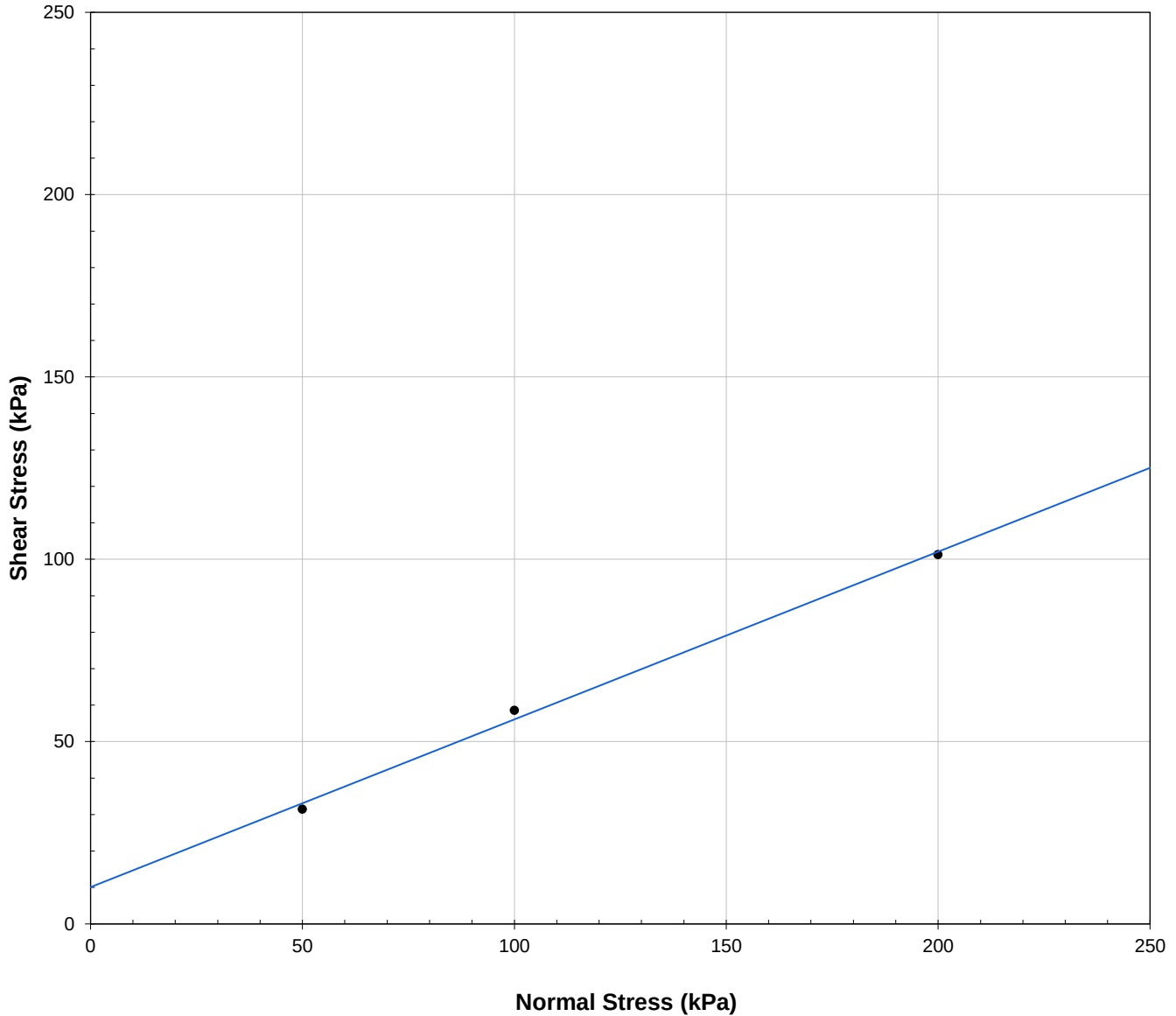
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No DBH1
Depth (m) 0.90-1.20
Sample Type B

Description:

Brown mottled grey sandy CLAY. Sand is fine.

Shear Stress v Normal StressPeak: $c' = 10$ $\Phi' = 24.5$

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24/03/2023

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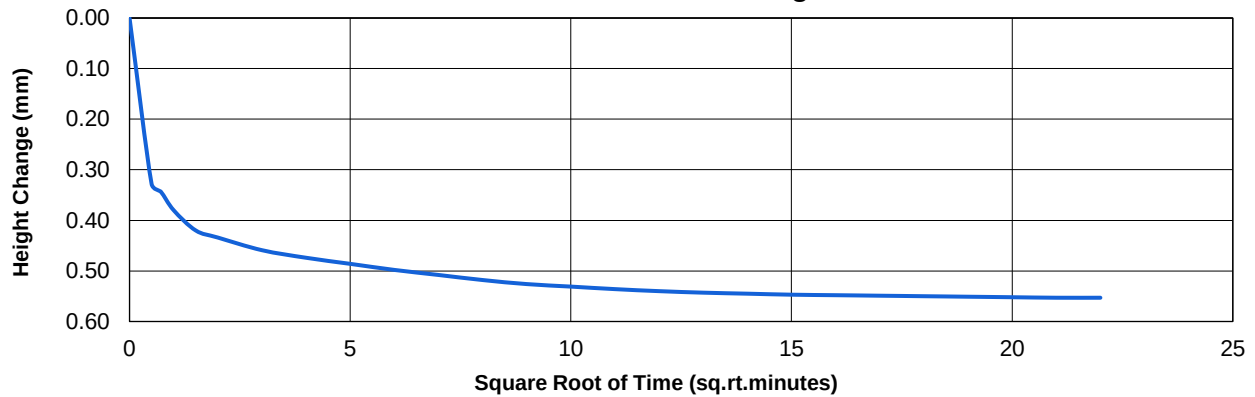
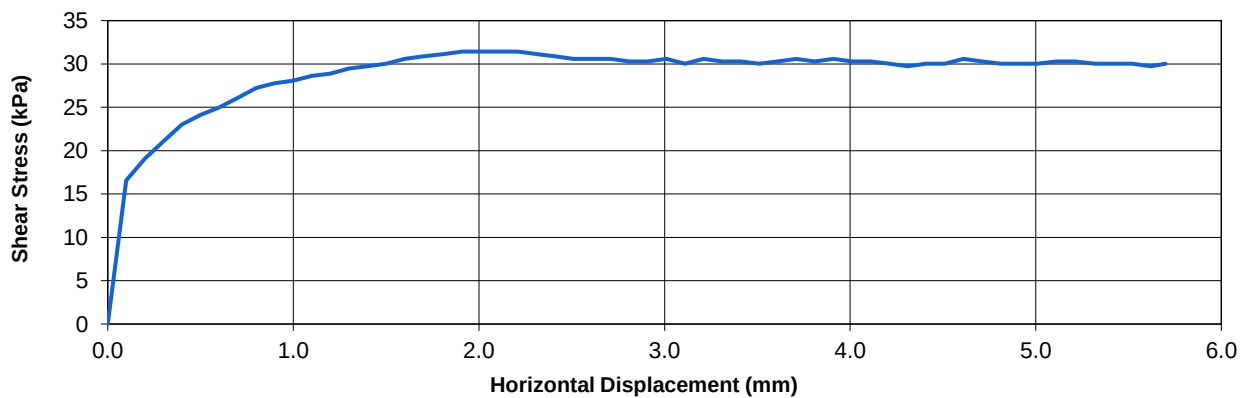
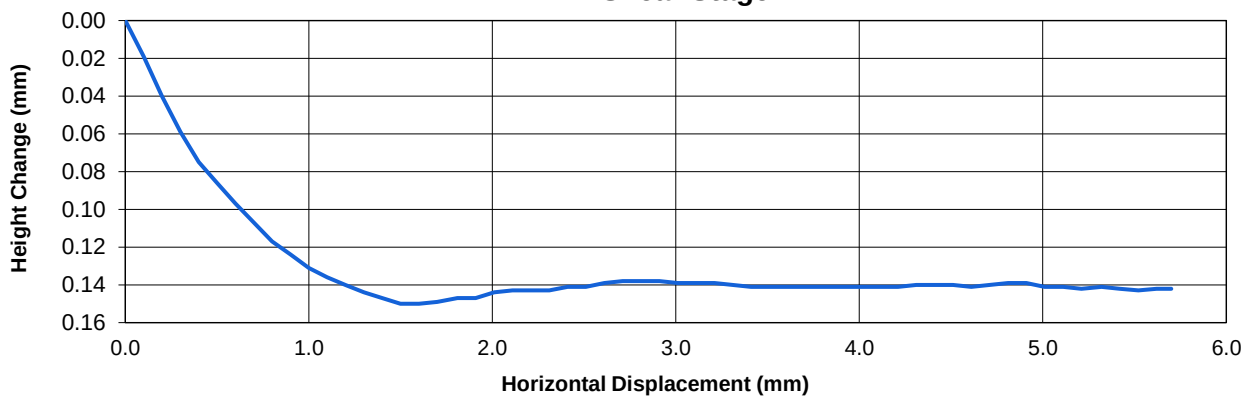
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No DBH1
Depth (m) 0.90-1.20
Sample Type B

Description:

Brown mottled grey sandy CLAY. Sand is fine.

Specimen: 1**Consolidation Stage****Shear Stage**

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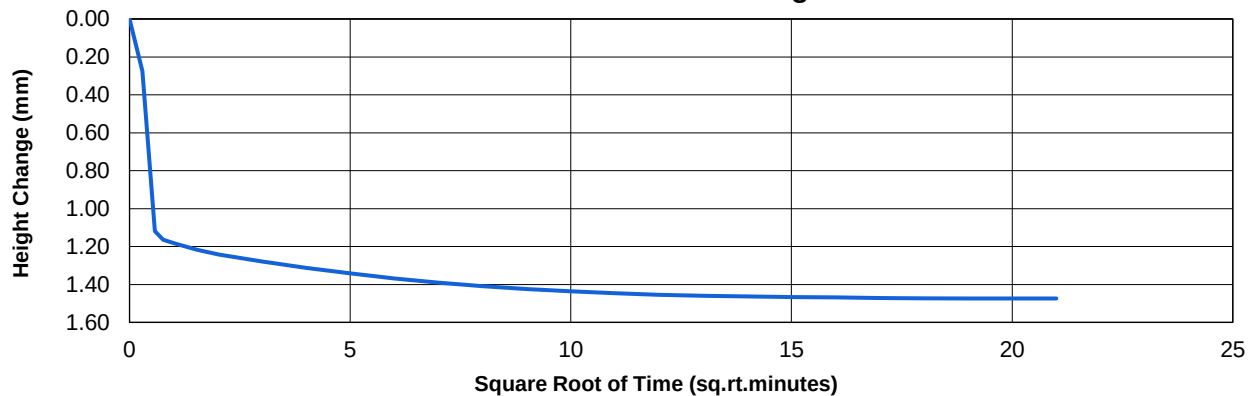
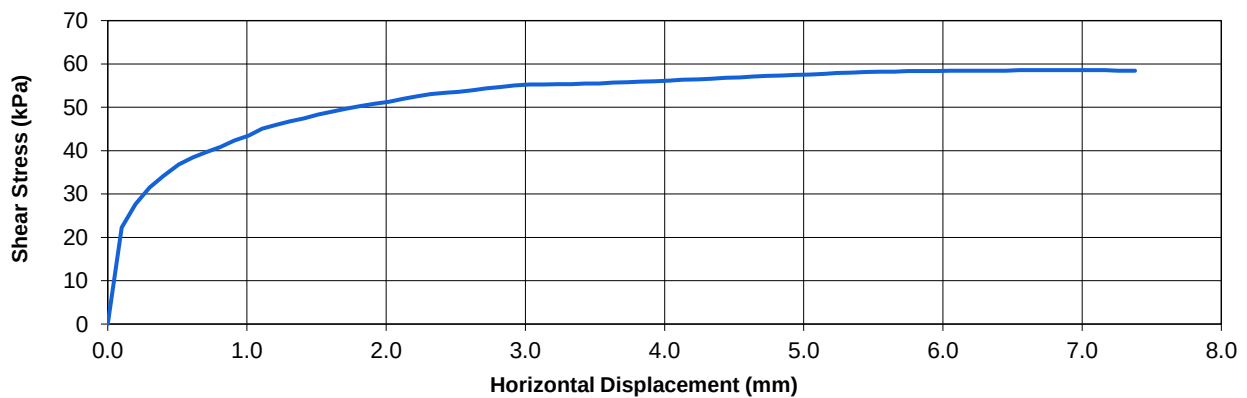
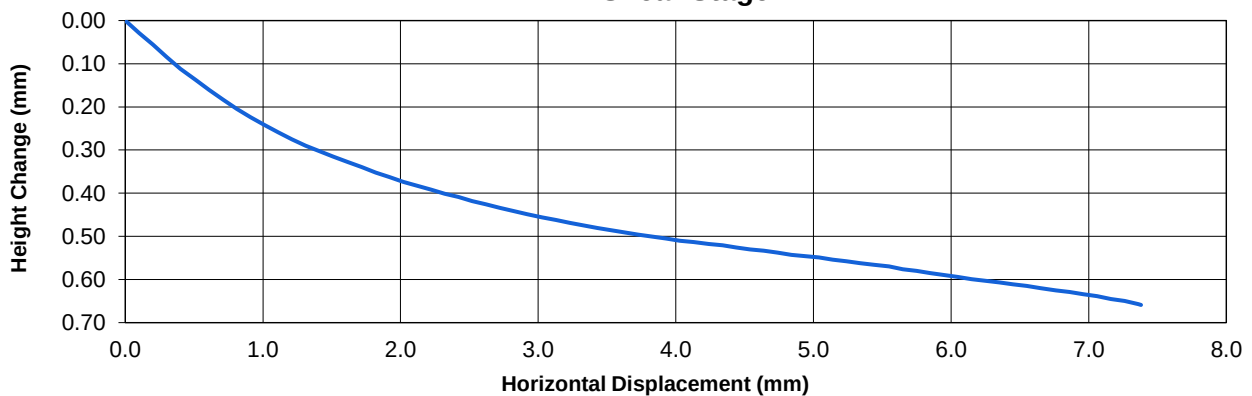
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No DBH1
Depth (m) 0.90-1.20
Sample Type B

Description:

Brown mottled grey sandy CLAY. Sand is fine.

Specimen: 2**Consolidation Stage****Shear Stage**

Tested by JJR / IT
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C F Wallace - Technical Director
24/03/2023

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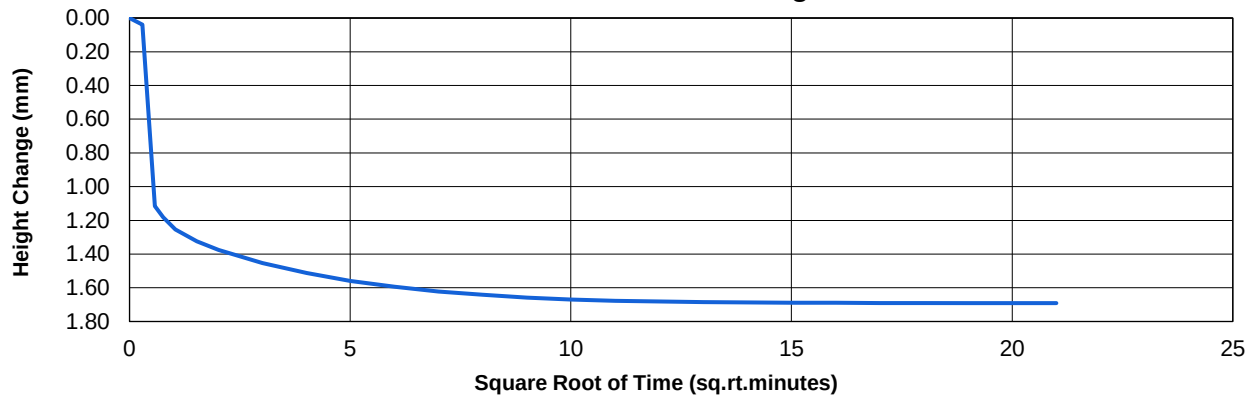
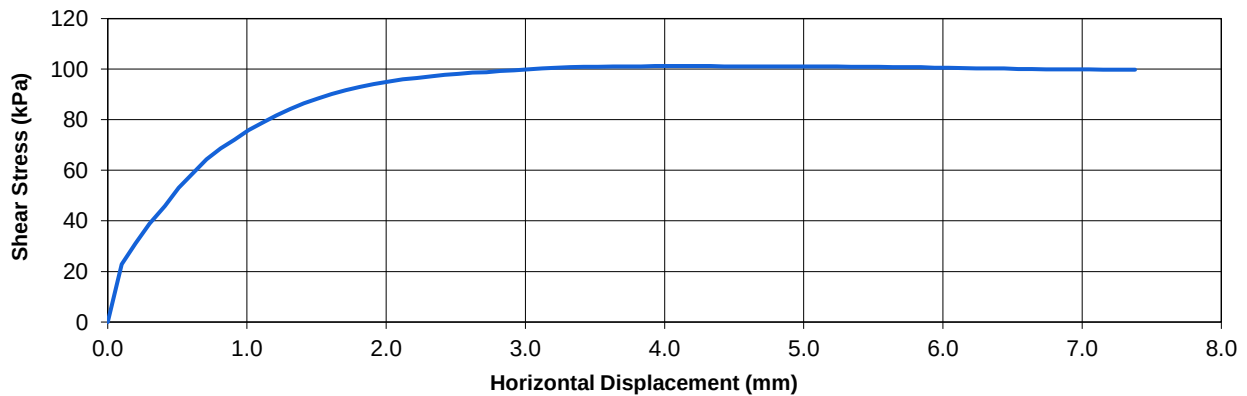
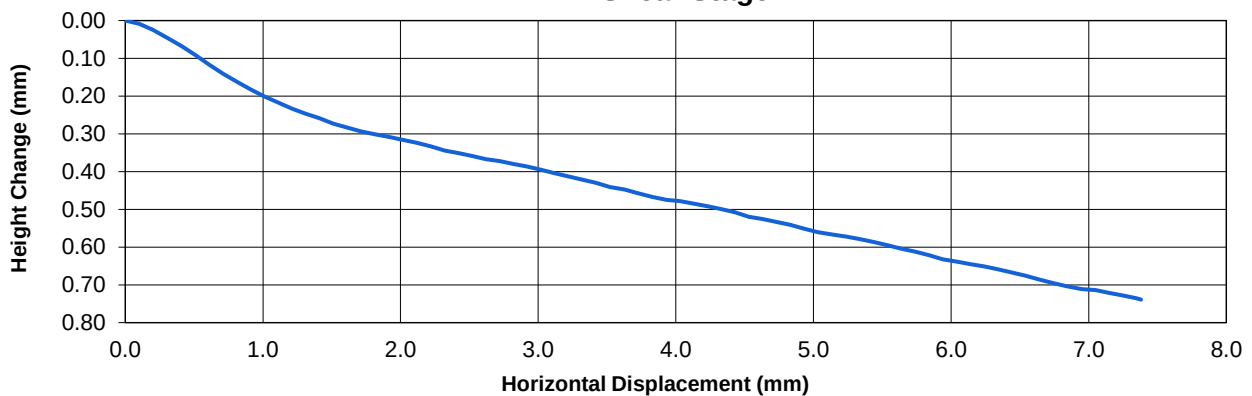
DIRECT SHEAR TEST – SHEARBOX

(small shearbox apparatus)

Borehole No DBH1
Depth (m) 0.90-1.20
Sample Type B

Description:

Brown mottled grey sandy CLAY. Sand is fine.

Specimen: 3**Consolidation Stage****Shear Stage**

Tested by JJR / IT
Checked and Approved by


C F Wallace - Technical Director
24/03/2023

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