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Geo-environmental Ground Investigation Report

ON

PROPOSED RESIDENTIAL DEVELOPMENT

AT

**LAND NORTH OF LINGARDS ROAD,
SLAITHWAITE**

FOR

SB HOMES Ltd

OCTOBER 2023

E22/7931/R001

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0.0 **EXECUTIVE SUMMARY**

SITE	The site is located on land to the north of Lingards Road, Slaithwaite. The site is irregular in shape, with residential properties to the north, east and south beyond Lingards Road. To the west are further fields. The site is divided into four separate grassed fields by stone walls, a large central field, two smaller fields to the west and a smaller field to the east. There is an area of marshy ground in the western third of the site. Two watercourses are noted crossing the main central field, one from south to north, a second from west to east. A partially buried water tank is located in the western third of the site. The site falls steeply from the southern boundary with Lingards Road, before continuing at a shallower grade towards the northern boundary.
HISTORY	The site has been shown as open fields since 1854, with little development except the installation of the existing water tank in 1906 and the watercourses indicated in 1968. A sandstone quarry was indicated to the southwest of the site in 1854, shown as disused in 1968 and infilled by 1993. There has primarily been residential development adjacent the site since 1930.
GEOLOGY	No superficial deposits or artificial ground are recorded on the site. The majority of the site is underlain by the Millstone Grit Group consisting of Sandstone, Siltstone and Mudstone. The north east corner of the site is underlain by the East Carlton Formation consisting of Sandstone and Mudstone. A fault line is shown crossing the site from north to south in the western quarter of the site. Generally, the site investigation proved up to 2.8m of clays overlying weathered mudstone, except in the north west of the site where no mudstone was encountered and the clays directly overlaid sandstone. Beneath this, there was a sandstone bedrock encountered at 0.5-14.6m beneath existing ground levels. The depth to the sandstone reduced the further north and west within the site the borehole was. No discontinuities were encountered between trial pits and boreholes that would indicate the presence of the fault line.
MINING/QUARRYING	The Phase 1 Environmental Desk Study by CoDa Structures (Ref: 7364 dated February 2014) states that the site lies outside development high risk areas.

	The nearest recorded historical quarry was approximately 15m south west of the site which has been infilled.
HYDROLOGY	The nearest surface water features are the un-named watercourses crossing the site. The site is not located within any Environment Agency defined flood zones or shown to be at risk of flooding from rivers or the sea.
HYDROGEOLOGY	The groundwater vulnerability map for the area indicates that the site overlies rocks designated as a Secondary (A) aquifer. Groundwater was encountered at the base of the clay strata (1.75-1.9m BGL) in the marshy area in the west of the site during the investigation works. During the gas monitoring, groundwater has been measured at 1.4-1.9m below ground level in the south and west of the site where there are deeper clays.
HAZARDOUS GAS	The property is in an area where no radon protective measures are required. Gas monitoring has been undertaken on four occasions to date and recorded no methane and a maximum carbon dioxide concentration of 4.2%. Due to the low levels of carbon dioxide levels and flow rates on site, we would recommend the gas regime on this site be currently classified as Green by the NHBC traffic light system, or CS1 by BS 8485:2015 Table 2. This will be confirmed in a separate report following the completion of the gas monitoring.
CONTAMINATION	Only the soil sample from TP10 in the north west of the site recorded elevated levels of Lead, PAH (Total) and individual PAH compounds. No contaminants were recorded in the other samples taken from site. No asbestos was recorded in the samples taken from site.
REMEDIATION	Contamination hotspot identified at TP10 to be removed from site. Temporary works to prevent contamination from surface water run-off during development to be provided to watercourses crossing site. Land drainage system to be installed on site. Topsoil to be scraped and stockpiled behind protective fencing in phases on site prior to construction work commencing.
FOUNDATIONS	We would suggest that the proposed two storey residential properties should be constructed on reinforced strip/trench fill footings founded entirely onto weathered sandstone/sandstone strata. The foundation widths will vary dependent upon the line loadings calculated and bearing strata.

Due to the steep nature of the site, and the requirement to raise ground levels, piled foundations may be required. A review of the foundation proposals should be undertaken following design of finalised plot levels

1.0 INTRODUCTION

- 1.1 As requested by SB Homes, this practice carried out ground and contamination investigation works for a proposed development on land north of Lingards Road, Slaithwaite.
- 1.2 A Phase 1 Environmental Assessment has previously been undertaken by CoDa Structures (Report 7364 Dated December 2014) and this has been used to guide the site investigation works and for reference for Sections 3-6.
- 1.3 The purpose of the report was to:-
 - 1.3.1 Identify the nature of the near surface strata, in order to enable recommendations to be made as to the most economic foundation solution for the proposed residential development.
 - 1.3.2 To identify any areas of contaminated ground.
 - 1.3.3 Propose a suitable outline remediation strategy, which will enable the site to be developed safely, to the satisfaction of the overseeing regulators and in compliance with the current environmental standards.
 - 1.3.4 Determine if ground gas migration from historical infilled quarries in the vicinity would adversely affect the site.
 - 1.3.5 Undertake boreholes to allow a cross section through the site strata to be determined for slope stability analysis.
- 1.4 Soil sampling was undertaken via trial pits to determine the near surface strata. Distributed samples were taken for testing to ascertain the nature of the soils and fills present.
- 1.5 The conclusions and recommendations made in this report are limited to the findings of the preliminary Geotechnical Survey. The report is made on condition that Haigh Huddleston Associates will not in any circumstances be liable for loss, arising directly or indirectly from ground conditions encountered between trial pits and boreholes, which have not been revealed by the investigation.
- 1.6 Any opinion given on the possible configuration of strata between trial pit and borehole locations and below maximum depth of the investigation is for guidance only. Any remarks on groundwater conditions made are based solely on observations made at the time of investigation. Kindly note that levels may differ from those reported due to seasonal variations or other influences.

- 1.7 Furthermore, there is the possibility that any trial pits or boreholes undertaken as part of the investigatory works may be within the influence of existing or proposed foundations or excavations. Haigh Huddleston Associates cannot be held responsible for any failure of any excavations, foundations or structures within the influence of the trial pits or boreholes.

2.0 THE SITE

- 2.1 The site is located on land to the north of Lingards Road, Slaithwaite and lies around OS Grid Reference 407300, 413350. A site location plan is attached in Appendix A at the rear of the report.
- 2.2 The site is irregular in shape, with the southern boundary fronting onto Lingards Road. To the north and east the boundary is formed by the adjacent residential properties. To the west of the site is open field. The site area is approximately 2.1ha including the proposed P.O.S.
- 2.3 The site is divided into four separate grassed fields by dry stone walls with gated access between the fields allowing access throughout site. Access to the site is from Lingards Road in the south east of the site. At the time of the site investigation, the access area has been built up in crushed stone to form a level compound area to allow the access of plant to site, and currently contains a site cabin and some construction materials.
- 2.4 The central largest field is divided in two by an open watercourse in the northern third of the site crossing from west to east. A marshy area is noted in the south west of the field. The two fields to the west of the central field were also noted to have large marshy areas. At the confluence of the three fields there is a mature tree and a partially buried water tank. The small easternmost field contained a stable and was used for horse grazing at the time of the investigation, the remainder of the fields contained no livestock.
- 2.5 The boundaries to the site are formed by a mix of dry stone wall and post and wire fences.
- 2.6 The site initially falls steeply from the southern boundary with Lingards Road before recusing to an average grade of 1 in 4.5 to 1 in 6 towards the northern boundary. A high point of 203.13m AOD is recorded in the south western corner of the site with a low point of 170.65m AOD in the north western corner.
- 2.7 It was noted that there was a ripple effect to the topsoil on the existing slope supporting Lingards Road, indicating small movements within the shallow superficial strata over time.

3.0 SITE HISTORY

- 3.1 The Phase 1 Environmental Assessment by CoDa Structures has been consulted and below is a brief description outlining the significant developments that may affect future construction on the site.
- 3.2 The site itself has remained as open field with little change since 1854 save for the follow:
- In 1906 a small tank was added in the western third of the site, this is still present today.
 - In 1968 the current watercourses crossing the site were first shown.
- 3.3 Bank Stone Pit sandstone quarry was shown immediately south west of the site in 1854. This was renamed Sally Bank Quarry and shown as disused by 1968 and then infilled by 1993.
- 3.4 There has been primarily residential developments in the immediate vicinity of the site. In 1930 there was residential development to the north west, north east and south east. In 1968 there was residential development to the west and north east and further residential development in the south east in 1982. There have been no significant developments since then to the present day.

4.0 SITE GEOLOGY & MINING

- 4.1 The BGS Digital Geological map of Great Britain at 1:50,000 has been consulted and we would report as follows:-
- 4.2 No artificial or superficial deposits are shown directly overlying the site.
- 4.3 The majority of the site is underlain by the Millstone Grit Group consisting of Sandstone, Siltstone and Mudstone. The north east corner of the site is underlain by the East Carlton Formation consisting of Sandstone and Mudstone.
- 4.4 A fault line is shown crossing the site from north to south in the western quarter of the site, roughly following the line of a drystone boundary wall.
- 4.5 The online BGS Geoindex Onshore has been consulted and they have no records of historical landslides associated with the development site, or in the immediate vicinity of the site. Additionally, the Phase 1 Environmental Assessment does not highlight any risk associated with slope stability for the site.
- 4.6 The Phase 1 Environmental Assessment by CoDa Structures includes a Coal Mining Search Report by David Bellis Consulting Surveyors (Report 309290) which states that there are no recorded workings beneath the site and future workings are considered unlikely.
- 4.7 From the Coal Authority Online Interactive Map, the site is shown to lie outside development high risk areas. In addition to this, the site is shown to be outside areas of both past shallow mine working and probable shallow workings.
- 4.8 It is therefore considered that the site is at a low risk from historical coal workings.
- 4.9 There are no detailed deep BGS boreholes recorded in the vicinity of the site.

5.0 ENVIRONMENTAL CONSIDERATIONS

5.1 Radon

The UK Radon online maps indicate the property is in an area where 1-3% of properties are above the action level.

No Radon Protective Measures are required.

5.2 Landfill Sites

There are three recorded historical landfill sites within 250m of the site.

The nearest is located 15m south west of the site and last accepted inert, commercial and industrial waste in 1989. The second is located 122m south east of the site and last accepted inert and commercial waste in 1986. The third is located 154m south west of the site and last accepted inert, commercial and industrial waste in 1989.

5.3 Flood Risk

The site is not located in a currently defined Environment Agency floodzone or at risk of flooding from rivers and the sea.

5.4 Groundwater

The groundwater vulnerability map for the area indicates that the site overlies bedrock designated as a Secondary (A) aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The site is not within a currently defined (Groundwater) Source Protection Zone (SPZ).

There are no licensed groundwater or surface water abstractions within 250m of the site.

There are no Licensed Discharge Consents within 250m of the site.

There are no recorded pollution incidents to controlled water within 250m of the site.

The nearest water feature is an unnamed watercourse on site that issues centrally and flow to the north east where it exits the site. In addition to this, a partially submerged storage tank is located in the west of the site which is understood to be supplied by spring water, and it is likely the watercourses crossing the site are sourced by spring water too. Existing land drains are also noted to be crossing the site.

6.0 **PRELIMINARY CONCEPTUAL SITE MODEL**

6.1 The initial stage in assessing the risks posed from contaminated land during the redevelopment of a site is to prepare a conceptual model. A generalised conceptual model can be developed highlighting the main pollutant linkages through a contaminant ► pathway ► receptor model for a residential development. In order to prepare the conceptual model for a particular site the following parameters need to be reviewed as discussed below.

6.2 Contamination of existing land can be caused by a number of factors, including:-

- i) Possible historical/current industrial activities.
- ii) Disposal of waste materials.
- iii) Storage of materials.
- iv) A number of natural processes can also lead to hazardous gases and elevated heavy metals.

6.3 Potential pathways can include ground and surface water, permeable strata, existing services providing a conduit and voided ground. Potential receptors can include human health, ecosystems, controlled waters and building structures. There are a number of ways that a receptor can be exposed to the contaminant these include, inhalation, direct contact, ingestion, dermal contact and uptake.

6.4 Sources of potential contamination, that could affect the proposed development, from either on or off site activities would include the following:-

- i) Possible ground gas migration from infilled quarry located to the south of the site.

Based on the above activities the potential for some contamination to exist on site is considered to be low.

6.5 Considering the proposed residential end use, there will be two possible human receptor groups exposed to the existing onsite contamination:-

- a) Site operatives during development.
- b) End users, future site residents (the critical receptor is a 6 year-old girl).

- 6.6 Human receptors may be exposed to site contamination by a number of possible pathways. These pathways are summarised in Table 1 below.

Table 1- Potential Human Exposure Pathways

<u>Human Exposure Pathway</u>	<u>Site Residents</u>	<u>Construction Workers</u>
Soil Ingestion	YES	YES
Consumption of Home Grown Vegetables	YES	NO
Dermal Contact	YES	YES
Dust Inhalation	YES	YES
Gases/Vapours	YES	NO

- 6.7 The construction workers will come into contact with any contaminated soil to a far greater extent than future residents. The exposure pathways are generally through dermal contact and indirect ingestion. However their exposure will be for a limited time and the provision and correct use of personnel protective equipment and adequate welfare facilities during construction should restrict their risks to acceptable levels.
- 6.8 Future site residents can be protected in the long term development of the site via a suitable remediation strategy that ensures any proposed contaminated materials remaining on-site are suitably isolated beneath an effective capping layer.
- 6.9 The risk of pollution to controlled waters by existing contamination is considered low. There have been no historical uses of the site, or in the immediate vicinity of the site, likely to cause contamination. There are no licensed ground water abstractions recorded within 250m of the development. There have been no recorded pollution incidents to controlled waters associated with the site.
- 6.10 No specific areas of ecological importance have been identified in the initial desk top study. Therefore the site is considered to be in a low risk environmental setting. The potential for phototoxic materials to exist at shallow depth should be considered, these could pose a potential risk to new planting and soft landscaping areas within the proposed development.
- 6.11 The proposed planning drawings indicate residential properties with private garden areas and hard paved site access and parking areas. The presence of elevated

sulphates and hydrocarbons could affect the long term integrity of buried concrete structures, including foundations and drainage pipes. Plastic water supply pipes can also be damaged by the presence of hydrocarbon contamination.

7.0 FIELDWORK

- 7.1 Trial pit excavations were undertaken on 10-12 July 2023 using an 8 tonne tracked excavator with 600mm wide bucket. Twenty three trial pits were undertaken in total. In addition to this, sixteen rotary boreholes were undertaken on site, to depths between 3 and 18m. Six of these boreholes were fitted with gas monitoring stations to determine if ground gas generation from historic landfills in the vicinity would adversely affect the site, as well as to allow the monitoring of groundwater levels, particularly in the vicinity of the proposed attenuation tank.
- 7.2 Materials encountered in the trial pits and boreholes were examined and categorised. Trial pit and borehole logs are contained within Appendix B of the report.
- 7.3 The site investigation works were designed to achieve comprehensive site coverage within the proposed development area.
- 7.4 Soil samples were removed from the natural ground deposits within the trial pits. The samples were removed by operatives wearing gloves and placed into airtight clean plastic containers and glass bottles for transportation to the laboratory.
- 7.5 A total of thirteen samples from the natural ground deposits were recovered from the trial holes for chemical analysis. The testing was carried out by a UKAS accredited laboratory to nationally or accredited in-house methods. The results of the contamination testing are contained within Appendix C of this report.
- 7.6 A suite of common potential contaminants consisting of heavy metals, phytotoxic metals, sulphates, sulphides and poly-aromatic hydrocarbons was analysed for, including a range of metals and inorganic substances and asbestos.
- 7.7 All samples were stored in airtight containers within cool boxes at approximately 4°C until delivery to the laboratory within 48 hours.

8.0 RESULTS OF THE INVESTIGATION

8.1 GEOTECHNICAL INVESTIGATION

- 8.1.1 A copy of the trial hole and borehole logs providing a complete record of strata encountered beneath the proposed development is presented in Appendix B.
- 8.1.2 The fieldwork generally proved a shallow depth of soils, clays and weathered mudstone overlying a sandstone bedrock.
- 8.1.3 At the surface of all the trial pits was rough grass over a dark brown sometimes loamy, sometimes sandy topsoil. The topsoil varied in thickness between 0.2 and 0.5m across site.
- 8.1.4 Below the topsoil in all the trial pits there was a 0.3-2.3m thick layer of soft, becoming firmer with depth, brown/grey clay with numerous gravels. TP22 was terminated in this strata at a depth of 0.9m as a blue plastic water supply pipe was encountered.
- 8.1.5 At the lower northern end of the site, beneath the clay a weathered sandstone was encountered at depths of 0.55-2.8m beneath existing ground levels. This was noted to be shallower the further north in the site and rapidly became difficult to excavate.
- 8.1.6 At the higher southern end of the site, there was a greater depth of clay with a weathered mudstone encountered at 1.4-2.9m below existing ground levels. This was generally excavated as angular shaley gravels, however in TP15, TP17 and TP13 in the south west of the site, the gravels were noted to be in a clay matrix. The trial pits were terminated in this strata at depths of 2.7-3.8m below existing ground levels.
- 8.1.7 Generally, the rotary boreholes undertaken on site proved up to 2.8m of clays overlying 1.3-12.3m of weathered mudstone, except in the north west of the site where no mudstone was encountered and the clays directly overlaid sandstone. Beneath this, there was a sandstone bedrock encountered at 0.5-14.6m beneath existing ground levels. The depth to the sandstone reduced the further north and west within the site the borehole was.

8.1.8 Borehole 1 was undertaken to the south west of the site, at a level approximately 10m above the remainder of the boreholes. This was done to provide details of the composition of the existing slope. It was not possible to do this on site due to the steep gradient of the slope.

8.1.9 Sections of the strata through the existing site are included in Appendix A in the rear of the report.

Table 2 - Summary of Strata Encountered in Boreholes

Borehole No.	Clay (m)	Mudstone (m)	Sandstone (m)	Mudstone (m)	Water Strike
1	0.0-2.8		2.8-3.3	3.3-18.0	-
2	0.0-1.5	1.5-8.5	8.5-9.5	-	-
2G*	0.0-1.5	1.5-3.0	-	-	-
3	0.0-2.3	2.3-3.3	3.3-4.5	-	-
4*	0.0-1.4	1.4-1.8	1.8-4.00	-	-
5	0.0-2.2	2.2-4.8	4.8-6.0	-	-
6*	0.0-1.4	1.4-2.7	2.7-4.0	-	-
7	0.0-2.3	2.3-9.0	9.0-10.0	-	-
8	0.0-2.3	2.3-14.6	14.6-16.0	-	-
8G*	0.0-2.3	2.3-4.0	-	-	-
9	0.0-2.5	2.5-8.7	8.7-10.0	-	-
10	0.0-1.8	1.8-3.3	3.3-5.0	-	-
11*	0.0-1.3	1.3-4.0	-	-	-
12	0.0-0.5	-	0.5-3.0	-	-
13	0.0-1.0	-	1.0-4.0	-	-
14*	0.0-1.0	-	1.0-4.0	-	-

8.1.10 Standard Penetration Test 'N' values taken at 1.5m depth increments within boreholes 7 and 8 to determine the properties of the overlying clay and mudstone and are summarised in Table 2 below:-

Table 3 - Summary of SPT (N Values)

Depth (m)	1.00-1.45	2.50-2.95	4.00-4.45
BH07	3	22	REFUSAL
BH08	26	41	REFUSAL

8.1.11 The SPT results showed the overlying clay to be soft to stiff with refusals recorded in the underlying mudstone.

8.1.12 Trial trenches were excavated across the projected alignment of the fault line and proved no evidence of displaced superficial strata. The strata either side of the projected fault line was examined and there was no displaced strata that would indicate the present of a fault line.

8.2 GEOTECHNICAL TESTING OF THE MATERIAL

8.2.1 The results of the geotechnical analysis undertaken on the samples of clayey soil indicates the clay to be of medium plasticity (Plasticity Index 17-22%). If the modified results are calculated, taking into account the percentage of material retained on a 425micron sieve, the results correspond to a medium shrinkage clay. The test certificate is contained in Appendix C.

8.2.2 The testing undertaken on site proves that the liquid limit determined in accordance with BS 1377: Part 2 does not exceed 90 and the plasticity index determined in accordance with BS 1377: Part 2 does not exceed 65, therefore the clays are deemed suitable for re-use on site. The material on site would therefore not be considered to fall into classes U1, U1A or U2.

8.2.3 The grading of the samples of material on site would indicate that it could be classified as Grade 2C. The results of the geotechnical analysis, along with extracts from Specifications for Highway Works Series 600 Table 6/1 and Table 6/2 for comparison.

8.2.4 Determination of shear strength by direct shear was undertaken on samples of the gravelly clay and clayey sand were taken. Each sample was tested under three different normal pressures (60kPa, 80kPa and 100kPa) to replicate the conditions of increasing site levels on the underlying natural strata. The results have been summarised in Table 4 below:

Table 4 – Summary of Shear Box Test Results

SAMPLE LOCATION	PEAK SHEAR STRESS (kPa)			Effective Cohesion (C')	Effective Angle of Friction (ϕ')
	NORMAL PRESSURE (kPa)				
	60	80	10		
TP09	83	55	96	52	17.5
TP15	42	63	68	6	32.5
TP16	34	58	68	3	40
TP17	40	61	74	6	41
TP19	45	74	75	20	37

- 8.2.5 The sample from TP09 was noted to have the highest moisture content, highest void ratios, and the lowest bulk and dry densities which contribute towards the lower effective angle of friction recorded compared to the other samples.

8.3 GROUNDWATER

- 8.3.1 In the marshy area in the west of the site, perched groundwater was encountered at the base of the clay strata at depths of 1.75 and 1.9m below existing ground levels in TP14 and TP19 respectively.
- 8.3.2 No groundwater strikes were recorded during the rotary borehole investigation. During the gas monitoring, groundwater has been measured at 1.4-1.9m below existing ground levels in the southernmost and westernmost monitoring stations on site. The southernmost stations are located where there are greater depths of clays and mudstone.
- 8.3.3 It should be recognised that ground water levels may vary throughout the year. During periods of heavy rainfall the groundwater levels may be substantially higher than the results revealed in these investigations.

8.4 GAS MONITORING

- 8.4.1 As discussed previously, six of the rotary boreholes were installed with gas standpipes and lockable covers. Gas testing is currently being undertaken on site and to-date the wells have been monitored on four occasions following the installation of the standpipes.

8.4.2 A standard gas monitoring procedure has been followed in accordance with CIRIA guidance, including measurement of the following:-

- i) Methane, Oxygen and Carbon Dioxide concentrations.
- ii) Atmospheric Pressure.
- iii) Gas Flow Rate.
- iv) Standing water level.

8.4.3 The result of the monitoring undertaken to-date is summarised in Table 5 below. A complete set of results will be reported on completion of the intended testing programme.

Table 5 - Summary of Recorded Gas Levels.

Borehole No.	Date	Oxygen %	Carbon Dioxide %	Methane %	Flow Rate (l/hr)	Depth to Water (m)	Atmospheric Pressure (mb)
BH02G	26.07.23	18.6	1.9	ND	ND	1.80	986
	09.08.23	18.6	2.3	ND	ND	2.10	994
	29.08.23	18.9	2.4	ND	ND	1.80	988
	26.09.23	18.6	2.1	ND	ND	2.20	988
BH04	26.07.23	21.4	ND	ND	ND	DRY	986
	09.08.23	20.9	ND	ND	ND	DRY	995
	29.08.23	19.9	1.2	ND	ND	DRY	986
	26.09.23	20.7	ND	ND	ND	DRY	988
BH06	26.07.23	15.1	2.2	ND	ND	DRY	986
	09.08.23	15.8	4.2	ND	ND	DRY	994
	29.08.23	17.1	4.2	ND	ND	DRY	988
	26.09.23	16.3	4.2	ND	ND	DRY	989
BH08G	26.07.23	18.4	ND	ND	ND	1.80	983
	09.08.23	17.0	ND	ND	ND	2.20	992
	29.08.23	17.3	ND	ND	ND	1.90	985
	26.09.23	17.6	ND	ND	ND	2.30	987
BH11	26.07.23	19.5	1.5	ND	ND	1.40	985
	09.08.23	19.8	1.9	ND	ND	1.40	994
	29.08.23	16.2	3.5	ND	ND	1.40	986
	26.09.23	16.7	3.4	ND	ND	1.65	989
BH14	26.07.23	21.3	ND	ND	ND	DRY	986
	09.08.23	20.9	ND	ND	ND	DRY	995
	29.08.23	20.2	0.7	ND	ND	DRY	986
	26.09.23	20.1	0.7	ND	ND	DRY	989

8.4.4 The gas monitoring on 26th July and 29th August 2023 was undertaken during falling air pressure. During the monitoring to date, a maximum steady carbon dioxide concentration of 4.2% has been recorded in BH06. No methane has been recorded on site. No flow rates have been detected within the monitoring stations.

8.4.5 Due to the low levels of carbon dioxide levels and flow rates on site, we would recommend the gas regime on this site be currently classified **CS1** by BS 8485:2015 Table 2.

8.4.6 The gas monitoring is ongoing and a final report confirming any gas protection measures required will be prepared when the monitoring is completed.

9.0 CONTAMINATION

9.1 HUMAN HEALTH RISK ASSESSMENT

9.1.1 The appraisal of contaminated land within the UK is based on a risk assessment approach. The method involves the principle of defining a source ► pathway ► receptor, linkage to establish a human health risk. For any risk to exist to a potential receptor from an identified contaminant there must be an unbroken source ► pathway ► target relationship.

9.1.2 In the first instance site data for the contaminant levels are compared against guidance such as the CLEA values published by DEFRA. Should the site values exceed the guidance criteria, the contamination levels are recognised to have the potential to pose a risk to human health. Two scenarios are then available:-

- a) To break or remove one of the source ► pathway ► receptor linkages, by specifying an appropriate level of remedial work. Examples of remedial action may include the removal of the contaminated material or alternatively specifying a sufficient capping layer.
- b) The alternative approach is to provide a more detailed human health site specific risk assessment. This will involve examining factors such as soil properties, exposure assumptions, groundwater flows and contamination composition.

9.2 CONTAMINATION RESULTS

9.2.1 As stated above, in order to put the analytical results into context, the data has in the first instance been assessed in relation to several sets of guidelines: -

9.2.2 The analytical results have been assessed via an initial screening assessment with regard to the current Contaminated Land Exposure Assessment model (CLEA UK) for human health, which has been produced for the Environment Agency and the Department of Environment, Food and Rural Affairs (DEFRA). The CLEA model provides Soil Guideline Values (SGVs) for a limited range of contaminants only, and these are based on risk to human health. As such they do not take into account potential risks to other receptors eg groundwater and third party land.

- 9.2.3 It is proposed to redevelop the site for residential properties with private garden areas. Soil results have therefore been assessed against Generic Assessment Criteria (GAC) based on guidelines from the Chartered Institute of Environmental Health (CIEH) and Land Quality Management Ltd (LQM) S4UL document. Where there is no GAC, guidance limits have been adopted from sources referenced in the table below.
- 9.2.4 In addition to the above, the calculation of SGVs based on an acceptably low level of risk is currently being undertaken. These Category 4 Screening Levels (C4SL) have been calculated for six substances to date by modifying the toxicological/exposure parameters within CLEA. C4SLs have been used as tier 1 trigger levels within this assessment, superseding the previous CIEH and LQM SGVs.
- 9.2.5 Assessment of risk is considered as a tiered approach. Assessment based on non intrusive means is considered Tier 1 assessment, comparison against SGVs and GACs is a Tier 2 assessment, and the generation of and comparison with Site Specific Assessment Criteria (SSAC) is a Tier 3 assessment and is conducted where deemed appropriate following the Tier 2 assessment.
- 9.2.6 The sulphate and acid concentrations have been compared against the BRE digest “Concrete in Aggressive Ground” parts 1-4. This will enable the concrete class to be specified in relation to possible contact with aggressive soils.
- 9.2.7 The results of the chemical analysis on the 13 samples are presented on the laboratory analysis sheets with Appendix C. A summary of the significance of the results is presented in Table 6.

Table 6**Comparison of contaminant against accepted guidance values for residential use with plant uptake**

<u>CONTAMINANT</u>	<u>SGV</u> <u>MG/KG</u>	<u>CONCENTRATION IN</u> <u>ALL SOILS.</u> <u>MG/KG</u>	<u>No. OF</u> <u>SAMPLES</u> <u>EXCEEDING</u> <u>GUIDANCE</u> <u>VALUES</u>	<u>PERCENTAGE</u> <u>OF SAMPLES</u> <u>EXCEEDING</u> <u>GUIDELINE</u> <u>VALUE</u>
Arsenic	37 (4)	3.9-32	0/13	
Cadmium	22 (4)	<0.1-1.4	0/13	
Chromium (Total)	130 (2)	8.3-36	0/13	
Lead	200 (4)	27-320	1/13	7.69%
Mercury (Total)	40 (1,5)	<0.05-0.77	0/13	
Selenium	250 (1)	<0.5-1.1	0/13	
Copper	2400 (1)	9.3-130	0/13	
Nickel	180 (1)	5.6-24	0/13	
Zinc	3700 (1)	27-320	0/13	
Sulphate	0.24 (3)	0.04-0.72	1/13	7.69%
Thiocyanate	50	<0.6-4.8	0/13	
Sulphide	250	<10-240	0/13	
Naphthalene	2.3 (1)	<0.1-4.4	1/13	7.69%
Benzo(a)pyrene	5 (4)	<0.1-59	1/13	7.69%
PAH (Total)	40	<1.6-780	0/13	
Phenols	760 (1)	<0.3-2.4	0/13	
Asbestos	No fibres	None	0/8	
pH	6-8	4.8-7.3	9/13	69.2%

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(2) DEFRA CLR SGV's withdrawn used for initial comparison

(3) BS 8110 1985 Table 6.1

(4) Category 4 Screening Levels

(5) Unless there is considered to be historical site usage that would result in elemental and methylmercury compounds to be present, the inorganic mercury SGV is used as this is the most prevalent for of mercury present in the natural environment.

9.2.8 Only the topsoil sample from TP10 recorded elevated levels of Lead (320 mg/kg) and PAH Total and individual PAH compounds including Naphthalene (4.4 mg/kg), Benzo(a,h)anthracene (61 mg/kg), Benzo(b)Flouranthene (42 mg/kg), Benzo(a)pyrene (59 mg/kg) and Dibenzo(a,h)anthracene (6.7 mg/kg).

9.2.9 No other elevated levels of heavy metals, phytotoxic metals, PAH (Total) or individual PAH compounds were recorded in the samples taken from site.

9.2.10 No asbestos was recorded in the samples taken from site.

9.2.11 A single elevated level of sulphate of 0.72% was recorded in the clay of TP04 at a depth of 1.7m. In addition to this, pH values as low as 4.8 were recorded. This corresponds to a design sulphate class DS-3, ACEC class AC-4, when compared against the BRE Special Digest 1 "Concrete in aggressive ground" in the vicinity of TP04. No other elevated levels of sulphate were recorded, therefore a design sulphate class DS-1, ACEC class AC-2z may be used elsewhere on site.

9.3 QUALITATIVE RISK ASSESSMENT

9.3.1 The Qualitative Risk Assessment is based upon the previously discussed source ► pathway ► receptor principle. In relation to the proposed site these may be described as follows:-

9.3.2 SOURCE

- i) Lead and PAH hotspot identified on site at TP10.
- ii) No elevated levels of ground gas.

9.3.3 PATHWAYS

- i) Ingestion of contamination material.
- ii) Inhalation of contaminated particles.
- iii) Dermal contact with the known contamination.
- iv) Leaching to controlled waters.

9.3.4 RECEPTORS

- i) Residential site users.
- ii) Construction and maintenance workers.
- iii) Controlled waters.
- iv) The building structure.

9.3.5 Each of the receptors will now be appraised and attribute the likely risks involved.

i) Residential site users.

Based on the chemical results obtained it is considered that there is currently a **low/negligible** risk to end users from localised ground contamination on-site.

Only the topsoil sample from TP10 recorded elevated levels of Lead (320 mg/kg) and PAH Total and individual PAH compounds including Napthalene (4.4 mg/kg), Benzo(a,h)anthracene (61 mg/kg), Benzo(b)Flouranthene (42 mg/kg), Benzo(a)pyrene (59 mg/kg) and Dibenzo(a,h)anthracene (6.7 mg/kg).

No other elevated levels of heavy or phytotoxic metals or PAH compounds were recorded in the samples from site. It is considered likely that the hotspot identified is the location of historical bonfires on site, which explains why the contamination is restricted to this one location.

No asbestos recorded in the samples taken from site.

We would recommend that the contamination hotspot at TP10 identified on site is excavated to the natural clay strata and the topsoil is removed from site to a suitable licensed waste facility. Further sampling should be taken to the perimeter and base of the excavation to confirm the extent of contaminated material has been removed.

Following the removal of the hotspot, the remaining topsoil on site should be stockpiled and fenced off prior to developing the site to prevent cross contamination. Further testing will be required to provide a robust sample set confirming the topsoil is suitable to remain on site. The topsoil should be screened prior to being re-laid in garden areas to remove any deleterious materials.

During the monitoring to date, a maximum steady carbon dioxide concentration of 4.2% has been recorded in BH04. No methane has been recorded on site. Due to the low levels of carbon dioxide levels and flow rates on site, we would recommend the gas regime on this site be currently classified as **CS1** by BS 8485:2015 Table 2. The gas monitoring is ongoing and a final report confirming any gas protection measures required will be prepared when the monitoring is completed.

ii) Construction and Maintenance Workers.

It is considered that there is a **low** risk to construction and maintenance workers from the redevelopment of the site.

Construction workers should always wear PPE including overalls, boots and gloves when handling the contaminated materials onsite. In addition eating, drinking and smoking should be restricted to designated areas where the above hygiene facilities are available.

iii) Controlled Waters

The chemical analysis undertaken on samples of the natural strata from site have proved a limited area of contaminated topsoil on site. The excavation work undertaken has proven the site to be underlain by relatively impermeable clays. It is therefore considered that there is a negligible risk to groundwater and controlled waters from existing contamination on site.

Due to the presence of the watercourse crossing the development site, a temporary works plan should be prepared to ensure no surface water run-off during development on site causes pollution to the watercourse.

iv) Building Structures.

Service providers should be forwarded the final validated chemical levels in order for them to provide an accurate specification for the apparatus to be provided. New services should be surrounded and backfilled with clean material to afford some protection to the apparatus and allow any future maintenance work to be undertaken in clean material.

A single elevated level of sulphate of 0.72% was recorded in the clay of TP04 at a depth of 1.7m. In addition to this, pH values as low as 4.8 were recorded. This corresponds to a design sulphate class DS-3, ACEC class AC-4, when compared against the BRE Special Digest 1 "Concrete in aggressive ground" in the vicinity of TP04. No other elevated levels of sulphate were recorded, therefore a design sulphate class DS-1, ACEC class AC-2z may be used elsewhere on site.

10.0 CONCLUSIONS AND RECOMMENDATIONS

10.1 GEOTECHNICAL ASSESSMENT

- 10.1.1 The fieldwork generally proved varying depths of superficial clays overlying weathered mudstone or sandstone. For initial design purposes we would envisage a safe bearing capacity of 100kN/m² where foundations are cited into the clay strata and 200kN/m² where foundations are extended onto the solid sandstone or mudstone strata.
- 10.1.2 Due to the steep nature of the site, and varying depth of the underlying clays, we would initially suggest that the proposed two/three storey residential constructions should be constructed on foundations taken through the superficial clay strata and founded entirely onto the underlying mudstone or sandstone strata. The foundation widths will vary dependent upon the line loadings calculated and bearing strata.
- 10.1.3 However, it should be noted that the site is likely to undergo significant cut/fill to suit the new highway and proposed split level units. The design of the foundations will need to take into consideration the proposed finished floor levels in relation to the depth to suitable load bearing strata.
- 10.1.4 All foundations should be placed below a line of 45° drawn up from the base of any services or other structures.
- 10.1.5 Where existing foundations or structures are encountered during construction, these should be totally removed from the excavations to enable the new foundations to be constructed without obstructions.
- 10.1.6 At present it is not anticipated that excessive ground water control measures will be required outside of the marshy area identified in the west of the site. However, it is recommended that a land drainage scheme is established early in the development to prevent overland groundwater flow affecting the lower site areas once the topsoil is stripped. Please note that ground water flows can vary throughout the year and a further assessment should be undertaken if construction work is proposed following a prolonged rainfall event.

- 10.1.7 A single elevated level of sulphate of 0.72% was recorded in the clay of TP04 at a depth of 1.7m. In addition to this, pH values as low as 4.8 were recorded. This corresponds to a design sulphate class DS-3, ACEC class AC-4, when compared against the BRE Special Digest 1 “Concrete in aggressive ground” in the vicinity of TP04. No other elevated levels of sulphate were recorded, therefore a design sulphate class DS-1, ACEC class AC-2z may be used elsewhere on site.
- 10.1.8 Wherever any foundations are located near existing or proposed new trees, their foundations must be sited below the root growth zone. Reference should be made to the NHBC standards Chapter 4.2 “Building Near Trees” which provides guidance on foundation criteria, depths and construction. All services should be similarly protected. Plasticity testing of the clays on site has shown them to be of medium volume change potential. It should be noted however that limited clay was encountered in the north of the site, and there were very few trees in the south of the site where the clay was deepest. Additionally, due to the regrading works required, it is recommended that the foundations are taken down to the underlying bedrock.

10.2 **GROUND FLOOR SLAB – GAS MEASURES**

- 10.2.1 As discussed previously, gas monitoring stations were installed in six of the borehole locations on site due to the possibility of ground gas migration from infilled land in the vicinity of the site.
- 10.2.2 A maximum steady carbon dioxide concentration of 4.2% was recorded in BH06. No methane has been recorded. No flow rates have been detected on site.
- 10.2.3 The proposed development consists of low rise residential housing and therefore the gas regime has been characterised in accordance with the traffic light methodology as outlined in *CIRIA Report C665*. Due to the low carbon dioxide levels on site, we would recommend the gas regime on this site be currently classified as **Green** by the NHBC traffic light system, or **CS1** by BS 8485:2015 Table 2.
- 10.2.4 No Radon Protection measures are required for the site.
- 10.2.5 A detailed analysis of the results and any gas protection measures required will be confirmed on completion of the on-site gas testing in a separate report.

10.3 CONTAMINATION ASSESSMENT

- 10.3.1 Only the topsoil sample from TP10 recorded elevated levels of Lead (320 mg/kg) and PAH Total and individual PAH compounds including Napthalene (4.4 mg/kg), Benzo(a,h)anthracene (61 mg/kg), Benzo(b)Flouranthene (42 mg/kg), Benzo(a)pyrene (59 mg/kg) and Dibenzo(a,h)anthracene (6.7 mg/kg).
- 10.3.2 No other elevated levels of heavy or phytotoxic metals or PAH compounds were recorded in the samples from site.
- 10.3.3 No asbestos was recorded in the samples taken from site.
- 10.3.4 We would recommend that the contamination hotspot at TP10 identified on site is excavated to the natural clay strata and the topsoil removed from site to a suitable licensed waste facility. Further sampling should be taken to the perimeter and base of the excavation to confirm the extent of contaminated material has been removed.
- 10.3.5 The topsoil on site should be stockpiled and fenced off prior to developing the site to prevent cross contamination. However, it is recommended that the strip is phased to suit the build program to prevent excessive surface water run-off. The topsoil should be screened prior to being relaid in garden areas to remove any deleterious materials.
- 10.3.6 Should any suspected areas of contamination be exposed during site strip/construction, an engineer should be contacted to determine if additional chemical testing should be undertaken. The on-site staff should maintain a photographic record and dates of any exposed contaminated material.
- 10.3.7 It is not currently anticipated that any topsoil will be required to be imported to site based on the currently available information. However, should any material need to be imported, all imported material should be tested for the range of contaminants listed previously in Table 4. Only material found to be below published trigger levels should be deemed uncontaminated and accepted for use on site.
- 10.3.8 If the imported material is from a Greenfield site, a minimum of 3 samples or 1 per 250m³ of imported material should be taken for testing, whichever is greater. If it is from a brownfield site, a minimum of 6 samples, or 1 per 100m³ of imported material

should be taken for testing, whichever is greater. Material provided by a commercial supplier should be certified to the same level of testing, with the certificate less than two months old.

10.3.9 All imported certified material should be placed immediately. If this is not possible, or the material is not certified and sampling is to be carried out prior to being laid, it should be securely stored on site prior to use to prevent possible contamination from any materials on site.

10.3.10 If any areas of made ground are removed off site, they should be taken to a licensed waste site and full documentation should be obtained. Any material to be taken off-site should be suitably quarantined prior to removal to prevent cross contamination. Any relevant chemical test results should be given to the landfill operator, so that they can determine if this material is suitable to be disposed of in their licensed landfill.

10.4 REMEDIATION AND REGRADING WORKS

10.4.1 The investigation works undertaken on site have proved varying depths of clays overlying weathered mudstone and sandstone.

10.4.2 Due to the steep nature of the site, it will be necessary to undertake extensive regrading works. In particular, it will be necessary to raise levels on the southern boundary where the properties are accessed directly from Lingards Road.

10.4.3 It is anticipated that the sandstone material on site will be suitable for re-use beneath the adoptable highway following crushing. It is recommended that all excavated sandstone is stockpiled on site pending the results of testing to confirm its suitability for use.

11.0 SUGGESTED FURTHER WORK

- 11.1 Gas monitoring to be completed on site and final recommendations for ground gas protection measures to be made.
- 11.2 Contamination hotspot at TP10 to be removed from site and validated.
- 11.3 Further grading testing to be undertaken on excavated sandstone following stockpiling to confirm its suitability for use beneath the adopted highway.
- 11.4 Temporary works to be agreed to prevent surface water run-off from site during development contaminating the watercourse on the southern boundary of the site. It is recommended that the topsoil strip on site is phased to suit the build program where possible to help alleviate the surface water run-off. A land drainage system should be established early in the development during the regrading works.

12.0 APPROVALS

12.1 Proposals for the remediation of contaminated land may require the approval of numerous bodies.

These include:

- a) Kirklees Council Environmental Health Department as required by the building and planning regulations.
- b) The NHBC or similar as they will provide the insurance costs to cover the property.
- c) The Environment Agency if there are risks of contamination to ground or surface water systems. They will also require notification if material is removed from site and taken to an appropriate tip.
- d) Relevant highways and drainage authorities and other service companies may also wish to know about the level of contaminants.

Prepared by



M. Dean. BSc(Hons) HND

Checked by



M. Huddleston. MEng

October 2023

This report is subject to the provisions of the Copyright Acts and is for the sole benefit of SB Homes Ltd in respect of the proposals described.

APPENDIX A

Site Location Plan

Site Investigation Plan

Sections Through Strata

Typical Site Conceptual Model



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Firth Building
99-101 Leeds Road
Dewsbury
WF12 7BU

Client : SB Homes

Job Title: Lingard's Road, Slaithwaite

Job Number : E19/7567/002

LOCATION PLAN

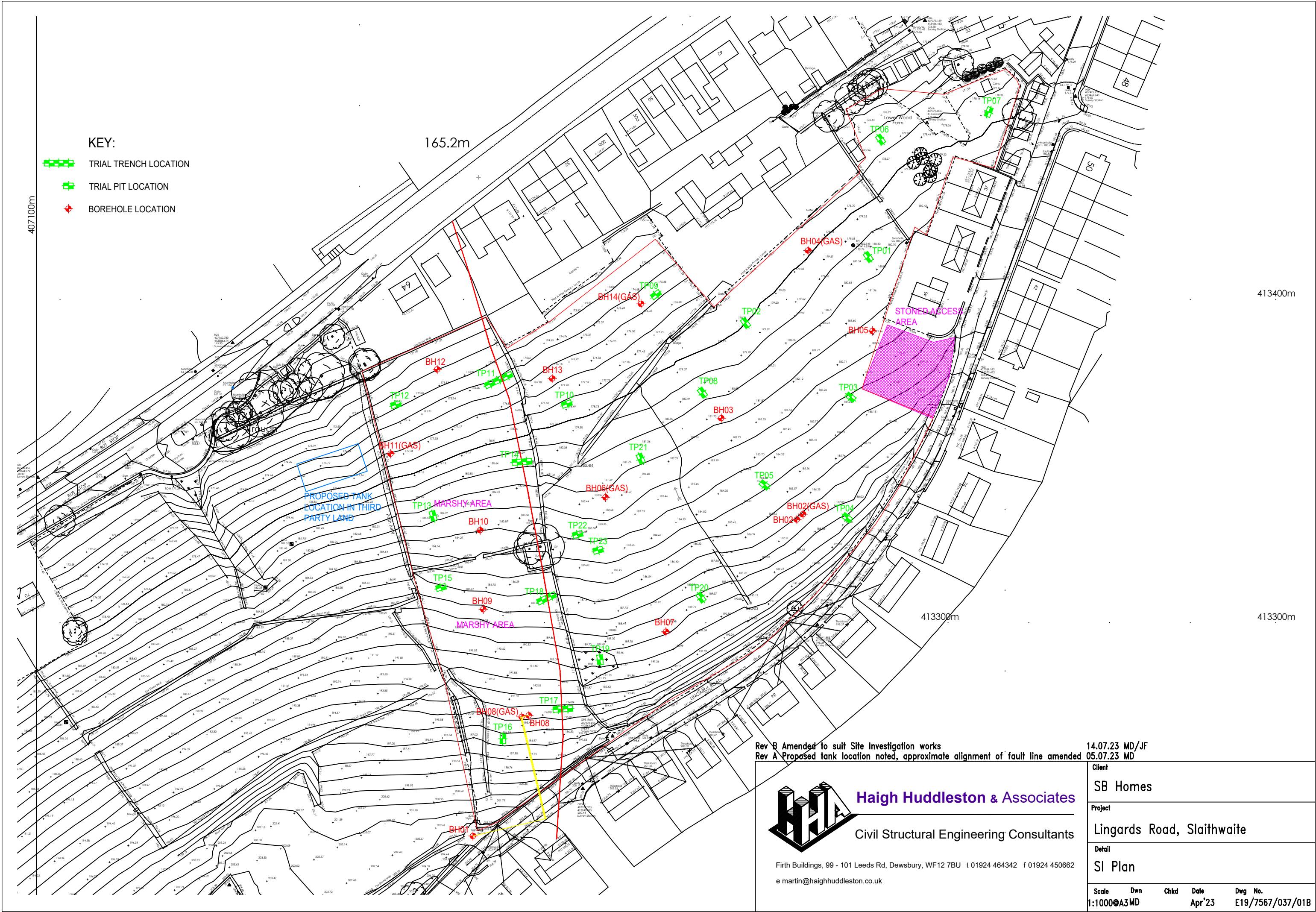
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Easting : 407303

Northing : 413358

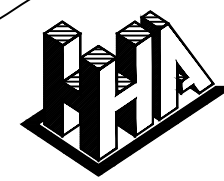
Topographical Survey carried out using
GPS.





Rev B Amended to suit Site Investigation works
Rev A Proposed tank location noted, approximate alignment of fault line amended

14.07.23 MD/JF
05.07.23 MD

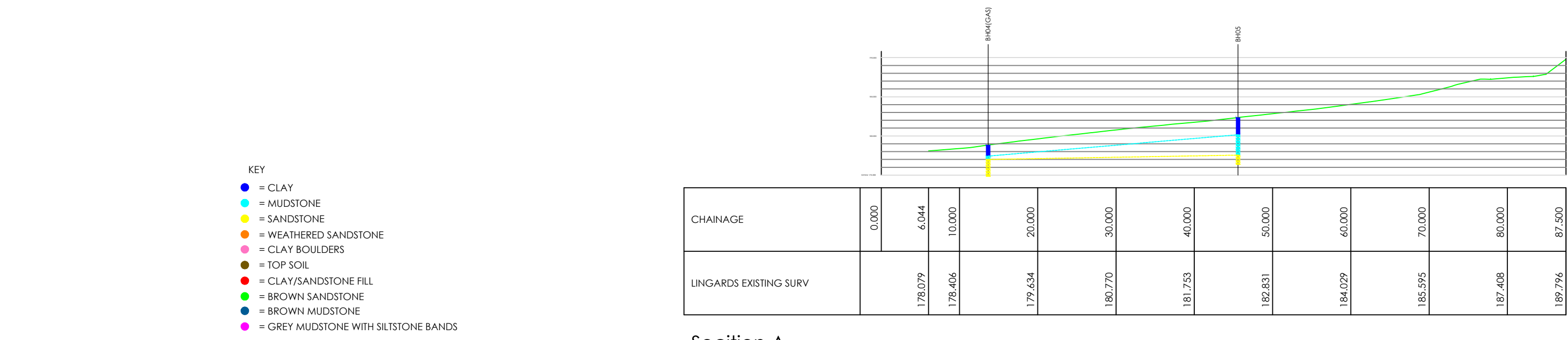


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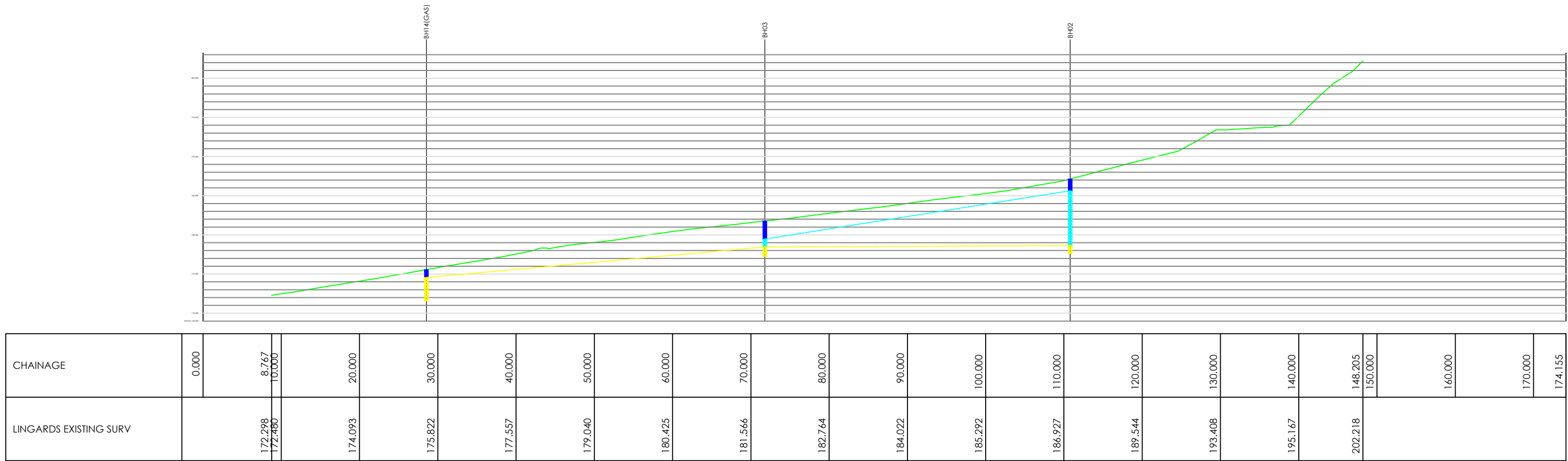
Civil Structural Engineering Consultants

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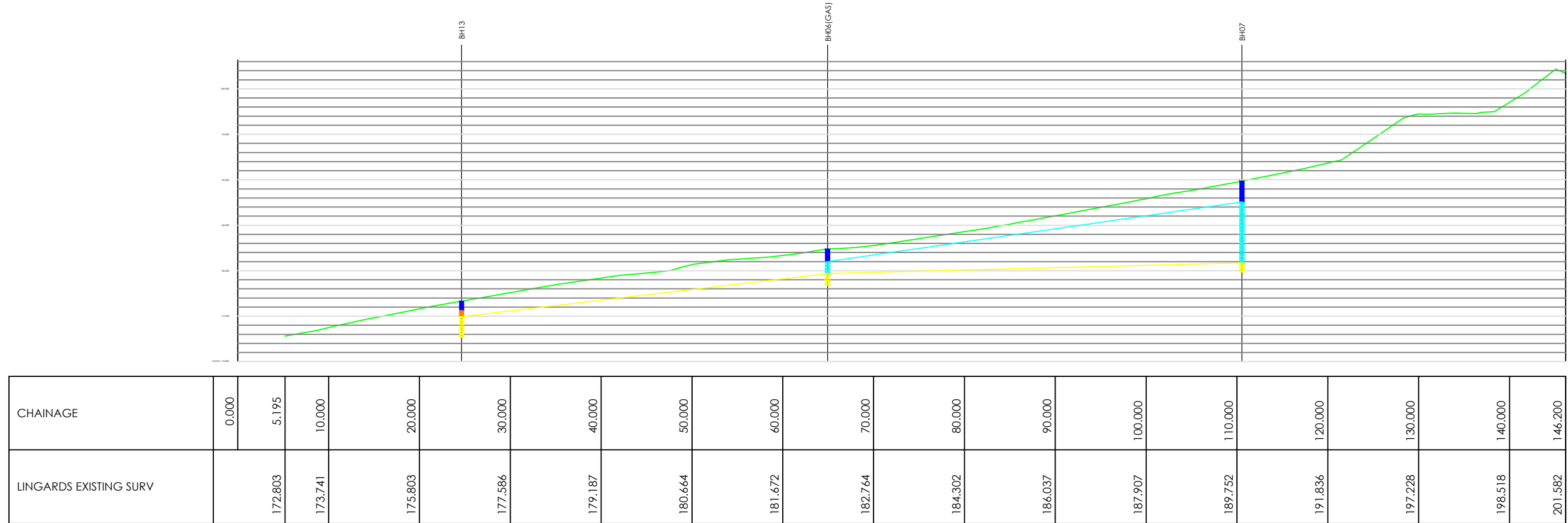
Client				
SB Homes				
Project				
Lingards Road, Slaithwaite				
Detail				
SI Plan				
Scale	Dwn	Chkd	Date	Dwg No.
1:1000@A3 MD			Apr'23	E19/7567/037/01B



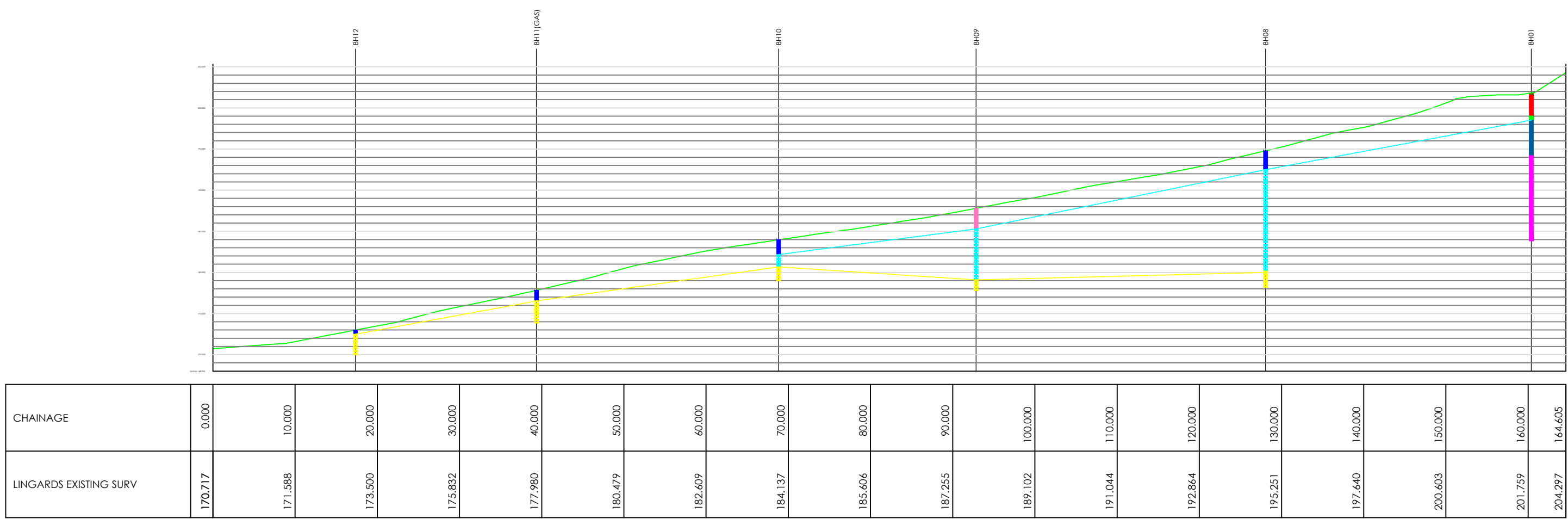
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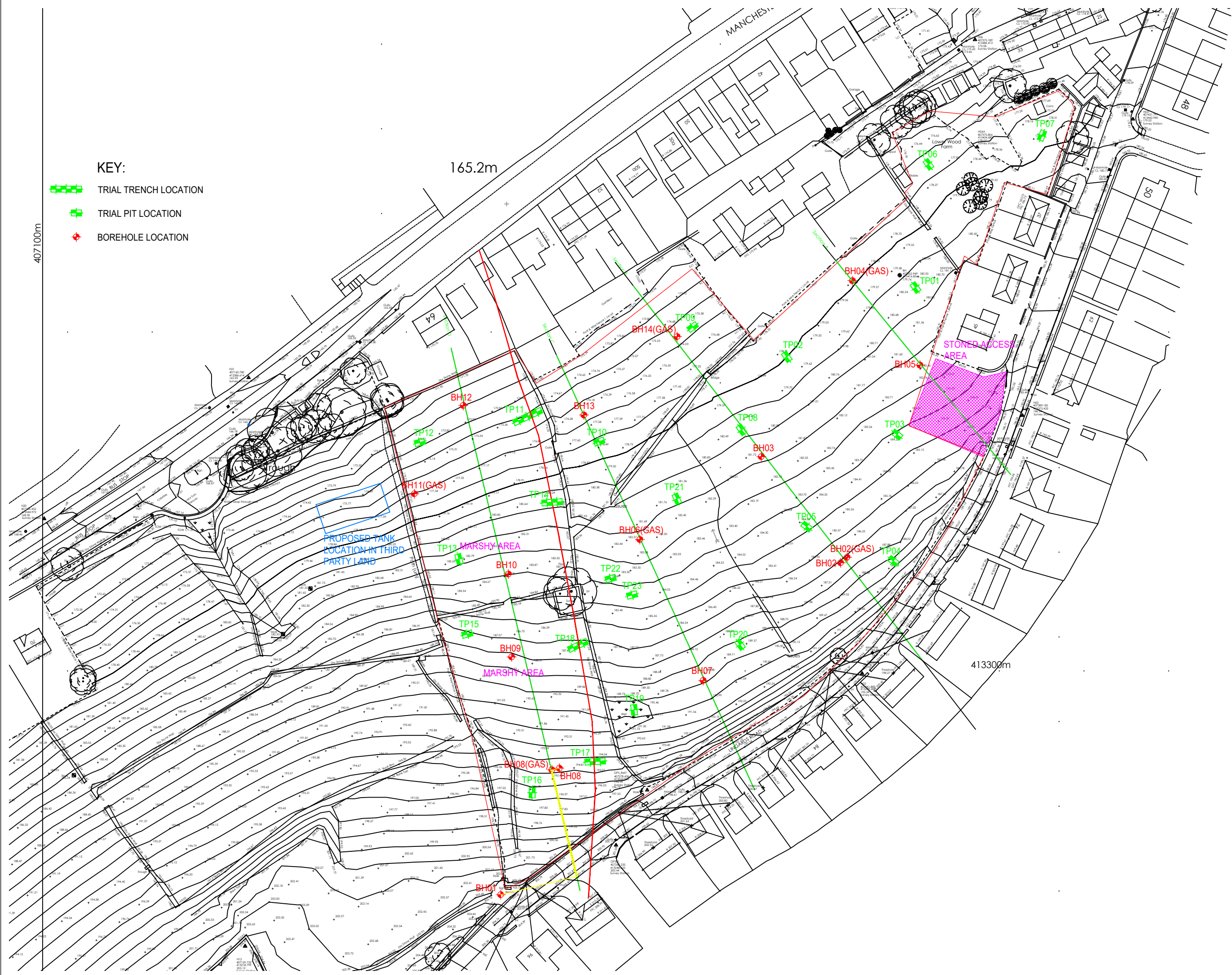
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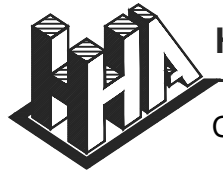
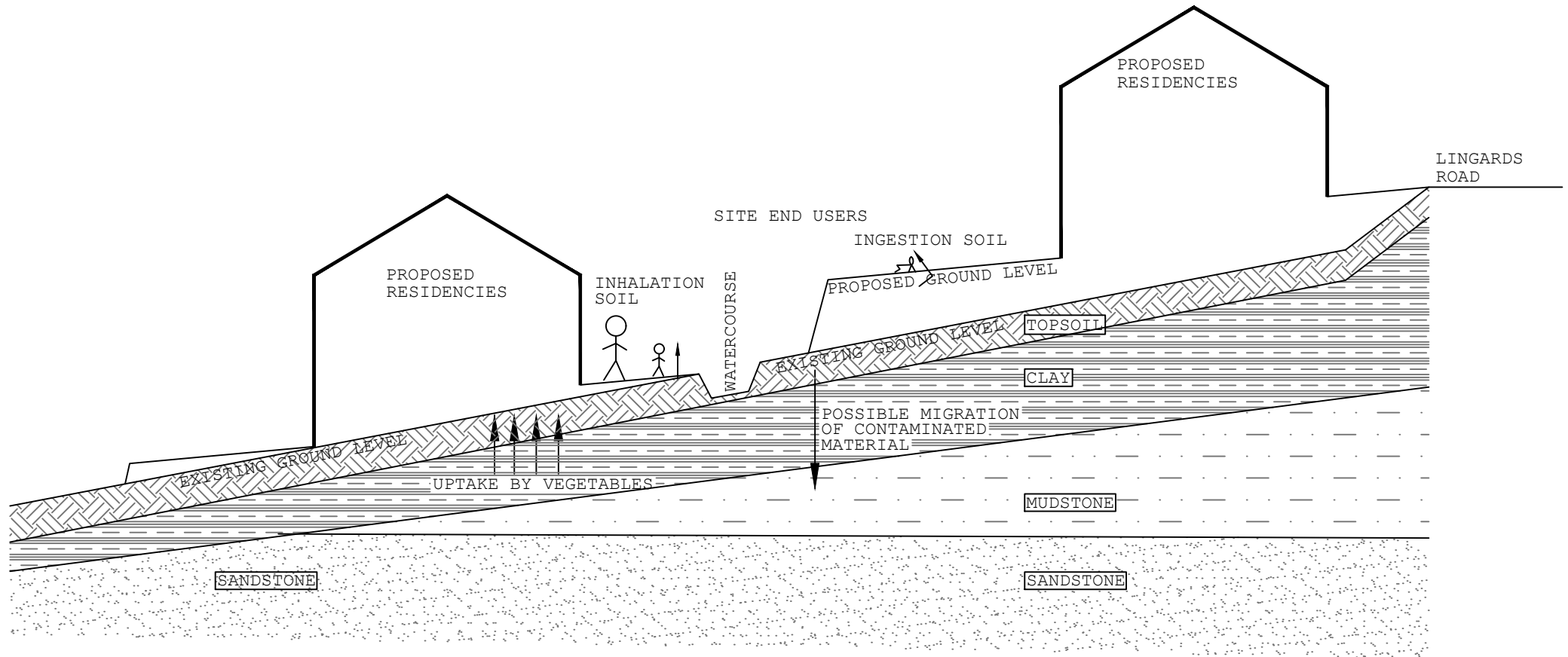
Section C



Section D



SCALE
1:1000@A1



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Client

SB Homes Ltd

Project

Lingards Road, Slaithwaite

Detail

Typical Site Conceptual Model

Scale
NTS

Dwn
MD

Chkd
MD

Date
Oct'23

Dwg No.
E19/7567/32

APPENDIX B

Trial Hole Logs

Borehole Logs

TRIAL HOLE NO. 1



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.1	Rough grass over light brown loamy topsoil with occasional gravels. Sample taken at 0.1m.
	0.2	
	0.5	Soft/firm very sandy orange brown clay.
0.5	0.8	Firm slightly sandy orange brown clay with occasional gravels of sandstone. Sample taken at 0.8m.
1.0		
	1.3	
1.5	1.7	Soft/firm grey/brown slightly sandy clay with occasional sandy gravels and cobbles.
	1.9	Firm grey boulders clay.
2.0	3.0	Firm brown grey clay with occasional gravels of sandstone.
2.5		
3.0	3.5	Very weak light grey highly weathered mudstone excavated as small angular gravels.
3.5	4.0	
4.0		

REMARKS:

Ground water encountered during excavation

NO

Sample taken

YES at 0.1 and 0.8m.

Sides of excavation remained stable

YES

Level

.....

NOTES:

.....

TRIAL HOLE NO. 2



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.1	Rough grass over dark brown topsoil. Sample taken at 0.1m.
	0.2	
	0.4	Sample taken at 0.4m. Soft/firm light brown sandy clay.
0.5		
1.0		
	1.2	Soft/firm brown slightly sandy clay with occasional sandstone gravels.
1.5		
	1.6	Firm grey boulder clay.
2.0	2.0	
	2.3	Very weak dark grey highly weathered mudstone excavated as sandy angular gravels. Moderately strong sandstone. Unable to excavate further.
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

Land drain encountered in top face of trial pit.

.....

TRIAL HOLE NO. 3



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.2	Rough grass over light brown very sandy topsoil.
0.5	0.5	Firm light brown very sandy clay. 75mm clay land drain at 500mm.
	0.6	Sample taken at 0.6m. Soft/becoming firm dark brown/mottled grey sandy clay with occasional sandstone gravels and cobbles.
1.0		
1.5		
2.0		
2.5		
	2.9	
3.0		Moderately weak dark grey compact weathered mudstone excavated as small angular gravels.
3.5		
	3.8	
4.0		

REMARKS:

Ground water encountered during excavation NO

Sample taken NO

Sides of excavation remained stable YES

Level

NOTES:

.....

.....

TRIAL HOLE NO. 4



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.2	Rough grass over dark brown topsoil with occasional roots.
0.5		Firm light brown very sandy clay.
1.0		
	1.4	
1.5		Weak light grey highly weathered mudstone excavated as small angular gravels.
	1.7	Sample taken at 1.7m.
2.0		
2.5		
3.0		
	3.4	
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

.....

TRIAL HOLE NO. 5



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.2	Rough grass over dark brown topsoil.
0.5		Soft/firm light brown very sandy clay with occasional sandstone gravels.
1.0	1.0	
		Soft/firm grey clay with occasional gravels of sandstone.
1.5		
	1.6	
		Weak light grey (occasional ironstone) highly weathered mudstone.
2.0		
2.5		
	2.7	
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO

Sample taken NO

Sides of excavation remained stable YES

Level

NOTES:

.....

.....

TRIAL HOLE NO. 6



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough grass over dark brown topsoil. Sample taken at 0.2m.
1.0		Soft light brown very gravelly clay with numerous sandstone gravels. Sample taken at 0.8m.
	1.2	
	1.4	Strong becoming very strong light brown sandstone becoming difficult to excavate with depth.
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation

NO

Sample taken

YES at 0.2 and 0.8m.

Sides of excavation remained stable

YES

Level

.....

NOTES:

.....
.....

TRIAL HOLE NO. 7



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough grass over dark brown topsoil.
1.0		Soft light brown very gravelly clay.
	1.4	
1.5		Soft becoming firm dark grey gravelly clay with numerous sandstone gravels.
	1.9	
2.0		Strong light brown/grey sandstone becoming difficult to excavate with depth.
	2.1	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 8



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5		Soft becoming moderately firm light brown gravelly clay.
1.0		
	1.3	
1.5		Moderately firm becoming firm dark grey gravelly clay with occasional mudstone gravels.
2.0		
	2.3	
	2.4	Strong light brown/grey sandstone becoming difficult to excavate with depth.
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 9



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5		Soft light brown very gravelly clay.
1.0	1.0	
		Strong light brown/grey sandstone becoming difficult to excavate with depth.
	1.2	
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 10



Haigh Huddleston & Associates

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.25	Rough grass over dark brown topsoil.
0.5	0.5	Weak light brown sandstone excavated as gravels within a clay matrix.
	0.85	Soft light brown gravelly clay.
1.0		Strong light brown/grey clayey sandstone becoming difficult to excavate with depth.
	1.2	
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO

Sample taken NO

Sides of excavation remained stable YES

Level

NOTES:

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TRIAL HOLE NO. 10



Haigh Huddleston & Associates

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5		Soft light brown sandy clay with occasional sandstone gravels.
	0.7	
1.0		Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
1.5		
2.0	2.0	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 12



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5	0.55	Soft light brown sandy clay with occasional sandstone gravels.
	1.9	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 13



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Firth Buildings, 99 - 101 Leeds Road, Dewsbury, WF12 7BU

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5	0.75	Soft light brown sandy clay with occasional sandstone gravels.
1.0	2.1	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
1.5	2.1	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
2.0	2.1	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
2.5	2.1	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
3.0	2.1	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
3.5	2.1	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
4.0	2.1	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 14



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5		
	0.6	Rough grass over dark brown topsoil.
	0.8	Soft light brown/grey gravelly clay.
1.0		Soft to firm grey/dark brown slightly gravelly clay with occasional sandstone gravels.
1.5		
	1.6	
	1.7	Weak black highly weathered coal.
	1.8	Strong brown sandstone becoming difficult to excavate with depth.
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation

YES ingress at 1.75m.

Sample taken

NO

Sides of excavation remained stable

YES

Level

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NOTES:

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TRIAL HOLE NO. 15



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5	0.9	Soft light brown very gravelly clay.
1.0	1.1	Soft to moderately firm dark brown clay.
	3.0	Weak dark grey mudstone within a clayey matrix.
1.5		
2.0		
2.5		
3.0		
	4.0	
3.5		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 16



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5		Soft light brown very gravelly clay.
	0.8	
1.0		Strong brown sandstone becoming difficult to excavate with depth.
1.5		
	1.6	
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO

Sample taken NO

Sides of excavation remained stable YES

Level

NOTES:

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TRIAL HOLE NO. 17



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

Firth Buildings, 99 - 101 Leeds Road, Dewsbury, WF12 7BU

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough grass over dark brown topsoil.
1.0		Soft light brown very gravelly clay.
	1.2	
1.5		Weak dark grey mudstone within a clayey matrix.
2.0		
	2.2	
		Strong brown sandstone becoming difficult to excavate with depth.
	2.4	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 18



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough grass over dark brown topsoil.
1.0		Soft light brown gravelly clay.
1.5		
	1.6	
2.0		Soft grey/dark brown very gravelly clay with numerous sandstone gravels.
2.5		
	2.8	
	2.9	Strong light brown sandstone becoming difficult to excavate with depth.
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO

Sample taken NO

Sides of excavation remained stable YES

Level

NOTES:

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TRIAL HOLE NO. 19



Haigh Huddleston & Associates

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Firth Buildings, 99 - 101 Leeds Road, Dewsbury, WF12 7BU

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough marsh grass/marsh weed over dark brown clayey topsoil.
1.0		Soft dark grey/brown clay.
1.5		
	1.9	Perched ground water entry into trial pit at 1.9m.
2.0		Weak light brown highly weathered mudstone excavated as small angular shale.
2.5		
3.0		
3.5	3.5	
4.0		

REMARKS:

Ground water encountered during excavation YES at 1.9m.
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 20



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5		Soft light brown gravelly clay.
	0.95	
1.0		Moderately soft light brown/grey slightly gravelly clay.
1.5		
	1.9	
2.0		Weak dark grey/brown highly weathered mudstone excavated as small angular shale.
2.5		
3.0		
	3.2	
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 21



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5	0.8	Soft light brown gravelly clay.
1.0	1.5	Moderately soft light brown/grey slightly gravelly clay.
1.5	2.8	Weak dark grey/brown mudstone.
2.0	2.9	
2.5	4.0	

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 22



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5		
	0.9	Soft light brown/grey gravelly clay.
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO

Sample taken NO

Sides of excavation remained stable YES

Level

NOTES:

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TRIAL HOLE NO. 23



Haigh Huddleston & Associates

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5		
1.0		
	1.2	Soft light brown/grey gravelly clay.
1.5		
2.0		
2.5		
3.0		
	3.2	Weak to moderately weak dark grey/brown gravelly mudstone within a clay matrix with occasional sandstone gravels.
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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Equipment & Methods	Client: SB HOMES						
	Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 01	Ground Level						Date: 10/07/2023
Co-ordinates:							
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests			
				Depth	Sample		
	Type	No.					
Topsoil			0.3 (0.3)				
Clay/sandstone fill			2.8 (2.5)				
Brown sandstone			3.3 (0.5)				
Brown mudstone			7.6 (4.3)				
Grey mudstone with siltstone bands			18.0 (10.4)				
Remarks Soilmec 400							Logged by
							Scale
							FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 02		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.5 (1.5)					
Mudstone			8.5 (7.0)					
Sandstone			9.5 (1.0)					
Remarks Soilmec 400								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods	Client: SB HOMES							
	Site: LINGARDS LANE, SLAITHWAITE							
BOREHOLE No. 02G	Ground Level						Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	No.		Test
Clay			1.5 (1.5)					
Mudstone			3.0 (1.5)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 2m slotted								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
BOREHOLE No. 03		Site: LINGARDS LANE, SLAITHWAITE						
Co-ordinates:		Ground Level Date: 10/07/2023						
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			2.3 (2.3)					
Mudstone			3.3 (1.0)					
Sandstone			4.5 (1.2)					
Remarks Soilmec 400								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 04		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	No.		Test
Clay			1.4 (1.4)					
Mudstone			1.8 (0.4)					
Sandstone			4.0 (2.2)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 05		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			2.2 (2.2)					
Mudstone			4.8 (2.6)					
Sandstone			6.0 (1.2)					
Remarks Soilmec 400								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 06		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.4 (1.4)					
Mudstone			2.7 (1.3)					
Sandstone			4.0 (1.3)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 07		Ground Level						Date: 10/07/2023
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample			Test
					Type	No.		
Clay			1.0				CPT	1,0,1,1,1,1
			2.3 (2.3)					
Mudstone			2.5				CPT	3,4,5,5,5,7
			4.0				CPT	6,7,11,13,14 REFUSAL
			9.0 (6.7)					
Sandstone			10.0 (1.0)					
Remarks Soilmec 400								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 08		Ground Level						Date: 10/07/2023
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type No.	Test		
Clay			2.3 (2.3)	1.0 				

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Civil Structural Engineering Consultants

Equipment & Methods	Client: SB HOMES							
	Site: LINGARDS LANE, SLAITHWAITE							
BOREHOLE No. 08G	Ground Level						Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	No.		Test
Clay			2.3 (2.3)					
Mudstone			4.0 (1.7)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 09		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay boulders			2.5 (2.5)					
Mudstone			8.7 (6.2)					
Sandstone			10.0 (1.3)					
Remarks Soilmec 400								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
BOREHOLE No. 10		Site: LINGARDS LANE, SLAITHWAITE						
Co-ordinates:		Ground Level Date: 10/07/2023						
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.8 (1.8)					
Mudstone			3.3 (1.5)					
Sandstone			5.0 (1.7)					
Remarks Soilmec 400								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 11		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.3 (1.3)					
Sandstone			4.0 (2.7)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 12		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			0.5 (0.5)					
Sandstone			3.0 (2.5)					
Remarks Soilmec 400								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
BOREHOLE No. 13		Site: LINGARDS LANE, SLAITHWAITE						
Co-ordinates:		Ground Level Date: 10/07/2023						
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.0 (1.0)					
Weak sandstone			1.7 (0.7)					
Sandstone			4.0 (2.3)					
Remarks Soilmec 400								Logged by Scale FIG

Tel: 01924 464342
Fax: 01924 450662



Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 14		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.0 (1.0)					
Sandstone			4.0 (3.0)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by Scale FIG

APPENDIX C

Chemical Analysis of Samples

Geotechnical Analysis of Samples



Certificate of Analysis

Certificate Number 23-17025

Issued: 01-Aug-23

Client Haigh Huddleston & Associates Ltd
Firth Buildings
99-101 Leeds Road
Dewsbury
WF12 7BU

Our Reference 23-17025

Client Reference 7567

Order No (not supplied)

Contract Title LINGARDS ROAD

Description 5 Soil samples.

Date Received 18-Jul-23

Date Started 18-Jul-23

Date Completed 01-Aug-23

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "K. Bridgewood".

Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis

Matrix Descriptions

Our Ref 23-17025

Client Ref 7567

Contract Title LINGARDS ROAD

Sample ID	Depth	Lab No	Completed	Matrix Description
TP04	1.7	2204227	01/08/2023	Brown gravelly, sandy CLAY
TP07	0.85	2204228	01/08/2023	Brown gravelly, sandy CLAY
TP10	0.5	2204229	01/08/2023	Brown sandy CLAY
TP11	0.4	2204230	01/08/2023	Brown gravelly, clayey SAND
TP15	0.95	2204231	01/08/2023	Brown sandy CLAY

Summary of Chemical Analysis

Soil Samples

Our Ref 23-17025

Client Ref 7567

Contract Title LINGARDS ROAD

Lab No	2204227	2204228	2204229	2204230	2204231
Sample ID	TP04	TP07	TP10	TP11	TP15
Depth	1.70	0.85	0.50	0.40	0.95
Other ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	10/07/2023	10/07/2023	11/07/2023	11/07/2023	11/07/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Metals								
Arsenic	DETSC 2301#	0.2	mg/kg	9.8	3.5	7.1	3.9	5.9
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.1	< 0.1
Chromium	DETSC 2301#	0.15	mg/kg	36	22	27	8.6	30
Copper	DETSC 2301#	0.2	mg/kg	53	10	27	9.3	23
Lead	DETSC 2301#	0.3	mg/kg	42	13	26	16	14
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	21	16	19	5.6	23
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	60	36	51	51	46
Inorganics								
pH	DETSC 2008#		pH	6.0	6.8	6.1	5.2	5.2
Thiocyanate	DETSC 2130#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	2.0
Total Organic Carbon	DETSC 2084#	0.5	%	0.9	0.9	0.6	0.9	1.0
Sulphide	DETSC 2024*	10	mg/kg	< 10	16	< 10	12	12
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.72	0.02	0.06	0.02	0.02
PAHs								
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	0.7	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	1.4	< 0.1	0.2	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	1.2	< 0.1	0.2	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.7	< 0.1	0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	0.9	< 0.1	0.4	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.5	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.5	< 0.1	0.3	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	0.8	< 0.1	0.2	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	0.5	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	0.5	< 0.1	< 0.1	< 0.1
PAH 16 Total	DETSC 3301	1.6	mg/kg	< 1.6	8.0	< 1.6	< 1.6	< 1.6
Phenols								
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	1.8	< 0.3

Information in Support of the Analytical Results

Our Ref 23-17025
 Client Ref 7567
 Contract LINGARDS ROAD

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2204227	TP04 1.70 SOIL	10/07/23	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
2204228	TP07 0.85 SOIL	10/07/23	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
2204229	TP10 0.50 SOIL	11/07/23	GJ 250ml, PT 1L		
2204230	TP11 0.40 SOIL	11/07/23	GJ 250ml, PT 1L		
2204231	TP15 0.95 SOIL	11/07/23	GJ 250ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO ₄	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC 2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC 2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC 2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC 2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC 2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 2311	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO ₄	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	As Received	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3321	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3521	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3521	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3521	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3521	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3521	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

□nd □□Re□□rt



Certificate of Analysis

Certificate Number 23-17026

Issued: 01-Aug-23

Client Haigh Huddleston & Associates Ltd
Firth Buildings
99-101 Leeds Road
Dewsbury
WF12 7BU

Our Reference 23-17026

Client Reference 7567

Order No (not supplied)

Contract Title LINGARDS ROAD

Description 8 Soil samples.

Date Received 18-Jul-23

Date Started 18-Jul-23

Date Completed 01-Aug-23

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis

Matrix Descriptions

Our Ref 23-17026

Client Ref 7567

Contract Title LINGARDS ROAD

Sample ID	Depth	Lab No	Completed	Matrix Description
TP02	0.1	2204232	01/08/2023	Brown sandy CLAY including some rootlets
TP05	0.2	2204233	01/08/2023	Brown gravelly, sandy CLAY including some rootlets
TP06	0.3	2204234	01/08/2023	Brown gravelly, sandy CLAY
TP10	0.2	2204235	01/08/2023	Brown gravelly, sandy CLAY including some rootlets
TP12	0.2	2204236	01/08/2023	Brown gravelly, sandy CLAY including some rootlets
TP13	0.2	2204237	01/08/2023	Brown gravelly, sandy CLAY including some rootlets
TP16	0.2	2204238	01/08/2023	Brown gravelly, sandy CLAY including some rootlets
TP20	0.2	2204239	01/08/2023	Brown gravelly, sandy CLAY including some rootlets

Summary of Chemical Analysis

Soil Samples

Our Ref 23-17026

Client Ref 7567

Contract Title LINGARDS ROAD

Lab No	2204232	2204233	2204234	2204235	2204236	2204237
Sample ID	TP02	TP05	TP06	TP10	TP12	TP13
Depth	0.10	0.20	0.30	0.20	0.20	0.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	10/07/2023	15/07/2023	10/07/2023	11/07/2023	11/07/2023	11/07/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	21	21	32	12	26	15
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	0.2	0.7	0.8	0.1	0.1
Chromium	DETSC 2301#	0.15	mg/kg	22	17	26	21	15	8.3
Copper	DETSC 2301#	0.2	mg/kg	38	41	130	28	46	27
Lead	DETSC 2301#	0.3	mg/kg	88	74	170	320	91	45
Mercury	DETSC 2325#	0.05	mg/kg	0.15	0.19	0.77	0.12	0.35	0.38
Nickel	DETSC 2301#	1	mg/kg	12	11	20	16	8.9	6.8
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	0.6	1.1	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	60	46	320	190	42	27
Inorganics									
pH	DETSC 2008#		pH	5.8	5.7	5.9	5.8	5.0	5.6
Thiocyanate	DETSC 2130#	0.6	mg/kg	4.8	4.2	4.6	2.7	2.6	1.1
Total Organic Carbon	DETSC 2084#	0.5	%	4.6	7.1	11	9.0	6.5	4.5
Sulphide	DETSC 2024*	10	mg/kg	< 10	12	24	240	16	12
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.09	0.08	0.07	0.10	0.07	0.04
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	< 0.1	4.4	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.2	0.2	0.1	2.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	1.7	0.4	0.2	24	0.3	0.1
Fluorene	DETSC 3301	0.1	mg/kg	1.3	0.5	0.2	18	0.2	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	8.4	3.3	1.3	120	1.5	0.6
Anthracene	DETSC 3301	0.1	mg/kg	2.0	2.0	0.2	28	0.3	0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	11	7.2	2.1	140	2.7	0.7
Pyrene	DETSC 3301	0.1	mg/kg	9.7	6.7	2.0	130	2.5	0.6
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	4.4	3.2	0.9	61	1.3	0.2
Chrysene	DETSC 3301	0.1	mg/kg	5.4	4.2	2.0	68	4.9	0.6
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	3.2	2.1	0.8	42	0.9	0.2
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	2.2	1.6	0.7	28	0.8	0.4
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	4.9	3.6	1.2	59	1.7	0.5
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	2.4	1.6	0.6	30	0.8	0.3
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.4	0.4	0.2	6.7	0.2	0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	2.3	1.5	0.7	28	1.1	0.4
PAH 16 Total	DETSC 3301	1.6	mg/kg	59	38	13	780	19	4.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.6	0.5	0.6	1.3	0.6	0.5

Summary of Chemical Analysis

Soil Samples

Our Ref 23-17026

Client Ref 7567

Contract Title LINGARDS ROAD

Lab No	2204238	2204239
Sample ID	TP16	TP20
Depth	0.20	0.20
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	11/07/2023	12/07/2023
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	13	8.1
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	1.4
Chromium	DETSC 2301#	0.15	mg/kg	15	15
Copper	DETSC 2301#	0.2	mg/kg	31	40
Lead	DETSC 2301#	0.3	mg/kg	58	42
Mercury	DETSC 2325#	0.05	mg/kg	0.15	0.06
Nickel	DETSC 2301#	1	mg/kg	11	24
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	45	110
Inorganics					
pH	DETSC 2008#		pH	4.8	7.3
Thiocyanate	DETSC 2130#	0.6	mg/kg	1.1	< 0.6
Total Organic Carbon	DETSC 2084#	0.5	%	3.0	38
Sulphide	DETSC 2024*	10	mg/kg	28	100
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	0.06	0.07
PAHs					
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.1	0.2
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.3	0.6
Pyrene	DETSC 3301	0.1	mg/kg	0.3	0.6
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.1	0.3
Chrysene	DETSC 3301	0.1	mg/kg	1.0	0.8
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.2	0.2
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.5	0.4
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.2	0.4
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
PAH 16 Total	DETSC 3301	1.6	mg/kg	2.9	3.5
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.4	2.4

Summary of Asbestos Analysis Soil Samples

Our Ref 23-17026

Client Ref 7567

Contract Title LINGARDS ROAD

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2204232	TP02 0.10	SOIL	NAD	none	Ben Rose
2204233	TP05 0.20	SOIL	NAD	none	Ben Rose
2204234	TP06 0.30	SOIL	NAD	none	Ben Rose
2204235	TP10 0.20	SOIL	NAD	none	Ben Rose
2204236	TP12 0.20	SOIL	NAD	none	Ben Rose
2204237	TP13 0.20	SOIL	NAD	none	Ben Rose
2204238	TP16 0.20	SOIL	NAD	none	Ben Rose
2204239	TP20 0.20	SOIL	NAD	none	Ben Rose

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 23-17026
 Client Ref 7567
 Contract LINGARDS ROAD

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2204232	TP02 0.10 SOIL	10/07/23	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
2204233	TP05 0.20 SOIL	15/07/23	GJ 250ml, PT 1L		
2204234	TP06 0.30 SOIL	10/07/23	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
2204235	TP10 0.20 SOIL	11/07/23	GJ 250ml, PT 1L		
2204236	TP12 0.20 SOIL	11/07/23	GJ 250ml, PT 1L		
2204237	TP13 0.20 SOIL	11/07/23	GJ 250ml, PT 1L		
2204238	TP16 0.20 SOIL	11/07/23	GJ 250ml, PT 1L		
2204239	TP20 0.20 SOIL	12/07/23	GJ 250ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix A - Details of Analysis

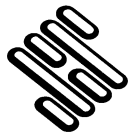
Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO ₄	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC 2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC 2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC 2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC 2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC 2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 2311	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO ₄	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	As Received	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3321	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3521	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3521	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3521	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3521	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3521	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

□nd □□Re□□rt



STRUCTURAL SOILS LTD

TEST REPORT



1774

Report No. 785444 r1

Date 15-August-2023 Contract Lingards Road

Client Haigh Huddleston Associates
Address Firth Building
99-101 Leeds Road
Dewsbury
WF12 7BU

For the Attention of Mark Dean

Samples submitted by client	14-July-2023	Client Reference	*
Method of sampling	Unknown	Client Order No.	*
Testing Started	21-July-2023	Instruction Type	Written
Testing Completed	15-August-2023		

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

UKAS Accredited Tests Undertaken

Water Content BS EN ISO 17892-1
Moisture Content (oven drying method) BS EN ISO 17892-1
Liquid Limit (definitive method) BS EN ISO 17892-12
Plastic Limit BS EN ISO 17892-12
Plasticity Index Derivation BS EN ISO 17892-12
Particle Size Distribution BS EN ISO 17892-4:2016
Bulk density by linear measurements BS EN ISO 17892-2
Consolidated drained shear strength by direct shear BS EN ISO 17892-10

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

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.

Results relate only to items tested

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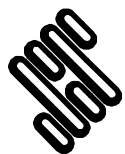
Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.0117 9471000. e-mail dimitris.xirouchakis@soils.co.uk

SUMMARY OF WATER CONTENT TESTS

In accordance with BS EN ISO 17892-1 : 2014

[illegible]

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By

Date

Contract Ref:

Contract:

LORNA WHITWORTH

15.08.23

Lingard Road

785444

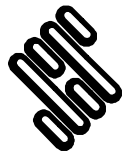


SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with Part 1, Part 12 of BS EN ISO 17892

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Water Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425um	Description of Sample
TP02	1	D	0.40	36.6	49	27	22	92	Brown slightly gravelly sandy silty CLAY
TP06	2	D	0.90	23.3	41	26	15	81	Brown slightly gravelly sandy CLAY with organic material
TP22	3	D	0.70	25.4	38	21	17	98	Brown slightly gravelly sandy CLAY with organic material

SYMBOLS: * denotes BS 1377



**STRUCTURAL
SOILS LTD**

Contract:

Lingard Road

Contract Ref:

785444



According to BS EN 14688-2:2018
Testing in accordance with BS EN ISO 17892-12:2018+A1:2021

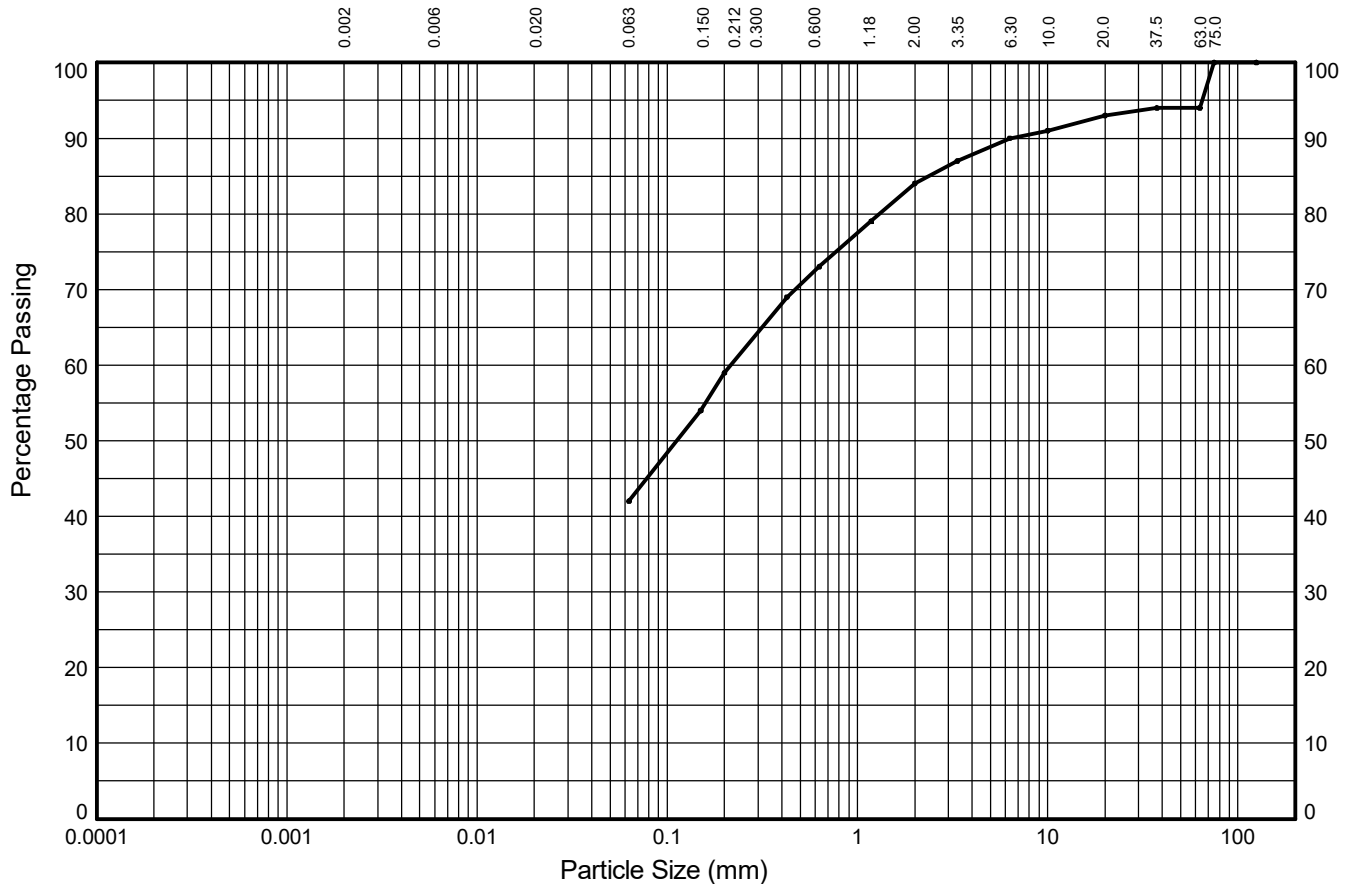


PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 5.2 of BS EN ISO 17892:Part 4:2016

NON-STANDARD TEST

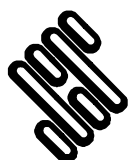
Trial Pit: **TP09** Sample Ref: **1** Sample Type: **B** Depth (m): **0.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	17%	14%	11%	6%	3%	1%	
	SILT			SAND			GRAVEL			
42%				42%			10%			6%

Test Sieve (mm)	Percent Passing (%)	Particle Diameter (mm)	Percent Passing (%)	Coefficients	
125.0	100			D ₁₀ (mm)	NA
75.0	100			D ₁₅ (mm)	NA
63.0	94			D ₃₀ (mm)	NA
37.5	94			D ₅₀ (mm)	0.112
20.0	93			D ₆₀ (mm)	0.216
10.0	91			D ₈₅ (mm)	2.375
6.30	90			D ₉₀ (mm)	6.300
3.35	87			C _U	NA
2.00	84			C _C	NA
1.18	79			Sedimentation sample was not pre-treated Soil Description: Brown slightly gravelly sandy CLAY	
0.630	73				
0.425	69				
0.200	59				
0.150	54				
0.063	42				

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By

LAURA SCHRAMM

Date

15/08/23

LAURA SCHRAMM

Contract

Lingard Road

Contract Ref:

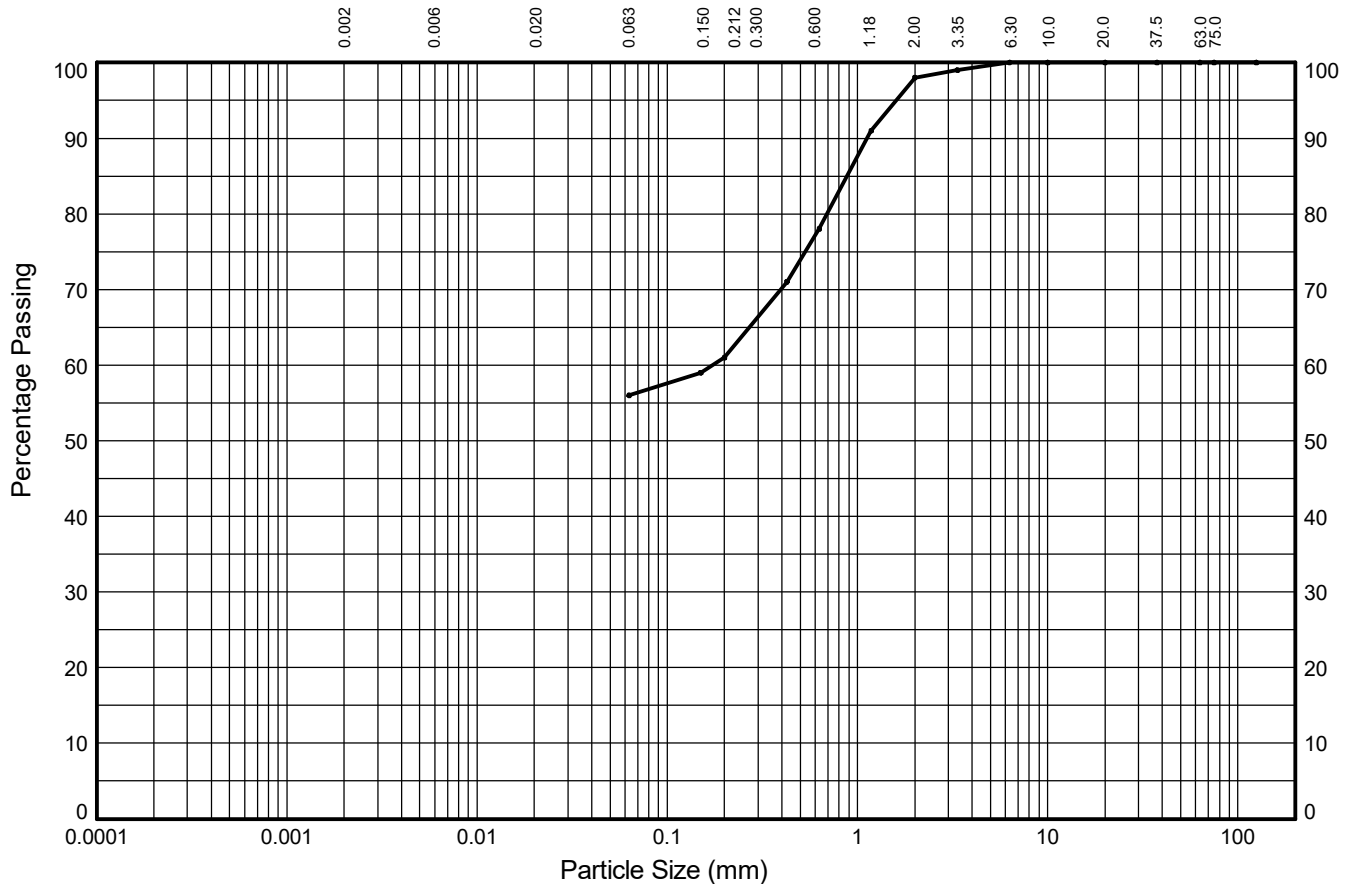
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PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 5.2 of BS EN ISO 17892:Part 4:2016

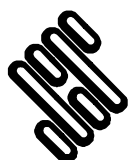
Trial Pit: **TP15** Sample Ref: **2** Sample Type: **B** Depth (m): **0.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	5%	17%	20%	2%	0%	0%	
	SILT			SAND			GRAVEL			
56%				42%			2%			0%

Test Sieve (mm)	Percent Passing (%)	Particle Diameter (mm)	Percent Passing (%)	Coefficients	
125.0	100			D ₁₀ (mm)	NA
75.0	100			D ₁₅ (mm)	NA
63.0	100			D ₃₀ (mm)	NA
37.5	100			D ₅₀ (mm)	NA
20.0	100			D ₆₀ (mm)	0.173
10.0	100			D ₈₅ (mm)	0.883
6.30	100			D ₉₀ (mm)	1.124
3.35	99			C _u	NA
2.00	98			C _c	NA
1.18	91			Sedimentation sample was not pre-treated Soil Description: Dark brown slightly gravelly sandy CLAY	
0.630	78				
0.425	71				
0.200	61				
0.150	59				
0.063	56				

Key: C_u = Uniformity coefficient. C_c = Coefficient of curvature as defined in BS EN ISO 14688-2:2018



STRUCTURAL SOILS
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W. Yorkshire WF10 1NJ

Compiled By		Date
		15/08/23
Contract	Contract Ref:	
Lingard Road	785444	

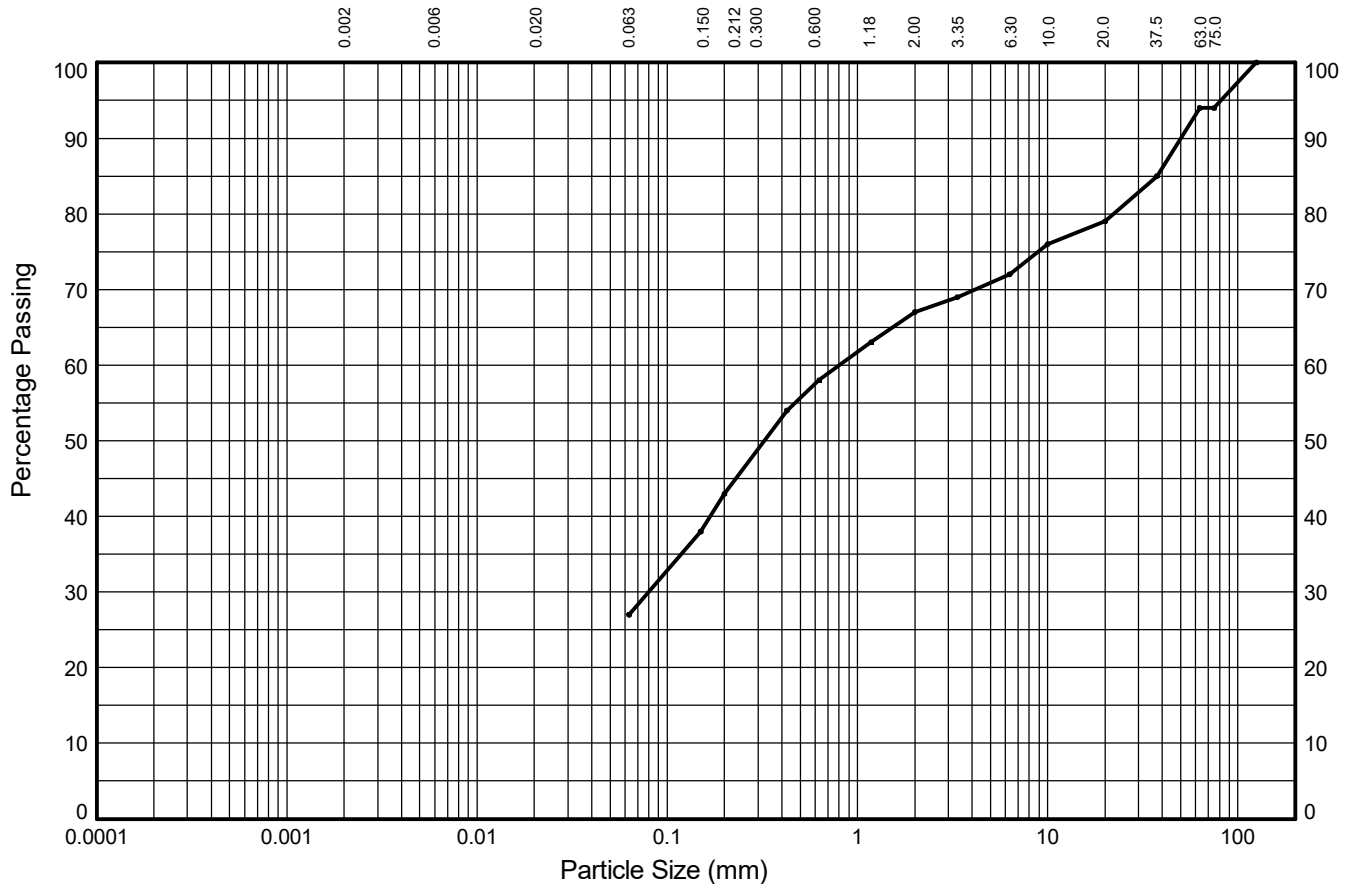


PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 5.2 of BS EN ISO 17892:Part 4:2016

NON-STANDARD TEST

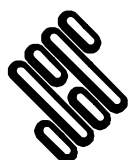
Trial Pit: **TP16** Sample Ref: **3** Sample Type: **B** Depth (m): **0.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	16%	15%	9%	5%	7%	15%	
	SILT			SAND			GRAVEL			
27%				40%			27%			6%

Test Sieve (mm)	Percent Passing (%)	Particle Diameter (mm)	Percent Passing (%)	Coefficients	
125.0	100			D ₁₀ (mm)	NA
75.0	94			D ₁₅ (mm)	NA
63.0	94			D ₃₀ (mm)	0.080
37.5	85			D ₅₀ (mm)	0.323
20.0	79			D ₆₀ (mm)	0.810
10.0	76			D ₈₅ (mm)	37.500
6.30	72			D ₉₀ (mm)	50.027
3.35	69			C _U	NA
2.00	67			C _C	NA
1.18	63			Sedimentation sample was not pre-treated Soil Description: Brown very gravelly very clayey SAND with medium cobble content	
0.630	58				
0.425	54				
0.200	43				
0.150	38				
0.063	27				

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By		Date
<i>Laura Schramm</i>		15/08/23
Contract	Contract Ref:	
Lingard Road	785444	

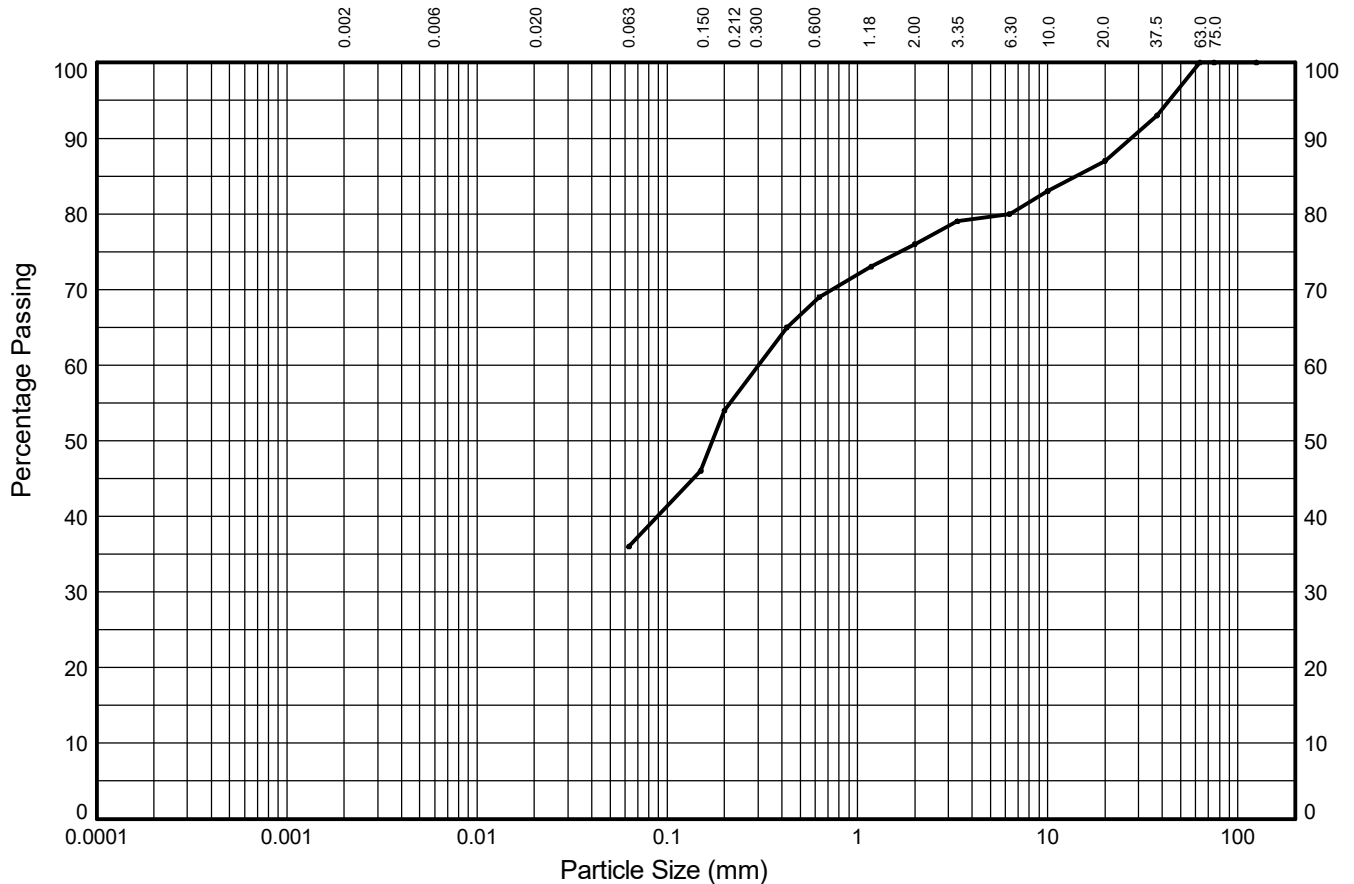


PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 5.2 of BS EN ISO 17892:Part 4:2016

NON-STANDARD TEST

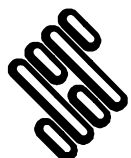
Trial Pit: **TP17** Sample Ref: **4** Sample Type: **B** Depth (m): **0.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	18%	15%	7%	4%	7%	13%	
	SILT			SAND			GRAVEL			
36%				40%			24%			0%

Test Sieve (mm)	Percent Passing (%)	Particle Diameter (mm)	Percent Passing (%)	Coefficients	
125.0	100			D ₁₀ (mm)	NA
75.0	100			D ₁₅ (mm)	NA
63.0	100			D ₃₀ (mm)	NA
37.5	93			D ₅₀ (mm)	0.173
20.0	87			D ₆₀ (mm)	0.302
10.0	83			D ₈₅ (mm)	14.142
6.30	80			D ₉₀ (mm)	27.386
3.35	79			C _U	NA
2.00	76				
1.18	73			C _C	NA
0.630	69				
0.425	65				
0.200	54				
0.150	46				
0.063	36				
		Sedimentation sample was not pre-treated			
Soil Description: Brown slightly gravelly sandy CLAY					

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By		Date
		15/08/23
Contract	Contract Ref:	
Lingard Road	785444	

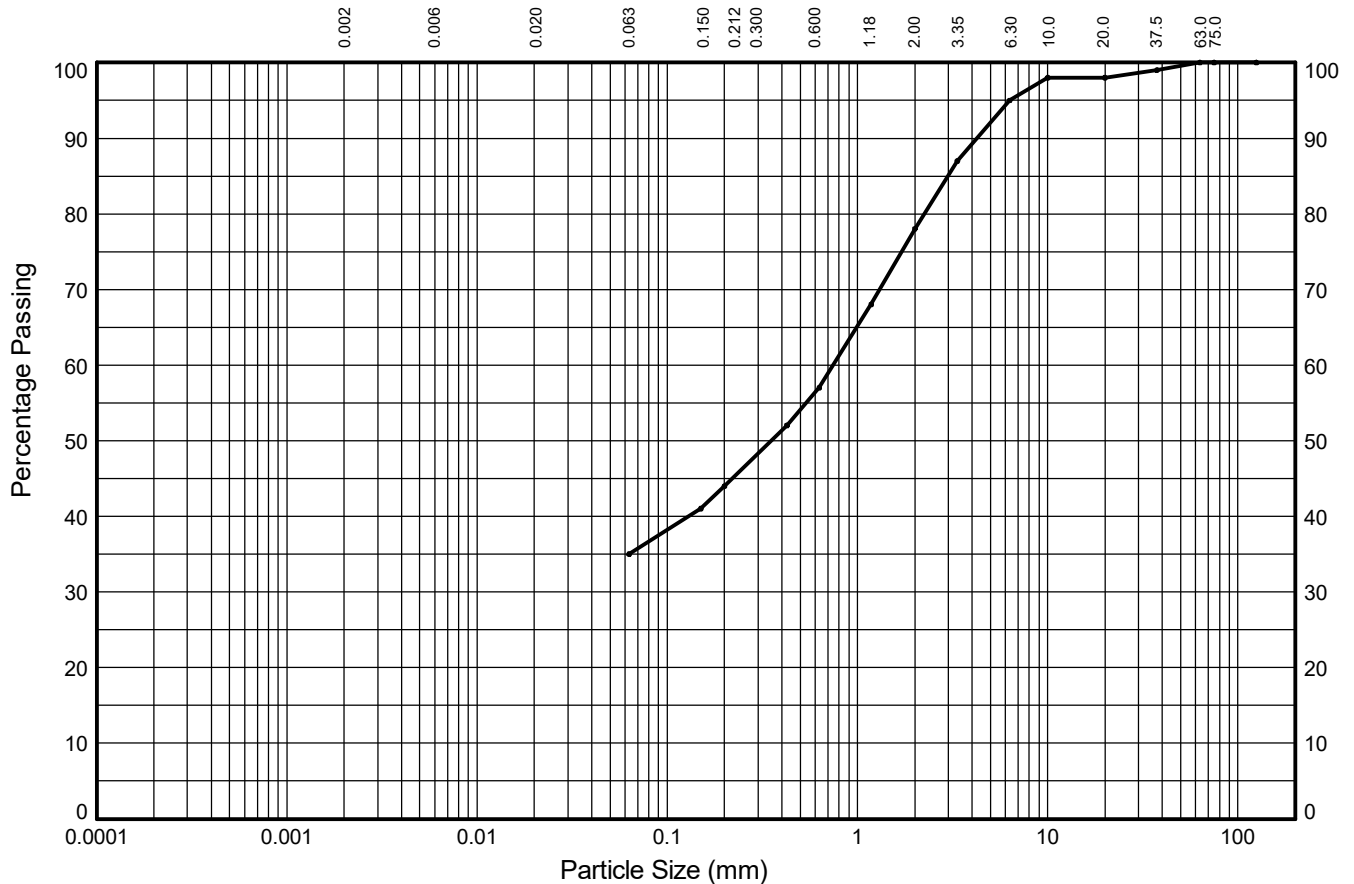


PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 5.2 of BS EN ISO 17892:Part 4:2016

NON-STANDARD TEST

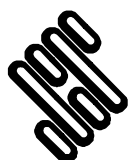
Trial Pit: **TP19** Sample Ref: **5** Sample Type: **B** Depth (m): **0.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	9%	13%	21%	17%	3%	2%	
	SILT			SAND			GRAVEL			
35%				43%			22%			0%

Test Sieve (mm)	Percent Passing (%)	Particle Diameter (mm)	Percent Passing (%)	Coefficients	
125.0	100			D ₁₀ (mm)	NA
75.0	100			D ₁₅ (mm)	NA
63.0	100			D ₃₀ (mm)	NA
37.5	99			D ₅₀ (mm)	0.352
20.0	98			D ₆₀ (mm)	0.748
10.0	98			D ₈₅ (mm)	2.987
6.30	95			D ₉₀ (mm)	4.245
3.35	87			C _u	NA
2.00	78			C _c	NA
1.18	68			Sedimentation sample was not pre-treated Soil Description: Brown slightly gravelly sandy CLAY	
0.630	57				
0.425	52				
0.200	44				
0.150	41				
0.063	35				

Key: C_u = Uniformity coefficient. C_c = Coefficient of curvature as defined in BS EN ISO 14688-2:2018



STRUCTURAL SOILS
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Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By		Date
<i>Laura Schramm</i>		15/08/23
Contract	Contract Ref:	
Lingard Road	785444	

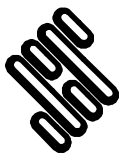


SUMMARY OF DENSITY TESTS

In accordance with BS EN ISO 17892-2 : 2014 Clause 6.1.1 (Linear Method)

[illegible]

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)



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DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

In accordance with BS EN ISO 17892-10

Trial Pit: **TP09** Sample Ref: **1** Sample Type: **B** Depth (m): **0.00**

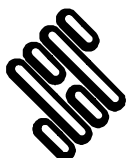
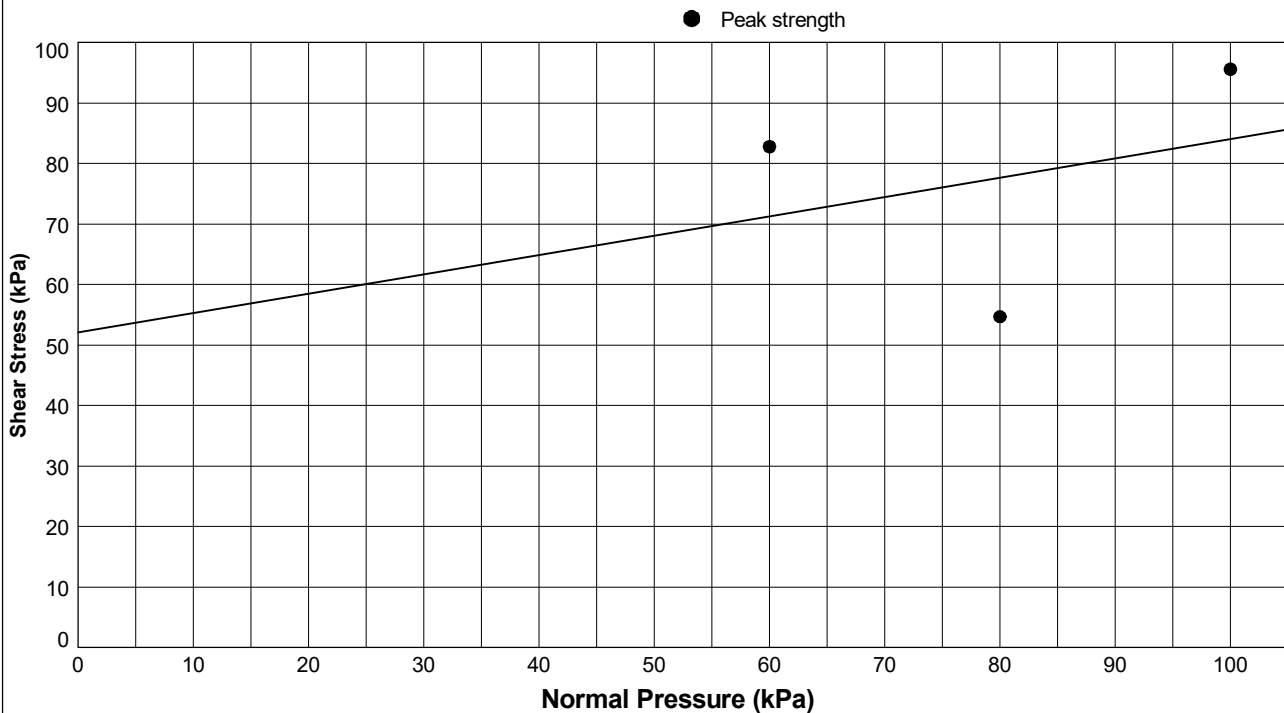
Description: **Brown slightly gravelly sandy CLAY**

Start Date: **25/07/2023**

Sample Condition: **Recompacted**

End Date: **29/07/2023**

SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Water Content (%)	28.1	28.0	27.9
	Initial Length (L ₁) (mm)	60.0	60.0	60.0
	Initial Width (L ₂) (mm)	60.0	60.0	60.0
	Initial Height (mm)	22.9	22.8	23.2
	Initial Bulk Density (Mg/m ³)	1.85	1.85	1.85
	Initial Dry Density (Mg/m ³)	1.45	1.45	1.44
	Particle Density (Mg/m ³)	2.65 _(Assumed)	2.65 _(Assumed)	2.65 _(Assumed)
	Initial Voids Ratio	0.8311	0.8334	0.8341
	Initial Degree of Saturation (%)	89	89	89
TEST CONDITIONS	Specimen Conditions	Submerged	Submerged	Submerged
	Test Duration (days)	2	2	3
CONSOLIDATION	Normal Pressure (kPa)	60	80	100
	Consolidated Height (mm)	22.3	22.5	22.7
	Voids Ratio after Consolidation	0.7820	0.8099	0.7941
SHEAR	Shearing Rate (mm/min)	0.0481	0.0161	0.0081
	Horiz. Displacement at Peak Shear Stress (mm)	2.2	0.8	1.8
	Voids Ratio after Shear	0.7817	0.8134	0.7861
	Peak Shear Stress (kPa)	83	55	96
PEAK STRENGTH	Effective Cohesion (C ') 52 (kPa)	Effective Angle of Friction (φ ') 17.5 (deg)		



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DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

In accordance with BS EN ISO 17892-10

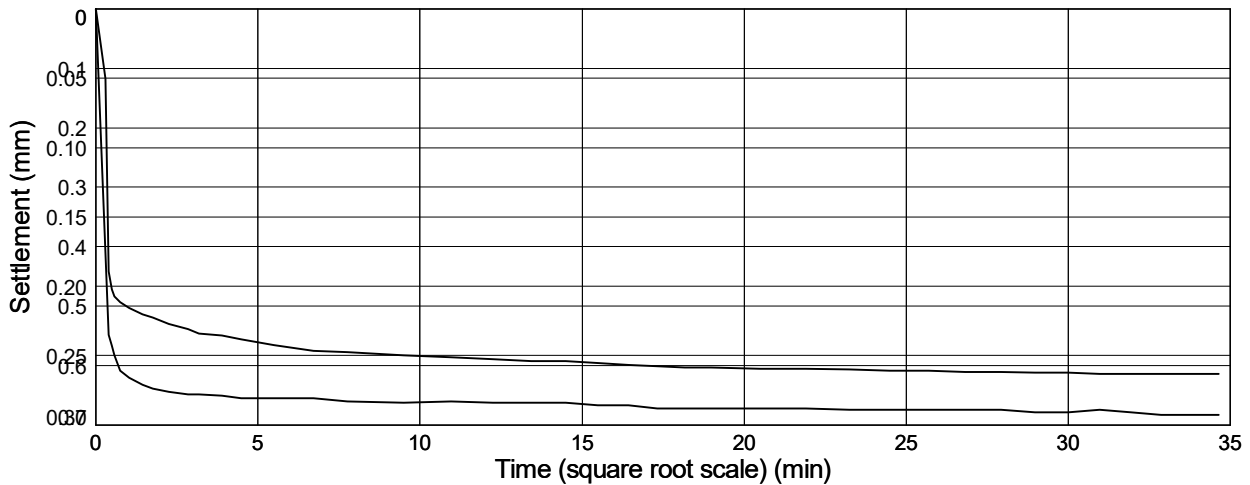
Trial Pit: **TP09**

Sample Ref: **1**

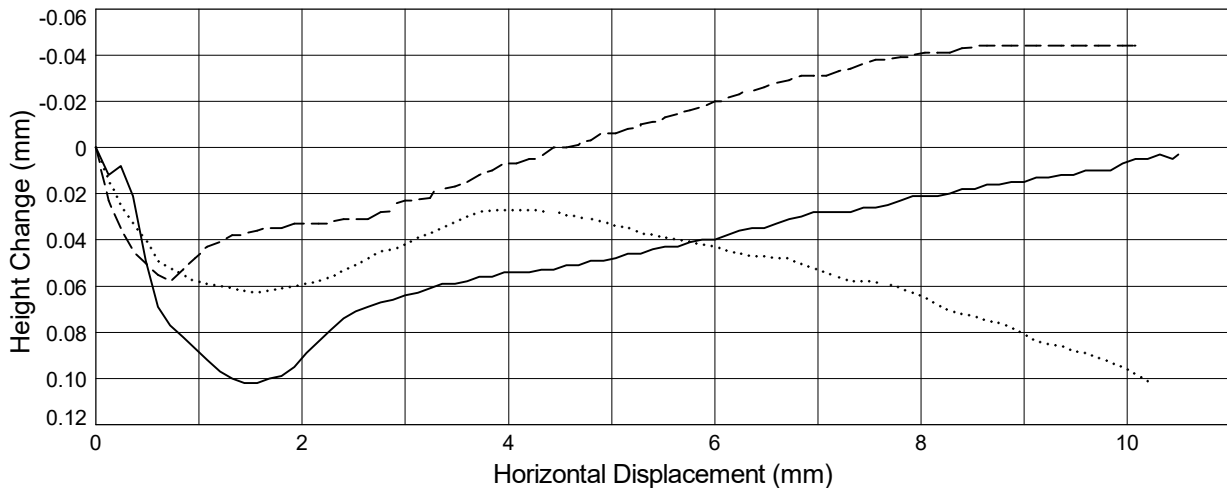
Sample Type: **B**

Depth (m): **0.00**

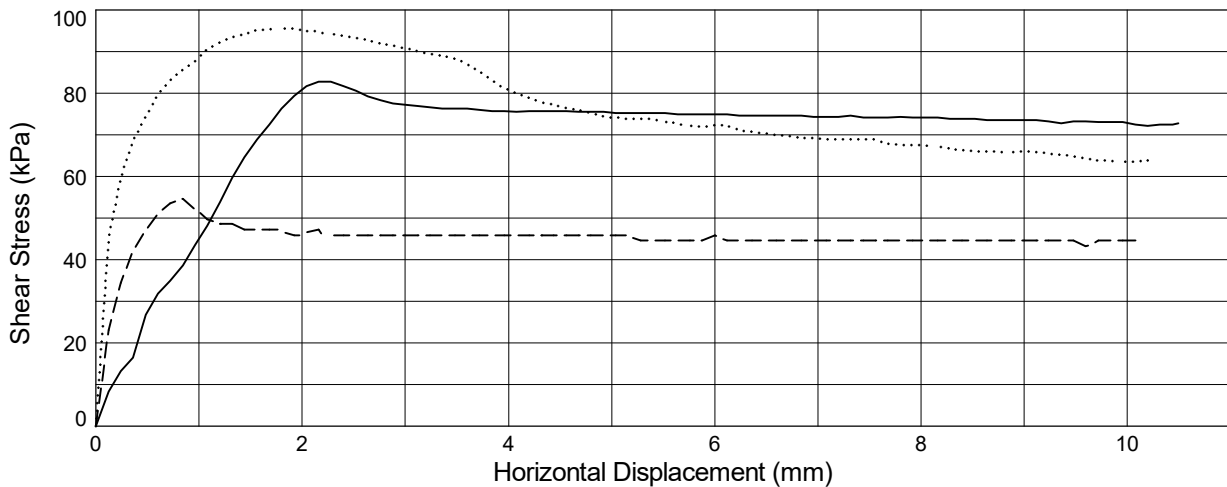
Consolidation Stage



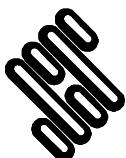
Shear Stage



Shear Stage



Solid Line = Specimen 1 (60 kPa) Dashed Line = Specimen 2 (80 kPa) Dotted Line = Specimen 3 (100 kPa)



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DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

In accordance with BS EN ISO 17892-10

Trial Pit: **TP15** Sample Ref: **2** Sample Type: **B** Depth (m): **0.00**

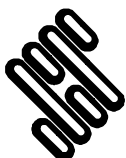
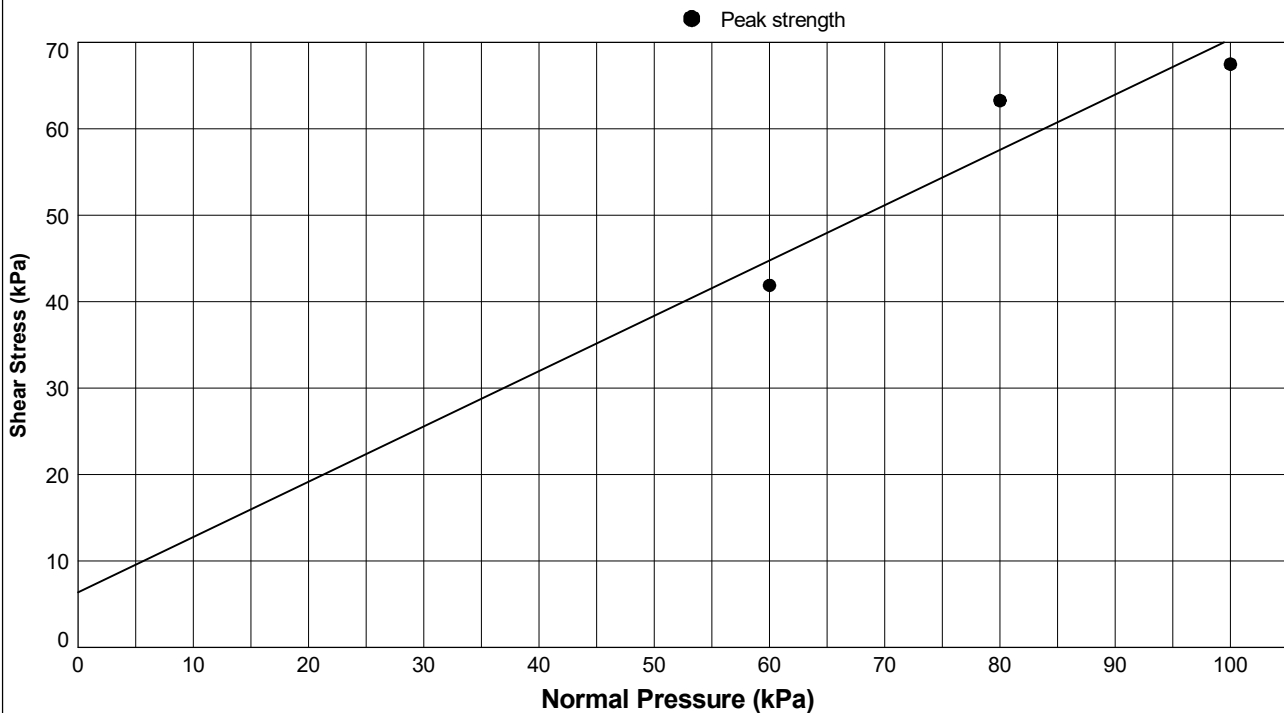
Description: **Dark brown slightly gravelly sandy CLAY**

Start Date: **07/08/2023**

Sample Condition: **Recompacted**

End Date: **09/08/2023**

SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Water Content (%)	21.9	21.7	21.3
	Initial Length (L ₁) (mm)	60.0	60.0	60.0
	Initial Width (L ₂) (mm)	60.0	60.0	60.0
	Initial Height (mm)	22.6	22.9	22.9
	Initial Bulk Density (Mg/m ³)	2.06	2.06	2.06
	Initial Dry Density (Mg/m ³)	1.69	1.69	1.70
	Particle Density (Mg/m ³)	2.65 _(Assumed)	2.65 _(Assumed)	2.65 _(Assumed)
	Initial Voids Ratio	0.5668	0.5653	0.5622
	Initial Degree of Saturation (%)	103	102	100
TEST CONDITIONS	Specimen Conditions	Submerged	Submerged	Submerged
	Test Duration (days)	2	2	3
CONSOLIDATION	Normal Pressure (kPa)	60	80	100
	Consolidated Height (mm)	22.3	22.1	22.2
	Voids Ratio after Consolidation	0.5423	0.5109	0.5080
SHEAR	Shearing Rate (mm/min)	0.0583	0.0699	0.0201
	Horiz. Displacement at Peak Shear Stress (mm)	0.5	0.6	1.6
	Voids Ratio after Shear	0.5344	0.4928	0.5028
	Peak Shear Stress (kPa)	42	63	68
PEAK STRENGTH	Effective Cohesion (C ') 6 (kPa)	Effective Angle of Friction (φ ') 32.5 (deg)		



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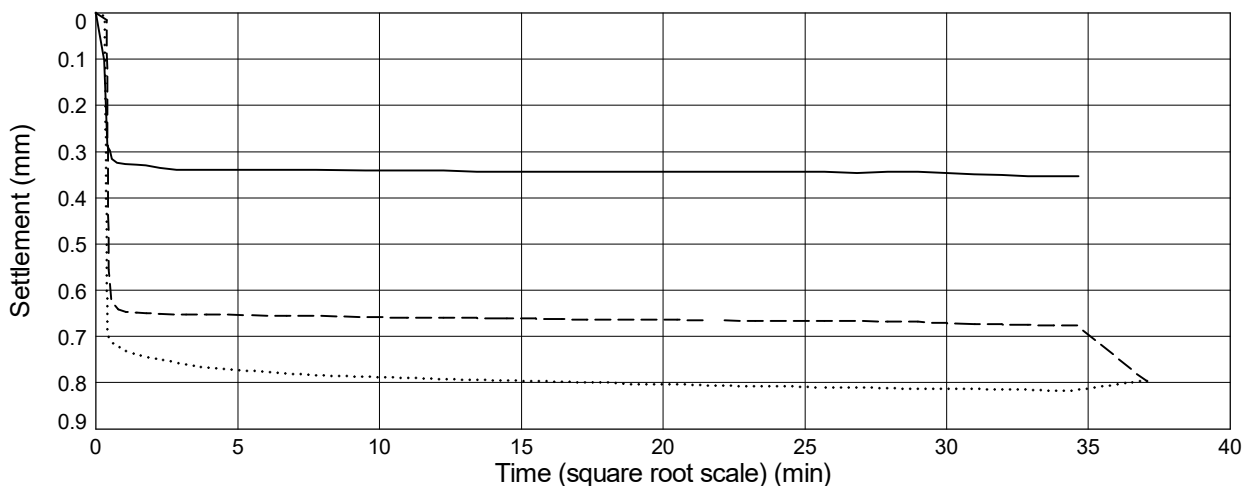


DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

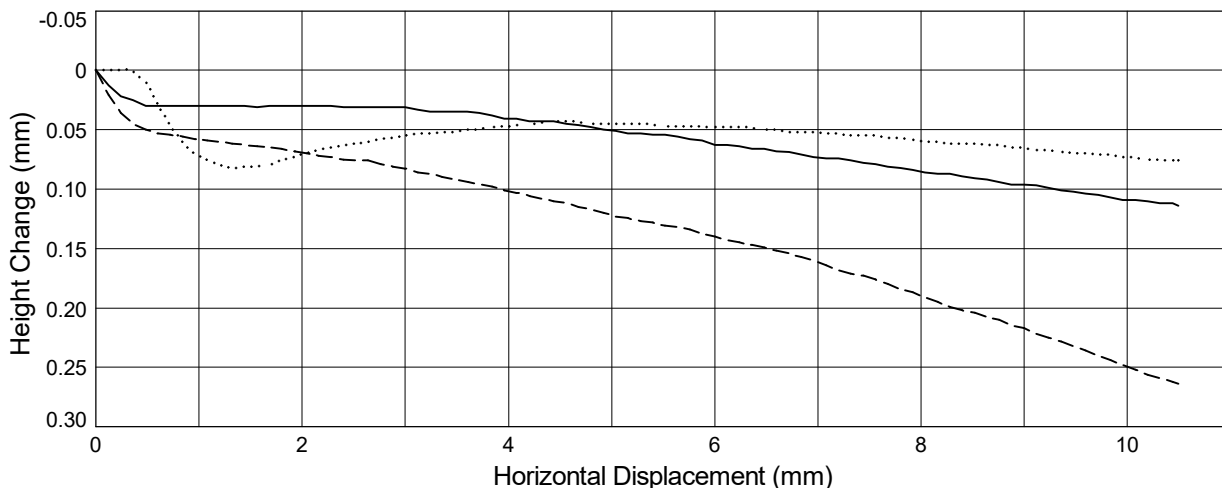
In accordance with BS EN ISO 17892-10

Trial Pit: **TP15** Sample Ref: **2** Sample Type: **B** Depth (m): **0.00**

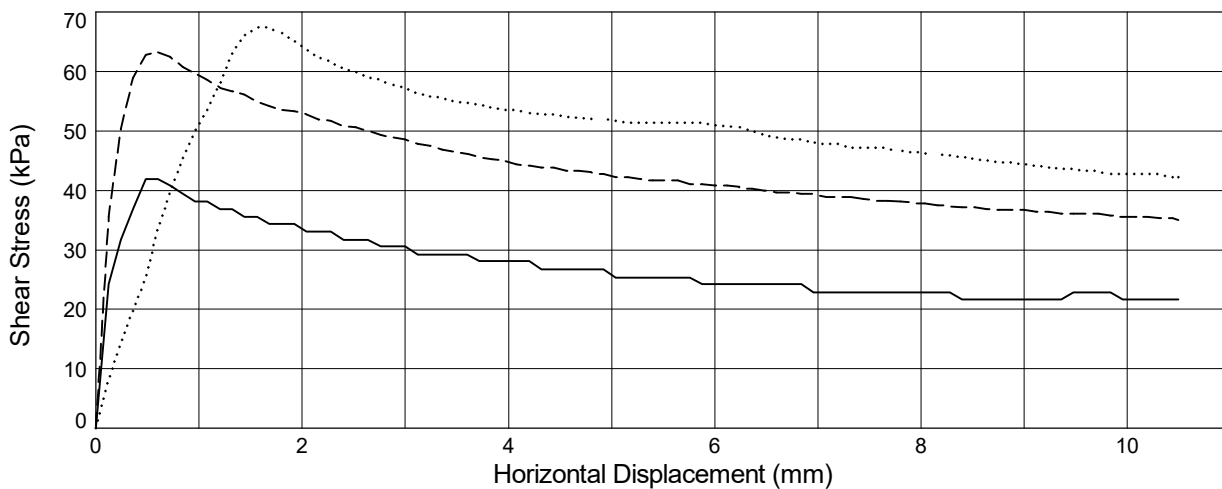
Consolidation Stage



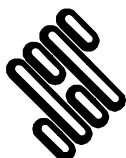
Shear Stage



Shear Stage



Solid Line = Specimen 1 (60 kPa) Dashed Line = Specimen 2 (80 kPa) Dotted Line = Specimen 3 (100 kPa)



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DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

In accordance with BS EN ISO 17892-10

Trial Pit: **TP16** Sample Ref: **3** Sample Type: **B** Depth (m): **0.00**

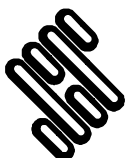
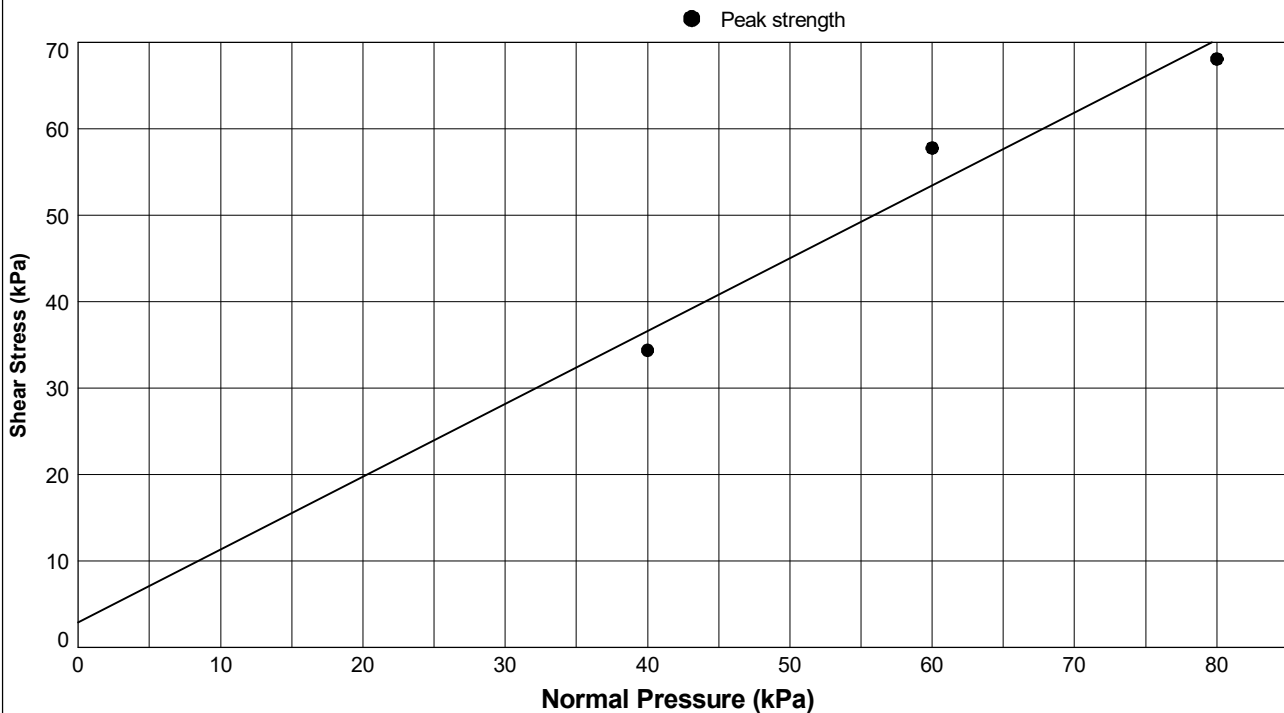
Description: **Brown very gravelly very clayey SAND with medium cobble content**

Start Date: **01/08/2023**

Sample Condition: **Recompacted**

End Date: **03/08/2023**

SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Water Content (%)	37.1	35.0	34.0
	Initial Length (L ₁) (mm)	60.0	60.0	60.0
	Initial Width (L ₂) (mm)	60.0	60.0	60.0
	Initial Height (mm)	23.1	23.3	23.3
	Initial Bulk Density (Mg/m ³)	1.74	1.75	1.75
	Initial Dry Density (Mg/m ³)	1.27	1.29	1.31
	Particle Density (Mg/m ³)	2.65 _(Assumed)	2.65 _(Assumed)	2.65 _(Assumed)
	Initial Voids Ratio	1.0820	1.0477	1.0301
	Initial Degree of Saturation (%)	91	88	87
TEST CONDITIONS	Specimen Conditions	Submerged	Submerged	Submerged
	Test Duration (days)	3	3	3
CONSOLIDATION	Normal Pressure (kPa)	40	60	80
	Consolidated Height (mm)	21.7	21.7	21.5
	Voids Ratio after Consolidation	0.9586	0.9073	0.8738
SHEAR	Shearing Rate (mm/min)	0.0113	0.0137	0.0143
	Horiz. Displacement at Peak Shear Stress (mm)	2.8	3.6	4.0
	Voids Ratio after Shear	0.9331	0.8753	0.8408
	Peak Shear Stress (kPa)	34	58	68
PEAK STRENGTH	Effective Cohesion (C ') 3 (kPa)	Effective Angle of Friction (φ ') 40 (deg)		



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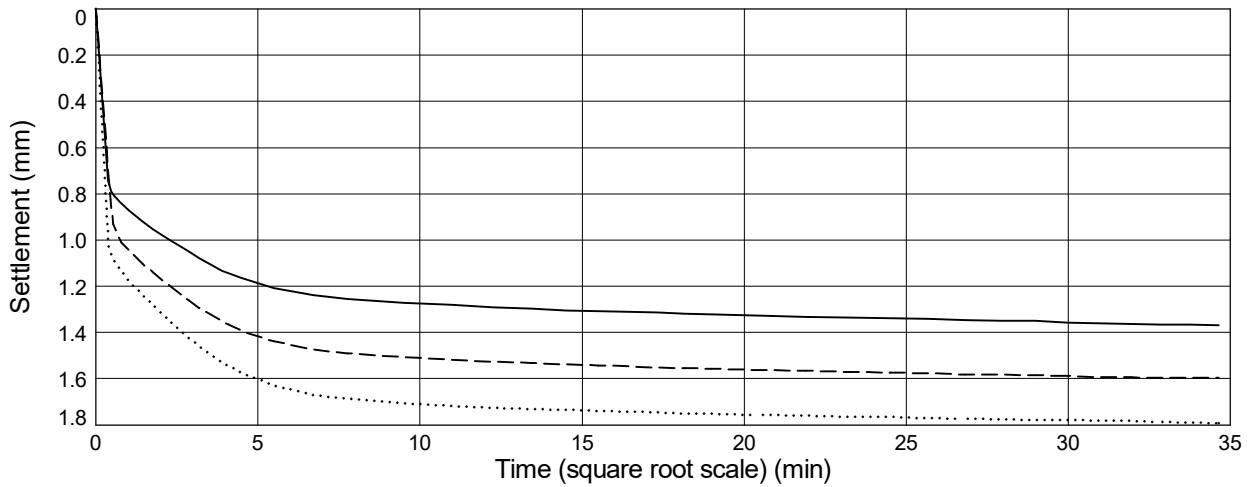


DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

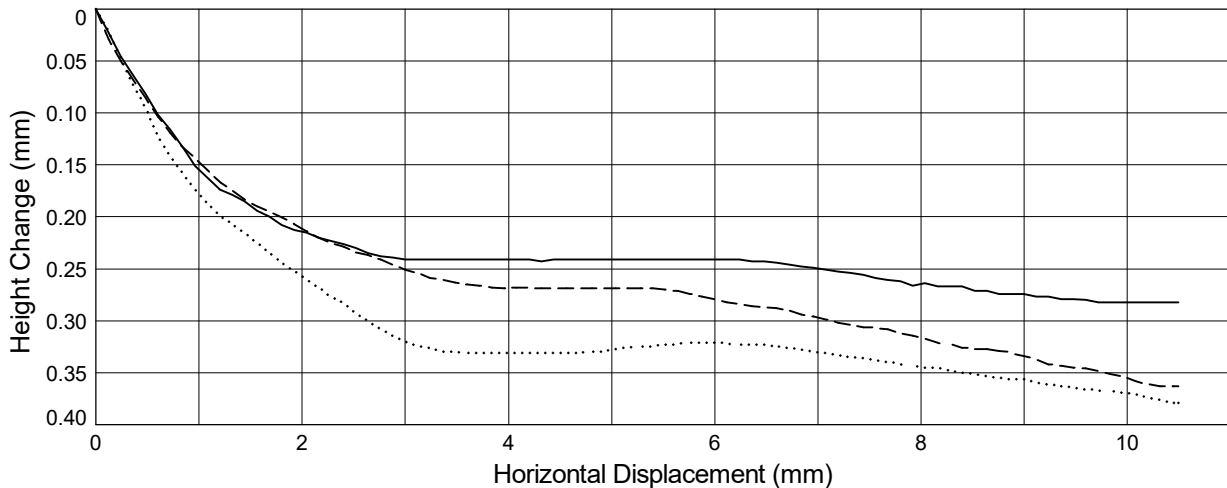
In accordance with BS EN ISO 17892-10

Trial Pit: **TP16** Sample Ref: **3** Sample Type: **B** Depth (m): **0.00**

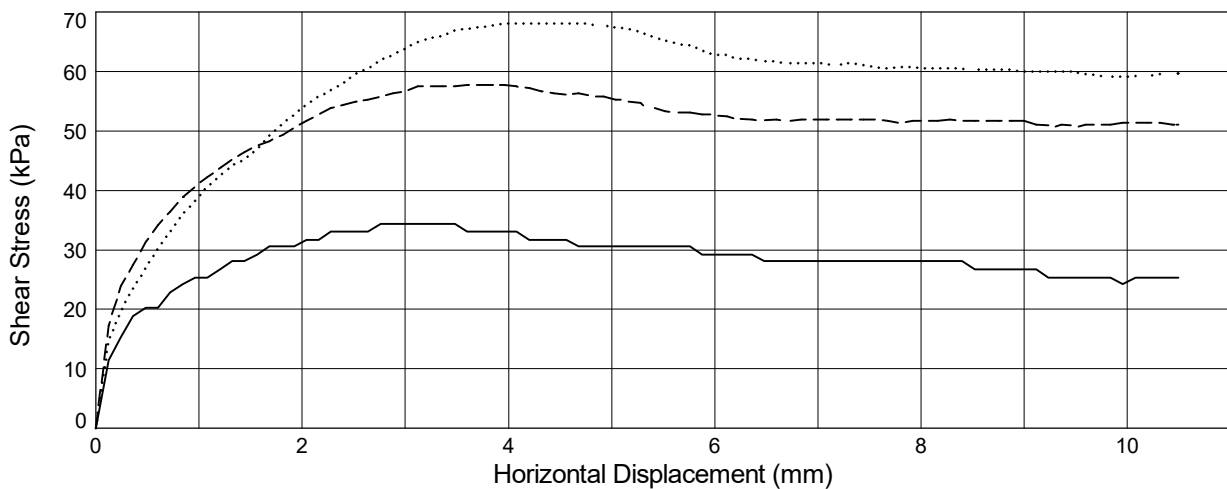
Consolidation Stage



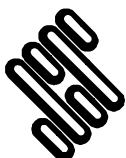
Shear Stage



Shear Stage



Solid Line = Specimen 1 (40 kPa) Dashed Line = Specimen 2 (60 kPa) Dotted Line = Specimen 3 (80 kPa)



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DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

In accordance with BS EN ISO 17892-10

Trial Pit: **TP17** Sample Ref: **4** Sample Type: **B** Depth (m): **0.00**

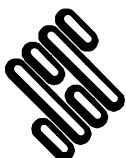
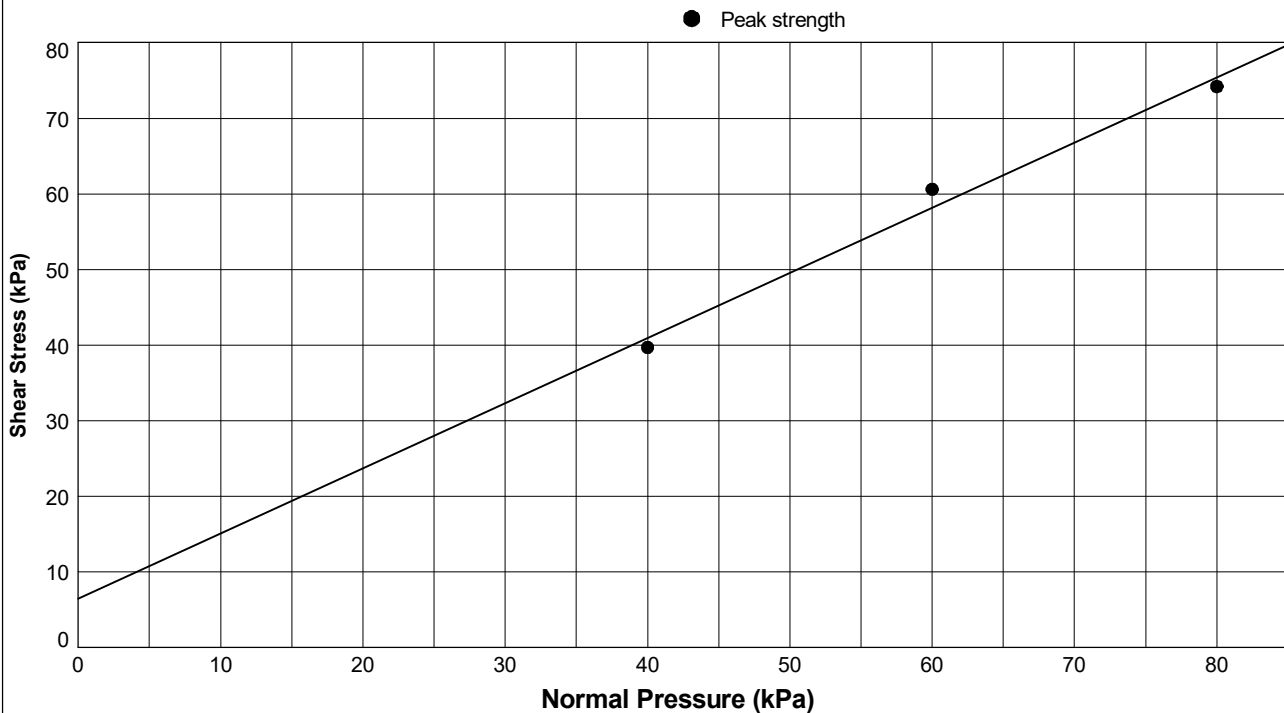
Description: **Brown slightly gravelly sandy CLAY**

Start Date: **27/07/2023**

Sample Condition: **Recompacted**

End Date: **29/07/2023**

SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Water Content (%)	15.2	14.4	14.6
	Initial Length (L ₁) (mm)	60.0	60.0	60.0
	Initial Width (L ₂) (mm)	60.0	60.0	60.0
	Initial Height (mm)	23.2	23.1	23.2
	Initial Bulk Density (Mg/m ³)	2.17	2.17	2.17
	Initial Dry Density (Mg/m ³)	1.88	1.90	1.90
	Particle Density (Mg/m ³)	2.65 _(Assumed)	2.65 _(Assumed)	2.65 _(Assumed)
	Initial Voids Ratio	0.4084	0.3973	0.3972
	Initial Degree of Saturation (%)	99	96	97
TEST CONDITIONS	Specimen Conditions	Submerged	Submerged	Submerged
	Test Duration (days)	3	3	3
CONSOLIDATION	Normal Pressure (kPa)	40	60	80
	Consolidated Height (mm)	22.5	22.2	22.6
	Voids Ratio after Consolidation	0.3646	0.3428	0.3627
SHEAR	Shearing Rate (mm/min)	0.0176	0.0155	0.0151
	Horiz. Displacement at Peak Shear Stress (mm)	1.4	1.4	3.0
	Voids Ratio after Shear	0.3610	0.3392	0.3320
	Peak Shear Stress (kPa)	40	61	74
PEAK STRENGTH	Effective Cohesion (C ') 6 (kPa)	Effective Angle of Friction (φ ') 41 (deg)		



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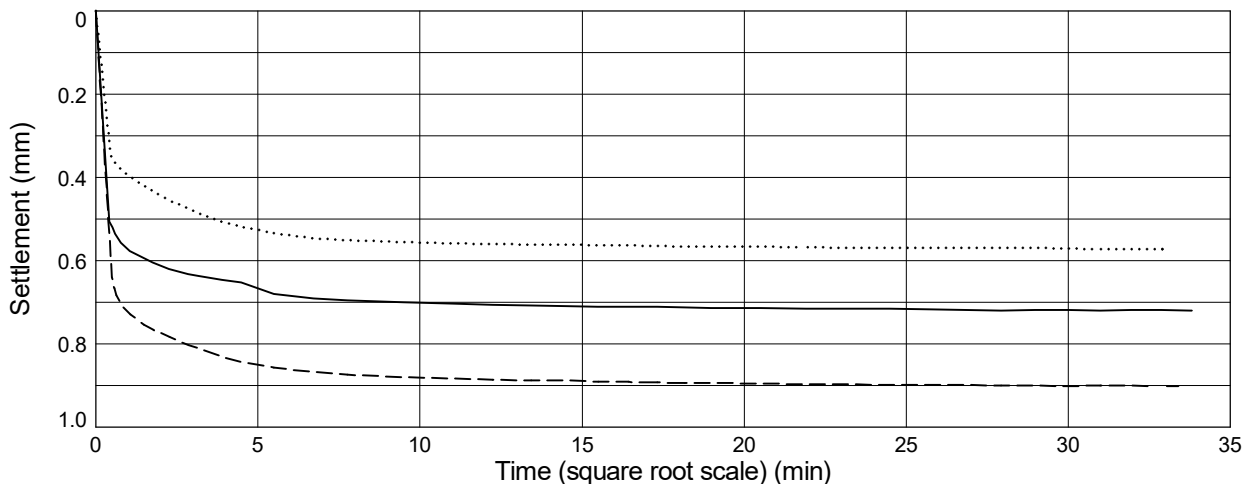


DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

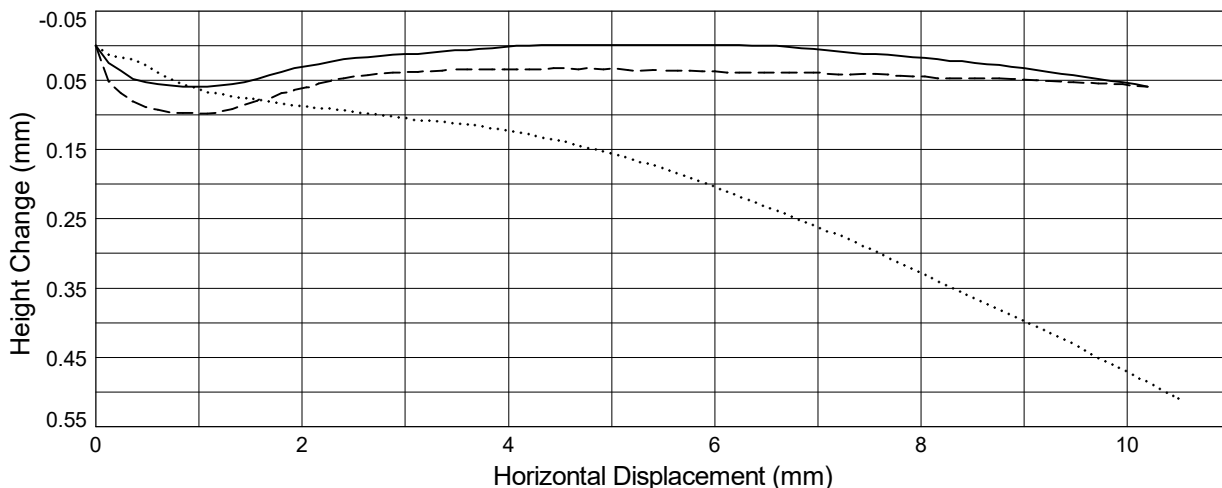
In accordance with BS EN ISO 17892-10

Trial Pit: **TP17** Sample Ref: **4** Sample Type: **B** Depth (m): **0.00**

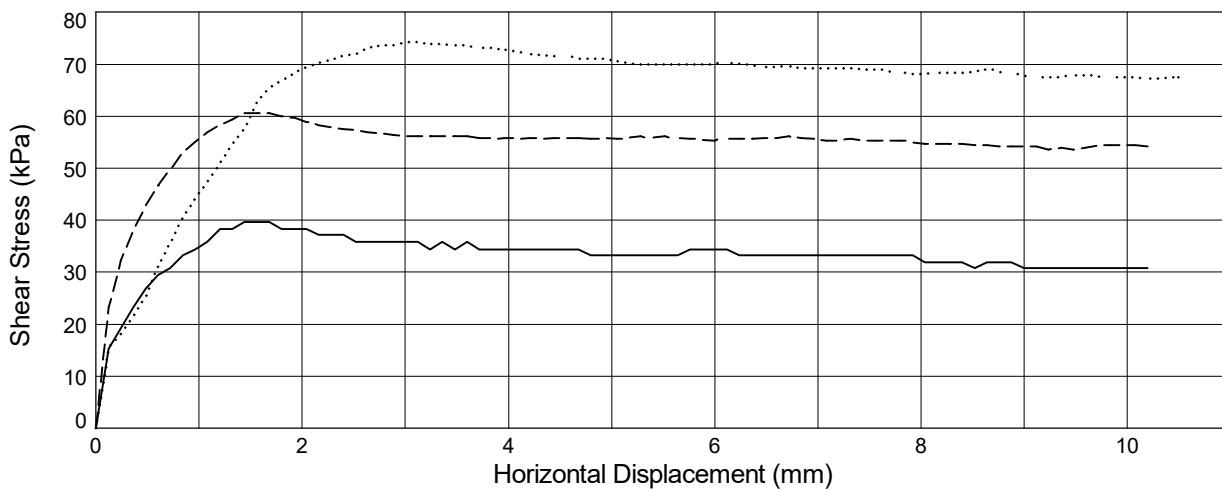
Consolidation Stage



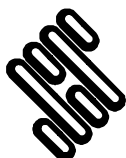
Shear Stage



Shear Stage



Solid Line = Specimen 1 (40 kPa) Dashed Line = Specimen 2 (60 kPa) Dotted Line = Specimen 3 (80 kPa)



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DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

In accordance with BS EN ISO 17892-10

Trial Pit: **TP19** Sample Ref: **5** Sample Type: **B** Depth (m): **0.00**

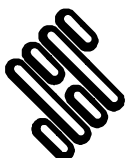
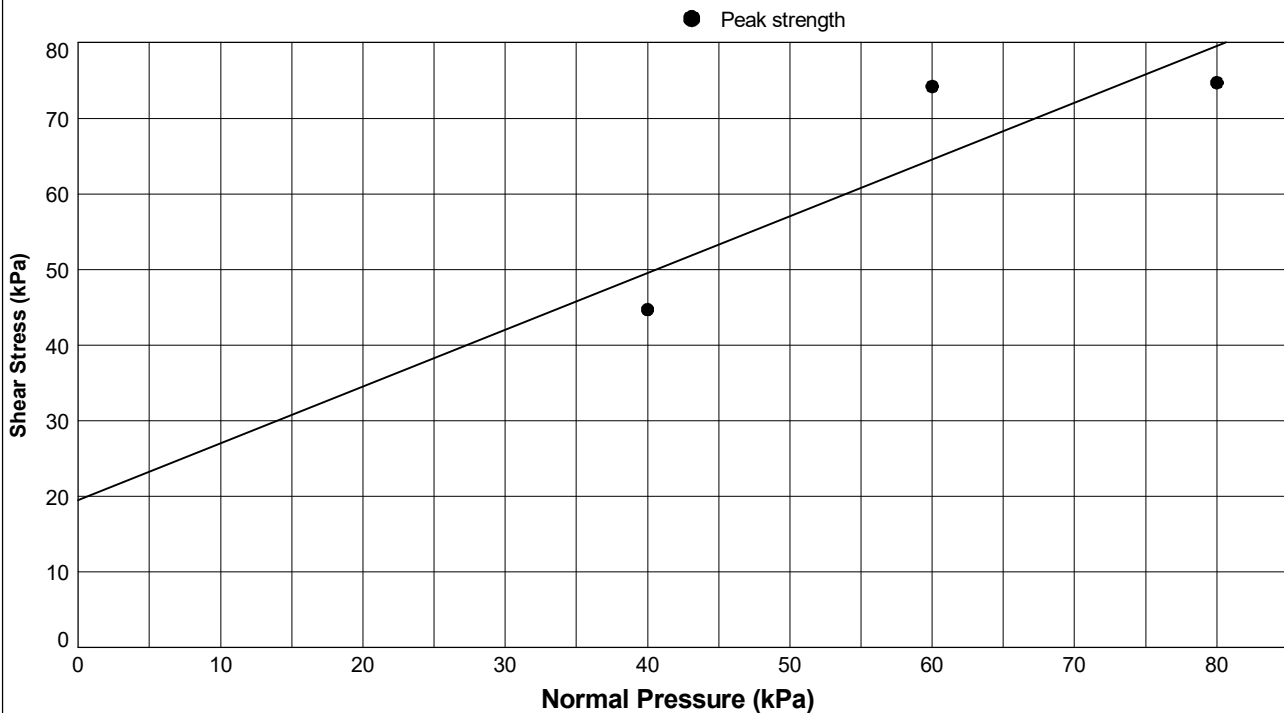
Description: **Brown slightly gravelly sandy CLAY**

Start Date: **09/08/2023**

Sample Condition: **Recompacted**

End Date: **11/08/2023**

SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Water Content (%)	21.2	20.2	20.2
	Initial Length (L ₁) (mm)	60.0	60.0	60.0
	Initial Width (L ₂) (mm)	60.0	60.0	60.0
	Initial Height (mm)	23.0	23.1	23.1
	Initial Bulk Density (Mg/m ³)	2.07	2.07	2.07
	Initial Dry Density (Mg/m ³)	1.71	1.72	1.72
	Particle Density (Mg/m ³)	2.65 _(Assumed)	2.65 _(Assumed)	2.65 _(Assumed)
	Initial Voids Ratio	0.5541	0.5410	0.5365
	Initial Degree of Saturation (%)	101	99	100
TEST CONDITIONS	Specimen Conditions	Submerged	Submerged	Submerged
	Test Duration (days)	3	3	3
CONSOLIDATION	Normal Pressure (kPa)	40	60	80
	Consolidated Height (mm)	22.6	22.5	22.4
	Voids Ratio after Consolidation	0.5224	0.5010	0.4889
SHEAR	Shearing Rate (mm/min)	0.0248	0.0312	0.0242
	Horiz. Displacement at Peak Shear Stress (mm)	1.7	3.0	2.9
	Voids Ratio after Shear	0.5513	0.5208	0.4840
	Peak Shear Stress (kPa)	45	74	75
PEAK STRENGTH	Effective Cohesion (C ') 20 (kPa)	Effective Angle of Friction (φ ') 37 (deg)		



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DETERMINATION OF SHEAR STRENGTH BY DIRECT SHEAR (SMALL SHEAR BOX APPARATUS)

In accordance with BS EN ISO 17892-10

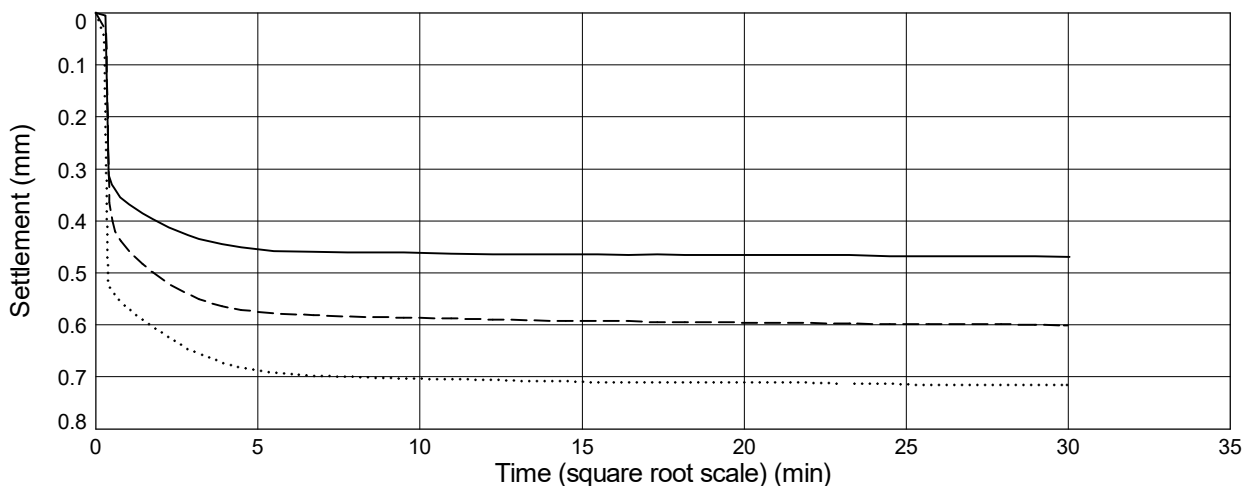
Trial Pit: **TP19**

Sample Ref: **5**

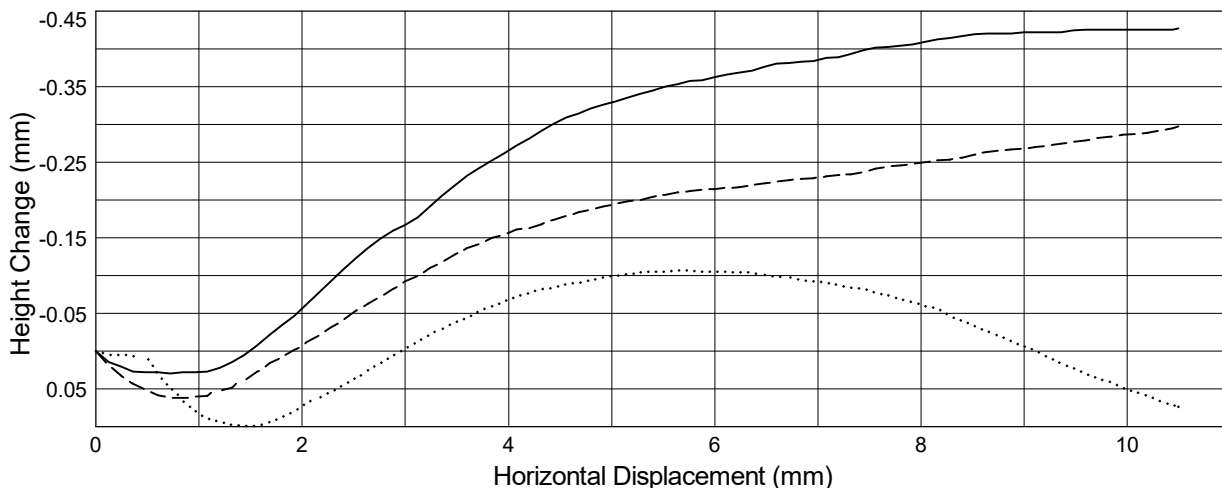
Sample Type: **B**

Depth (m): **0.00**

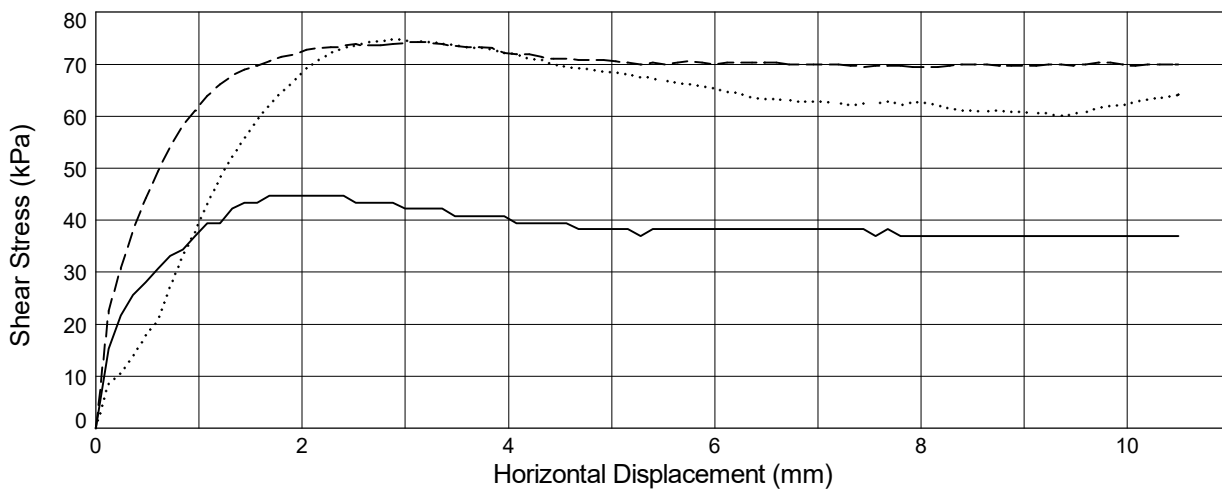
Consolidation Stage



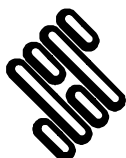
Shear Stage



Shear Stage



Solid Line = Specimen 1 (40 kPa) Dashed Line = Specimen 2 (60 kPa) Dotted Line = Specimen 3 (80 kPa)



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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: **17/08/2023 08:34:53**.

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

Approved Signatory
Luke Fisher (Laboratory Manager)

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

Castleford Laboratory
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Castleford
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Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

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



**STRUCTURAL
SOILS LTD**

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Lingard Road

Job No:

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
		Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:				Acceptable Limits Within:							
							Lower	Upper						
G E N E R A L	2	A	–	Wet cohesive material	General Fill	Any material, or combination of materials, other than chalk.	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 1 except for materials with liquid limit greater than 50, determined by BS 1377: Part 2, only deadweight tamping or vibratory tamping rollers or grid rollers shall be used.	2	A	–
							(ii) plastic limit (PL)	BS 1377: Part 2	–	–				
							(iii) mc	BS 1377: Part 2 See Note 4	PL -4%	App 6/1				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
							(v) Undrained shear strength of remoulded material	Clause 633	App 6/1	App 6/1				
C O H E S I V E	2	B	–	Dry cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	2	B	–
							(ii) plastic limit (PL)	BS 1377: Part 2	–	–				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	PL -4%				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
							(v) undrained shear strength of remoulded material	Clause 633	App 6/1	App 6/1				
F I L L	2	C	–	Stony cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	2	C	–
							(ii) plastic limit (PL)	BS 1377: part 2	–	–				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iv) MCV	Clause 632	App 6/1	–				
							(v) Undrained shear strength of remoulded material	Clause 633	App 6/1	–				

TABLE 6/2: (02/17) Grading Requirements for Acceptable Earthworks Materials Other Than Classes 6F4, 6F5 and 6S

Class	Size (mm)		Percentage by Mass Passing the Size Shown													Size (microns) BS Series				Size (microns)	Class
			Size (mm) BS Series													Size (microns) BS Series				Size (microns)	
	500	300	125	90	75	37.5	28	20	14	10	6.3	5	3.35	2	1.18	600	300	150	63	2	
1A		100	95-100																<15		1A
1B			100																<15		1B
1C	100		10-95													0-25			15		1C
2A & 2B			100											80-100					15-100		2A & 2B
2C			100											15-80					15-80		2C
2D			100																80-100	0-20	2D
6A	100									0-100		0-85				0-45			0-5		6A
6B	100		0-10																		6B
6C			100			0-100					0-100		0-35	0-10		0-2					6C
6D										100		89-100		60-100	30-100	15-80	5-48	0-15 except 0-20 for crushed rock			6D
6E & 6R			100	85-100						25-100						10-100				<15	6E & 6R
6F1					100	75-100				40-95		30-85				10-50			<15		6F1
6F2			100	80-100	65-100	45-100				15-60		10-45				0-25			0-12		6F2
6F3			100	80-100	65-100	45-100				15-60		10-45				0-25			0-12		6F3
6H								100				60-100			15-45	0-25		0-5			6H
6I & 6J			100		85-100				25-100					15-100		9-100			<15		6I & 6J
6K								100											0-10		6K
6L										100		89-100		60-100	30-100	15-100	5-70	0-15 except 0-20 for crushed rock			6L