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Geo-environmental ground investigation report

Land off Seagate Road, Long Sutton

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Produced for D. Brown Building Contractors Ltd

March 2021

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Document control

Title:	Geo-environmental ground investigation report Land off Seagate Road, Long Sutton
Client:	D. Brown Building Contractors Ltd
Report number:	1197/5350/P/P2

Revision	*Purpose*	*Originated*	*Checked*	*Date*
0.0	Issue report	R Lester *Geo-Environmental Engr*	M Driver *Director*	March 2021

Ground investigation report

Contents

EXECUTIVE SUMMARY

Proposed works	Large scale residential development (low rise dwellings with estate roads and other associated infrastructure)
Site history	Some former small possible farm buildings in limited areas of the site were removed during the 20th century There is a historic former sea bank crossing the east part of the site There is a former pond along the south boundary and a former drainage ditch in the southwest area A former gas works and Gas Holder were located about 20m north of the site, but these had been removed by the early 1980s.
Published geology	*Drift:* Tidal Flat Deposits (locally previously known as Terrington Beds - sandy silt, loose sand and soft clay) *Solid:* Oxford Clay Formation
Topography	Relatively flat and low-lying; c. 3m or 4m above Ordnance Datum A slight slope means east portion of the site is marginally higher
Hydrology	Drainage ditches along the north and south site boundaries The River Nene is 4km east and The Wash is about 7km northeast The site is in a Flood Zone 3 area
Site works	19 windowless-sampler boreholes (WS1-WS19) with SPTs to depths of 3.45 to 5.25m depth. DCP probing to 7.0m adjacent to WS10 2 shell and auger boreholes (BH1 and BH2) to depths of c.20m 24 trial pits (TP13 to TP37) to depths of 1.0m to 1.7m depth Soakaway testing in 6 trial pits, at depths of between 1.5m & 1.7m
Revealed ground conditions	· **Topsoil**: (across the site) loamy soil with rootlets (to a maximum depth of 0.50m) · **Tidal Flat Deposits (TFD)**: Locally, shallow firm clay present to a depth of about 1m bgl Common very loose to loose granular silts and fine sands - but sometimes locally clayey – to depths of about 4m bgl A band of (very) soft (slightly organic) clays and silts is present in much of the east area of the site (at depths of up to 4m bgl) Loose to medium dense sands present (below 4m bgl) TFD sands become increasingly gravelly (e.g. >11m bgl) The base of the TFD soils is 14.8m (BH2) to 16.8m (BH1) bgl · **Glacial till**: Stiff boulder clay (shown to extend deeper than 21.5m bgl) Local BGS records indicate the glacial till is comprised of boulder clay and reaches depths of at least 45m bgl

Groundwater	Recorded standing groundwater levels: 0.61m to 2.95m bgl
Foundation design	Strip footings and raft foundation are not considered generally feasible due to poor strength and stiffness of revealed ground conditions. Such foundations are probably only possible in small isolated areas (if at all), subject to further investigation works Piled foundations will need to be deep to reach suitable bearing stratum (e.g. c.17m depth to reach stiff boulder clay)
Shrinkable soil	Heave may occur if existing high water demand trees are present The *in situ* shallow cohesive soils are of l*ow volume change potential*
Buried concrete	ACEC Class AC2 required for concrete (shallow or deep)
Gas protection	Assessed NHBC classification of Green and CIRIA classification of CS1 No gas protection measures should be required
Road pavement design	Recorded CBR values are very low: e.g. 0.2% to 2%. Therefore, an onerous road design will be required to meet adoption criteria
Soakaway design	Surface water soakaways not feasible due to low infiltration of ground conditions and high water table
Contamination conceptual site model	The conceptual site model identified four main potential sources of contamination: 1. Possible made ground associated with previous buildings (metals, PAHs, asbestos) 2. Past land use – agricultural buildings (metals, PAHs, pesticides) 3. Highly organic subsoils (ground gases) 4. Nearby former gas holder and gas works (metals, PAHs, cyanides, thiocyanate, ammonia)
Contamination risk assessment	No unacceptable risks were identified. No visual or olfactory evidence of potential contamination was found in the 45 exploratory holes at the site Any unforeseen contamination (for example, hydrocarbon odours or staining) encountered during the development of the site must be monitored and reported to the local authority

1 Introduction

Humberside Materials Laboratory Limited (HML) has undertaken a geo-environmental ground investigation for a proposed development on land between Seagate Road and Wisbech Road, Long Sutton, Lincolnshire, as requested by the client, D. Brown Building Contractors Ltd. The land will be hereinafter referred to as *the site*.

1.1 Aims

The aim is to investigate and assess the geo-environmental (i.e. geotechnical and environmental) ground conditions to facilitate engineering design and contamination assessment of the proposed development.

1.2 Scope

The scope of the investigation includes:

- Review of desk study information (including previous site investigation reports)
- Intrusive investigation works
- Geotechnical and geochemical laboratory testing
- Assessment of geotechnical engineering issues
- Development of a conceptual site model of potential contamination linkages
- Assessment of contamination risk using a source-pathway-receptor approach
- Recommendations for further works, where appropriate

1.3 Conditions and Limitations

This report is produced solely for the client and should only be copied in full. When transmitted electronically, the definitive copy of the report is held by Humberside Materials Laboratory Ltd.

This report is prepared on the assumption that all facts have been disclosed.

The comments given in this report and the opinions expressed assume that conditions do not vary beyond the range revealed by this study and the information provided in the production of this report is complete and reliable.

2 Desk study information

2.1 Sources of site information

A variety of sources of desk study information have been used to gather information about the site, as listed below (in Table 1).

Table 1: Sources of site information

Source description		*Details*	*Date*
Site specific	Site visit and walkover	Photos (in Appendix A) and notes of HML visit	Dec 2020 to Jan 2021
	Envirocheck report	Landmark™ Envirocheck report (Appendix E) with historical maps (Appendix D). Landmark order number: 273783579_1_1	22 Feb 2021
	Proposed site layout	Templeman Design drawing number 3359-TD-XX-XX-DRG-AR-0002-P0	Nov 2017
	Property sales brochure	Brown & Co estate agents four page sales brochure. Undated, date shown is date received by HML	Nov 2020
Local information	Local maps	www.google.co.uk, www.openstreetmap.org, www.promap.co.uk & www.streetmap.co.uk	Feb 2021
	Online British Geological Survey (BGS) data	www.bgs.ac.uk; geological maps & borehole records	Feb 2021
	Local BGS geology maps	1:50000 Series, King's Lynn and The Wash, Sheet 145 with part of 129, Solid & Drift Edition	1978
	Historical maps	www.oldmapsonline.org; www.old-maps.co.uk	Feb 2021
	Topographical data	http://en-gb.topographic-map.com	Feb 2021
	Radon gas data	Interactive map at www.ukradon.org	Feb 2021
	Environmental data	https://magic.defra.gov.uk/MagicMap.aspx	Feb 2021
	Historic landfill data	https://environment.data.gov.uk/	Feb 2021
	Coal authority data	http://mapapps2.bgs.ac.uk/coalauthority/home.html	Feb 2021

2.2 The site

2.2.1 Location and size

The site consists of an area of farmland which is situated between Seagate Road and Wisbech Road, Long Sutton. The site is centred around grid reference 543690, 322310.

The site occupies a roughly rectangular piece of land, which measures about 500m in length and about 200m in width. The total area is about 10 hectares.

Current pedestrian and vehicle access is via Seagate Road or Wisbech Road.

A site location plan is included in Appendix A.

2.2.2 Site features

Photographic views of the site are shown later (in Appendix A).

At the time of the site walkovers in December 2020 and January 2021, the following site features were noted.

The site currently consists of arable farm fields, as shown below (in Table 2). The ground surface is mostly ploughed bare earth with occasional short crop stalks and vegetables. There is also a grassed area in the northeast corner of the site.

Table 2: Ground surface covering at the site

Surface covering:	**Ploughed bare earth**	**Grassed field**
Approximate estimated area (m^2):	940000	50000
Approximate percentage of total:	**94**	**6**
All values shown are approximate only		

There is an isolated pair of existing residential dwellings located within the centre of the site which does *not* form part of the site. The two dwellings are accessed via a gravelled track which spurs off Wisbech Road which also does *not* form part of the site.

There are no significant above ground structures within the site. Nevertheless, there are a few telegraph poles and overhead cables.

There are some trees along or close to some parts of the site boundaries. There is a cluster of trees along the west boundary. There is a line of trees close to the northern boundary (on the far side of a drainage ditch). There are also some trees within the isolated existing residential dwelling in the centre of the site.

Some localised ponding was evident on the ground surface in parts of the site. Water did not appear to quickly drain into the topsoil.

2.2.3 Visible evidence of potential contamination

No evidence (visual or olfactory) was identified of potentially significant contamination during the site walkover. No sign of vegetation distress, unusual staining, discolouration or strange odours was noted and inspected vegetation appeared healthy. No evidence of any storage (past or current) of hazardous liquids was noticed (including heating oil tanks). No above or below ground tanks were evident.

A close inspection of the ground surface around the site did not reveal any evidence of made ground or anthropogenic material. This included areas where previous small buildings were formerly located as shown in historical maps (discussed later). It seems

likely that any previous waste materials was probably removed off site (or possibly used to build up the existing access track that cuts through the east part of the site).

2.2.4 Adjacent land use

The site is located within a rural area with several adjacent residential areas, as shown below (in Table 3).

Table 3: Adjacent land use and boundaries

Direction:	**North**	**East**	**South**	**West**
Boundary type:	Drainage ditch and fencing	Undefined	Drainage ditch	Undefined
Adjacent land use:	Residential gardens	Wisbech Road	Arable Farmland	Seagate Road
Nearby land use:	Residential	Farmland	Farmland	Residential

2.2.5 Site topography

The site is relatively flat and level but with some localised minor variations in ground level. There is a very gentle short slope which cuts across the east area of the site from north to south. Ground levels fall by about 0.5m to 1.0m (moving from east to west).

The ground level of the existing access road (in or adjacent to the east part of the site) is about 0.5m above adjacent ground levels within the site.

Ground levels at the site are estimated to be about 3m or 4m above Ordnance datum (AOD).

2.2.6 Local topography

Locally, ground levels in the area of the site are very flat and low-lying. The site and the village of Long Sutton are in the Lincolnshire Fens close to The Wash.

Nevertheless, the ground levels rise up next to the northeast corner of the site. There is an adjacent road embankment (about 4m in maximum height) for the approach road (part of Wisbech Road) to a railway bridge (railway now disused).

2.2.7 Proposed development

Development proposals comprise the construction of a new residential development which includes about 215 dwellings. The proposed dwellings are expected to be low rise houses (i.e. one to three storeys in height) with front and rear gardens.

New access roads will be required for the proposed development. A main estate road is expected to join Seagate Road (in the west) to the B1358 Wisbech Road (in the east). Other spur roads and crescents will provide access to the remaining parts of the site.

Some public open spaces are expected to be included in the development. This could include a pond (possibly an attenuation pond) in the northwest corner of the site. A green corridor could run around the edge of much of the site.

2.3 Site History

2.3.1 Historical timeline

Historical documents (maps and photos) have been reviewed. Features considered to be potentially relevant are detailed below (in Table 4).

Table 4: Historical timeline

Map details	*Within the site boundary*	*Outside of the site boundary*
Year: **1887** Scale: 1:10560	The site is part of farm fields. There is an existing building (possible farmhouse and outbuilding) in the centre of the site There is another small building (possible farm dwelling) (in the southeast area) A "ROMAN BANK (Site of)" (possible former embankment) runs across the site (southeast part at the location of an existing slope) A railway line runs along the north boundary of the site	Brunswick Mill, corn mill (adjacent southeast) Some marshy ground (5m north) Gas Works including two possible tanks/pits, c. 9m diameter (40m north) Note: "ROMAN BANK" extends to the north and south of the site. It is evident as an embankment in some places (e.g. 1km south)
Year: **1888** Scale: 1:2500	*(No significant change identified)*	*(No significant change identified)*
Year: **1905** Scale: 1:2500	*(No significant change identified)*	*(No significant change identified)*
Year: **1931** Scale: 1:2500	Former (possible farm) building *removed* (near centre of the site) Former possible farm dwelling *removed* (southeast area) A line of small buildings (possible mill outbuildings) built (in the southeast corner) A pair of small buildings (possible dwellings or farm outbuildings) built (inside the west boundary) Trees (in the southwest corner)	No Gas Works shown but two small round tanks/pits are still evident (40m north)
Year: **1938** Scale: 1:10560	*No significant change identified)*	*No significant change identified)*
Year: **1953** Scale: 1:10560	Possible small pond (inside the south boundary)	Existing two dwellings built in the centre of the site (adjacent)

Table 4: Historical timeline		
Map details	*Within the site boundary*	*Outside of the site boundary*
	Line of possible mill outbuildings removed (southeast corner)	
Year: **1959** Scale: 1:10000	*No significant change identified)*	*No significant change identified)*
Year: **1972** Scale: 1:1250	Additional small buildings (possible stables or farm outbuildings) built inside the west boundary Possible small pond (inside south boundary) is no longer shown Railway (north boundary) dismantled Trees removed (southwest corner)	Gas Holder – about 19m diameter (20m north)
Year: **1974** Scale: 1:2500	Drainage ditch infilled (southwest corner)	Gas Holder no longer labelled (20m north)
Year: **1980** Scale: 1:2500	Some buildings removed (inside west boundary)	Builders Yard (adjacent, southeast)
Year: **1986** Scale: 1:2500	*No significant change identified)*	Gas Holder building removed (20m north)
Year: **1989** Scale: 1:2500	*No significant change identified)*	Gas Holder building removed (20m north)
Year: **1991** Scale: 1:2500	An existing possible farmhouse removed (centre area) Possible small farm outbuilding removed (inside west boundary)	*No significant change identified)*
Year: **1994** Scale: 1:2500	*No significant change identified)*	*No significant change identified)*
Year: **1999** Aerial photo	*(No significant change identified)*	*(No significant change identified)*
Year **2020** Scale 1:10000	*(No significant change identified)*	*(No significant change identified)*

2.3.2 Historical summary

2.3.2.1 On-site features

Historical features at or near the site are shown in a historical features plan, presented later (in Appendix A).

There is some evidence of previous small buildings in limited areas of the site that were removed during the 20th century. These are mainly possible dwellings or outbuildings located in small clusters or isolated positions around the site.

The existing small slope evident within the east half of the site appears to be the location of a former sea bank. Historical maps suggest that there is a former sea defence embankment which could date back to Roman times.

There are a couple of small (possibly infilled) former water features within the site. This includes a former pond along the south boundary and a former drainage ditch in the southwest area. There is also some evidence of ponds and marshy land in the nearby surrounding area.

2.3.2.2 Off-site features

A former gas works was located very close to the north boundary of the site. Originally (in maps dated 1888 to 1905), this included a couple of small tanks or pits (about 9m in diameter) about 40m north of the site. Later, a 19m-diameter 'Gas Holder' is shown (only about 20m north), but this is only labelled in the map of 1972, so was probably only used for a few years. The Gas Holder is shown to have been removed in a map of 1986.

2.4 Geology,

2.4.1 Drift deposits

2.4.1.1 Tidal Flat Deposits (TFD)

The British Geological Survey (BGS) online map shows the site is underlain by "Tidal Flat Deposits – Clay And Silt." These are described as: *"mud flat and sand flat deposits, [which] are deposited on extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty clay, with layers of sand, gravel and peat. Characteristically low relief."*

Historically, the Tidal Flat Deposits have been called Marine Alluvium or Fen Beds. Locally, these are referred to as the **Terrington Beds**. These are described as: *"younger marine alluvium; salt marsh, tidal creek and river deposits (sandy silt, sand and clay)."*

BGS historical records show six boreholes (1 to 6) were sunk between 20m and 100m west of the site in December 2002. The log from the nearest borehole (BGS ref: TF42SW142), which comprised soil sampling to 4.0m depth and then probing to 5.65m depth, indicates the following sub-strata (in descending order):

- Hardcore. MADE GROUND (to 0.20m)
- Soft brown slightly gravelly fine sandy CLAY... MADE GROUND (to 0.50m)
- Soft brown fine sandy CLAY. MARINE ALLUVIUM. (to 0.80m)
- Soft orange brown slightly gravelly SILT. MARINE ALLUVIUM. (to 1.00m)
- Soft orange brown fine sandy SILT. MARINE ALLUVIUM. (to 2.00m)
- Soft brown fine sandy SILT. MARINE ALLUVIUM. (to at least 4.00m)

· (Probing indicated possible harder strata at about 5.05m depth)

The other five nearby boreholes also indicated broadly similar ground conditions, but with some locally firm and very soft clays. Some fine sand and granular silt soils were also logged. Generally, the logs indicate soft ground which is close to the borderline between either (a) a granular silt/fine sand or (b) a cohesive sandy silt or clay.

SPT N values in the nearby previous BGS borehole logs also confirm the somewhat soft nature of the local shallow ground conditions. SPT N values were mostly zero at a starting depth of 1.0m, as shown below (in Table 5). Higher N values (4 to 11) were recorded at 2.0m depth. However, N values of only zero to 5 were recorded at 3.0m depth.

Table 5: Previous SPT test results from nearby BGS boreholes

SPT start depth (m bgl)	Borehole					
	1	2	3	4	5	6
	Recorded SPT N value (blows/300mm)					
1	5	0	0	0	-	-
2	6	11	4	8	-	-
3	5	1	0	2	-	-
4	2	-	5	-	-	-

Probing into the slightly deeper soils suggested firmer strata was encountered at about 4.0m to 5.0m depth.

2.4.1.2 Historical sea bank

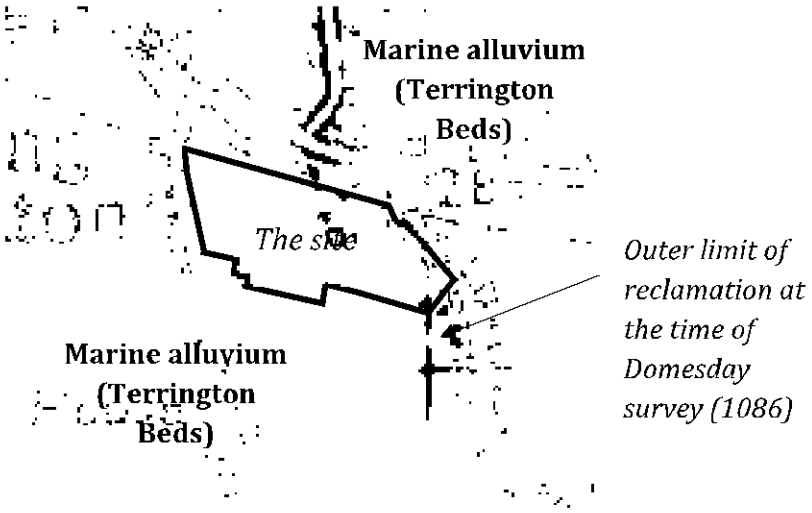
The local BGS geology map shows a historical coastline crosses the site, as reproduced below (in Figure 1). Evidently, this is the same *'Roman Bank'* or *'Sea Bank'* shown in local historical maps (see Appendix D). The location probably coincides with the slight slope still visible within the site.

The historical sea bank is probably a former coastal sea defence embankment. To the west would have been drier land, while to the east were probably marshy sea flats.

2.4.1.3 Glacial Till

Glacial till (about 40m in thickness) is anticipated below the Tidal Flat Deposits at a depth of about 17m, based on nearby BGS historical records of deep boreholes, copies of which are shown below (in Table 6). The glacial till is expected to mainly comprise boulder clay – stiff gravelly clay.

Figure 1: Extract of local geology map



BGS 1:50000 Series, King's Lynn and The Wash, Sheet 145 with part of 129, Solid & Drift Edition ©NERC

Table 6: BGS borehole records

Distance (m):		950	*Distance (m):*	1600
Direction:		Northwest	*Direction:*	Southwest
Elevation (m AOD):		c.4	*Elevation (m AOD):*	c.3
BGS ref:		TF42SW4	*BGS ref:*	TF42SW7
Date:		c.1885	*Date:*	Pre 1921
Water (mbgl):		-	*Water (mbgl):*	-
Stratum		*Depth to base (m bgl)*	*Stratum*	*Depth to base (m bgl)*
Fen Beds	Silt and fine sand	14.3	Yellow sand	16.8
	Gravel and sea shingle	17.4		
Boulder Clay (Glacial Till)	Blue clay with small pieces of chalk and occasionally flints ...	47.9	Grey boulder clay with flint and chalk pebbles	59.4
Ampthill Clay Formation	Blue clay without chalk-stones ...	83.2+	Bluish grey clay	91.7+

2.4.2 Solid geology

BGS online mapping shows the site is underlain by the Ampthill Clay Formation (ACF) - Mudstone. This is described as: *"Mudstone, mainly smooth or slightly silty, pale to medium grey with argillaceous limestone."*

The mudstone rockhead is not expected until a depth of about 50m to 60m below ground level. The mudstone is expected to reach a depth of at least 90m below ground level (bgl).

2.4.3 Mining and quarrying

According to the Coal Authority, the site is in an area that might *not* be affected by coal mining. With respect to non-coal mining activity, a designation of *No Hazard* is given in the Envirocheck report.

There are no BGS recorded mineral sites in the area of the site. There are none within at least 1km.

2.4.4 Summary of anticipated geology

Based on the reviewed desk top information, the anticipated ground conditions are as shown below (in Table 7).

Table 7: Anticipated geology (subject to confirmation with site works)

Strata		*Description*	*Anticipated approx. depth to base (m bgl)*
Topsoil		Loamy silts, clays and sands with occasional rootlets	<1
Superficial soils (Drift)	Tidal Flat Deposits (TFD)	Sandy silt, sand and clay (possibly soft or loose)	16 – 19
	Glacial till	Stiff boulder clay with occasional bands of (water-bearing) sands and gravels	48 – 60
Bedrock	Ampthill Clay Formation	Mudstone, mainly smooth or slightly silty, pale to medium grey with argillaceous limestone."	+90

2.4.5 BGS geological hazards

Geological hazards are risk rated as *No hazard* to *Moderate* as reported by the British Geological Survey (BGS) and shown below (in Table 8). The moderate risk ratings relate to compressible ground stability and running sand.

Table 8: Geological hazards

Hazard	*Hazard potential*
Collapsible ground stability	No hazard
Compressible ground stability	Moderate
Ground dissolution stability	No hazard
Landslide ground stability	Very Low
Running sand ground stability	Moderate
Shrinking & swelling clay	Low

The moderate risk of compressible ground stability probably reflects the potential for soft highly compressible clays to be present in the shallow Tidal Flat Deposits (TFD).

The moderate risk of running sand probably is probably due to fine sands (and possibly a high water table) being expected in the shallow TFD.

2.5 Hydrogeology (i.e. groundwater)

2.5.1 Groundwater table

The location of the groundwater table is unknown, but it is likely to be very shallow given the site's low-lying topography. Moreover, inspection of BGS records of nearby boreholes (from December 2002) suggests that groundwater levels could typically be somewhere between 0.90m to 1.73m below ground level (bgl).

The underlying groundwater table is likely to be relatively flat – reflecting the generally flat topography. Thus, it is difficult to predict the direction of any groundwater flow beneath the site, and any such flow is likely to be slow.

2.5.2 Permeability, aquifers and groundwater vulnerabiilty

Overall, the site is classified as being of combined *unproductive groundwater vulnerability*. The anticipated superficial soils (i.e. the tidal flat deposits and glacial till) and the mudstone bedrock are all likely to be of (very) low permeability. The anticipated superficial geology is classified as Unproductive Strata. The anticipated bedrock geology is also classed as Unproductive Strata.

The nearest reported groundwater abstraction is located about 803m north of the site and concerns a catchpit, catchment tank or collecting tank. 850m east of the site. This is for spray irrigation. The only other reported groundwater abstraction is located about 1283m east of the site and used to provide water for industrial processing, but the status is now revoked.

2.6 Hydrology (i.e. surface water)

The nearest surface water features are the existing drainage ditches that are present along some parts of the north and south site boundaries. During the site works, the drain along much of the northern boundary and the drain along parts of the southern boundary were noted to be about 2m in depth and contain substantial water. The drain along parts of the west boundary was noted to be shallower and no water was recorded.

There are many small water courses (mainly land drains) in the wider area around the site. However, the most notable large water course is the River Nene which is about 4km east of the site. The River Nene flows north towards The Wash, which is about 7km northeast of the site.

There are no nearby reported *surface water abstractions.* There are none within at least 2km.

2.6.1 Flooding

The site is reported to be at risk from flooding (and extreme flooding) from rivers or sea without defences. This is based on data from fluvial / tidal models.

There are no reported flood defences or flood storage areas near the site. The site is not reported to be in an *Area Benefitting from Flood Defences.*

The site is shown by www.gov.uk (flood maps for planning) to be in a Flood Zone 3 area. *"Land and property in flood zone 3 have a high probability of flooding."*

2.7 Environmental Data

2.7.1 Pollution and pollution control

There are no recorded *contaminated land entries and notices* within at least 1km of the site.

There is a reported historical discharge consent for one of the existing domestic properties (number 2 Wisbech Road) which is enclosed by the site. This was issued in July 1990 but was revoked in October 1996. Possibly, this could have been for a soakaway or septic tank.

There is an active discharge consent for sewage discharge into a soakaway, but this is located about 460m northwest of the site.

There are no known significant discharge consents to the surface water features at or near to the site.

There are no *prosecutions relating to controlled waters* within 1km of the site. Similarly, there are no *enforcement and prohibition notices.*

In relation to (Local Authority / Integrated) Pollution Controls (and Preventions and Enforcements), there are several recorded in the area and the closest is about 44m northwest of the site. This pertains to the blending, packing, loading and use of bulk cement at C Warrick & Son Ltd off Seagate Road. The next nearest is 78m northwest of the site and concerns a petrol filling station (authorisation revoked). There are no other such pollution controls, preventions, etc. within 300m of the site.

The nearest reported pollution incident to controlled waters occurred only 24m east of the site, evidently on the opposite side of Wisbech Road. The Minor Incident took place in 1995 and concerned some oils – diesel into surface water drains.

There are no reported *prosecutions relating to authorised processes* within 0.6km of the site.

There are no reported *registered radioactive substances* within 1km of the site.

There are no reported entries on the *substantiated pollution incident register* located within 1km of the site.

There are no reported *water industry act referrals* within 1km of the site.

With respect to hazardous substances, there are no *COMAH, NIHHS* or *Explosive* sites within 1km of the site.

2.7.2 Waste

2.7.2.1 Nearby landfills

There are no reported Historical, Local Authority Recorded or BGS Recorded landfills near the site. The nearest is a historical landfill located about 683m southeast of the site at Mill Hill. However, inspection of historical maps has not yielded any evidence to suggest this was a refuse tip and possibly the record pertains to some small, infilled sand pits.

2.7.2.2 Infilled land

The nearest Landmark-identified potentially infilled land is about 157m southwest of the site and concerns infilled water features (e.g. pond or river). This relates to mapping dated 1889.

On the other hand, there is a historical pond inside the southern boundary of the site, as shown in historical maps. This could have been infilled, or it could have simply silted up.

Also, there was a historical gas holder – about 19m in diameter – only about 20m north of the site. This was shown in historical maps dated 1972. There were also two possible small gas works pits about 40m north of the site, e.g. as shown in maps dated 1888. These could have been infilled.

2.7.2.3 Other waste sites

There is no *Integrated Pollution Control Registered Waste Site* in the area (within 1km).

The nearest registered waste treatment or disposal site is located about 807m northwest of the site. This concerns a scrapyard. There is another scrapyard located about 849m west of the site.

2.7.3 Soil chemistry

Estimated soil chemistry data from the BGS indicates element concentrations for rural soil around the site, as shown below (in Table 9). None of these are considered high enough to be of concern.

Table 9: BGS Estimated Soil Chemistry (rural soil)

Contaminant	*Concentration (mm/kg)*
Arsenic	15 – 25
Cadmium	<1.8
Chromium	60 – 90
Lead	<100
Nickel	15 – 30

2.7.4 Radon

With respect to *radon potential*, the site is in a *Lower probability radon area* in which less than 1% of homes are estimated to be at or above the *Action Level*. BGS and National Geoscience Information Services report that: "No radon protection measures are necessary in the construction of new dwellings or extensions".

2.7.5 Industrial land use

A review of historical maps and photos has identified some limited industrial activity near to the site. This includes the former gas works about 40m north of the site and the former gas holder about 20m north of the site, both on the far side of the drainage ditch and former railway line. There was also a works building located about 20m west of the site on the opposite side of Seagate Road.

The site itself has been used to house farm buildings during its history. There have been several small buildings within the site that are probably former farm buildings. However, these were removed many decades ago and no discernible trace of former buildings has been found from a close inspection of the existing ground surface.

The nearest reported *Contemporary Trade Directory Entry* is 44m northwest of the site and probably pertains to the former works building on the opposite side of Seagate Road. The location was involved in the production of concrete products but is classed as inactive.

The nearest reported *Point of Interest (POI) – Commercial Services* is located 137m east of the site and concerns vehicle repairs, testing and servicing.

The nearest reported *Point of Interest (POI) – Manufacturing and Production* is positioned 45m northwest of the site. It pertains to industrial features (unspecified works or factories).

The nearest reported *Point of Interest* (POI) relating to Public Infrastructure is positioned 258m northwest of the site. It is an existing sewage pumping station.

There are no reported fuel stations currently nearby the site. On the other hand, there was a historical filling station about 78m northwest of the site on London Road.

2.7.6 Sensitive land use

There are no identified sensitive land uses at or near to the site.

3 Initial Contaminated Land Assessment

3.1 Assessment principles

Current legislation and best practice, such as Part IIA of the Environmental Protection Act and CLR 11 (EA/Defra, 2004), recommend that potentially contaminated land is managed using a risk-based approach. Model procedures to assess the risks from contaminated land involve the development of a conceptual site model (CSM) and the identification and assessment of relevant contamination linkages.

A contamination linkage comprises a *source* (i.e. a contaminant capable of causing pollution or harm), a *receptor* and a viable *pathway* by which one can be transmitted to the other. If one of these three elements are missing, there is no significant risk.

The risk from a potential contamination can be assessed as a product of the severity of the consequences that might arise from of the contamination hazard and the probability of the hazard occurring, as outlined in CIRIA C552 (Rudland et al., 2001). The definitions used to perform the risk assessment for the subject site are shown below (in Tables 10 to 13).

Table 10: Severity of contamination hazard being realised

Classification	*Category/Definition*			
	Human	*Controlled waters*	*Property*	*Eco system*
Severe	Short term acute risk	Short term risk	Catastrophic damage	Short term risk
Medium	Chronic damage	Pollution to sensitive water resources		Significant change
Mild		Pollution to non-sensitive water resources	Significant damage	Significant damage
Minor	Non-permanent health effects		Repairable damage	

Table 11: Probability of hazard being realised

Classification	*Definition*
Highly likely	There is a pollution linkage and an event that appears very likely in the short term and or almost inevitable over a long term, or evidence at the receptor of harm or pollution
Likely	There is a pollution linkage and all elements are present which means that it is probable that an event will occur.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event will occur. However, it is not certain that even over a long period such an event would occur and is less likely in the short term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the long term.

A matrix can be used to determine a suitable risk classification, as shown below (in Table 12). The largest risks are where the severity of the contaminant is great and the probability of the contaminant linkage occurring is highly likely. The definitions of the different classifications used in this assessment, based on CIRIA C552 (Rudland *et al.*, 2001), are also shown below (in Table 13).

Table 12: Risk classification matrix

		Consequence			
		Severe	*Medium*	*Mild*	*Minor*
Probability	*Highly likely*	Very high		Moderate	Moderate/low
	Likely		Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	
	Unlikely	Moderate/low	Low		

Table 13: Risk classification definition

Classification	*Definition*
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard or there is evidence that severe harm to a designated receptor is currently occurring. This risk if realised is likely to result in a substantial liability. Investigation and or remediation is required.
High	Harm is likely to a designated receptor from an identified hazard or there is evidence that severe harm to a designated receptor is currently occurring. This risk if realised is likely to result in a substantial liability. Investigation and or remediation may be necessary in the short term and likely over the long term.
Moderate	It is possible that harm could arise to a designated receptor from the identified hazard. However, it is relatively unlikely that such a hazard would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is normally required to clarify and determine the potential risk. Some remedial works may be required in the long term.
Low	It is possible that harm could arise to a designated receptor from the hazard identified but is likely that this hazard if realised would at worst normally be mild.
Very low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe

3.2 Initial conceptual site model (CSM)

The following conceptual site model considers all plausible sources, pathways and receptors of potential contamination. This is based on the proposed development which is a residential development (with gardens and the potential for consumption of home grown produce).

3.2.1 Sources of contamination

Based on the assembled desk study information, the identified potential sources of soil contamination are shown below (in Table 14). The plausibility of the pollution sources or the feasibility of pathways to receptors is not considered at this stage.

Table 14: Potential sources of contamination							
Location	*Source*	*Potential contaminants*					
		Metals & metalloids	*Polycyclic aromatic hydro-carbons (PAHs)*	*Asbestos*	*Pesticides*	*Cyanides & thiocyanate & ammonia*	*Harmful ground gases*
On-site	1. Possible made ground associated with previous (probably farm) buildings	**P**	**P**	**P**			
	2. Past land use – agricultural buildings	**P**	**P**		**P**		
	3. Highly organic soils						**P**
Off-site	4. Nearby former gas holder and gas works	**P**	**P**			**P**	**P**

The identified on-site contamination sources mainly concern previous development and activity on the site. Previous possible farm outbuildings have been identified which could have given rise to made ground when they were removed, which could contain pollutants such as PAHs, metals and asbestos. Some hazardous materials (e.g. pesticides) may have been stored on the site and could have potentially leaked or spilt into the ground.

There is also some potential for highly organic soils below the site. The underlying tidal flat deposits (TFD) can contain organic peaty layers which can give rise to methane and carbon dioxide gases.

There is a former small gas works close to the northern site boundary. There is some limited potential for migration of contaminants (e.g. within groundwater) from the gas works to the site. Contaminants of concern could include PAHs, cyanides, thiocyanate and ammonia. If infilled, there is also some limited potential for the generation of harmful gases.

3.2.2 Pathways

There are many potential pathways to receptors considered. For the proposed site, these may include:

- Inhalation (i.e. indoor or outdoor dust or vapour).
- Ingestion (i.e. swallowing soil, dust).

- Absorption (i.e. direct contact with soil).
- Migration (i.e. vertical/lateral movement through soil, rock, groundwater, building materials, voids and along services).

In outdoor areas, the pathways for contaminants are likely to occur in garden areas where humans or other entities have more direct access to any contaminated soils. Ingestion, absorption and dust inhalation can affect people and ecology.

Within any indoor areas, the main pathway from pollutant to people is typically through inhalation of vapours and gases. Therefore, low volatility pollutants – such as heavy metals – tend to be non-hazardous in indoor areas.

Migration can occur to facilitate other pathways, e.g. inhalation of vapours in groundwater after migration through permeable soil strata or even the build-up and combustion of some ground gases, e.g. methane.

3.2.3 Receptors

Receptors comprise those material items or living beings that may be impacted by contaminants. For the site, these may include:

- human site users (i.e. shop workers, funeral service workers, customers, trespassers)
- controlled waters (i.e. bodies of groundwater and surface water)
- building materials and services (e.g. clean water pipework and buried concrete)
- ecological systems (e.g. local wildlife)
- adjacent site users (e.g. humans, ecological systems)

3.3 Preliminary risk assessment (PRA)

A preliminary risk assessment of potential contamination linkages which also presents the findings of the initial conceptual site model is presented below (in Table 15).

Risk ratings of *very low* or *low* are not considered significant while ratings of *medium / low* (or above) are deemed unacceptable and the associated source-pathway-receptor is taken to be a relevant contamination linkage (RCL) and in need of further consideration. Accordingly, the preliminary risk assessment (below) has only identified one unacceptable contamination risk associated with the proposed development, associated with hazardous ground gas from highly organic subsoils.

There are no identified RCLs associated with soil contamination. The plausibility of these contaminants is low considering the main potential pollution source is from a few small buildings as shown in historical maps. The age of the site and its use for arable farming means that the near surface soils are repeatedly mixed and aerated which should

attenuate and degrade any potential pollutants. Moreover, no made ground or anthropogenic material has been identified from a close inspection of the bare earth ground surface.

Table 15: Initial conceptual site model and preliminary risk assessment

Initial conceptual site model			*Preliminary risk assessment*			
Potential source	*Potential pathway*	*Potential receptor*	*Probability*	*Severity*	*Risk rating*	*Comments*
1. Possible made ground associated with previous buildings **metals, PAHs, asbestos,**	Inhalation, ingestion, absorption	Site users	Unlikely	Mild	Low	Previous buildings were removed many years ago. Subsequent inspection of the bare earth ground surface has not identified any significant anthropogenic made ground material (e.g. ashy soils or construction waste)
	Inhalation, ingestion, absorption	Site workers	Unlikely	Mild	Low	
	Migration	Bedrock aquifer	Unlikely	Minor		
	Migration	Surface waters	Unlikely	Minor		
	ingestion, absorption	Local flora and fauna	Unlikely	Minor		
	Aggressive attack	Building materials	Unlikely	Mild	Low	
2. Past land use – agricultural buildings **metals, PAHs, pesticides**	Inhalation, ingestion, absorption	Site users	Unlikely	Mild	Low	Previous buildings were removed many years ago. The land has been used for arable farming so the topsoil has been repeatedly ploughed which will have encouraged the attenuation and degradation of any contaminants.
	Inhalation, ingestion, absorption	Site workers	Unlikely	Mild	Low	
	Migration	Bedrock aquifer	Unlikely	Minor		
	Migration	Surface waters	Unlikely	Minor		
	ingestion, absorption	Local flora and fauna	Unlikely	Minor		
	Aggressive attack	Building materials	Unlikely	Mild	Low	
3. Highly organic soils **Ground gases**	Inhalation, migration	Site users	Unlikely	Severe	Low/ Moderate	No peaty materials noted in BGS historical logs of nearby deep boreholes (see Section 2).
	Inhalation, migration	Site workers	Unlikely	Medium	Low	
4. Nearby former gas holder and gas works **metals, PAHs, cyanides, thiocyanate, ammonia**	Migration, Inhalation, ingestion, absorption	Site users	Unlikely	Medium	Low	The anticipated ground conditions are low permeability which should restrict migration. The gas works are very old and were removed long ago and replaced with residential dwellings
	Migration, inhalation, ingestion, absorption	Site workers	Unlikely	Medium	Low	

The only identified relevant contamination linkage (RCL) concerns the generation of harmful ground gases by organic material in the underlying soils. The TFD can contain organic peat layers that can degrade to produce carbon dioxide or methane. While the

likelihood is very low, the effect would be severe, so this risk needs further consideration.

Some other minor contamination risks do not require consideration as they will be mitigated as a matter of course through standard construction practices. For example, the risk of sulphate attack on buried concrete should be nullified by design to BRE Special Digest 1.

3.4 Further investigation

As discussed, the risk from hazardous ground gas (created by highly organic soils) requires further consideration. Ground gas monitoring is one way to investigate the presence of harmful ground gases at a site. Alternatively, current best practice is to provide some limited gas protection measures (e.g. CIRIA CS2 or NHBC Amber 1), where no gas monitoring has been carried out and the only gas source is highly organic natural soils.

It is noted that little or no highly organic peaty soils have been recorded in BGS records of nearby historical boreholes. Therefore, it may be possible to investigate the presence of any significant highly organic at the site with deep boreholes. This could provide further information about the risk of hazardous ground gas.

It should be noted that any unforeseen contamination (e.g., petroleum hydrocarbons odour or staining) encountered during the development of the site should be monitored and reported to the local authority. Work should be halted in any area of the revealed potential contamination and the contamination investigated and assessed to the satisfaction of the local authority.

4 Site Investigation Works

The procedures adopted for this site investigation are based on BS 5930 (2015) – Code of Practice for Site Investigations and BS 10175 (2011 + A2, 2017). The soils and rocks encountered have been described based on BS5930 (2015), BS EN ISO 14688-1 (2018), BS EN ISO 14688-2 (2018) and BS EN ISO 14689-1 (2018).

4.1 Fieldwork

Fieldwork took place between the 9th December 2020 and the 1st February 2021.

Approximate locations of the site works are shown in the exploratory hole location plan which is presented later (in Appendix A).

The positions of the exploratory holes were established relative to existing site features and using GPS locating equipment. The depths to sub-strata and groundwater were measured from existing ground level.

Logs for the exploratory holes are presented later (in Appendix B).

4.1.1 Shell and auger boreholes (BH1 & BH2)

Two shell and auger boreholes (BH1 & BH2) were drilled between 27th January 2021 and 2nd February 2021 by SIS Drill (UK) Ltd of Willoughton, Lincolnshire. The rig extracted disturbed samples as well as some split spoon samples. The borehole was about 150mm in diameter and reached depths of between 18.5m (BH2) and 21.5m (BH1) below ground level (bgl). Standard penetration tests (SPTs) were carried out at frequent intervals within the deeper ground material.

4.1.2 Windowless sampler boreholes

19 windowless-sampler boreholes (WS1 to WS19) were drilled by HML between 9th December 2020 and 21st January 2021 with a Dando Terrier rig to a maximum depth of sampling of typically 3.45m below ground level (bgl). The rig extracted consecutive 1m-long tubes of soil material for logging and sampling. The diameter of the borehole decreased from about 100mm to about 75mm. Standard penetration tests (SPTs) were carried out at frequent intervals. Shear vane testing was carried out on suitable cohesive material within the windowless-sampler sampling tubes using a calibrated Impact shear vane.

4.1.3 DCP testing

Super heavy (SH) dynamic cone penetrometer (DCP) testing was carried out adjacent to WS10 using the Dando Terrier rig. The DCP testing reached a depth of 7.0m bgl.

4.1.4 Soakaway testing

Soakaway testing (also referred to as infiltration or percolation testing) took place in six trial pits (TP15, TP18, TP22, TP28, TP33 and TP36) which ranged between 1.5m and 1.7m in depth. Water was poured into the pits and the water levels monitored against time until at least about 75% of the water had drained away (or monitored for several hours if negligible drainage observed) as per guidance in BRE365 (2016).

Ideally, three fills should be repeated consecutively. However, if negligible infiltration occurs, this is not always practicable.

4.2 Laboratory testing

Geotechnical testing was undertaken at the HML UKAS accredited laboratory. The scope of geotechnical testing comprised the following.

- 3 number moisture content (MC) and plasticity index (PI) tests
- 2 particle size distribution tests (sedimentations)
- 9 particle size distribution tests (wet gradings)
- 3 linear shrinkage tests
- 25 CBR tests on remoulded samples (at natural moisture content)

Geochemical testing was undertaken by Chemtech Environmental, a UKAS and MCERTS accredited laboratory. The scope of geochemical testing comprised the following.

- 4 number tests for pH and sulphates

A schedule of testing is shown below (in Table 16). Results for all the laboratory testing undertaken are included later in this report (in Appendix C).

Table 16: Laboratory test schedule

Sample hole	*Sample location*	*HML Sample ref. (S/_)*	*Chemtech sample ref.*	*Depth (m bgl)*	*CBR (soaked)*	*pH and sulphates*	*Grading*	*Linear shrinkage*	*sedimentation*	*PI & MC*
WS2	WS2-2	58217	92468-1	0.6-0.9		P				
WS3	WS3-2	58220		0.6-1.4			P			
WS5	WS5-3	58221		0.9-1.5			P			
WS7	WS7-2	58222		0.8-1.5				P	P	
WS8	WS8-3	58223		1.4-2.0			P			
	WS8-5	58224		3.0-3.5						P
WS9	WS9-2	58225		0.7-0.9			P	P		
	WS9-4	58218	92468-1	2.1-2.6		P				
WS10	WS10-2	58219	92468-1	0.5-1.0		P				
WS11	WS11-3	58226		1.0-1.8			P			
	WS11-5	58227		3.0-3.5						P
BH1	BH1-1	58466		4.0-10.0				P		
	BH1-6	58467		16.0-16.5			P			
	BH1-8	58468		17.0-18.0						P
BH2	BH2-2	58469		11.0-11.5			P			
	BH2-6	58470		14.0-14.5		P	P			
	BH2-10	58471		18.0-18.45						
TP13-1 to TP37-1		59192 - 58216		0.5-1.0*	P x 25					
TP15	TP15-1	58194		0.5-1.0					P	
TP28	TP28-1	58207		0.5-1.0			P			

*approximately

5 Ground Conditions & Soil Properties

5.1 Sequence of sub-strata

The sub-strata as revealed during the site works (in BHs 1 to 2 and WSs 101 to 110) are summarised below (in Table 17 and 18). Copies of the borehole logs are presented later (in Appendix B). Cross sections of the revealed sub-strata are also presented later (in Appendix A).

Table 17: Ground conditions in boreholes (WSs 1 to 19 and BHs 1 to 2)

Strata:	*Topsoil*	*Tidal Flat Deposits*							*Glacial till*
		(SOFT/ FIRM) cohesive clayey SILT	*(VERY LOOSE TO LOOSE) granular (SILT / fine SAND*	*(VERY) SOFT cohesive clayey SILT*	*(VERY) SOFT cohesive (SILT/ CLAY)*	*(VERY) LOOSE becoming LOOSE to MEDIUM DENSE granular (SILT / fine SAND)*	*Cohesive (SILT/ CLAY*	Medium dense granular SAND/ GRAVEL	(Stiff) boulder CLAY
Hole	*Depth to base of stratum (m bgl)*								
WS1	0.40					3.45+			
WS2	0.40		1.10	1.50		3.50+			
WS3	0.42					3.45+			
WS4	0.38	0.73				3.45+			
WS5	0.45		0.60	0.90		3.45+			
WS6	0.45		1.30	1.80		3.45+			
WS7	0.40		0.80	1.70		3.45			
WS8	0.34		2.10		3.50	4.45+			
WS9	0.50	1.00	1.71	2.00	2.70	4.45+			
WS10	0.32					5.25+			
WS11	0.35		1.85	2.25	3.20	4.45+			
WS12	0.47		1.24	1.68		3.45+			
WS13	0.36			1.02	1.49	3.45+			
WS14	0.42		0.72	2.28	2.79	3.45+			
WS15	0.42					3.45+			
WS16	0.45					3.45+			
WS17	0.43		1.05	2.60	2.60	3.45+			
WS18	0.41		0.61	1.75		3.45+			
WS19	0.35	0.72				3.45+			
BH1	0.40			2.50		16.00		16.80	21.50+
BH2	0.30	0.60				10.80		14.80	18.50+

The windowless sampler boreholes generally show that the shallow Tidal Flat Deposits (TFD) soils consist mainly of both granular silts (and sand) with some cohesive silts (and clays). This is normal for the expected local tidal flats geology as these deposits were laid progressively over time by a tidal action which could (at different times) have deposited either coarse silts and fine sands or clays and finer silts. The results are similar to those

reported in BGS boreholes slightly to the west of the site, as discussed earlier (in Section 2).

The trial pits (TP13 to TP37) were used to obtain CBR samples and perform soakaway tests. Nevertheless, they also show much detail about the shallow ground conditions, as shown below (in Table 18). The trial pit logs show there was much granular sands and silts at shallow depth, but there was equally as much shallow sandy silt that was either clayey or locally clayey.

Table 18: Ground conditions in trial pits (TP13 to TP37)

Strata:	*Topsoil*	*Tidal Flat Deposits*						
		Granular SILT/ SAND	*(FIRM) cohesive sandy SILT/ CLAY*	*Granular SILT/ SAND*	*Locally clayey sandy SILT*	*Cohesive sandy clayey SILT*	Granular SILT/ SAND	Cohesive SILT/CLAY
Hole	*Depth to base of stratum (m bgl)*							
TP13	0.31	0.41	0.51			1.00+		
TP14	0.31					1.00+		
TP15	0.17				1.00+			
TP16	0.25				0.80		1.00+	
TP17	0.31	0.58	0.95				1.00+	
TP18	0.18	0.55		1.05		1.70+		
TP19	0.31				0.90	1.00+		
TP20	0.35	0.50				1.00+		
TP21	0.30	0.65				1.00+		
TP22	0.22	0.50	0.65		1.50+			
TP23	0.40	0.55				1.00+		
TP24	0.30				1.00+			
TP25	0.28	0.62				1.00	1.10+	
TP26	0.31	0.65			1.10+			
TP27	0.32	0.52		0.66	1.00+			
TP28	0.33			1.30			1.50+	
TP29	0.34	0.90					1.00+	
TP30	0.28	0.85					1.00+	
TP31	0.30			1.00+				
TP32	0.36				0.90		1.00+	
TP33	0.31			1.35			1.65+	
TP34	0.30				1.00+			
TP35	0.33					0.70	1.00+	
TP36	0.35				0.77		1.40	1.65+
TP37	0.35	1.00+						

5.2 Topsoil

Topsoil was found across the site in all exploratory holes. It was logged to depths of between 0.17m (TP15) and 0.50m (WS9).

The topsoil was logged as a dark brown sandy, silty and clayey soil with occasional rootlets. Locally, some stone gravel was logged.

Only in WS6 (in the south part of the site) were any fine gravel of brick fragments logged within the topsoil. Otherwise, no anthropogenic material was recorded.

5.3 Tidal Flat Deposits (TFD)

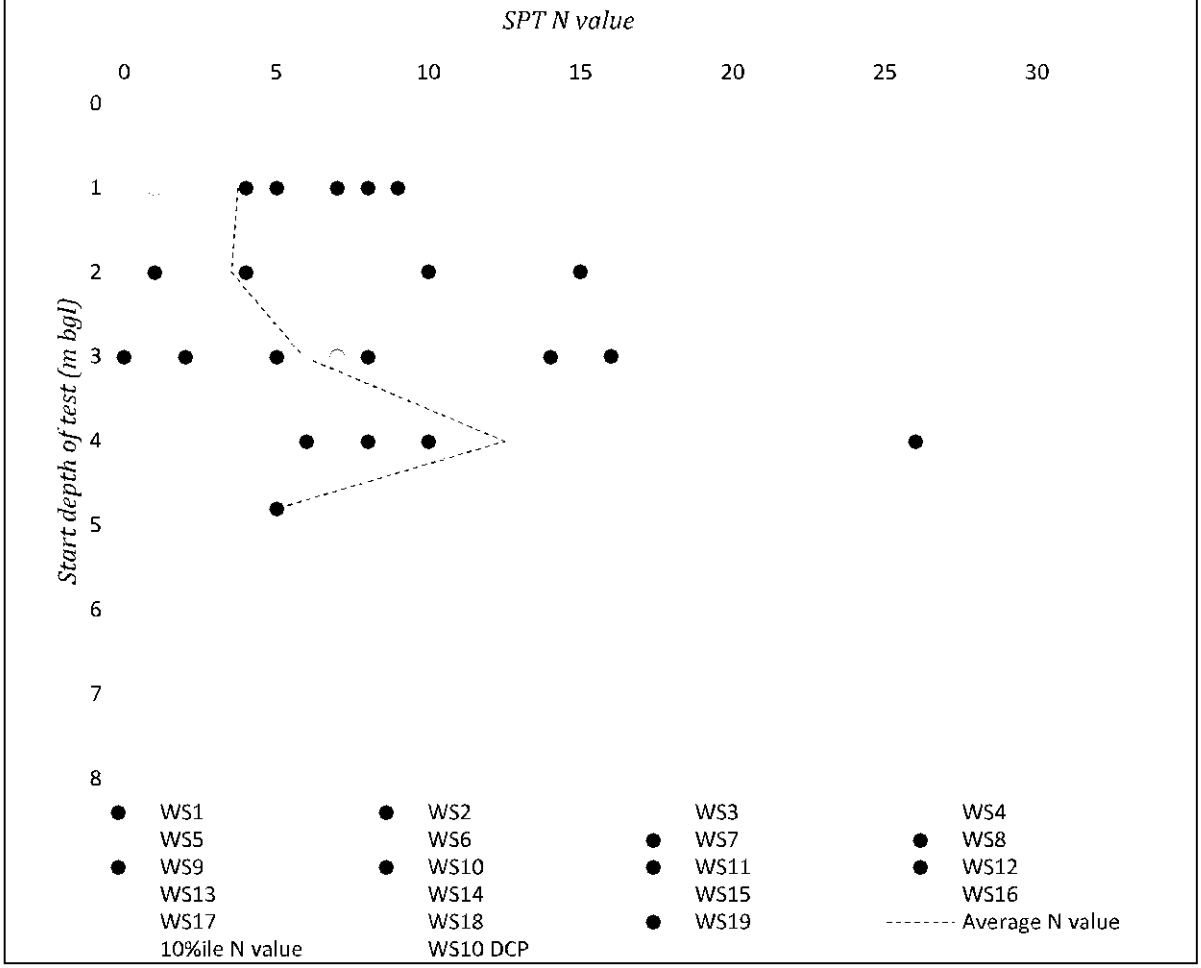
Thick tidal flat deposits (TFD) were revealed across the site. They were logged in all exploratory holes at shallow depth and were found to reach depths of between 14.8m (in BH2) and 16.8m (in BH2) bgl.

The shallower TFD soils were found to be an assortment of granular (silt or sand) and cohesive (silt or clay) soils. Generally, the granular soils were found to be more common but cohesive soils were often present in distinct bands or found locally (e.g. as thin bands, lenses or partings) within granular strata.

The engineering properties of the revealed TFD shallow soils were found to generally be poor, as shown by the results of SPTs below (in Figure 2). The average N value is about 3 or 4 at start depths of 1m and 2m, with several readings of zero. These values would equate to a very loose or loose granular soil. The lower 10th percentile (a cautious, conservative evaluation) of the N value is between 0 and 1 (from 1.0m to 3.45m depth).

There was little evidence of anywhere on site where the ground conditions were consistently better or worse. The N values were modest and sporadically very poor across the site, as shown later, in an SPT plan (in Appendix A).

Figure 2: **SPT N values in the TFD soils**



5.3.1 Shallow TFD granular silts/sands

The revealed shallow TFD soils were mostly comprised of granular silts and fine sands (although much of the material was on borderline between granular and cohesive soil and many bands of cohesive silts and clays were revealed). Granular silts and fine sands were the main soil constituent in all the exploratory holes at shallow depth.

Notably, many of the granular silts and sands were found to be locally clayey. This was very evident in trial pit records.

Important engineering features of sands and granular silts tend to be the particle size distribution, relative density and particle angularity. These properties will usually determine the strength and stiffness.

5.3.1.1 Particle size distribution

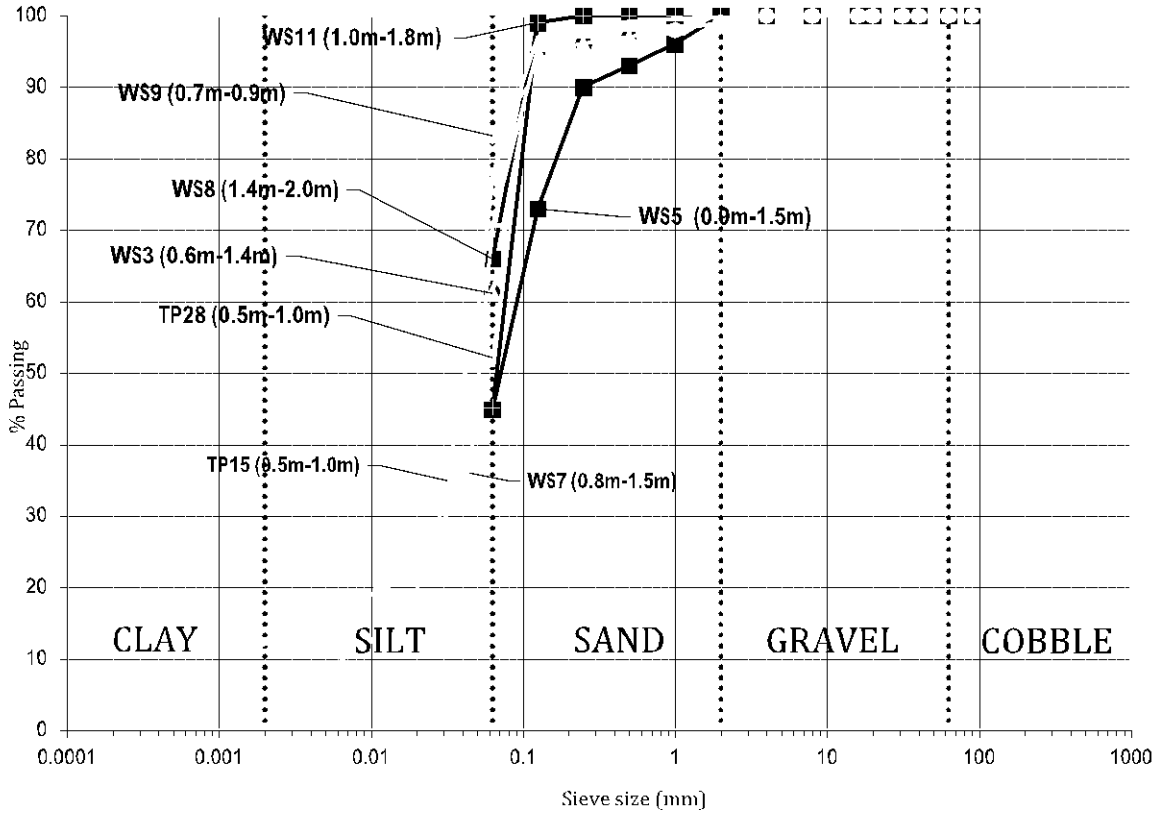
Wet gradings were carried out on five samples of the shallow granular TFD silts. The complete results are presented later (in Appendix C). The findings, as shown below (in

Figure 3), indicate the samples roughly contained 0% to 1% gravel, 34% to 52% sand and 45% to 66% fines (of silt or clay). The results show the shallow granular TFD samples could be typically described as: "Sandy SILT. Sand is fine."

A wet grading was also carried out on a borderline cohesive/granular sample of TFD soil (from WS9, 0.7m to 0.9m) and indicated only 16% sand (and gravel), but 84% fines (of silt or clay), as shown below (in Figure 3). A subsequent linear shrinkage test indicated a significant plasticity index of 19%. Therefore, overall, the results show the sample material could be described as a "**(cohesive)** slightly sandy clayey SILT" (rather than a granular SILT).

Sedimentation tests were carried out on two samples of the borderline cohesive/granular shallow TFD soils, as also shown below (in Figure 3). The sample from TP15 contained minimal clay particles (and so is probably granular) while the sample from WS7 was found to contain about 23% clay particles (and is probably cohesive). The results show the samples could be typically described as: "Sandy (clayey) SILT. Sand is fine."

Figure 3: **Grading curves for shallow TFD silts**



Overall, the grading curves from Figure 3 appear to show six shallow TFD soil samples could probably be logged as *granular* SILT, as shown below (in Table 19). Two samples could be classed as *cohesive* clayey SILT.

Table 19: Assessment of silts as cohesive or granular from grading curves			
Borehole (m bgl)	*Depth*	*Percentage fines (%)*	*Predominantly cohesive or granular?*
WS3	0.6-1.4	**61**	**Granular**
WS5	0.9-1.5	**45**	**Granular**
WS7	0.8-1.5	**70**	**Cohesive**
WS8	1.4-2.0	**66**	**Granular**
WS9	0.7-0.9	**83**	**Cohesive**
WS11	1.0-1.8	**45**	**Granular**
TP15	0.5-1.0	**78**	**Granular**
TP28	0.5-1.0	**52**	**Granular**

The findings of the grading curves suggest the TFD silts and sands have a narrow spread of particle size. The soils are mostly very closely-graded.

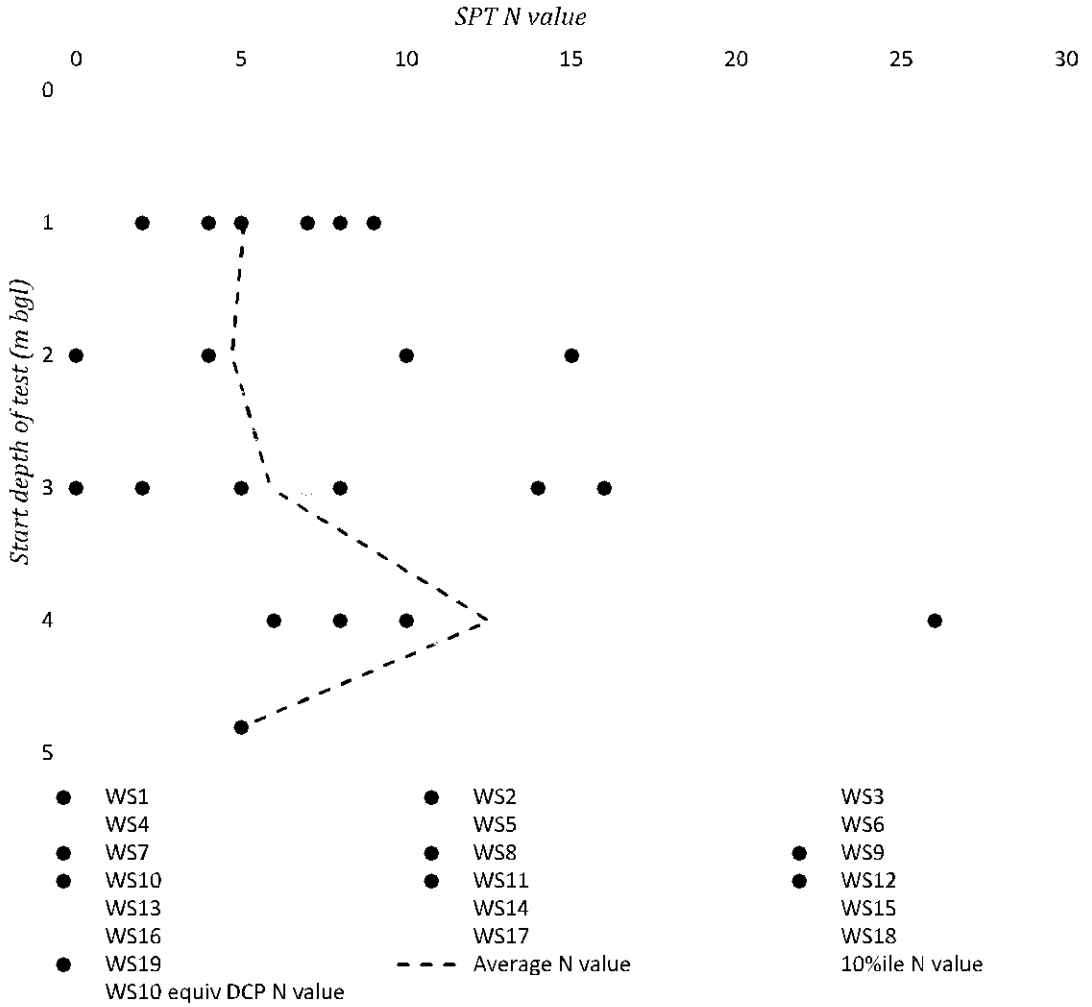
5.3.1.2 Relative density and SPT N value

The relative density of the revealed shallow TFD granular silts and sands was generally very loose or loose, as shown in the borehole logs (in Appendix B). SPT N values in the granular TFD soils mostly ranged between 1 and 10, as shown below (in Figure 4).

Characteristic values are design values used to ensure a proposed structure will not reach an ultimate failure state. A generally suitable characteristic (i.e. cautious value for) N value in the shallow TFD granular silts and fine sands (1.0m to 3.5m depth) could be 1 (blows / 300mm).

Average SPT N values are often used to predict settlement. The average N value in the shallow TFD granular soils (1.0m to 3.5m depth) is about 5 (blows/300mm).

Figure 4: **SPT N values in the shallow granular TFD soils**



The peak effective angle of friction, φ'_{pk}, of granular soil depends on (a) angularity of particles, (b) particle size distribution and (c) relative density. The *characteristic* peak effective angle of shearing resistance, $\varphi'_{pk,k}$, is a cautious estimate of the actual φ'_{pk}.

Given the logged descriptions of angularity and the results of particle size analyses and SPT N values, 27 degrees should be a suitably conservative value of $\varphi'_{pk,k}$ for the revealed TFD granular silts and sands. A *constant volume* angle of friction, $\varphi'_{cv,k}$, of 27 degrees should also be acceptably conservative.

5.3.2 Shallow cohesive TFD soils

5.3.2.1 Nature and extent of shallow cohesive TFD soils

Cohesive TFD soils include the clayey silt, silt/clay and silty clay logged around the site. These soils were not found to be as common as granular silts and sands but were

recorded in nearly all exploratory holes at shallow depths (i.e. less than 4m bgl). No cohesive TFD soils were revealed at greater depths (>4m bgl).

Only seven exploratory holes (TPs 28, 30, 31, 33 and BHs 10, 15 and 16) of the total 45 exploratory holes did not explicitly record any cohesive soils. Incidentally, these holes (which only recorded granular soils) were all located in the central and eastern parts of the site.

Even where only granular soils were logged, it is possible some (very) soft clayey cohesive soil could be present in localised bands, lenses or partings. For example, no cohesive soil was logged in WS10, but the DCP results indicate zero blows between 1.7m and 2.1m which suggests there could be a localised band of soft clayey silt present.

Much of the cohesive soil revealed on site was logged as sandy clayey SILT. The plasticity (and shrinkability) of such soils tends to be quite low.

On the other hand, a band of (very) soft clay (about 0.5m to 1.5m thick) was logged exclusively in the east part of the site (in WSs 8, 9, 11 & 12 and TP36). The top of the silty clay band ranged between 1.24m (in WS12) and 2.1m (WS8). It was about 0.5m to 1.5m in thickness. This band was logged to be *slightly organic* could represent the bottom of a former pond or historic marshland.

5.3.2.2 Plasticity and moisture content

Linear shrinkage tests on some samples of sandy clayey silt TFDs indicated probable cohesive soils, as shown below (in Table 20). The samples from WS7 (0.8m-1.5m) and WS9 (0.7m-0.9m) saw estimated plasticity indexes of 13% and 19%, respectively, which indicates a shrinkable cohesive material, but only of *low volume change potential.*

Table 20: Linear shrinkage of TFD soils

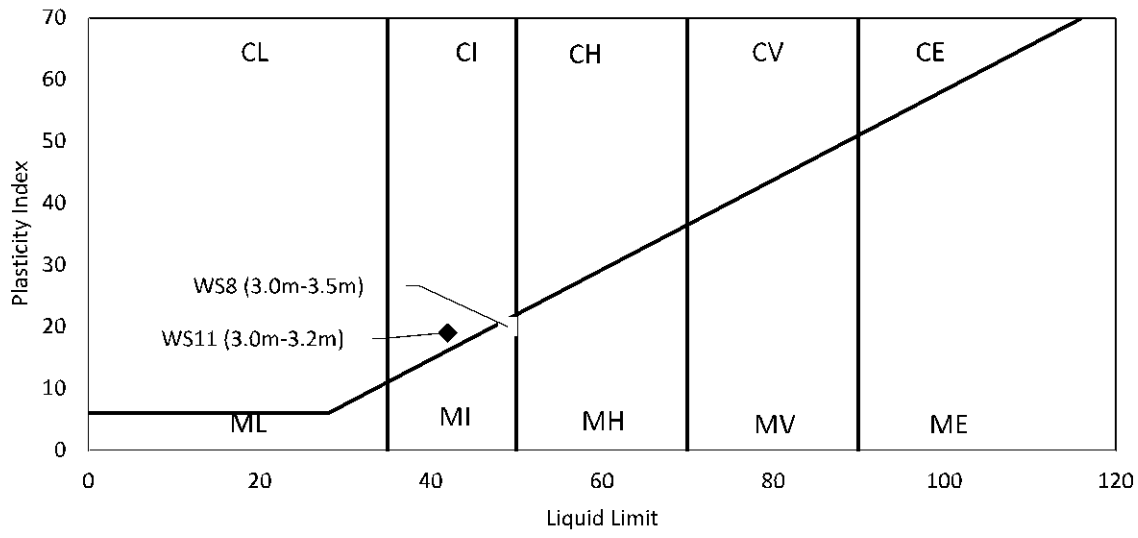
Borehole	*Depth (m bgl)*	***Measured linear shrinkage (%)***	*Estimated plasticity index (%)*	*Shrinkable? y/n*	*Cohesive or granular?*
BH1	4.0-10.0	**0**	0	n	Granular
WS7	0.8-1.5	**6.1**	13	y	Borderline
WS9	0.7-0.9	**8.7**	19	y	Cohesive

Two samples of the deeper silty clay band (possible pond base) of TFD soils were tested for plasticity index and moisture content, the results of which are shown later (in Appendix C). A summary is shown below (in Table 21).

Table 21: Plasticity and moisture content test results for TFD clays									
Sample geology	*Sample location*	*Depth (m bgl)*	*HML Sample reference*	*Natural moisture content (%)*	*Plastic limit (%)*	*Liquid limit (%)*	*Plasticity index (%)*	*% of sample passing 425µm sieve*	*Modified plasticity index (%)*
TFD clay	WS8-5	3.0-3.5	58224	28	29	49	20	100	20
	WS11-5	3.0-3.2	58227	20	23	42	19	100	19

The plasticity data for the silty clay band samples, as shown below (in Figure 5) suggests the soil is intermediate plasticity silty CLAY. The sample data points are close to the A-line indicating both a high silt and clay content.

Figure 5: **Plasticity data for band of TFD silty clays**



The calculated modified plasticity index (i.e. the plasticity index multiplied by the fraction of sample passing a 425um sieve) of the (slightly organic) silty clay band samples is between 19% and 20%. Thus, the shallow TFD cohesive material is shrinkable, and could probably be safely categorised as being of *low volume change potential* (based on NHBC Standards).

5.3.2.3 Undrained shear strength, c_u

The strengths of most of the *in situ* cohesive (sandy) silts and clays are likely to be relatively low (e.g. <40kPa). The encountered clayey silts and silty clays were often logged as very soft or soft.

Nevertheless, some firm clays were found locally around the site, typically at shallow depth. For example, soft to firm (or stiffer) clays were logged in ten locations (WSs 4, 5, 18 and 19 and TPs 13, 17, 20, 21 22 and 25), but generally at depths no greater than

about 1m. One notable exception was some firm clay found in TP36 (in the east corner of the site) below a depth of 1.4m.

Measured hand vane shear strengths in the TFD cohesive silts/clays show some reasonably high strengths mainly at shallow depth. The raw results range from 66kPa (at 0.8m in WS18) up to 174kPa (at 0.55m in TP20). When corrected for plasticity, the corrected values range from 53kPa to 141kPa, as shown below (in Table 22), which would be typical for a firm or stiff clay.

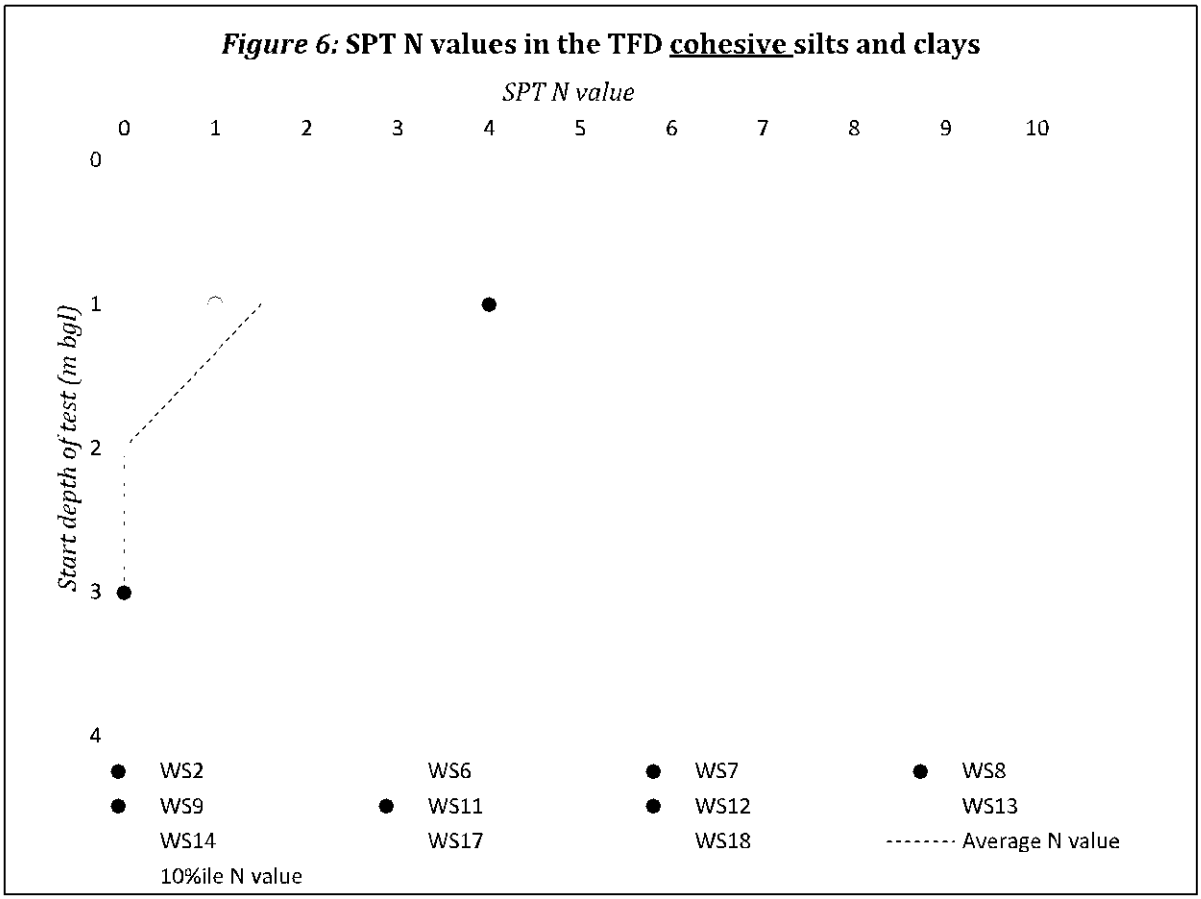
Table 22: Shear vane results in clays

Test location	*Depth (m bgl)*	*Raw results (kPa)*	*Corrected results (kPa)*
WS18	0.8	66	**53**
TP20	0.55	159, 174, 159	**129, 141, 129**
	1.00	159, 125, 133	**129, 101, 107**
TP22	0.55	143, 117, 140	**116, 95, 113**
TP36	1.6	78, 83	**63, 67**

Note: correction based on formula from Morris and Williams (1994) with a plasticity of 20%

Most of the SPTs were mainly carried out in the TFD granular silts, sands and gravels, but some mostly tested the cohesive silts/clays of the TFD, as shown below (in Figure 6). SPT N values mainly in the silty clays ranged between 0 and 4 (blows per 300mm penetration), but were usually 0 or 1.

Figure 6: **SPT N values in the TFD <u>cohesive</u> silts and clays**



The undrained shear strengths of the underlying TFD cohesive silts/clays can be roughly correlated from SPT N values (e.g. using Stroud, 1976). Based on the SPT N values shown above (in Figure 6), the average undrained shear strength could be of the order of 10kPa by a depth of about 1.3m, but by 2.0m, only extremely low strength is available (i.e. <10kPa).

A characteristic value is a cautious or conservative value that is suitable for design calculations (e.g. according to Eurocode 7). A suitable characteristic undrained shear strength for the TFD cohesive silts/clays to a depth of about 1.0m bgl could be about 50kPa (in firm clays) but this could decrease to 10kPa by a depth of 1.3m and to less than 10kPa by a depth of 2.0m, as shown below (in Table 23).

Table 23: Characteristic undrained shear strength in TFD cohesive silts and clays

Depth (m bgl)	*Consistency*	*Characteristic undrained shear strength (kPa)*
<1.0	Firm	**50**
1.3	Soft / Very soft	**10**
2.0+	Very soft	**<10**

5.3.3 Deeper TFD granular silts/sands/gravels

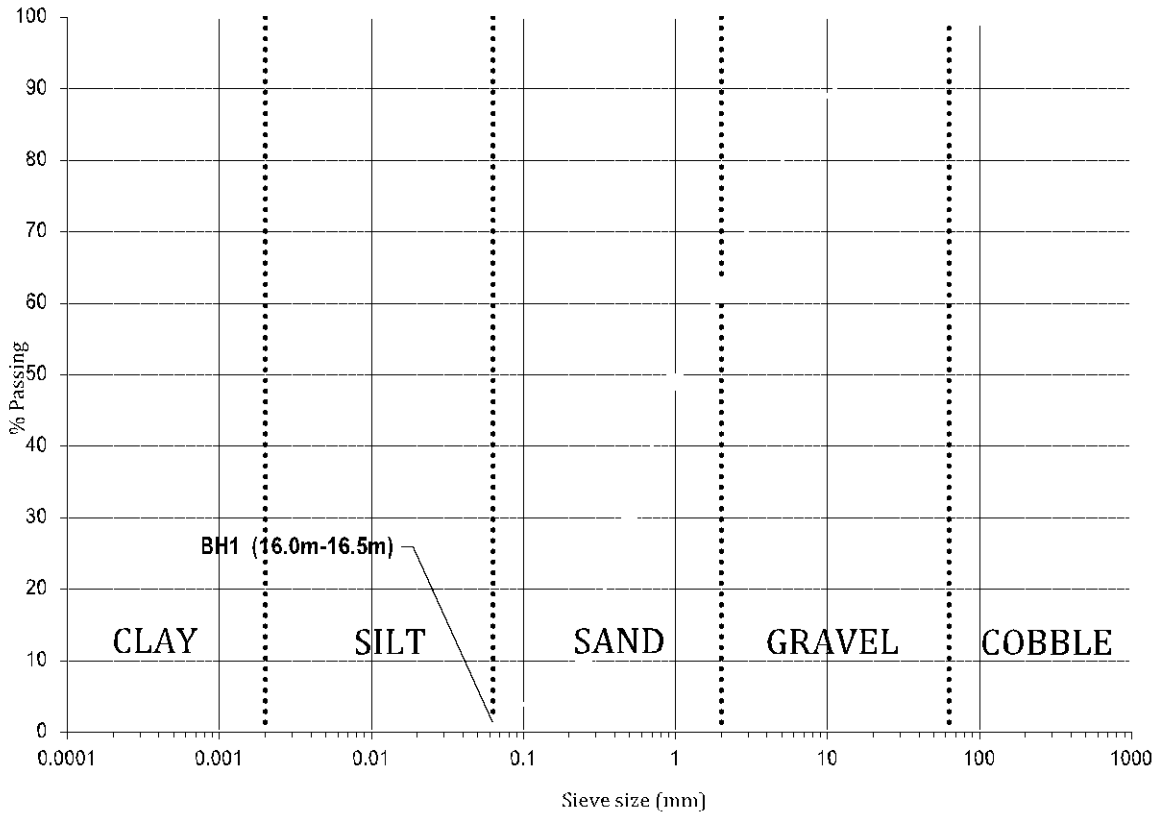
The revealed deeper TFD soils (i.e. greater than 4m depth) were found to be exclusively comprised of granular sands and gravels. These cohesionless soils were recorded to depths of between 14.8m (BH2) and 16.0m (BH1) bgl.

Silty sand was the main soil constituent for nearly all the deeper TFD soils. However, much gravel was located toward the base of both deeper shell and auger boreholes (BH1 and BH2) and a band of very gravelly sand was logged in BH1 (16.0m to 16.8m) which is presumed to be of TFD.

5.3.3.1 Particle size distribution

A particle size distribution test (wet grading) was carried out on a sample of the deeper gravelly sand (from BH1, 16.0,m-16.5m). The complete results are presented later (in Appendix C). The findings, as shown below (in Figure 7), indicate the sample roughly contained 38% gravel, 61% sand and 1% fines (of silt or clay). The results show the samples could be typically described as: "very gravelly medium to coarse SAND. Gravel is fine to medium."

Figure 7: **Grading curves for deeper TFD gravelly SAND**



The findings of the above grading curve suggests the deeper gravelly sand TFD soils have a broad spread of particle sizes. The soil is widely-graded.

5.3.3.2 Relative density and SPT N value

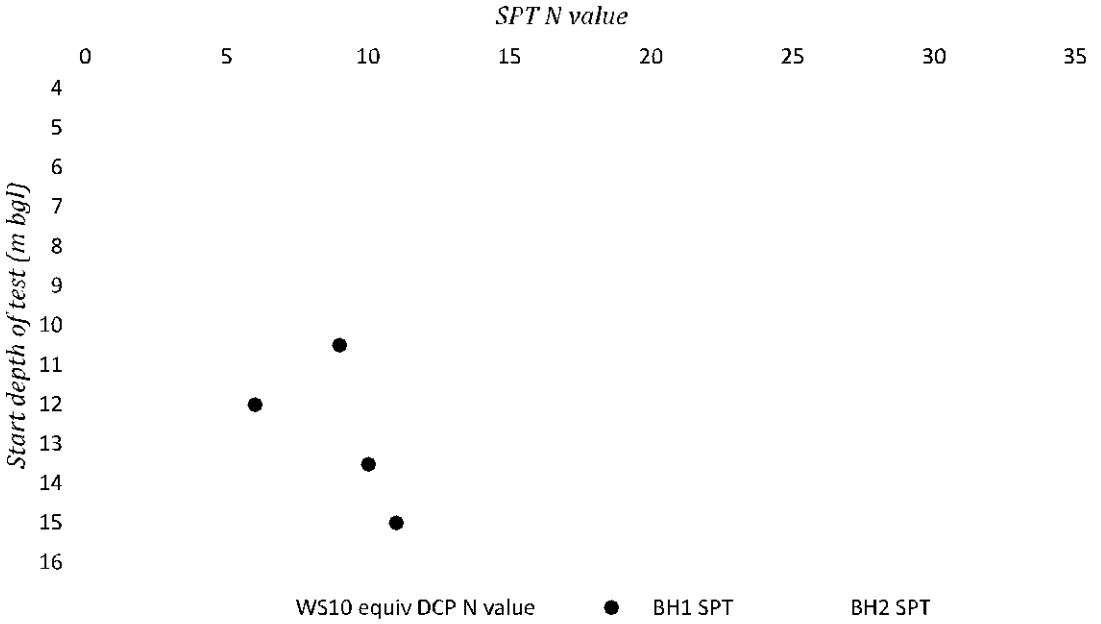
The relative density of the deeper granular TFD sands is probably slightly higher than the shallower TFD granular silts. The density is probably somewhere between loose and medium dense between 4m and 10m.

A characteristic N value of 4 should be suitably conservative for the sands revealed between 4m and 7m, as shown below (in Figure 8). However, a characteristic N value of 8 could be appropriate for the TFD sands deeper than 7m bgl.

The peak effective angle of friction, φ'_{pk}, of granular soil depends on (a) angularity of particles, (b) particle size distribution and (c) relative density. The *characteristic* peak effective angle of shearing resistance, $\varphi'_{pk,k}$, is a cautious estimate of the actual φ'_{pk}.

Given the logged descriptions of angularity and the results of particle size analyses and SPT N values, 30 degrees should be a suitably conservative value of $\varphi'_{pk,k}$ for the revealed deeper TFD granular sands. A *constant volume* angle of friction, $\varphi'_{cv,k}$, of 30 degrees should also be acceptably conservative.

Figure 8: **SPT N values in the deeper granular TFD soils**



5.4 Glacial Till (boulder clay)

Glacial Till was revealed at depth below the site in both shell and auger boreholes (BHs 1 to 2). It was found below depths ranging between 14.8m (BH2) and 16.8m (BH1) bgl and was logged to the full depth of exploration (of 18.5m to 21.5m bgl).

The Glacial Till below the site was encountered in the form of boulder clay. It was typically recorded as: "Stiff to very stiff greenish brown or grey silty CLAY with occasional chalk gravel."

The glacial till was known to be present as boulder clay and was expected to come in below depths of 16.8m and 17.4m, based on previous nearby historical borehole records (See Section 2). The boulder clay has been shown to extend to significant depths locally (of at least 45m bgl).

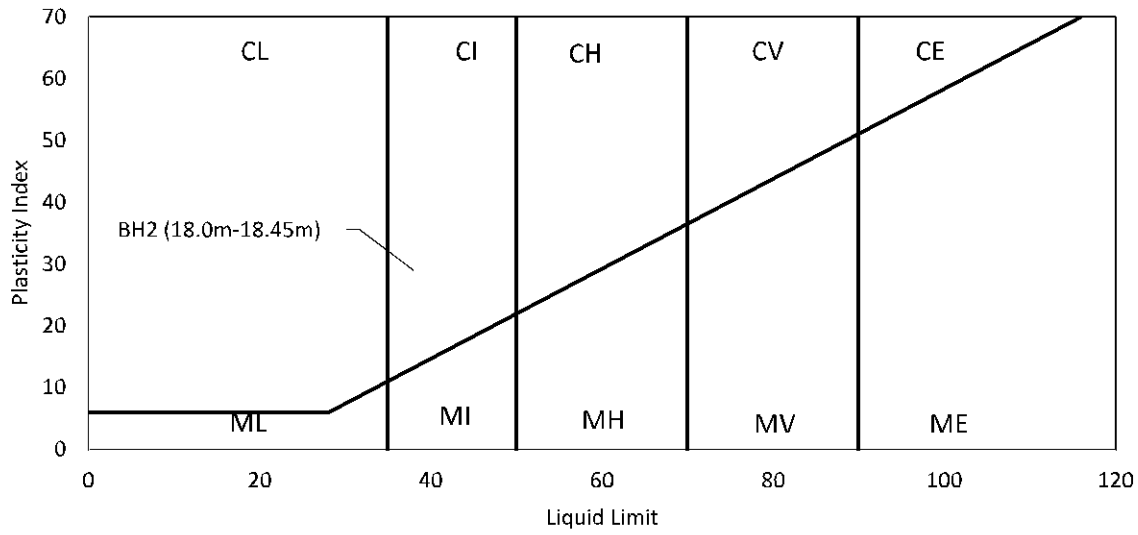
5.4.1 Plasticity and moisture content

One sample of the boulder clay was tested for plasticity index and moisture content, the results of which are shown later (in Appendix C). A summary is shown below (in Table 24).

Table 24: Plasticity and moisture content test results for boulder clay									
Sample geology	*Sample location*	*Depth (m bgl)*	*HML Sample reference*	*Natural moisture content (%)*	*Plastic limit (%)*	*Liquid limit (%)*	*Plasticity index (%)*	*% of sample passing 425µm sieve*	*Modified plasticity index (%)*
Boulder clay	BH2	18.0-18.45	58471	17	9	38	29	93	26

The plasticity data for the boulder clay, as shown below (in Figure 9), suggests it is intermediate plasticity CLAY. The sample data points are well above the A-line indicating a minor silt content.

Figure 9: **Plasticity data for band of boulder clay**



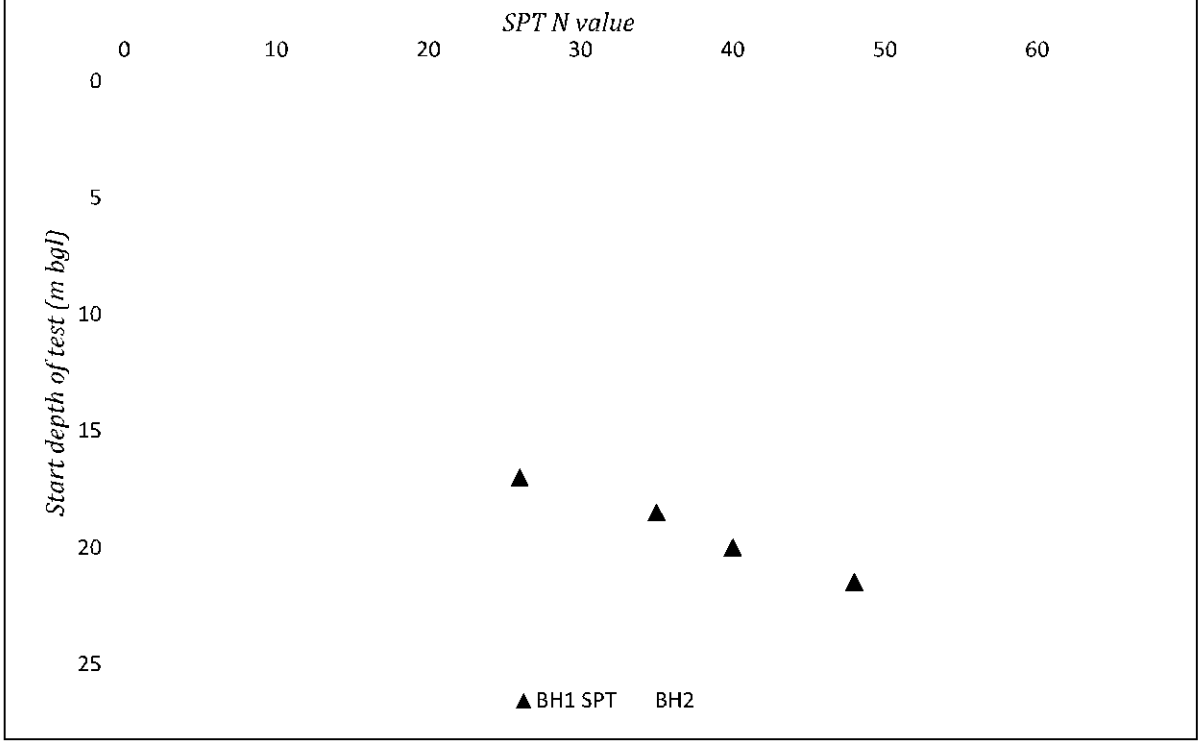
The calculated modified plasticity index (i.e. the plasticity index multiplied by the fraction of sample passing a 425um sieve) of the boulder clay 26%. Thus, it is of *medium volume change potential* (based on NHBC Standards).

5.4.2 Undrained shear strength, cu

The logged descriptions of the boulder clay indicate the material is generally stiff (apart from the uppermost half a metre of so that is probably moistened and weathered by overlying ground water). Stiff clays typically have undrained strengths of at least 75kPa.

SPT N values in the boulder clay range show a steady increase with depth, as shown below (in Figure 10). This suggests an increasingly heavily consolidated clay and increasingly greater strengths with depth.

Figure 10: **SPT N values in the boulder clays**



Evaluations of undrained shear strength range between about 140kPa to 160kPa at depths of around 17m bgl, as shown below (in Table 25). This increases to strengths of at least 190kPa below a depth of 18m bgl.

Table 25: Estimated strength of boulder clays from SPT correlations

Test location	*SPT start depth (m bgl)*	*Average SPT depth (m bgl)*	*SPT N value*	*Estimated undrained shear strength (kPa)*
BH1	17.0	17.3	26	156
	18.5	18.8	35	210
	20.0	20.3	40	240
	21.5	21.8	48	288
BH2	15.0	15.3	24	144
	16.5	16.8	24	144
	18.0	18.3	33	198

Note: uses a rule-of-thumb factor of 6 x N value = c_u (kPa). Average depth is 0.3m plus starting test depth.

Overall, a characteristic undrained shear strength of at least 150kPa should be suitable for the (very) stiff clay at a depth of about 17m bgl. Greater strengths should be available at even greater depths.

5.5 Groundwater observations

Groundwater was encountered during site works within all 21 boreholes (WSs 1 to 19 and BHs 1 and 2) but only in one trial pit (TP18), as shown below (in Table 26). The recorded resting groundwater levels ranged between 0.61m and about 2.95m.

The recorded groundwater levels in boreholes that were mainly drilled in free-draining granular soils are likely to more closely represent the groundwater level. Therefore, the groundwater level at the site could be about 0.6m to 2.0m bgl.

Of course, groundwater levels can fluctuate with climactic and seasonal variations. The recorded groundwater levels were measured in winter after a relatively wet autumn. It is possible, the groundwater table could be lower in late summer months.

Table 26: Summary of groundwater observations

Location	*Date*	*Prevailing shallow ground conditions*	*Water level after drilling (m bgl)*	*Comments*
BH1	27th Jan 2021	Sandy clay	2.5	Resting groundwater level
BH2	27th Jan 2021	Sandy silt	2.0	Resting groundwater level
TPs 13 to 17	10th Dec 2020	-	-	No groundwater observed
TP18	11th Dec 2020	Clayey silt	1.4	Very slight seepage
TPs 19 to 36	11th Dec 2020	-	-	No groundwater observed
WS1	9th Dec 2020	Silty sand	1.77	Resting groundwater level
WS2	9th Dec 2020	Silty sand	1.65	Resting groundwater level
WS3	9th Dec 2020	Silty sand	1.63	Resting groundwater level
WS4	9th Dec 2020	Sandy silt	1.60	Resting groundwater level
WS5	9th Dec 2020	Sandy silt	1.88	Resting groundwater level
WS6	9th Dec 2020	Silty sand	2.06	Resting groundwater level
WS7	9th Dec 2020	Clayey silt	1.66	Resting groundwater level
WS8	9th Dec 2020	Sandy clay	2.95	Resting groundwater level
WS9	9th Dec 2020	Sandy silt	1.45	Resting groundwater level
WS10	11th Dec 2020	Sandy silt	1.85	Resting groundwater level
WS11	11th Dec 2020	Silty clay	2.60	Resting groundwater level
WS12	11th Dec 2020	Sandy silt	2.45	Resting groundwater level
WS13	11th Dec 2020	Sandy silt	1.60	Resting groundwater level
WS14	11th Dec 2020	Clayey silt	1.62	Resting groundwater level
WS15	21st Jan 2021	Sandy silt	0.88	Resting groundwater level
WS16	21st Jan 2021	Sandy silt	1.01	Resting groundwater level
WS17	21st Jan 2021	Sandy silt	0.61	Resting groundwater level
WS18	21st Jan 2021	Clayey silt	1.05	Resting groundwater level

5.6 CBR test results

The results of 24 CBR laboratory tests (on remoulded samples at a natural moisture content) are presented below (in Table 27). The complete results are in Appendix C.

Table 27: Summary of CBR test results						
Location	*Specimen condition*	*Soil type*	*CBR (%)*		*Moisture content*	
			Top	*Bottom*	*Top*	*Bottom*
TP13	n	Sandy silt/clay	0.6	0.4	24	24
TP14	N	Sandy silt/clay	0.2	0.3	24	24
TP15	N	Sandy silt/clay	0.5	0.4	23	22
TP16	N	Sandy silt/clay	0.2	0.1	27	27
TP17	N	Firm sandy clay	-	6.8	25	26
TP18	N	V. soft sandy clay	1.0	1.1	21	21
TP19	N	Soft sandy silt/clay	0.4	0.3	26	28
TP20	N	Soft sandy silt/clay	0.5	0.5	25	25
TP21	N	Firm sandy clay	2.9	2.5	25	25
TP22	N	V. soft clayey sand	0.4	0.3	29	28
TP23	N	V. soft clayey sand	0.4	0.3	26	25
TP24	N	Soft sandy clay	0.9	1.4	25	25
TP25	N	Firm sandy clay	25	26	23	22
TP26	N	V. soft silty sand	1.1	1.1	21	21
TP27	N	V. soft clayey sand	1.0	1.1	21	21
TP28	N	V. soft sandy clay	0.4	0.2	22	24
TP29	N	V. soft clayey sand	0.7	0.8	22	21
TP30	N	V. soft clayey sand	3.5	3.7	20	19
TP31	N	Soft sandy clay	2.1	2.6	21	21
TP32	N	Soft sandy clay	1.0	1.4	22	22
TP33	N	Firm sandy clay	37	34	19	19
TP34	N	Soft sandy clay	0.4	0.4	28	25
TP35	N	V. soft clayey sand	0.5	0.7	23	23
TP36	N	V. Soft clayey sand	1.3	1.2	18	17
TP37	N	Soft sandy clay	0.6	0.6	18	17

By and large, the measured CBR values are relatively low and often less than 1%. This suggests the *in situ* soils have poor strength and compactability. This is not surprising, as soils comprising silts, clays and fine sands often react poorly to compaction.

Some locations saw reasonably high CBR values (e.g. greater than 2%). However, no area on site has been identified where CBR values are consistently reasonably high.

Two locations (TP25 and TP33) saw very high CBR values of 25% to 37%. It is possible these are anomalous results. There is no indication from the ground conditions to explain such locally high CBR values.

5.7 Soakaway test results

As discussed, soakaway testing was carried out in six trial pits (TPs 15, 18, 22, 28, 33 and 36). Water was poured into the pits and the water level was monitored, as detailed below (in Table 28).

Negligible infiltration was observed over several hours. Therefore, the testing was terminated.

Table 28: Selected soakaway / infiltration test results			
Location	*1st fill*		*Comments*
	Time (mins)	*Water level (m bgl)*	
TP15	0	1.34	Testing terminated due to lack of infiltration
	6	1.34	
	206	1.31	
TP18	0	1.36	Testing terminated due to lack of infiltration
	152	1.35	
TP22	0	1.25	Testing terminated due to lack of infiltration
	51	1.25	
	140	1.24	
TP28	0	1.16	Testing terminated due to lack of infiltration
	91	1.17	
	159	1.17	
TP33	0	1.32	Testing terminated due to lack of infiltration
	62	1.32	
	136	1.32	

6 Engineering Issues

6.1 Foundations

All foundations should be designed by a competent engineer with consideration to all factors and the information within this report.

6.1.1 Strip footings

Shallow strip footings do not seem generally feasible at the site due to the poor strength and stiffness of the shallow subsoils. The predominant granular silts and sands are mostly very loose or loose while the frequent clayey bands are often very soft below depths of about 1.0m bgl.

In the area around Long Sutton, there are locations where the tidal flat deposits are almost exclusively comprised of loose sands and coarse silts that can sometimes provide a bearing stratum for strip footings. However, at the site, the sands and coarse silts seem to often contain too much cohesive silt and clay: either as layers of soil or as localised lenses or pockets within the sands.

Overall, shallow strip footings do not seem generally workable at the site. Around the site, there may be some locally better ground conditions where shallow strip footings are feasible, but no such area has been identified thus far.

6.1.2 Shallow raft foundations

The ground conditions also appear to be generally unsuitable for raft foundations. Settlements of the underlying very loose and loose sands, especially when added to the consolidation settlement of clayey bands could be adversely large.

The average SPT N value in the shallow TFD granular soils is about 5, as shown above (in Figure 4). Such N values might normally be suitable for raft foundations and permit allowable bearing pressures of the order of about 25kN/m2 to 30kN/m2 (based on 40mm allowable settlement). However, SPT N values are sporadically only 1 or 2 (even zero) around the site, so it might be unsafe to assume an N value of 5 to determine settlement.

It is possible there may be some plots around the site where the ground conditions are suitable for shallow raft foundations. However, the ground conditions vary unpredictably (possibly because of the site's former seaside location). The available information (presented herein) is considered insufficient to safely design such raft foundations.

For example, the revealed ground conditions at WS10 show only granular silts and sands, so a raft solution could be potentially feasible around WS10. On the other hand, the revealed ground conditions in boreholes nearby WS10 show significant thicknesses of (very) soft clay which could cause excessive consolidation settlement beneath raft foundations. For instance, in nearby WS8 and WS12, there is some highly compressible very soft clayey soil at shallow depth (around 1m to 4m bgl).

6.1.3 Further investigation works

Further ground investigation works might be able to identify some plots where shallow foundations (strip footings or rafts) could be suitable. For instance, additional boreholes and probing near WS10 might show several plots could be suitable for shallow foundations. However, significant additional investigation works will be needed and may only be able to identify small isolated areas (if any) as suitable for shallow foundations.

6.1.4 The influence of trees

The tidal flat deposits (TFD) have been found to include much clayey soil, especially between the ground surface and 1m depth. These have been found to be of *low volume change potentia*l. Therefore, strip footings would need to be at least 0.75m in depth but this depth could increase near to trees.

It is possible heave protection measures may be required for foundations located close to existing trees. These will probably only be needed where there are nearby existing high water demand trees. A tree survey could confirm the requirement for heave protection measures.

6.1.5 Piled foundations

The deeper glacial till consists of boulder clay which has good strength and stiffness properties and should be able to provide a suitable bearing stratum for deep foundations (i.e. piles). As discussed, the boulder clays deeper than 17m should have an undrained shear strength of at least 150kPa.

It is also possible that 'floating piles' in the deeper denser tidal flat deposits will provide sufficient bearing resistance. There should be substantial frictional resistance available from long piles (e.g. about 12m to 15m long) in the revealed underlying sands.

Possible bored (i.e. cast in-situ) pile *ultimate* load resistances have been estimated, as shown below (in Table 29). The calculations are for preliminary design purposes only. Negative skin friction has been ignored. The adopted geotechnical properties are intended to be suitably cautious. Different, more suitable values may need to be used in

the final design to comply with relevant design standards and the final design should be undertaken by a suitable piling specialist.

Table 29: Preliminary ultimate (cast in-situ) pile load resistances

Stratum	*Depth range (m bgl)*	*Soil type*	*Adopted geotechnical parameters*	*Average friction or adhesion (kPa)*	*End bearing resistance (kPa)*
1	0.0 – 4.0	TFD	γ=17kN/m³, γ'=7kN/m³	-	-
2	4.0 – 7.0	TFD silt sand	K.tanδ=0.2, Nq=10, γ'=9kN/m³	9.2	varies
3	7.0 – 12.0	TFD sand	K.tanδ=0.2, Nq=10, γ'=9kN/m³	15.5	varies
	12.0 – 17.0	TFD sand	K.tanδ=0.2, Nq=10, γ'=9kN/m³	24.5	varies
4	17.0+	Stiff to v. stiff clay	c_u=150kPa, α=0.3, Nc=9, γ'=10kN/m³	45	1350
End bearing: clays: $q_p = N_c \times c_u$; sands: $q_p = N_q \times \sigma'_{vo}$ where $\sigma'_{vo} = \gamma' \times D_c$ (10B to 20B) Friction/Adhesion: clays: $q_a = \alpha c_u$; sands: $q_f = K tan\delta \times \sigma'_v$					

The above resistances have been used to estimate the *ultimate* load for single piles of different lengths and widths, as shown below (in Table 30). *Working* loads have also been estimated based on a factor of safety of 2.5. As discussed, these are indicative and for preliminary design purposes only.

Table 30: Preliminary estimated bored pile loads

Pile length (m)	*Pile diameter (mm)*	*Estimated ultimate load (kN)*	*Estimated working load based on 2.5 global factor of safety (kN)*
12	300	118	**47**
	450	213	**85**
18	300	352	**141**
	450	600	**240**

The preliminary estimations suggest that an 18m-long 300mm-diameter bored pile might be able to provide a working load in the region of 141kN, as shown above (in Table 37). Longer, wider piles should have greater carrying capacity. These values are subject to re-evaluation and confirmation by a specialist piling engineer.

Alternative types of pile (e.g. driven/displacement piles) may also be suitable at the site. However, noise and vibration could be an issue with some installation methods.

6.1.6 Alternative foundation solutions

It is possible a ground improvement method (e.g. deep compaction) might be able to improve the ground conditions sufficiently for shallow foundations to be suitable. However, this is considered unlikely. Specialist ground improvement contractors may be able to offer further advice.

Some other deep foundation solutions (e.g. stone columns) might be potentially feasible at the site. At this stage, such solutions are not expected to be the most cost effective. However, specialist contractors may be able to offer further advice.

6.2 Slab design

Heave could potentially be an issue near existing (or recently removed) trees where shallow clays are present, especially if the trees are high water demand. A tree survey can help determine if heave is likely to be significant.

6.3 Excavations and groundwater control

Based on the findings of the site works, conventional mechanical excavation plant should be suitable at the site. However, the presence of unforeseen underground obstacles cannot be ruled out.

Shallow excavations in the soft clays and loose sands might quickly become unstable at depths approaching 2m (or shallower). Appropriate safety precautions should be taken with any open excavations, especially where man-entry is involved.

The groundwater table at the site could be between about 1.0m and 2.0m bgl based on recorded groundwater observations. However, localised groundwater levels as shallow as 0.61m bgl have been measured. Accordingly, groundwater ingresses are likely in modestly deep excavations and some form of groundwater control will be needed to maintain dry excavations.

6.4 Buried concrete

The results of sulphate (SO_4) and pH tests (full copies of which are included in Appendix C) provide information about the required sulphate resistance of buried concrete within the ground conditions at the site. The buried concrete should be designed in accordance with BRE Special Digest 1 (BRE, 2005) using these results.

The (shallow) ground conditions have been found to be largely of cohesive silt/clays and granular silts/sands and some groundwater has been observed. Therefore, it would be prudent to assume a *mobile* groundwater regime for the specification of buried concrete.

A maximum concentration of 213mg/kg of water-soluble sulphate was detected in the ***shallow silts*** (in WS2 and WS10), as shown below (in Table 31). The soil samples were not acidic (pH was 8.6 to 8.8). However, a significant quantity of oxidisable sulphides was present (>0.3%). *Therefore, a DS-2 Design Sulfate and an AC-2 ACEC classification should be suitable in the shallow silts (BRE Special Digest 1, 2005)*

Table 31: Soil sulphate content										
Stratum	*Sample location*	*HML sample ref. (S/_)*	*Chem-tech sample ref.*	*Depth (m bgl)*	*Water-soluble sulfate (mg/l)*	*pH*	*Total sulfur, [TS] (%)*	*Total (acid-soluble) sulfate, [AS] (%)*	*Total potential sulfate, [3TS] (%)*	*Oxidisable sulfides (%) [3TS-AS]*
Sandy silt	WS2	58217	92468-1	0.6-0.9	16	8.4	0.011	0.026	0.032	0.01
Silty clay	WS9	58218	92468-2	2.10-2.60	538	7.9	0.91	0.15	2.7	2.3
Sandy silt	WS10	58219	92468-3	0.50-1.00	213	8.3	0.19	0.072	0.58	0.51
Gravelly sand	BH2	58470	93484-1	14.0-14.5	86	8.6	0.0917	0.0596	0.28	0.22

A maximum concentration of 538mg/kg of water-soluble sulphate was detected in the deeper soils (in WS9), as shown above (in Table 31). The soil samples were not acidic (pH was 7.9 to 8.6). Significant quantities of oxidizable sulphides were present (>0.3%), but the significant depth of these soil strata means there is not expected to be any opportunity for these to oxidise into sulphates. Therefore, *a DS-2 Design Sulfate and an AC-2 ACEC classification should be suitable for concrete (e.g. in piles) within the deeper soil strata, based on the BRE Special Digest 1 (2005).*

6.5 Road pavement design

Lab tests indicate (soaked) CBR values typically ranging between 0.2% and 2%, as shown later (in Appendix C) and summarised previously (in Table 27). No significant zones have been identified on site where CBR values are better or worse.

The CBR values can be used to inform the road pavement design, e.g. for proposed estate roads and parking areas. To meet local authority adoption criteria, a relatively thick and expensive design will be need.

6.6 Soakaway design

Surface water soakaways are not expected to be feasible at the site for two main reasons. Firstly, groundwater levels are shallow. Secondly, the ground conditions are of very low infiltration rate, as evidenced by soakaway testing (see Section 7).

7 Revised Contamination Assessment

Based on the preliminary risk assessment and findings of the site works, a revised combined CSM and risk assessment has been developed, as shown below (in Table 32), based on a *source-pathway-receptor* consideration of potential pollution linkages.

A risk rating of *very low* or *low* is not considered significant while a rating of *moderate / low* (or greater) could be potentially hazardous and the associated source-pathway-receptor taken to be a plausible contamination linkage and in need of further consideration. However, the revised risk assessment below has not identified any unacceptable risks associated with potential contamination.

There is not considered to be a significant risk from permeation of contaminants into water pipes. Nevertheless, the installed pipework should comply with the local water authority's requirements, for instance, based on the findings of this report.

No evidence has been found of contamination on site. Accordingly, if should be possible to re-use clean, natural, site-won soils around the site.

Any unforeseen contamination (for example, hydrocarbon odours or staining) encountered during the development of the site must be monitored and reported to the local authority. Work must be halted in any area of the revealed potential contamination and the contamination investigated and assessed to the satisfaction of the local planning authority.

7.1 Ground gas risk assessment

The site is not in a radon gas affected area. There are no nearby landfills or mineworkings. There is no made ground present. The only identified potentially significant source would be organic material within the underlying tidal flat deposits, which can contain peaty soils.

However, no significant amount of peaty soil has been found at the site and nearby BGS borehole records show tidal flat deposits in the area are not of significant organic content. The only slightly organic soils found on site was a thin band of slightly organic silty clay in the east part of the site. But this was typically less than 1m in thickness. Therefore, there is locally insufficient organic material for the underlying tidal flat deposits to be a plausible source of hazardous ground gas.

Accordingly, a CIRIA CS-1 classification (or NHBC green traffic light classification) should be suitable for the site. No ground gas protection measures should be required.

Table 32: Revised conceptual site model and risk assessment						
Revised conceptual site model			*Revised risk assessment*			
Potential source	*Potential pathway*	*Potential receptor*	*Probability*	*Severity*	*Risk rating*	*Comments*
1. Possible made ground associated with previous buildings **metals, PAHs, asbestos,**	Inhalation, ingestion, absorption	Site users	Unlikely	Mild	Low	Previous buildings were removed many years ago. Subsequent inspection of the bare earth ground surface has not identified any significant anthropogenic made ground material (e.g. ashy soils or construction waste). **Extensive site works have not revealed any made ground.**
	Inhalation, ingestion, absorption	Site workers	Unlikely	Mild	Low	
	Migration	Bedrock aquifer	Unlikely	Minor		
	Migration	Surface waters	Unlikely	Minor		
	ingestion, absorption	Local flora and fauna	Unlikely	Minor		
	Aggressive attack	Building materials	Unlikely	Mild	Low	
2. Past land use – agricultural buildings **metals, PAHs, pesticides**	Inhalation, ingestion, absorption	Site users	Unlikely	Mild	Low	Previous buildings were removed many years ago. The land has been used for arable farming so the topsoil has been repeatedly ploughed which will have encouraged the attenuation and degradation of any contaminants.
	Inhalation, ingestion, absorption	Site workers	Unlikely	Mild	Low	
	Migration	Bedrock aquifer	Unlikely	Minor		
	Migration	Surface waters	Unlikely	Minor		
	ingestion, absorption	Local flora and fauna	Unlikely	Minor		
	Aggressive attack	Building materials	Unlikely	Mild	Low	
3. Highly organic soils **Ground gases**	Inhalation, migration	Site users	Unlikely	Medium		**No significant peaty materials noted in borehole logs (apart from a thinl band of slightly organic clay).** Also, no peat noted in BGS historical logs of nearby deep boreholes (see Section 2).
	Inhalation, migration	Site workers	Unlikely	Medium	Low	
4. Nearby former gas holder and gas works **metals, PAHs, cyanides, thiocyanate, ammonia**	Migration, Inhalation, ingestion, absorption	Site users	Unlikely	Medium	Low	The anticipated ground conditions are low permeability which should restrict migration. The gas works are very old and were removed long ago and replaced with residential dwellings
	Migration, inhalation, ingestion, absorption	Site workers	Unlikely	Medium	Low	

8 SUMMARY & CONCLUSIONS

8.1 Ground conditions

The findings of the investigation indicate the following sub-strata at the site.

- **Topsoil**: (across the site) loamy soil with rootlets (to a maximum depth of 0.50m)
- **Tidal Flat Deposits (TFD)**:
  - Locally, some shallow firm clay present to a depth of about 1m bgl
  - Common very loose to loose granular silts and fine sands - but sometimes locally clayey – to depths of about 4m bgl
  - A band of (very) soft (slightly organic) clays and silts is present in much of the east area of the site (at depths of up to 4m bgl)
  - Loose to medium dense sands present (at depths greater than about 4m bgl)
  - TFD sands become increasingly gravelly at significant depth (>11m)
  - The base of the TFD soils was revealed at 14.8m (BH2) to 16.8m (BH1) bgl
- **Glacial till**:
  - Stiff boulder clay (revealed to reach greater than 21.5m bgl)
  - Local BGS records indicate the glacial till is comprised of boulder clay and reaches depths of at least 45m bgl

8.2 Geotechnical properties

The geotechnical properties as determined from measurements, estimations and evaluations are presented below (in Table 33).

Table 33: Geotechnical properties

Soil	*Depth (m bgl)*	*Geotechnical property*	*Value*
TFD: shallow granular silts/sands	0.5-1.80	Gravel content	0%-1%
		Sand content	34%-52%
		Fines content	45%-66%
	1.0-3.5	Characteristic SPT N value	1
		Average SPT N value	5
		Angle of friction, ϕ	27°
TFD: shallow cohesive silts/clays	0.7-3.5	Plasticity index	13%-20%
		Volume change potential	Low
	<1.0	Characteristic undrained shear strength, $c_{u,k}$	53
	1.3		10
	>2.0		<10
TFD: deeper sands	16.0-16.5	Gravel content	38%
		Sand content	61%
		Fines content	1%
	4.0 – 7.0	Characteristic SPT N value	4
	>7.0		8
Glacial till (boulder clay)	17.0	Characteristic undrained shear strength, $c_{u,k}$	150kPa

8.3 Engineering issues

8.3.1 Foundations

8.3.1.1 Strip footings

Shallow strip footings do not seem feasible at the site due to the poor strength and stiffness of the shallow subsoils. There may some areas of the site where locally better ground conditions mean that shallow strip footings are feasible, but no such areas have been identified.

8.3.1.2 Shallow raft foundations

The ground conditions also appear to be generally unsuitable for raft foundations. Settlements of the underlying very loose and loose sands, especially when added to the consolidation settlement of clayey bands could be adversely large.

It is possible there may be some plots around the site where the ground conditions are suitable for shallow raft foundations. However, the ground conditions vary unpredictably (possibly because of the site's former seaside location).

8.3.1.3 Further investigation works

Further ground investigation works might be able to identify some plots where shallow foundations (strip footings or rafts) could be suitable. However, significant additional investigation works will be needed and may only be able to identify small isolated areas (if any) as suitable for shallow foundations.

8.3.1.4 The influence of trees

The tidal flat deposits (TFD) clays have been found to be of low volume change potential. Therefore, strip footings would need to be reach at least 0.75m bgl, but this depth could increase near to trees.

It is possible heave protection measures may be required for foundations located close to existing high water demand trees.

8.3.1.5 Piled foundations

The deeper boulder clay has good strength and stiffness properties and should be able to provide a suitable bearing stratum for deep piled foundations. 'Floating piles' in the deeper denser tidal flat deposits might also be able to provide sufficient bearing resistance. There should be substantial frictional resistance available to long piles (e.g. about 12m to 15m long) in the revealed underlying sands.

Preliminary estimations suggest that a 12m-long 300mm-diameter pile in the TFD sands might provide a working load of about 47kN. Similarly, an 18m-long 300mm-diameter pile in the boulder clay might be able to provide a working load around 141kN, as shown above (in Table 37).

8.3.1.6 Alternative foundation solutions

It possible a ground improvement method (e.g. deep compaction) or alternative deep foundation solutions (e.g. stone columns) might be potentially feasible at the site. These solutions are considered unlikely to be cost effective. However, specialist contractors may be able to offer further advice.

8.3.2 Slab design

Heave could potentially be an issue for slab design near any existing high water demand trees. A tree survey could confirm this.

8.3.3 Excavations and groundwater control

Shallow excavations in the soft clays and loose sands might quickly become unstable at depths approaching 2m (or shallower).

The groundwater table at the site could be between about 1.0m and 2.0m depth. Localised groundwater levels as shallow as 0.61m bgl have been measured. Accordingly, some form of groundwater control will be needed for modestly deep excavations.

8.3.4 Buried concrete

The results of sulphate (SO_4) and pH tests indicate, a DS-2 Design Sulfate and an AC-2 ACEC classification should be suitable for the in situ soils at the site (based on BRE Special Digest 1, 2005).

8.3.5 Road pavement design

Lab tests indicate CBR values typically ranging between 0.2% and 2%. No significant zones have been identified on site where CBR values are better or worse. To meet local authority adoption criteria, a relatively thick road design will be needed.

8.3.6 Soakaway design

Surface water soakaways are not expected to be feasible at the site as groundwater levels are very shallow and the ground conditions are of negligible infiltration rate, as evidenced by percolation testing.

8.4 Contamination Assessment

8.4.1 Initial conceptual site model

The conceptual site model presented herein identified four main potential sources of contamination:

Source 1 Possible made ground associated with previous buildings (metals, PAHs, asbestos)

Source 2 Past land use – agricultural buildings (metals, PAHs, pesticides)

Source 3 Highly organic subsoils (ground gases)

Source 4 Nearby former gas holder and gas works (metals, PAHs, cyanides, thiocyanate, ammonia)

8.4.2 Preliminary risk assessment

Unacceptable risk was only found for one potential contamination linkage. This linkage concerned ground gas from highly organic subsoils (source) and the effect on future site users (receptor) through migration and inhalation or combustion (pathway).

The possible made ground was not considered to pose a significant risk as no made ground could be found on site. A close inspection of the site revealed only natural soils within the exposed bare earth. Moreover, the site has been used as farm fields for many years so any contaminants are likely to have been attenuated and degraded.

Similarly, past land use was not considered a viable source. Previous buildings evident from historical maps are too small, isolated and aged to have any significant impact on the site.

The nearby former gas holder is unlikely to have affected the site. The underlying subsoils are of (very) low permeability. There is a drainage ditch and trees between the site and the gas holder.

8.4.3 Revised risk assessment

Following the results of site works, no unacceptable contamination risks are considered to be present for the proposed site development. No potentially significant contamination linkages have been identified.

The extensive boreholes drilled on site have not revealed any significant organic material that could offer a plausible source of hazardous ground gas. No peat has been found and the predominant soils are granular silts and sands. A thin band of slightly organic clay was revealed in the east of the site, but this has a negligible gas generating

potential. Accordingly, the underlying subsoils are no longer considered as a viable source of hazardous ground gas.

No evidence has been found of contamination on site. No made ground or substantial anthropogenic material has been recorded. Therefore, it should be possible to re-use clean, natural, site-won soils around the site.

Nevertheless, any unforeseen contamination (for example, hydrocarbon odours or staining) encountered during the development of the site must be monitored and reported to the local authority. Work must be halted in any area of the revealed potential contamination and the contamination investigated and assessed to the satisfaction of the local planning authority.

8.4.4 Ground gas risk assessment

No viable source of hazardous ground gas has been found at the site. Accordingly, a CIRIA CS-1 classification (or NHBC green traffic light classification) should be suitable for the site. No ground gas protection measures should be required.

- End of Report -

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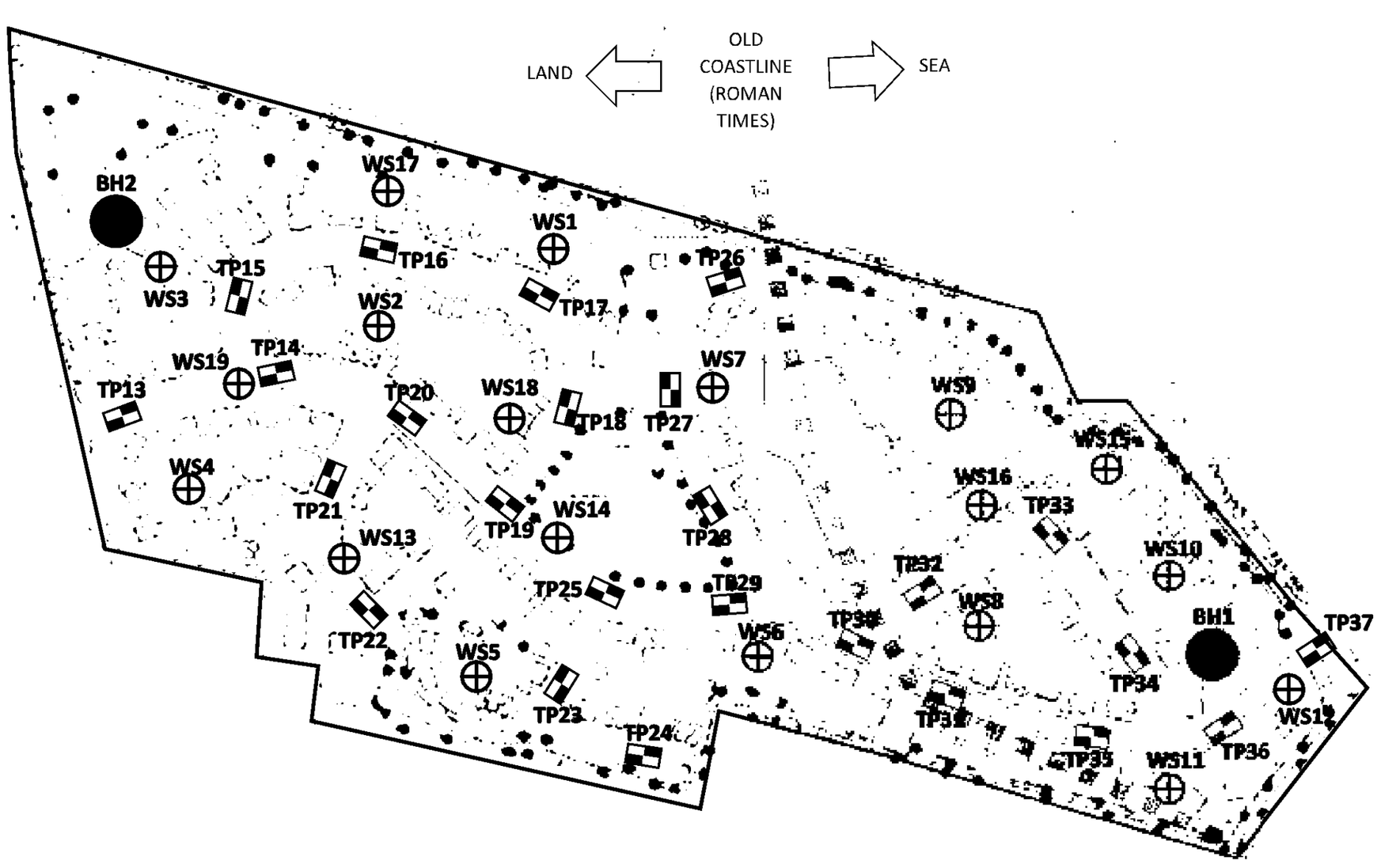
Appendix A

Plans & Photographs



LEGEND

- Windowless sampler holes
- Trial pits for CBR samples
- Trial pits for CBR samples and soakaway testing
- Shell and auger borehole

Notes:

1. Do not scale
2. Locations of all features are approximate only
3. Background image taken from Templeman Design drawing number 3359-TD-XX-DRG-AR-0002-PO, dated November 2017

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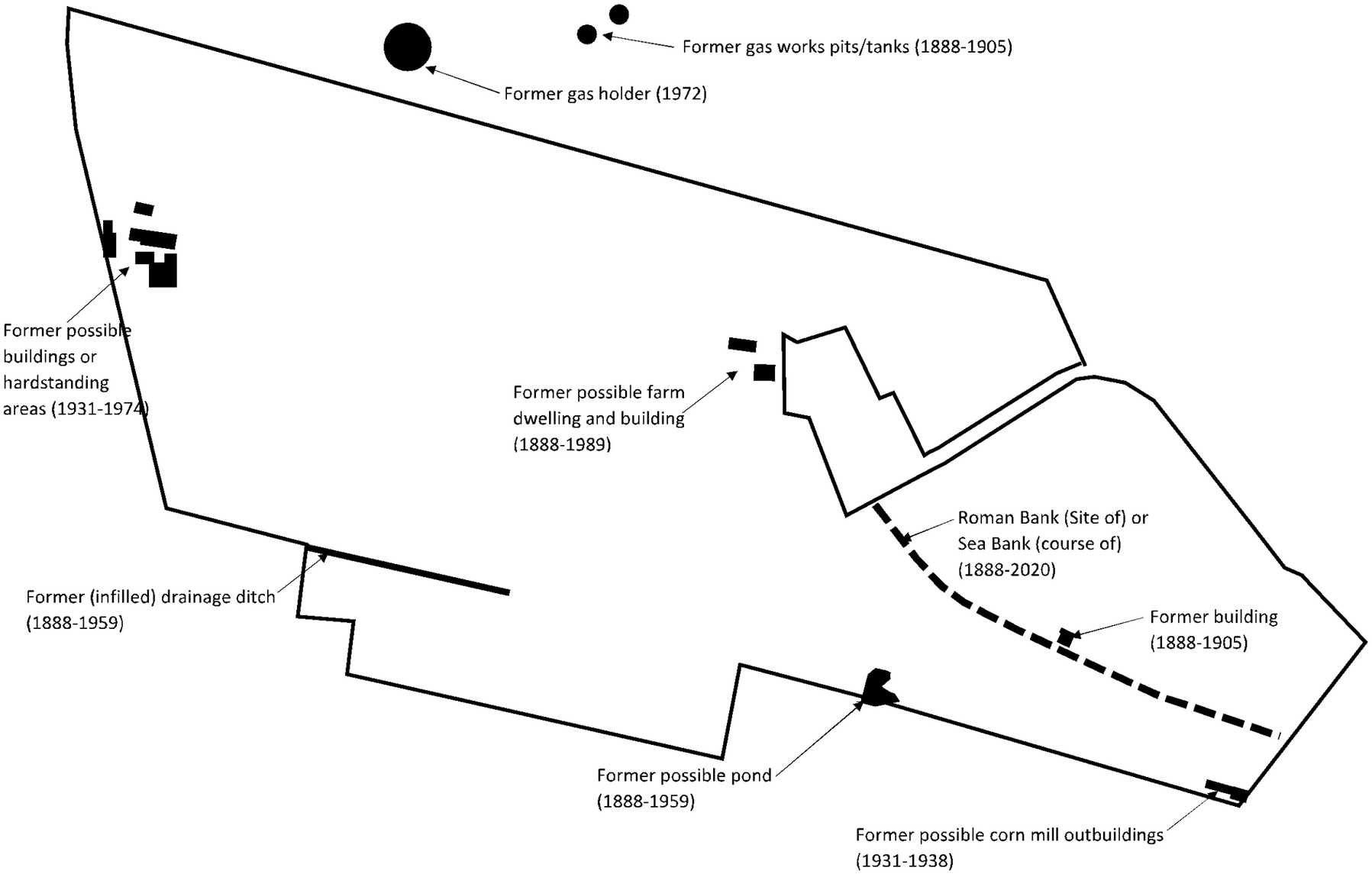
Drawing Title: **Exploratory hole location plan**
Drawing No.: 1197-5350-SI-01 *Revision:* 0
Site: Land off Seagate Rd, Long Sutton
Client: D Brown Building Contractors Ltd
Project No.: 1197/5350/P
Date: 18/02/2020



Notes:

1. Do not scale
2. Locations of all features are approximate only
3. Background image taken from Templeman Design drawing number 3359-TD-XX-DRG-AR-0002-PO, dated November 2017 – shows proposed development

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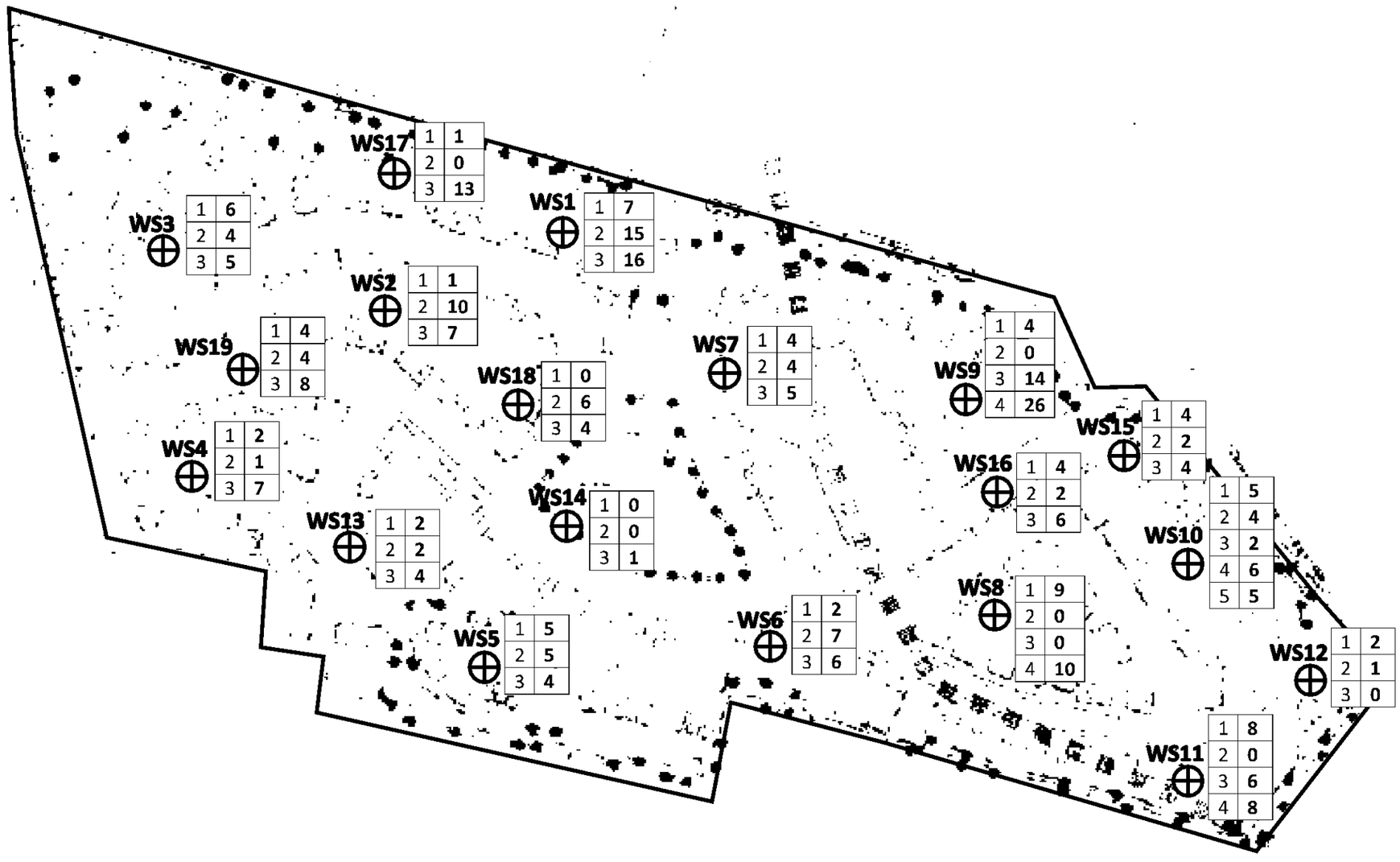
Drawing Title: **Historical features plan**
Drawing No.: 1197-5350-SI-02 *Revision:* 0
Site: Land off Seagate Rd, Long Sutton
Client: D Brown Building Contractors Ltd
Project No.: 1197/5350/P
Date: 18/02/2021



Notes:

1. Do not scale
2. Locations of all features are approximate only
3. Background image taken from Templeman Design drawing number 3359-TD-XX-DRG-AR-0002-P0, dated November 2017

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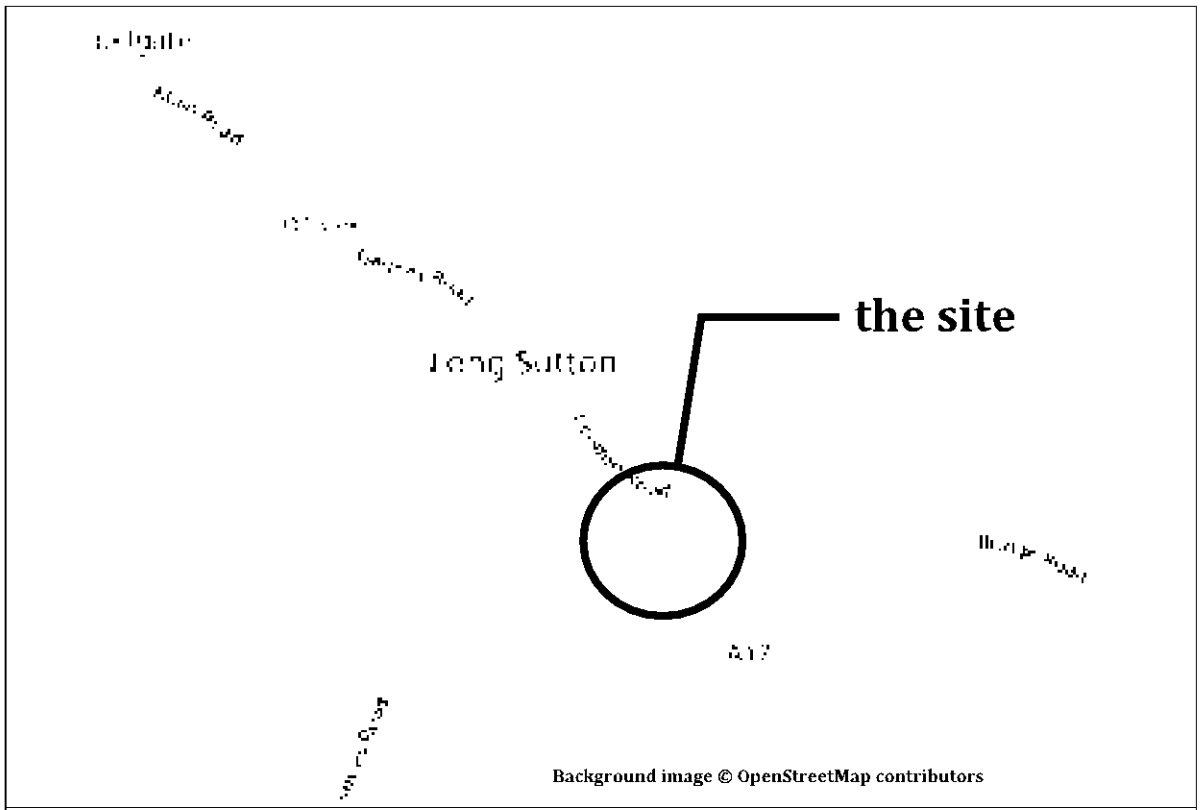
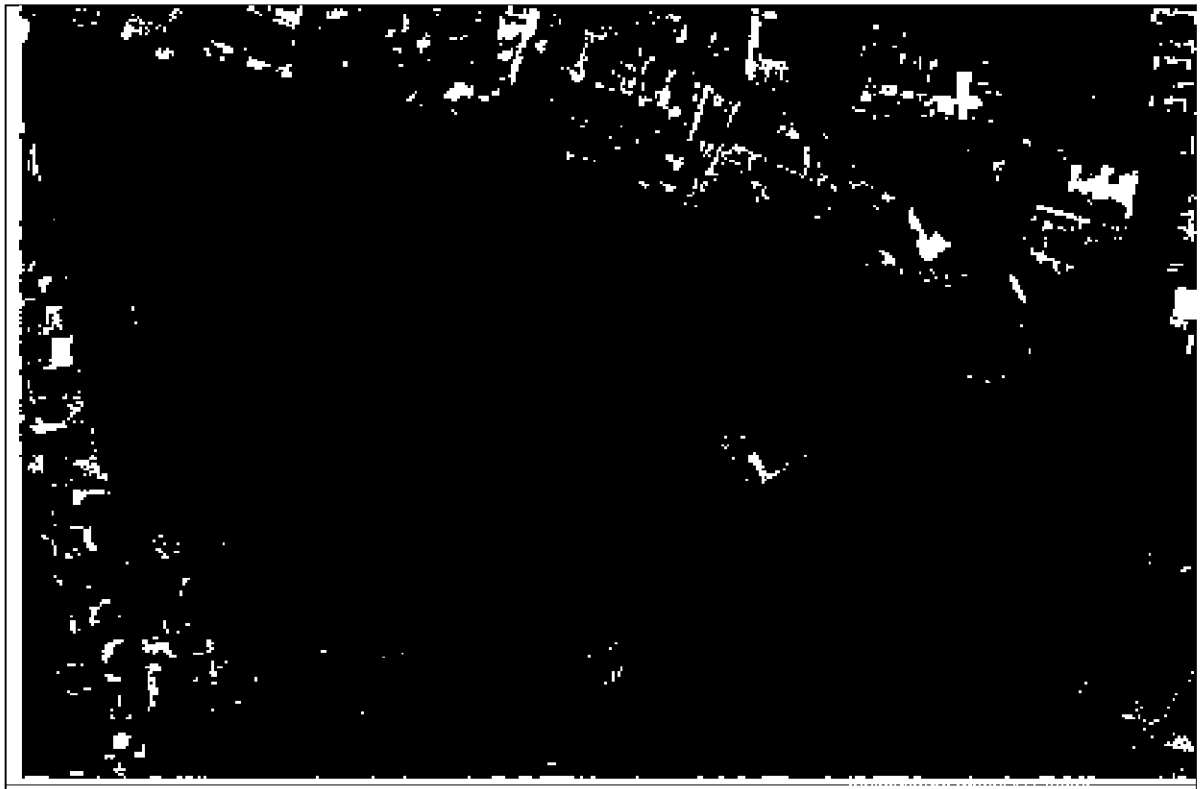
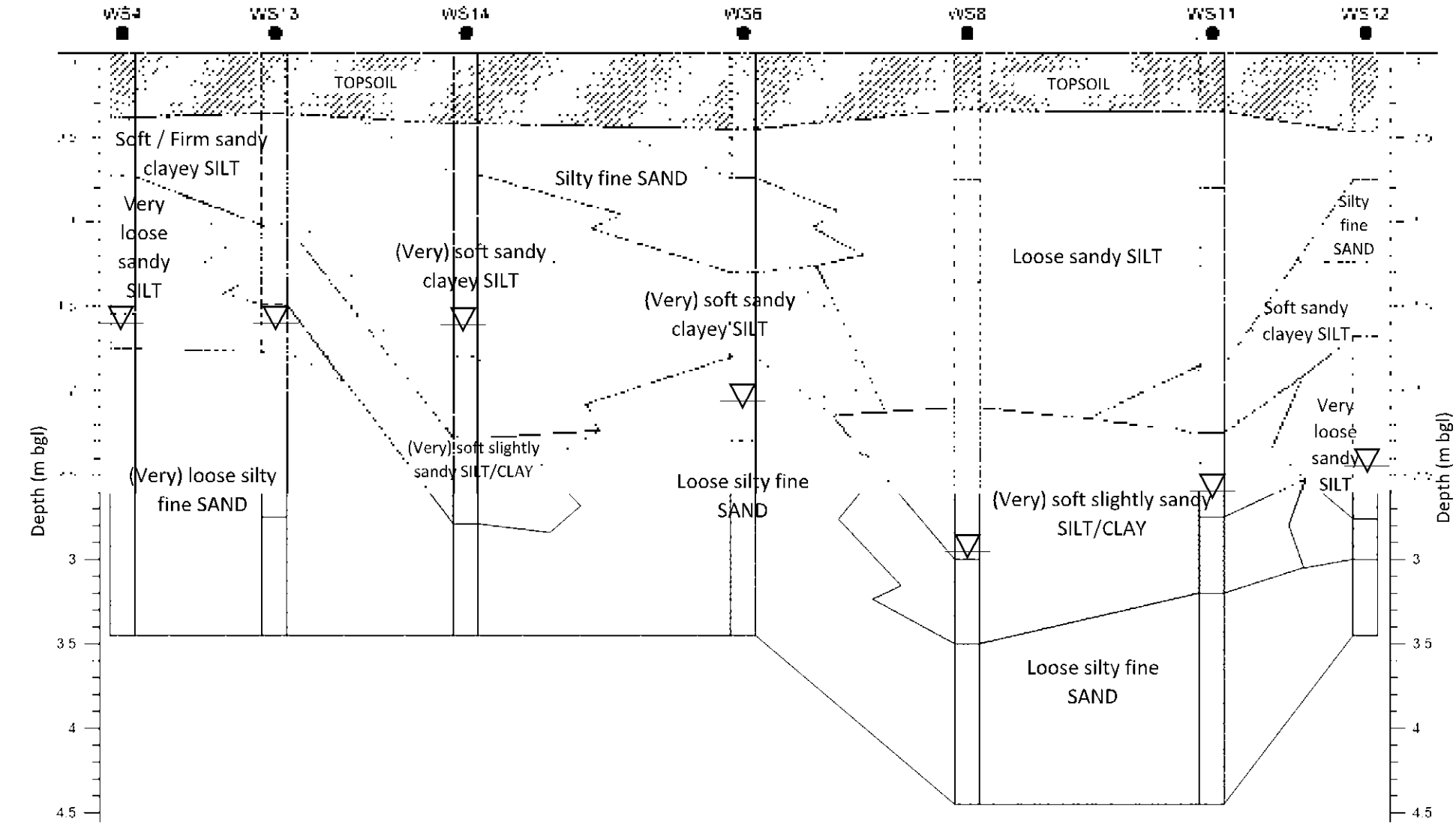
Drawing Title: **Shallow SPT results**
Drawing No.: 1197-5350-SI-05 *Revision:* 0
Site: Land off Seagate Rd, Long Sutton
Client: D Brown Building Contractors Ltd
Project No.: 1197/5350/P
Date: 10/03/2020



Site location plan *Date copied:* 22 Feb 2021 *Source:* openstreetmap.org



Aerial photograph: 1 *Date copied:* 22 Feb 2021 *Source:* Google Maps



Notes:

1. Do not scale
2. Strata boundaries and locations are inferred and approximate only
3. Strata descriptions are generic and unlikely to represent whole strata

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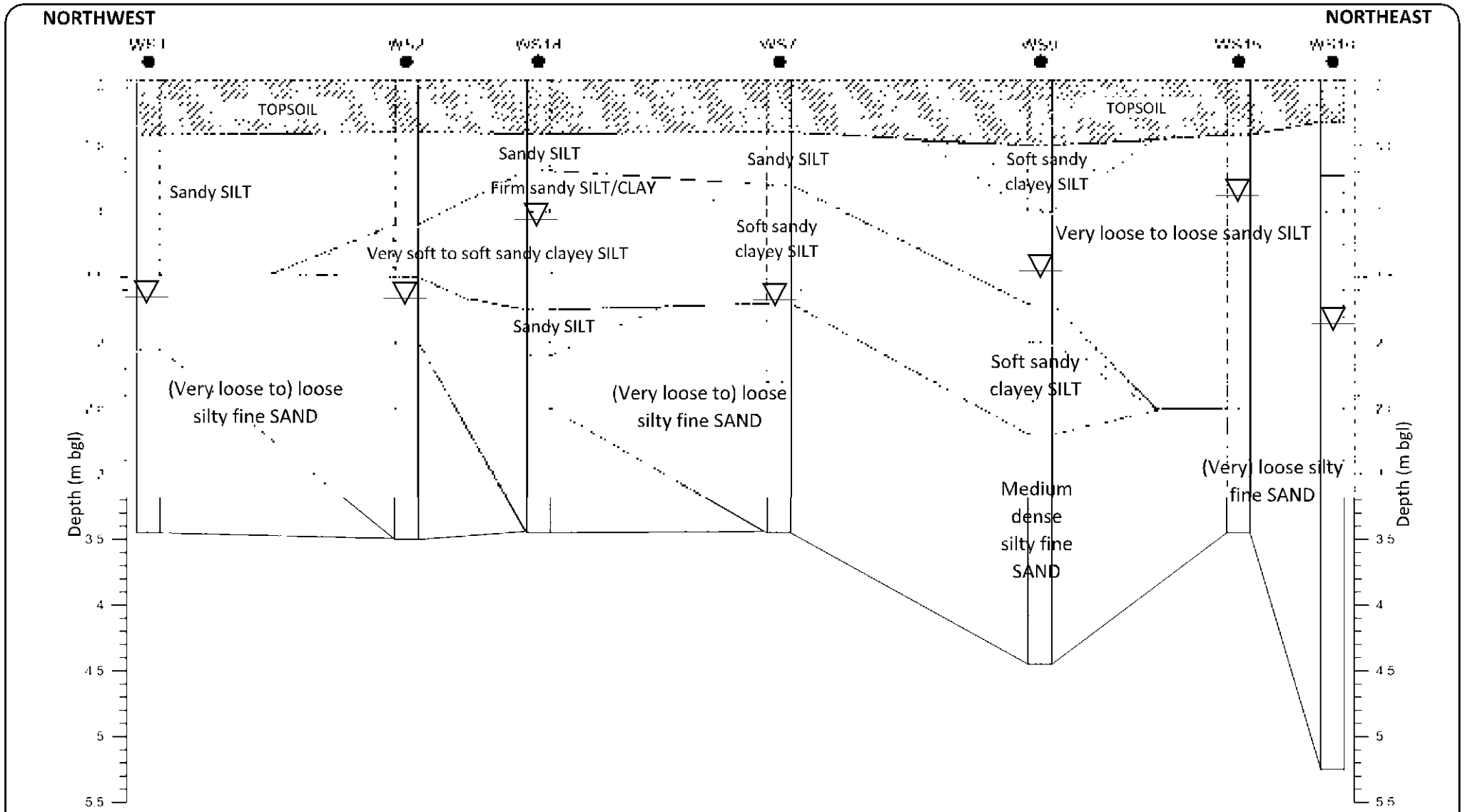
Drawing Title: **Cross-section of sub-strata 1**
Drawing No.: 1197-5350-SI-02 *Revision:* 0
Site: Land off Seagate Rd, Long Sutton
Client: D Brown Building Contractors Ltd
Project No.: 1197/5350/P
Date: 10/03/2020



Notes:

1. Do not scale
2. Strata boundaries and locations are inferred and approximate only
3. Strata descriptions are generic and unlikely to represent whole strata

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Drawing Title: **Cross-section of sub-strata 2**
Drawing No.: 1197-5350-SI-03 *Revision:* 0
Site: Land off Seagate Rd, Long Sutton
Client: D Brown Building Contractors Ltd
Project No.: 1197/5350/P
Date: 10/03/2020

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Description: Inside of TP15

Camera position:

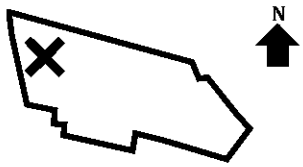

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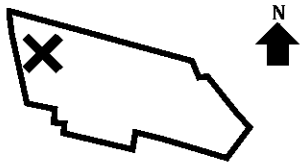
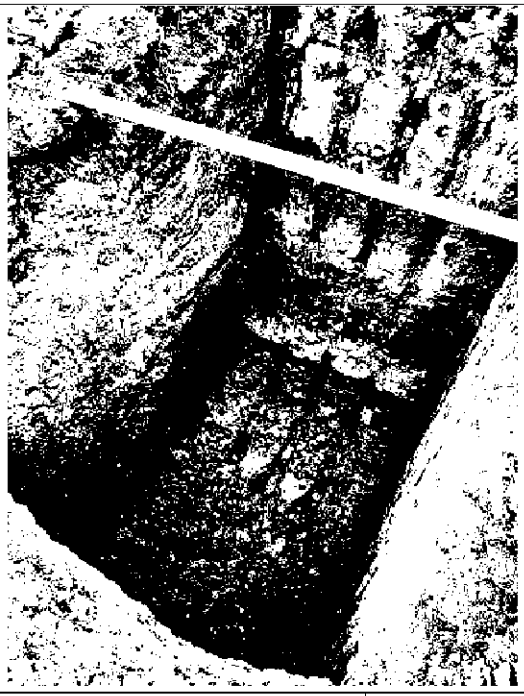
Photo direction: Southeast
Description: Spoil from TP15

Camera position:





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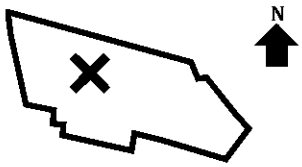


Photo: 4 *Date:* 10 Dec 2021
Photo direction: Southeast
Description: Inside of TP22 (during percolation testing)

Camera position:

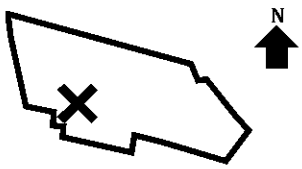


Photo: 5 *Date:* 10 Dec 2021
Photo direction: Southeast
Description: Spoil from TP22

Camera position:

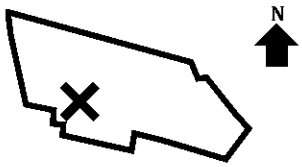


Photo: 6 *Date:* 10 Dec 2021
Photo direction: -
Description: Inside of TP28 (during percolation testing)

Camera position:

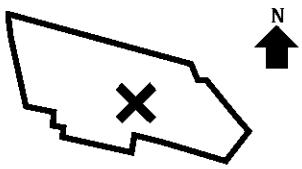


Photo: 7 *Date:* 10 Dec 2021
Photo direction: Southeast
Description: Inside of TP28

Camera position:

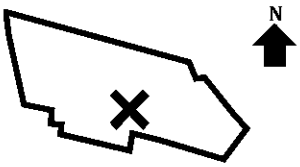


Photo: 8 *Date:* 10 Dec 2021
Photo direction: Southeast
Description: Inside of TP33

Camera position:

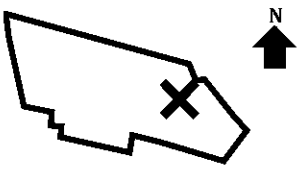


Photo: 9 *Date:* 10 Dec 2021
Photo direction: Southeast
Description: Inside of TP33

Camera position:

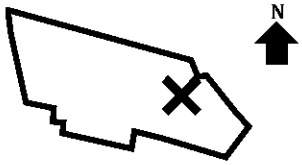


Photo: 10 *Date:* 10 Dec 2021
Photo direction: Southeast
Description: Inside of TP36

Camera position:

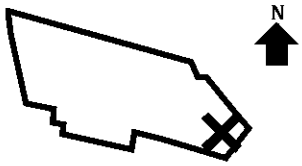
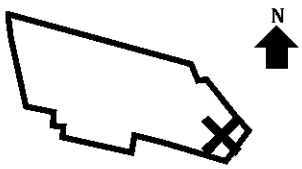


Photo: 11 *Date:* 10 Dec 2021
Photo direction: Southeast
Description: Spoil from TP36

Camera position:



Appendix B

Exploratory hole logs

HUMBERSIDE MATERIALS LABATORY Ltd.
Atherton Way, Brigg
North Lincs DN20 8AR
Tel & Fax 01652 652753

email info@humbersidematerialslab.co.uk

BOREHOLE LOG

Borehole No BH1

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 27-Jan-21

Coordinates E: N:
Elevation :-
Excavated by :- Shell & Auger
Drilled by :- SIS

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples		Water level & well	SPT / SH DCP	Notes
0	Dark brown sandy SILT/CLAY with occasional rootlets. Sand is fine. (TOPSOIL) 0.4	0	0.40					
2	Soft brown slightly sandy silty CLAY with occasional thin beds of greyish brown sandy SILT. 2.5	2	2.10			2.5m: after 16 hours at 10.8m hole depth		
	Very soft grey slightly sandy silty CLAY. Sand is fine. 4	4	1.50					
4	Grey silty fine to medium SAND	4						
6		6	6.00	1	B			
8		8						
10	10	10					9	SPT at 10.5m: 2,1,0,1,2,6
12	Loose to medium dense grey silty to very silty fine SAND	12					6	SPT at 12.0m: 1,0,1,1,2,3
			6.00				10	SPT at 13.5m: 2,2,3,3,2,2
14		14					11	SPT at 15.0m: 2,3,3,3,2,3
16	16	16						
	Greyish brown very gravelly medium to coarse SAND. Gravel is fine to medium of subrounded stone and angular sea shell fragments. 16.8		0.80	6	B		26	SPT at 17.0m: 4,4,4,6,7,9
18	Stiff greenish brown slgihtly sandy silty CLAY with occasional subrounded to subangular fine to medium chalk gravel.	18		7,SS	8,B			
			4.70	9	SS		35	SPT at 18.5m: 5,6,7,9,9,10
20		20		10	SS		40	SPT at 20.0m: 6,6,8,8,10,14
	21.5							
22		22		11	SS		48	SPT at 21.5m: 8,9,11,10,12,15

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-21.5
Casing depth :- 18

File Ref :- 1197/ 5350
Logged by :- R Lester

HUMBERSIDE MATERIALS LABATORY Ltd.
Atherton Way, Brigg
North Lincs DN20 8AR
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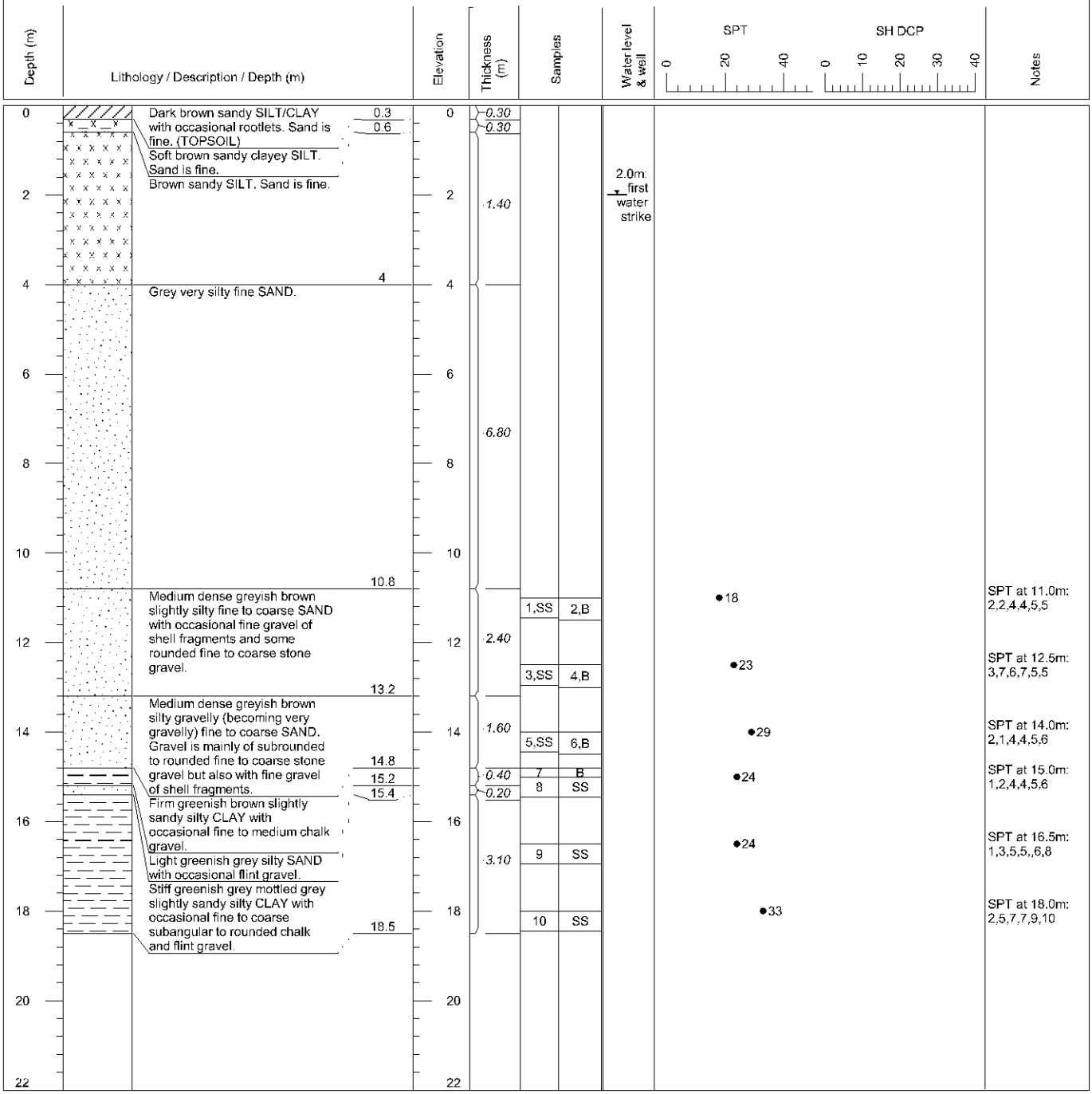
BOREHOLE LOG

Borehole No **BH2**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 01-Feb-21

Coordinates E: N:
Elevation :-
Excavated by :- Shell & Auger
Drilled by :- SIS



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-18.5
Casing depth :- 16

File Ref :- 1197/ 5350
Logged by :- R Lester

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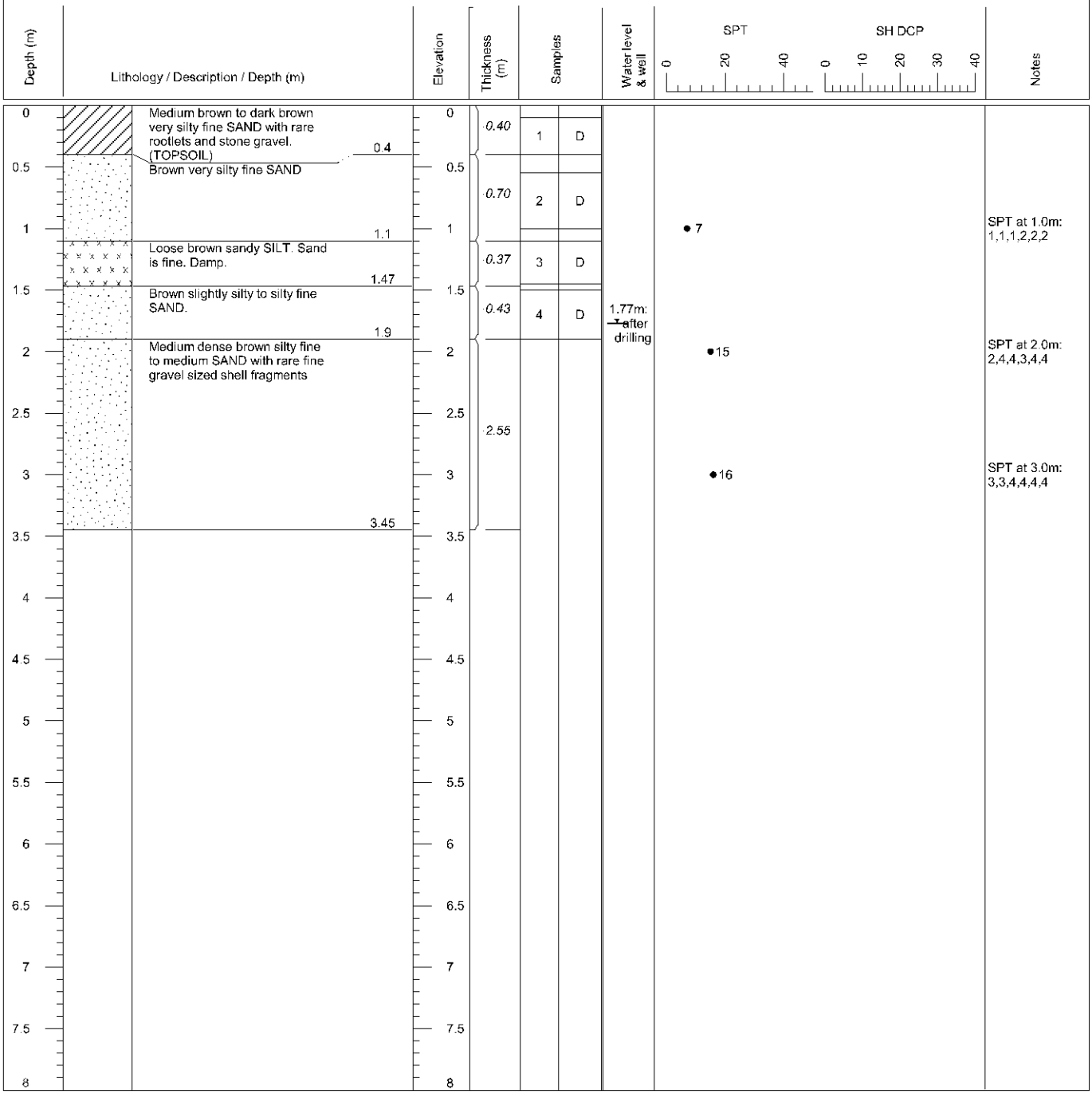
BOREHOLE LOG

Borehole No **WS1**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543712 N: 322398
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No **WS2**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543634 N: 322377
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Thickness (m)	Samples		Water level & well	SPT / SH DCP	Notes
0	Medium brown to dark brown very silty fine SAND with rare rootlets and stone gravel. (TOPSOIL)	0.40	1	D			
0.4	Brown sandy SILT. Sand is fine	0.70	2	D			
1.1	Very soft to soft brown sandy clayey SILT. Sand is fine. Damp.	0.40	3	D		1	SPT at 1.0m: 1,0,0,0,0,1
1.5	Brown silty fine SAND.	0.50	4	D	1.65m: after drilling		
2	Loose to medium dense (becoming loose) brown silty fine to medium SAND with rare fine gravel sized shell fragments	1.50				10	SPT at 2.0m: 2,2,3,2,3,2
3.5						7	SPT at 3.0m: 3,2,2,2,1,2

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No WS3

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543540 N: 322408
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples	Water level & well	SPT / SH DCP	Notes
0	Medium brown to dark brown very silty fine SAND with rare rootlets and stone gravel. (TOPSOIL) 0.42	0	0.42	1 D			
0.5	Loose brown sandy SILT. Sand is fine. Damp below 1.2m.	0.5					
1		1	1.06	2 D		6	SPT at 1.0m: 2,1,2,1,1,2
1.5	1.48 Brown very silty fine SAND.	1.5			1.63m: ~~after~~ drilling		
2	2.05 (Very loose to) loose greyish brown very silty fine to medium SAND.	2	0.47	3 D		4	SPT at 2.0m: 2,1,1,1,1,1
2.5		2.5	0.40	4 D			
3		3				5	SPT at 3.0m: 1,1,1,1,2,1
3.5	3.45	3.5					
4		4					
4.5		4.5					
5		5					
5.5		5.5					
6		6					
6.5		6.5					
7		7					
7.5		7.5					
8		8					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No **WS4**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543550 N: 322298
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Thickness (m)	Samples	Water level & well	SPT / SH DCP	Notes
0	Medium brown to dark brown very silty fine SAND with rare rootlets. (TOPSOIL) 0.38	0.38	1 D			
0.5	Soft to firm brown mottled grey sandy clayey SILT with rare rootlets. Sand is fine. 0.73	0.35	2 D			
1	Very loose brown sandy SILT. Sand is fine. Damp below 1.1m.	0.82	3 D		● 2	SPT at 1.0m: 1,1,0,0,0,2
1.5	1.55			1.60m: after drilling		
	Brown sandy SILT. Sand is fine. 1.75	0.20				
2	Very loose becoming loose greyish brown very silty fine to medium SAND.		4 D		● 1	SPT at 2.0m: 0,0,0,1,0,0
2.5		1.70				
3					● 7	SPT at 3.0m: 1,2,2,1,2,2
3.5	3.45					
4						
4.5						
5						
5.5						
6						
6.5						
7						
7.5						
8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No
WS5

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543644 N: 322227
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples		Water level & well	SPT / SH DCP	Notes
0	Medium brown to dark brown very silty fine SAND with rare rootlets. (TOPSOIL) 0.45	0	0.45	1	D			
0.5	Brown sandy SILT with rare rootlets. Sand is fine. 0.6	0.5	0.15					
	Soft to firm friable brown mottled grey sandy clayey SILT with rare rootlets. Sand is fine. 0.9		0.30	2	D			
1	Loose brown sandy SILT. Sand is fine.	1	0.60	3	D		● 6	SPT at 1.0m: 1,1,1,2,2,1
1.5	1.5	1.5						
	Greyish brown sandy SILT. Sand is fine. 1.9		0.40	4	D	1.88m: ▼ after drilling		
2	Loose (becoming very loose to loose) greyish brown very silty fine to medium SAND.	2					● 5	SPT at 2.0m: 0,0,1,1,1,2
2.5		2.5	1.55	5	D			
3		3					● 4	SPT at 3.0m: 0,0,0,0,2,2
3.5	3.45	3.5						
4		4						
4.5		4.5						
5		5						
5.5		5.5						
6		6						
6.5		6.5						
7		7						
7.5		7.5						
8		8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No
WS6

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543780 N: 322227
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples		Water level & well	SPT / SH DCP	Notes
0	Dark greyish brown very silty fine SAND with rare rootlets and rare brick fragments. (TOPSOIL) 0.45	0	0.45	1	D			
0.5	Light brown sandy SILT. Sand is fine. 0.74	0.5	0.29					
1	(Possibly very loose to loose) brown mottled grey friable very clayey fine SAND. Becoming damp at 1.1m. 1.3	1	0.56	2	D		SPT: 2	SPT at 1.0m: 1,0,1,0,1,0
1.5	Very soft to soft brown mottled grey clayey SILT. Sand is fine. 1.8	1.5	0.50	3	D			
2	(Probably loose) brown very silty fine SAND. 2.3	2	0.50	4	D	2.06m: ▼ after drilling	SPT: 7	SPT at 2.0m: 1,2,2,1,2,2
2.5	Loose greyish brown silty fine to medium SAND.	2.5		5	D			
3	3.45	3	1.15				SPT: 6	SPT at 3.0m: 1,1,2,2,1,1
3.5		3.5						
4		4						
4.5		4.5						
5		5						
5.5		5.5						
6		6						
6.5		6.5						
7		7						
7.5		7.5						
8		8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No
WS7

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543757 N: 322334
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples		Water level & well	SPT / SH DCP	Notes
0	Medium brown to dark brown sandy SILT with rare rootlets. Sand is fine. (TOPSOIL) 0.4	0	0.40	1	D			
0.5	Light brown sandy SILT. Sand is fine. 0.8	0.5	0.40					
1	Soft brown mottled grey sandy clayey SILT. Sand is fine. Becoming damp at 1.1m. 1.7	1	0.90	2	D		4	SPT at 1.0m: 1,0,0,1,1,2
1.5		1.5				1.66m: ▼ after drilling		
2	(Probably very loose to loose) brown very silty fine SAND. 2.3	2	0.60	3	D		4	SPT at 2.0m: 0,1,1,0,1,2
2.5	Very loose to loose greyish brown silty fine to medium SAND.	2.5	1.15	4	D			
3	3.45	3					5	SPT at 3.0m: 0,1,1,1,1,2
3.5		3.5						
4		4						
4.5		4.5						
5		5						
5.5		5.5						
6		6						
6.5		6.5						
7		7						
7.5		7.5						
8		8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No **WS8**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543871 N: 322240
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Thickness (m)	Samples	Water level & well	SPT / SH DCP	Notes
0	Medium to dark greyish brown very silty fine SAND with occasional rootlets and rare fine gravel. (TOPSOIL) 0.34	0.34	1 D			
0.5	Brown sandy SILT with rare dark blackish grey fine gravel of possible lignite 0.75	0.41				
1	Loose light brown sandy SILT. Sand is fine. 1.35	0.60	2 D		9	SPT at 1.0m: 2,3,2,2,2,3
1.5	Brown slightly sandy to sandy SILT. Sand is fine. Becoming damp at 1.9m.	0.75	3 D			
2	2.1				0	SPT at 2.0m: 0,0,0,0,0,0
2.5	Very soft to soft brown sandy SILT/CLAY. Sand is fine.	0.90	4 D			
3	3			2.95m: ▼ after drilling	0	SPT at 3.0m: 0,0,0,0,0,0
3.5	Very soft slightly organic dark bluish grey slightly sandy SILT/CLAY. Organic matter is amorphous peat. 3.5	0.50	5 D			
4	Loose to medium dense brown very silty fine SAND.	0.95	6 D		10	SPT at 4.0m: 1,1,2,2,3,3
4.5	4.45					
5						
5.5						
6						
6.5						
7						
7.5						
8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-4.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

HUMBERSIDE MATERIALS LABATORY Ltd.
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North Lincs DN20 8AR
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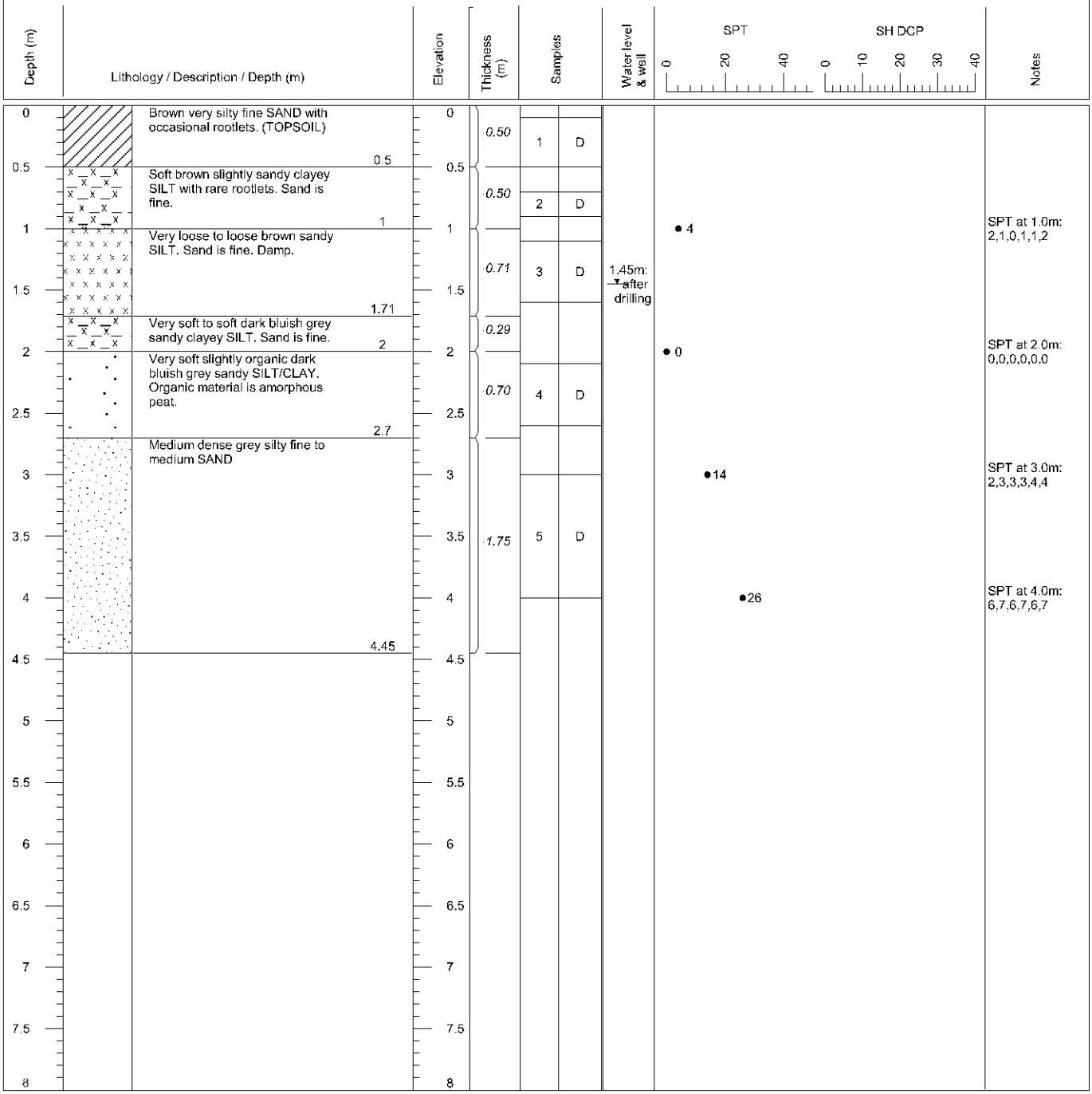
BOREHOLE LOG

Borehole No WS9

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 09-Dec-20

Coordinates E: 543857 N: 322332
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-4.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No
WS10

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 11-Dec-20

Coordinates E: 543955 N: 322285
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Thickness (m)	Samples	Water level & well	SPT / SH DCP	Notes
0	Medium to dark brown sandy (locally clayey) SILT with occasioanl rootlets. Sand is fine. (TOPSOIL) 0.32	0.32	1 D			SH DCP testing began adjacent to WS10 at ground level
0.5	Brown sandy to very sandy SILT with rare rootlets. Sand is fine. 0.73	0.41	2 D			
1	Light brown sandy SILT. Sand is fine. 1	0.27			5	SPT at 1.0m: 1,1,1,1,2,1
1.5	Loose brown sandy to very sandy SILT. Sand is fine. Damp. 1.8	0.80	3 D			
2	Very loose to loose brown sandy SILT. 2.5	0.70	4 D	1.85m: after drilling	4	SPT at 2.0m: 0,0,1,1,1,1
2.5	Brown silty to very silty fine SAND. 2.9	0.40				
3	Very loose becoming loose grey silty to very silty fine SAND.		5 D		2	SPT at 3.0m: 0,0,0,1,0,1
4		2.35			6	SPT at 4.0m: 0,1,2,1,1,2
4.5						
5	5.25				5	SPT at 4.8m: 0,1,1,1,1,2
5.5						
6						
6.5						
7						SH DCP testing ended at a depth of 7.0m bgl
7.5						
8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-5.25
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No
WS11

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 11-Dec-20

Coordinates E: 543950 N: 322178
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples	Water level & well	SPT / SH DCP	Notes
0	Medium brown to dark brown very silty fine SAND with occasional rootlets. (TOPSOIL) 0.35	0	0.35	1 D			
0.5	Light brown sandy SILT with rare rootlets. Sand is fine 0.8	0.5	0.45	2 D			
1	Loose brown sandy SILT. Sand is fine	1	1.05	3 D		SPT: 8	SPT at 1.0m: 1,2,2,2,2,2
1.5	1.85	1.5					
2	Soft brown sandy clayey SILT. Sand is fine. 2.25	2	0.40			SPT: 0	SPT at 2.0m: 0,0,0,0,0,0
2.5	Very soft to soft slightly sandy SILT/CLAY. Sand is fine. 2.75	2.5	0.50	4 D	2.60m: ~~after~~ drilling		
3	Very soft to soft probably slightly organic dark bluish grey slighlty sandy SILT/CLAY. Sand is fine. Organic matter is amorphous peat. Faint organic odour. 3.2	3	0.45	5 D		SPT: 6	SPT at 3.0m: 0,0,1,2,1,2
3.5	Grey silty fine to medium SAND.	3.5	1.25	6 D		SPT: 8	SPT at 3.85m: 0,1,1,2,2,3
4		4					
4.5	4.45	4.5					
5		5					
5.5		5.5					
6		6					
6.5		6.5					
7		7					
7.5		7.5					
8		8					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-4.3
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No
WS12

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 11-Dec-20

Coordinates E: 543998 N: 322219
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples		Water level & well	SPT / SH DCP	Notes
0	Medium brown to dark brown very silty fine SAND with occasional rootlets. (TOPSOIL) 0.47	0	0.47	1	D			
0.5	Brown sandy SILT with rare rootlets. Sand is fine. 0.75	0.5	0.28	2	D			
1	Light brown silty fine to medium SAND. 1.24	1	0.49				• 2	SPT at 1.0m: 1,0,1,0,1,0
1.5	Soft brown slighlty sandy to sandy clayey SILT. Sand is fine. 1.68	1.5	0.44	3	D			
2	Very loose brown occasionally with veins of reddish brown sandy to very sandy SILT. Sand is fine. Damp. 2.76	2	1.08	4	D		• 1	SPT at 2.0m: 0,0,0,1,0,0
2.5		2.5				2.45m: ~~▼~~ after drilling		
3	Possibly slighlty organic bluish grey sandy to very sandy SILT. Sand is fine. 3	3	0.24	5	D		• 0	SPT at 3.0m: 0,0,0,0,0,0
3.5	Very loose grey silty fine SAND. 3.45	3.5	0.45					
4		4						
4.5		4.5						
5		5						
5.5		5.5						
6		6						
6.5		6.5						
7		7						
7.5		7.5						
8		8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No
WS13

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 11-Dec-20

Coordinates E: 543608 N: 322275
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples		Water level & well	SPT / SH DCP	Notes
0	Medium to dark brown silty fine SAND with occasional rootlets. (TOPSOIL) 0.36	0	0.36	1	D			
0.5	Soft brown mottled light grey slightly sandy clayey SILT. Sand is fine. 1.02	0.5	0.66	2	D			
1		1					• 2	SPT at 1.0m: 0,0,0,0,1,1
1.5	Soft brown mottled light grey slightly sandy SILT/CLAY. Sand is fine. 1.49	1.5	0.47	3	D	1.60m: ▼ after drilling		
2	Brown sandy SILT. Sand is fine. 1.77	2	0.28	4	D		• 2	SPT at 2.0m: 0,0,1,0,1,0
2.5	Very loose brown slightly silty to silty fine to medium SAND. Damp. 2.75	2.5	0.98					
3	Very loose to loose brownish grey slightly silty to silty fine to medium SAND. Damp. 3.45	3	0.70				• 4	SPT at 3.0m: 0,1,1,1,1,1
3.5		3.5						
4		4						
4.5		4.5						
5		5						
5.5		5.5						
6		6						
6.5		6.5						
7		7						
7.5		7.5						
8		8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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BOREHOLE LOG

Borehole No
WS14

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 11-Dec-20

Coordinates E: 543685 N: 322290
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP

Depth (m)	Lithology / Description / Depth (m)	Elevation	Thickness (m)	Samples		Water level & well	SPT / SH DCP	Notes
0	Medium to dark greyish brown very silty fine SAND with occasional rootlets. (TOPSOIL) 0.42	0	0.42					
0.5	Light brown very silty fine SAND. 0.72	0.5	0.30					
1	(Possibly very soft to soft) brown mottled light grey with occasional reddish brown veins sandy clayey SILT. Damp. 1.8	1	1.08	1	D	1.62m: ▼ after drilling	● 0	SPT at 1.0m: 0,0,0,0,0,0
2	Very soft brown slightly sandy to sandy clayey SILT. Sand is fine. 2.28	2	0.48	2	D		● 0	SPT at 2.0m: 0,0,0,0,0,0
2.5	Very soft grey slightly sandy SILT/CLAY. Sand is fine. 2.79	2.5	0.51	3	D			
3	Very loose grey very silty fine SAND. 3.45	3	0.66	4	D		● 1	SPT at 3.0m: 0,0,0,1,0,0
3.5		3.5						
4		4						
4.5		4.5						
5		5						
5.5		5.5						
6		6						
6.5		6.5						
7		7						
7.5		7.5						
8		8						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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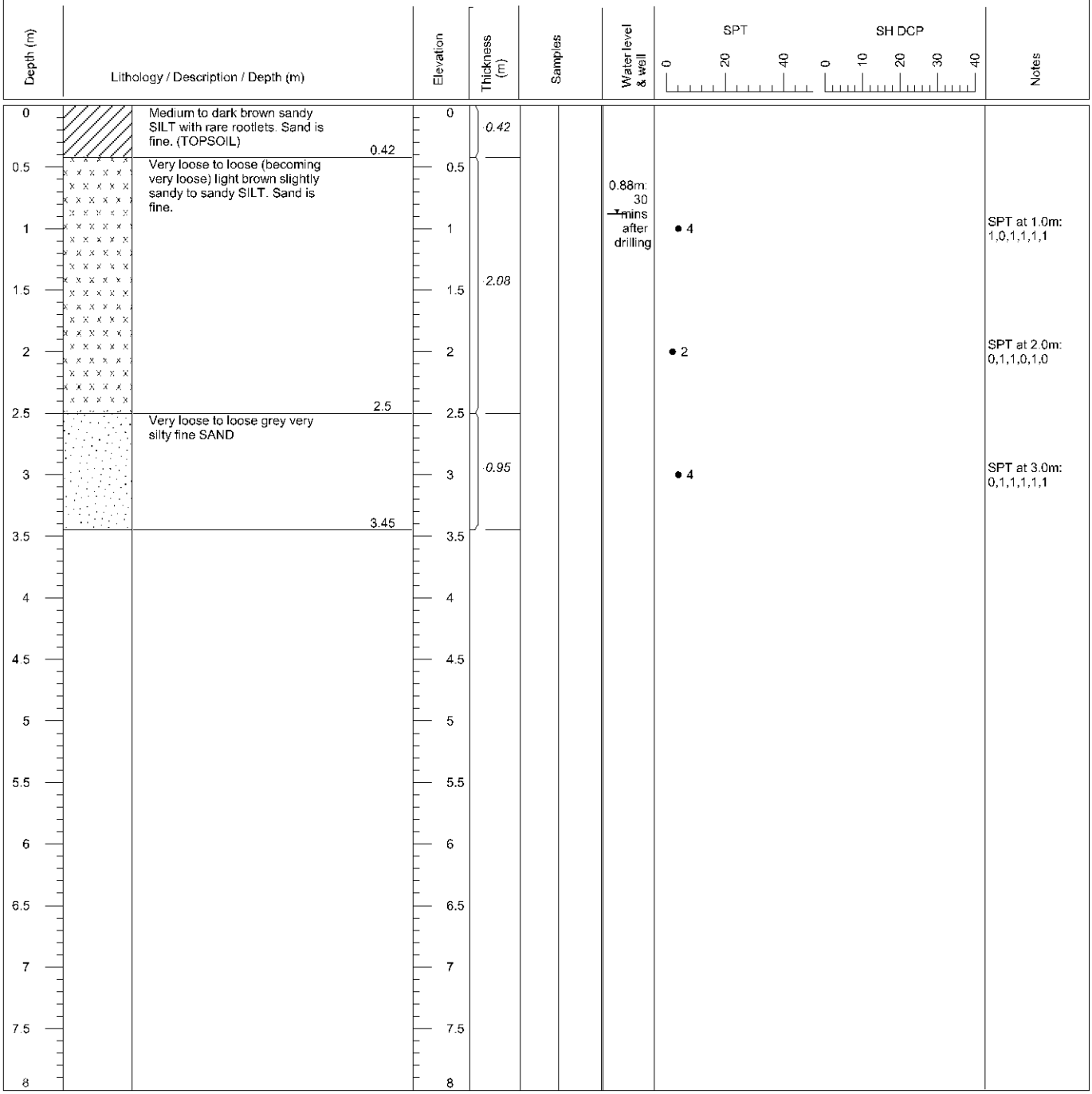
BOREHOLE LOG

Borehole No
WS15

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 21-Jan-21

Coordinates E: 543930 N: 322311
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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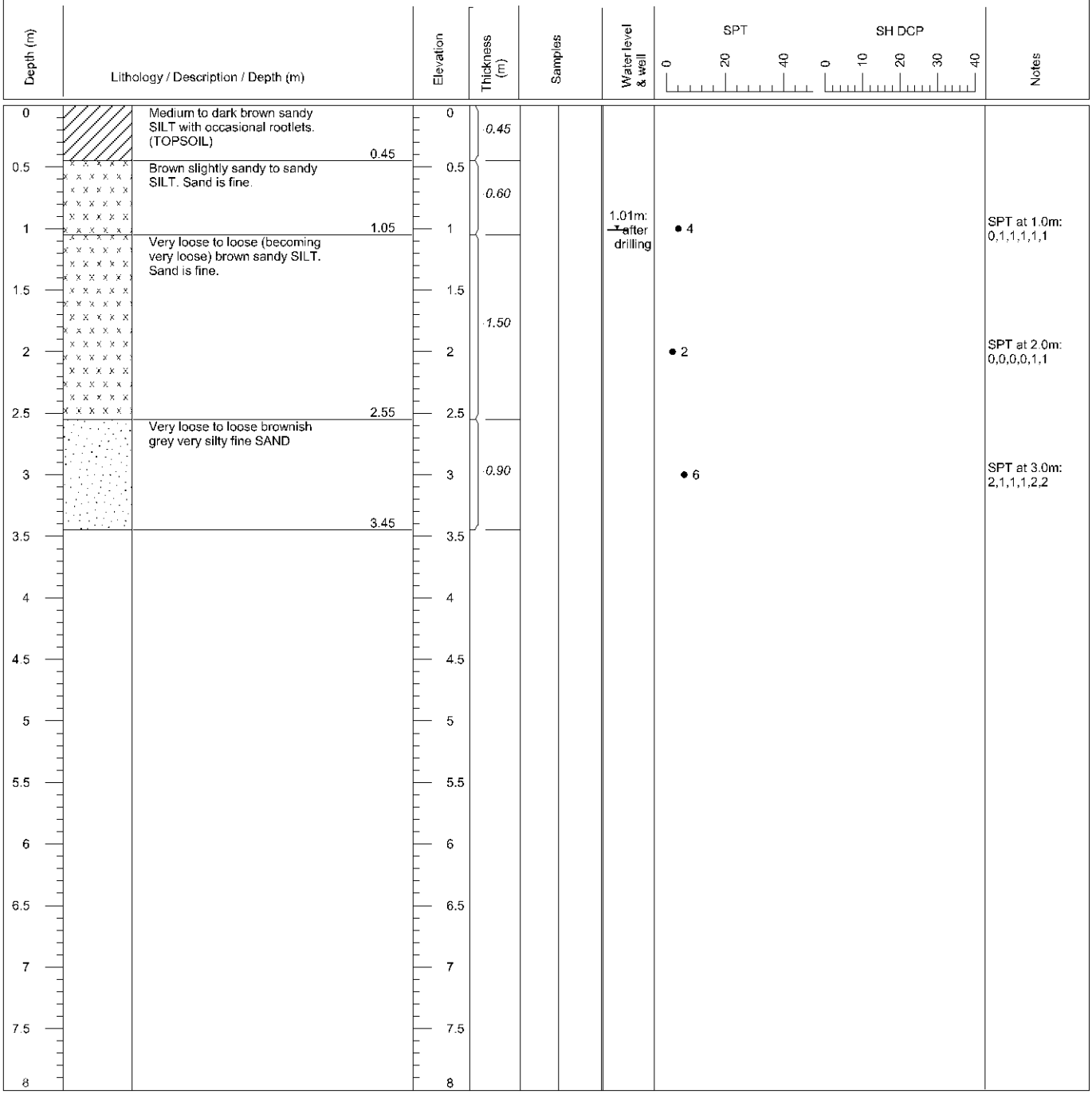
BOREHOLE LOG

Borehole No
WS16

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 21-Jan-21

Coordinates E: 543876 N: 322287
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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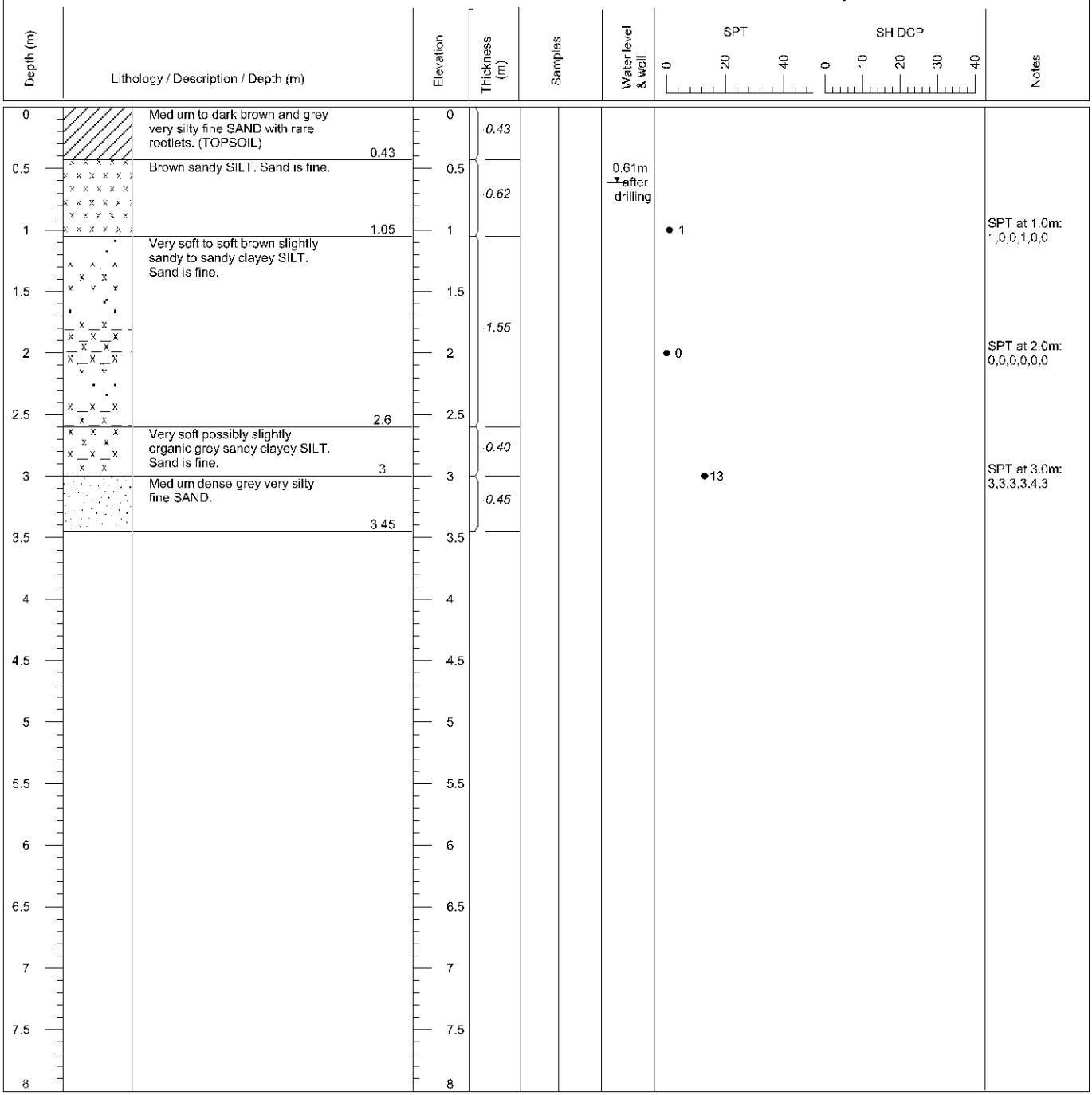
BOREHOLE LOG

Borehole No
WS17

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 21-Jan-21

Coordinates E: 543607 N: 322434
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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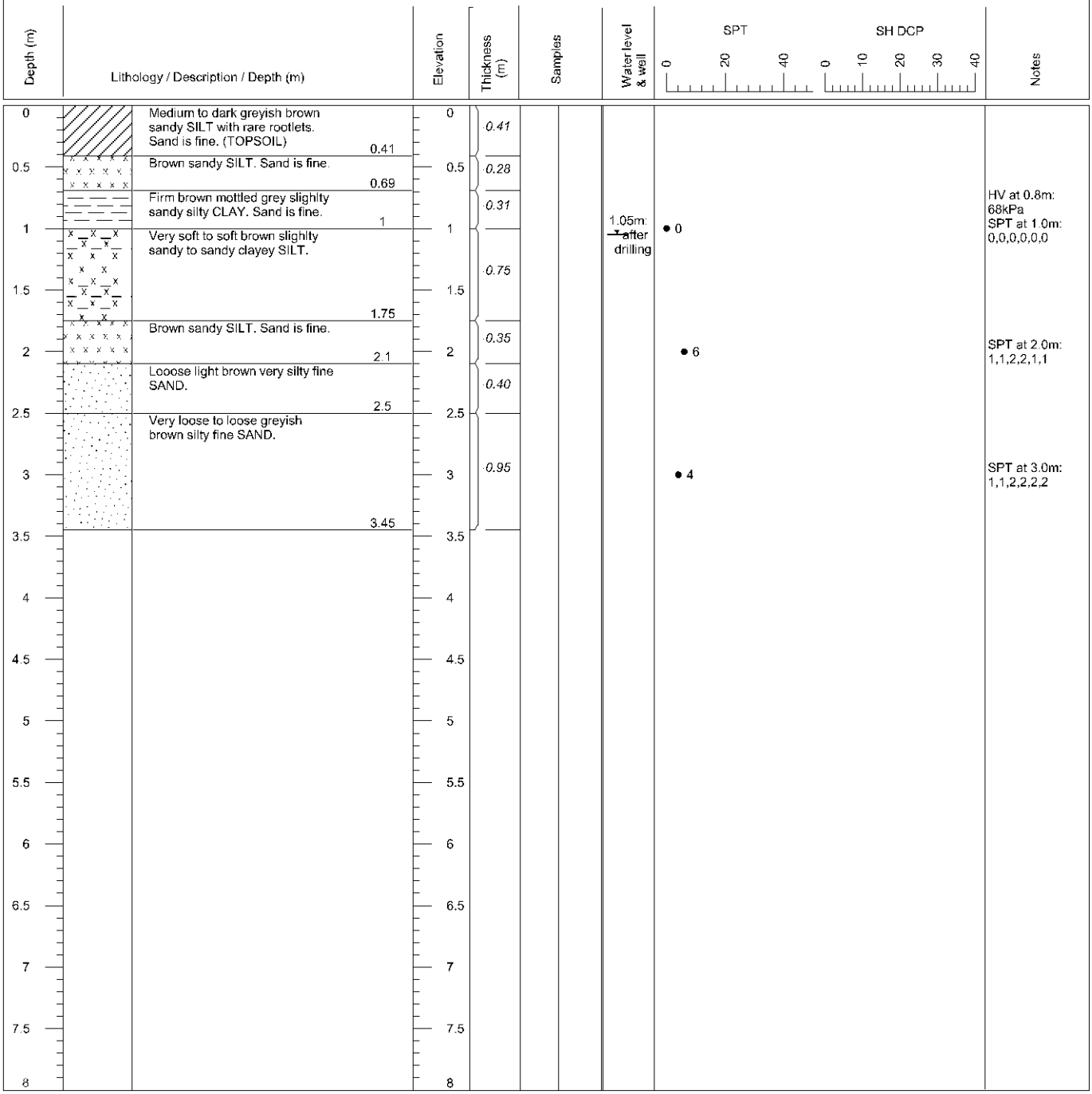
BOREHOLE LOG

Borehole No
WS18

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 21-Jan-21

Coordinates E: 543665 N: 322337
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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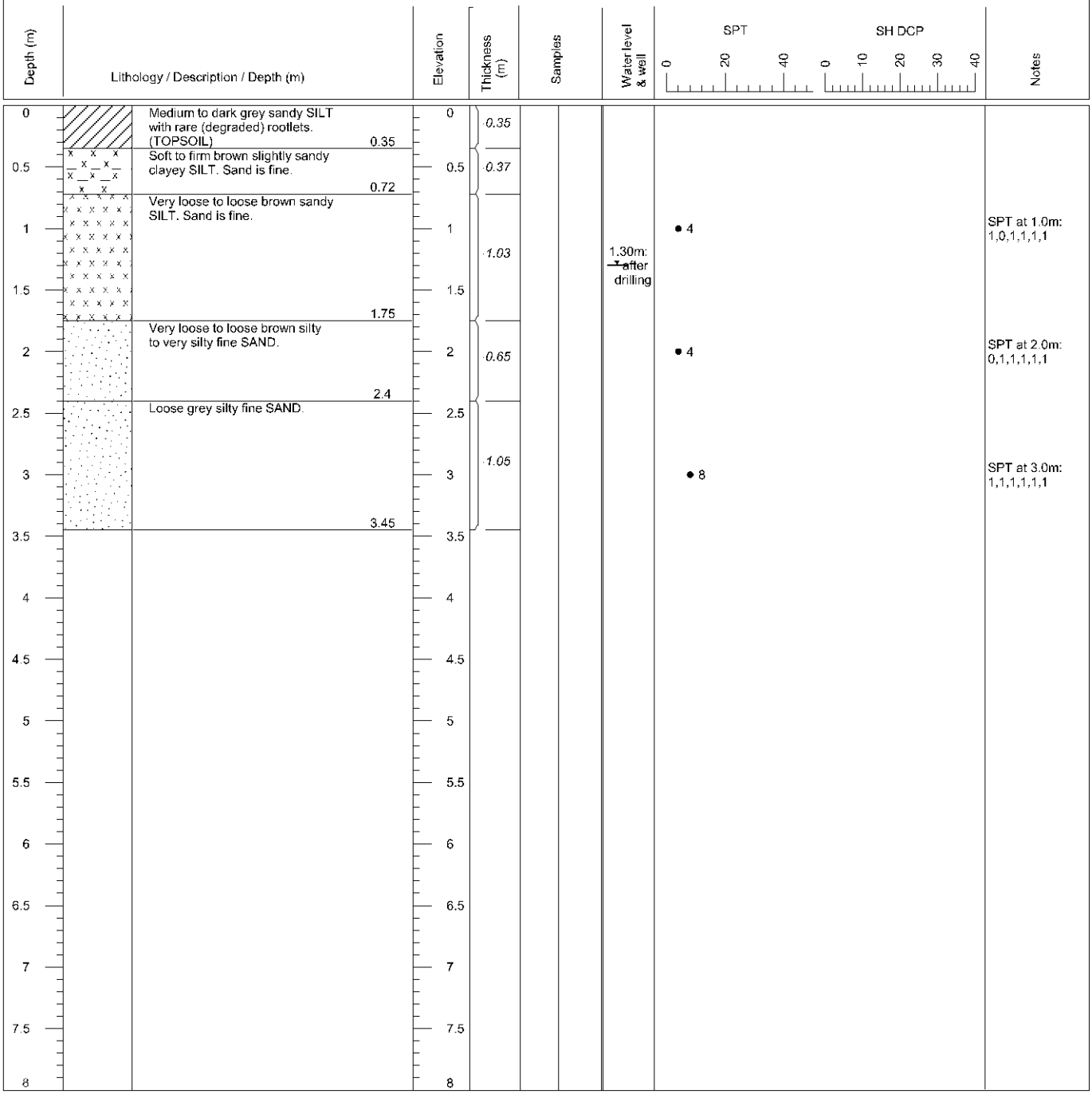
BOREHOLE LOG

Borehole No
WS19

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 21-Jan-21

Coordinates E: 543568 N: 322346
Elevation :-
Excavated by :- Dando Terrier
Drilled by :- RL & MBP



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
U undisturbed
DCP SHDCP
HV Hand Vane

Notes :-

Depth drilled :-3.45
Casing depth :- 0

File Ref :- 1197/ 5350
Logged by :- R Lester

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TRIAL PIT LOG

Trial pit No **TP13**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.31)	0					
0.31	Brown silty fine SAND. (0.1)						
0.41	Firm to stiff brown mottled grey slightly sandy SILT/CLAY. Sand is fine. (0.1)						
0.51	Soft greyish brown mottled orangish brown sandy clayey SILT. (0.49)		1	B			
1							

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP14**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0 – 0.31	Dark brown sandy SILT/CLAY with occasional rootlets. Sand is fine. (TOPSOIL) (0.31)	0 – 0.31					
0.31 – 1	Soft light brown mottled orangish brown sandy clayey SILT. Sand is fine. (0.69)	0.31 – 1	1	B			

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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Trial pit No

TP15

TRIAL PIT LOG

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy SILT/CLAY with occasional rootlets. Sand is fine. (TOPSOIL) (0.17)	0					
0.17	Brown mottled grey sandy SILT locally soft and clayey. Sand is fine.						
			1	B			
	(1.48)						
1.65							

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP16**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples	Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.25)	0				
0.25	Light brown to brown sandy SILT locally soft and clayey. Sand is fine. (0.55)					
0.8	Light brown mottled orangish brown very silty fine SAND. (0.2)		1 B			
1						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP17**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.31)	0					
0.31	Brown sandy SILT. Sand is fine. (0.27)						
0.58	Friable brown mottled grey sandy SILT/CLAY. Sand is fine. (0.37)		1	B			
0.95	Brown mottled grey very silty fine SAND. 1 (0.05)						
1		1					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP18**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.18) 0.18	0					
0.2	Friable brown mottled grey very clayey fine SAND. (0.37) 0.55	0.2					
0.4		0.4					
0.6	Light brown mottled light grey and brown sandy SILT locally soft and clayey. Sand is fine. (0.5) 1.05	0.6	1	B			
0.8		0.8					
1	Soft brown mottled grey sandy clayey SILT. Sand is fine. (0.65) 1.7	1			▼		
1.2		1.2					
1.4		1.4					
1.6		1.6					
1.8		1.8					
2		2					
2.2		2.2					
2.4		2.4					
2.6		2.6					
2.8		2.8					
3		3					
3.2		3.2					
3.4		3.4					
3.6		3.6					
3.8		3.8					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP19**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP20**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown very clayey fine SAND with occasional rootlets. (TOPSOIL) (0.35)	0					
0.35	Brown very silty fine SAND. (0.15)						
0.5	Firm brown mottled grey sandy clayey SILT. Sand is fine. (0.5)		1	B			HV at 0.55m: 159kPa, 174kPa & 159kPa
1							HV at 1.00m: 159kPa, 125kPa & 133kPa

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP21**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown very clayey fine SAND with occasional rootlets. (TOPSOIL) (0.3)	0					
0.3	Brown sandy SILT. Sand is fine. (0.35)	0.3					
0.65	Firm brown mottled grey sandy clayey SILT. Sand is fine. (0.35)	0.65	1	B			
1		1					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP22**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.22)	0					
0.22	Brown sandy SILT. Sand is fine. (0.28)						
0.5	Firm to stiff grey mottled brown sandy clayey SILT. Sand is fine. (0.15)						HV at 0.55m: 143kPa, 117kPa & 140kPa
0.65	Light greyish brown sandy SILT locally soft and clayey. Sand is fine. (0.85)		1	B			
1.5							

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

HUMBERSIDE MATERIALS LABATORY Ltd.
Atherton Way, Brigg
North Lincs DN20 8AR
Tel & Fax 01652 652753

email info@humbersidematerialslab.co.uk

TRIAL PIT LOG

Trial pit No **TP23**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.4)	0					
0.4	Light brown silty fine SAND. (0.15) 0.55	0.4					
0.6	Soft brown mottled orangish brown clayey SILT. Sand is fine. (0.45) 1	0.6	1	B			
1		1					
1.2		1.2					
1.4		1.4					
1.6		1.6					
1.8		1.8					
2		2					
2.2		2.2					
2.4		2.4					
2.6		2.6					
2.8		2.8					
3		3					
3.2		3.2					
3.4		3.4					
3.6		3.6					
3.8		3.8					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP24**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples	Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.3)	0				
0.3	Brown mottled orangish brown sandy SILT locally soft and clayey. (0.7)	0.3	1 B			
1		1				

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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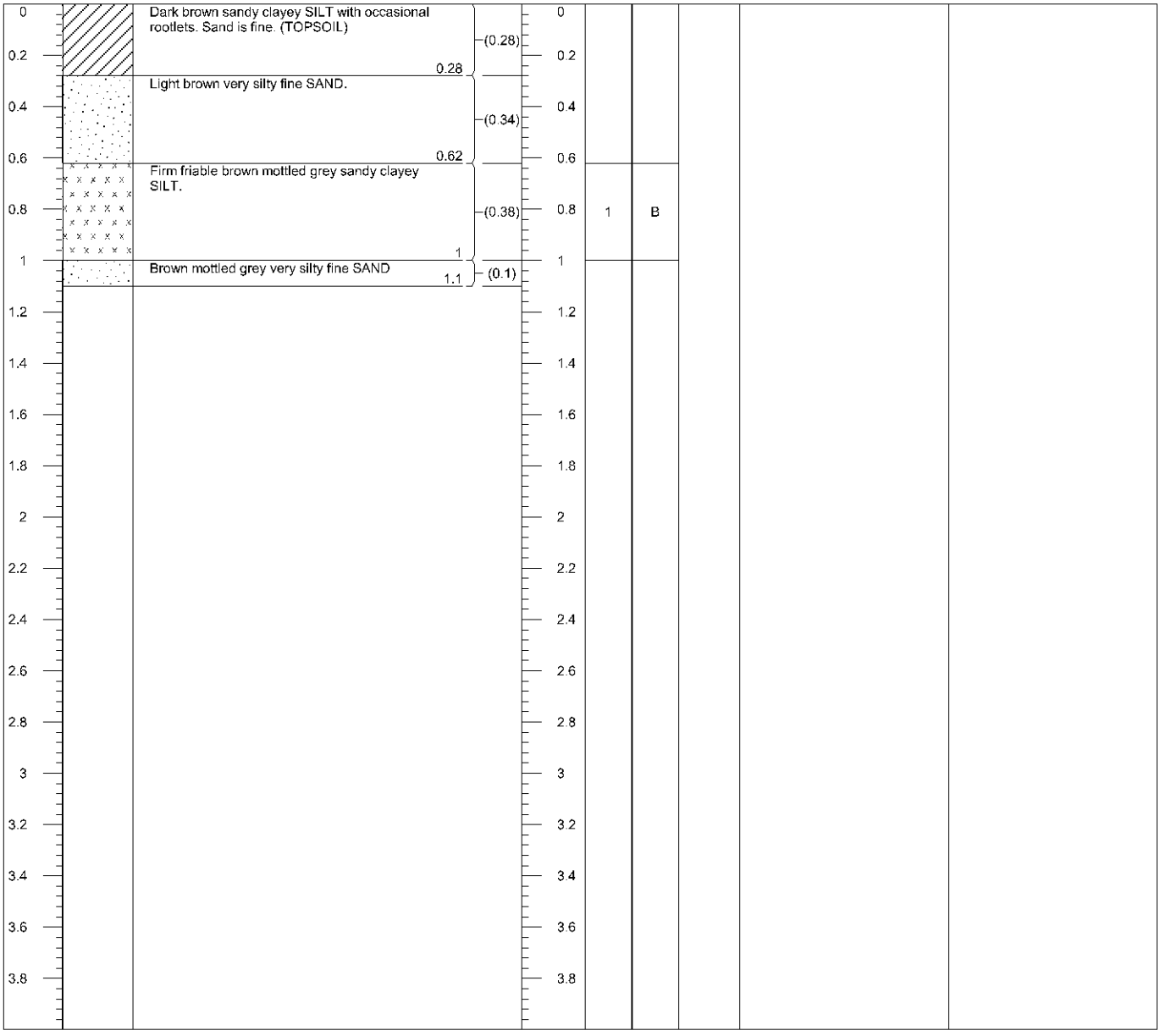
TRIAL PIT LOG

Trial pit No **TP25**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP26**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.31)	0					
0.31	Brown silty fine SAND. (0.34)						
0.65	Brown mottled grey sandy SILT locally soft and clayey. Sand is fine. (0.45)		1	B			
1.1							

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP27**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.32)	0					
0.32	Brown silty fine SAND. (0.2)						
0.52	Brown mottled grey sandy SILT. (0.14)						
0.66	Light brown mottled grey sandy SILT locally soft and clayey. Sand is fine. (0.34)		1	B			
1		1					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP28**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0 – 0.33	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.33)	0 – 0.33					
0.33 – 0.7	Brown sandy SILT. Sand is fine. (0.37)	0.33 – 0.7					
0.7 – 1.3	Brown mottled grey sandy SILT. Sand is fine. (0.6)	0.7 – 1.3	1	B			
1.3 – 1.5	Light greyish brown very clayey fine SAND. (0.2)	1.3 – 1.5					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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Trial pit No

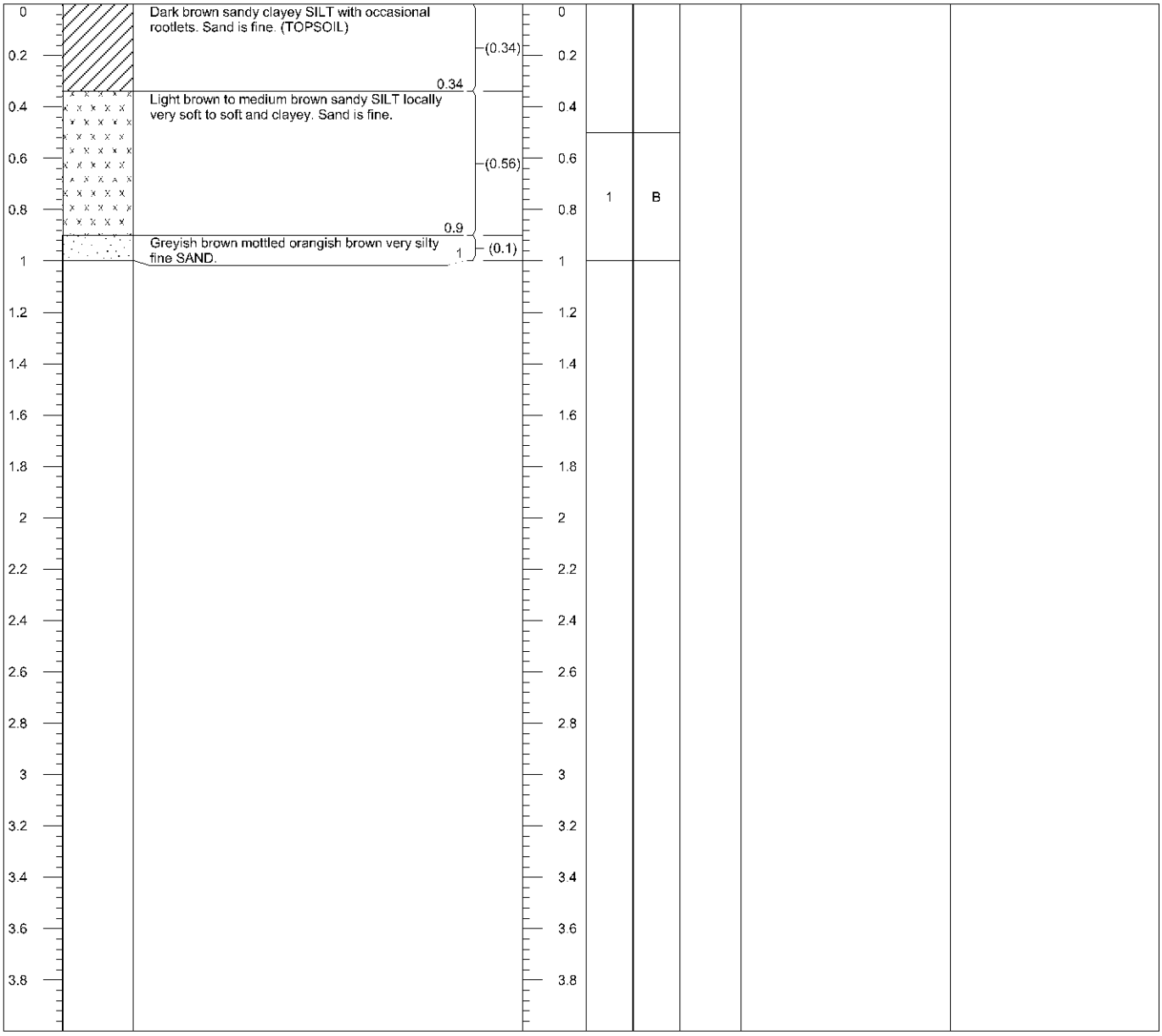
TP29

TRIAL PIT LOG

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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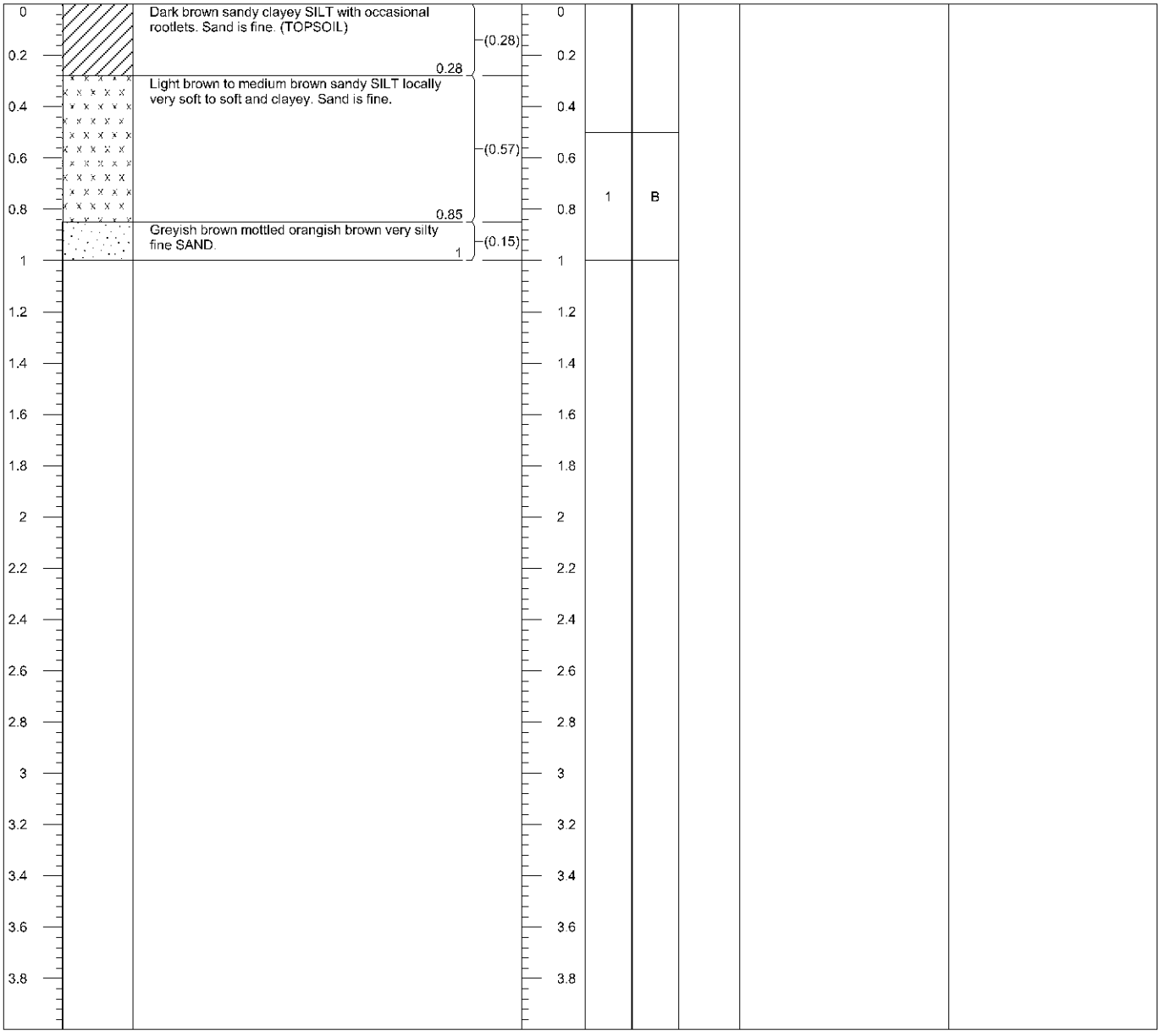
TRIAL PIT LOG

Trial pit No **TP30**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP31**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.3) 0.3	0					
0.4	Light brown to medium brown sandy SILT. Sand is fine. (0.7) 1	0.4	1	B			
1		1					
1.2		1.2					
1.4		1.4					
1.6		1.6					
1.8		1.8					
2		2					
2.2		2.2					
2.4		2.4					
2.6		2.6					
2.8		2.8					
3		3					
3.2		3.2					
3.4		3.4					
3.6		3.6					
3.8		3.8					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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Trial pit No

TP32

TRIAL PIT LOG

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples	Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.36)	0				
0.36	Light brown to medium brown sandy SILT locally soft and clayey. Sand is fine. (0.54)		1 B			
0.9	Greyish brown mottled orangish brown silty fine SAND. (0.1)					
1						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP33**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples	Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.31)	0				
0.31	Light brown to medium brown slightly sandy to sandy SILT. Sand is fine. (1.04)		1 B			
1.35	Brown mottled grey very silty fine SAND. (0.3)					
1.65						

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP34**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples	Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.3)	0				
0.3	Brown sandy locally clayey SILT. Sand is fine. (0.7)	0.3	1 B			
1		1				

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP35**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.33)	0					
0.33	Very soft to soft brown sandy clayey SILT. Sand is fine. (0.37)						
0.7	Light brown very silty fine SAND. (0.3)		1	B			
1		1					

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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North Lincs DN20 8AR
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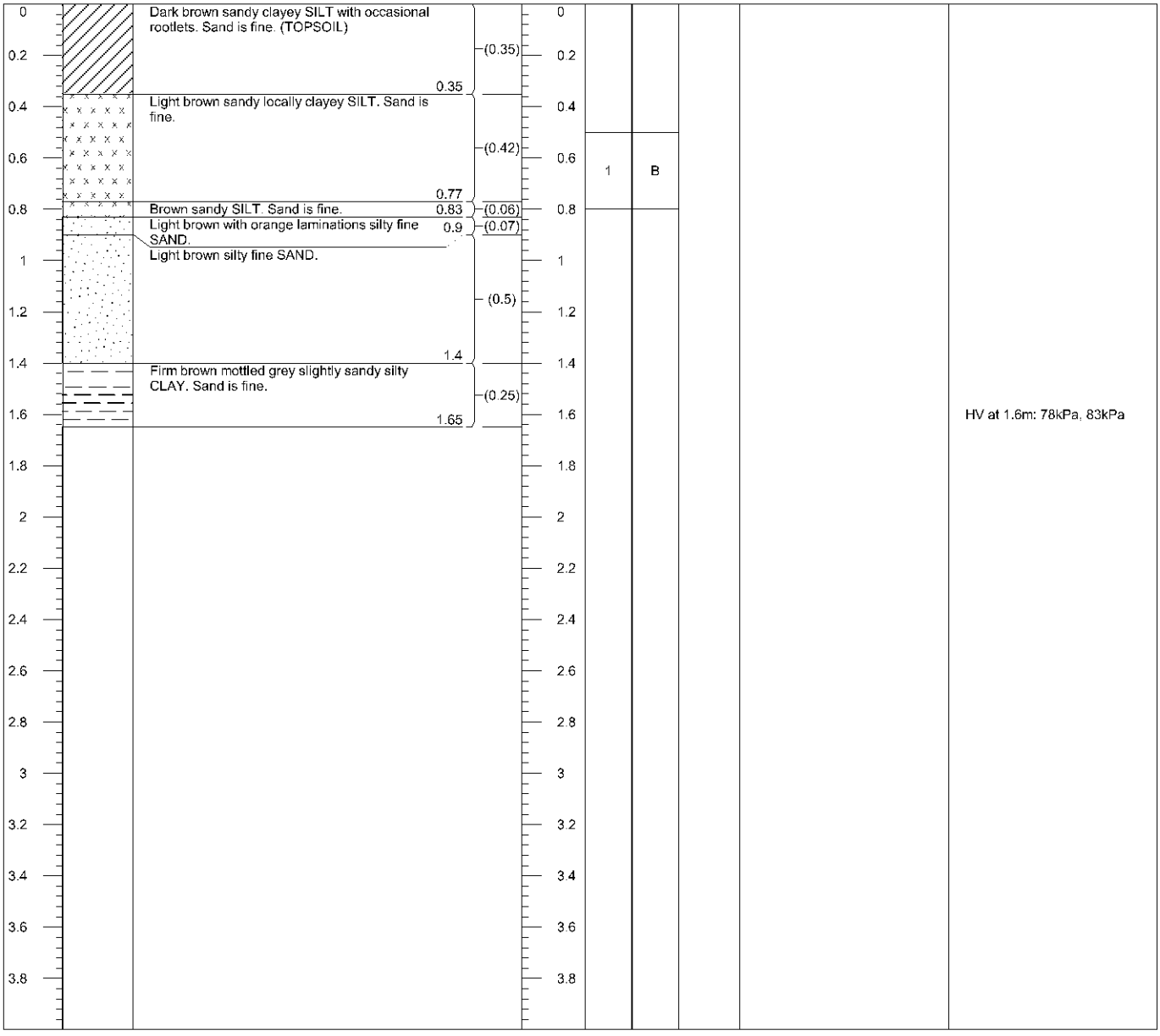
TRIAL PIT LOG

Trial pit No **TP36**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator



Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

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TRIAL PIT LOG

Trial pit No **TP37**

Client :- D Brown Builders Ltd
Site :- Seagate Road, Long Sutton
Project No :- 5350

Location :- see site plan
Date :- 10-Dec-20

Coordinates E: N:
Elevation :-
Excavated by :- Tracked excavator

Depth (m)	Lithology / Description / Depth / (thickness)	Elevation	Samples		Water level	Mackintosh Probe 0 5 10 15 20	Notes
0	Dark brown sandy clayey SILT with occasional rootlets. Sand is fine. (TOPSOIL) (0.35)	0					
0.35	Light brown sandy SILT. Sand is fine. (0.65)						
1		1	1	B			

Sample Key
B Bulk
D Disturbed
W Water
SS Split spoon
C Cone

Notes :-

File Ref :- 1197 / 5350
Logged by :- D Driver

Appendix C

Test results

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North Lincolnshire, DN20 8AR
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e-mail info@humbersidematerialslab.co.uk

1890

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58223 / 01 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location WS8-3
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 09/12/20
Client sample No WS8-3
Sampled by RL & MBP (HML) Sample point
Delivery No Sample Depth 1.4-2.0

Determination of grading
Test method BS EN 933-1: 2012 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	100	0	0	1	100	0	0
31.5	100	0	0	0.5	100	0	0
20	100	0	0	0.25	100	0	0
16	100	0	0	0.125	99	0	0
8	100	0	0	0.063	66.0	0	
4	100	0	0				
2	100	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 08/01/21
Date reported 08/02/21
Date received 09/12/20

Signed :- M.J. Green C. Driver
Director

Test results detailed in this report relate only to the materials submitted to the laboratory.
BS EN 933-1 1997 Test method includes sample reduction passing 20mm test sieve.
Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported
Appropriate methods and sieve sizes have been used where no instruction has been provided

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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58225 / 01 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location WS9-2
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 09/12/20
Client sample No WS9-2
Sampled by RL & MBP (HML) Sample point
Delivery No Sample Depth 0.7-0.9

Determination of grading
Test method BS EN 933-1: 2012 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	100	0	0	1	98	0	0
31.5	100	0	0	0.5	96	0	0
20	100	0	0	0.25	94	0	0
16	100	0	0	0.125	92	0	0
8	100	0	0	0.063	83.2	0	
4	100	0	0				
2	99	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 08/01/21
Date reported 08/02/21
Date received 09/12/20

Signed :- M.J. Green C. Driver
Director

Test results detailed in this report relate only to the materials submitted to the laboratory.
BS EN 933-1 1997 Test method includes sample reduction passing 20mm test sieve.
Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported
Appropriate methods and sieve sizes have been used where no instruction has been provided

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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58226 / 01 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location WS11-3
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 09/12/20
Client sample No WS11-3
Sampled by RL & MBP (HML) Sample point
Delivery No Sample Depth 1.0-1.8

Determination of grading
Test method BS EN 933-1: 2012 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	100	0	0	1	100	0	0
31.5	100	0	0	0.5	100	0	0
20	100	0	0	0.25	100	0	0
16	100	0	0	0.125	99	0	0
8	100	0	0	0.063	45.2	0	
4	100	0	0				
2	100	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 08/01/21
Date reported 08/02/21
Date received 09/12/20

Signed :- M.J. Green C. Driver
Director

Test results detailed in this report relate only to the materials submitted to the laboratory.
BS EN 933-1 1997 Test method includes sample reduction passing 20mm test sieve.
Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported
Appropriate methods and sieve sizes have been used where no instruction has been provided

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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58467 / 01 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location BH1-6
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 02/02/21
Client sample No BH1-6
Sampled by SIS Sample point Bore hole
Delivery No Sample Depth 16.0-16.5

Determination of grading
Test method BS 1377 Part 2 1990 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	100	0	0	1	49	0	0
31.5	99	0	0	0.5	31	0	0
20	94	0	0	0.25	10	0	0
16	93	0	0	0.125	5	0	0
8	87	0	0	0.063	1.3	0	
4	76	0	0				
2	62	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 11/02/21
Date reported 19/02/21
Date received 02/02/21

Signed :- M.J. Green C. Driver
Director

Test results detailed in this report relate only to the materials submitted to the laboratory.
BS EN 933-1 1997 Test method includes sample reduction passing 20mm test sieve.
Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported
Appropriate methods and sieve sizes have been used where no instruction has been provided

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SOIL CLASSIFICATION TESTS

Sample Ref S 58468

Client D Brown Building Cntrcs
Seas End Road
Moulton Seas End
Spalding
Lincolnshire
PE12 6JX

Site Land between Seagate Rd and B1359, Long Sutton
Location BH1-8
Date/Time sampled 02/02/21
Client sample No BH1-8
Sampled by SIS Sample point Bore hole

Trial pit / Bore hole No BH1
Depth of sample 17-18 m Sample type Small Bulk
Description Firm Grey CLAY

comments

Determination of moisture content
Test method BS 1377 Part 2 1990 - Clause 4.4 Single Point / Definitive Method Clause 4.3 (As Below)

Portion No 02
Method Oven dried

% Moisture 18

Determination of liquid limit, Plastic limit and Plasticity index
Test method BS 1377 Part 2 1990

Portion No 01
Test condition Sieved
Method Single point cone pen
% retained 0.425mm sieve 23

Liquid limit 31

% passing 0.425mm sieve 77

Plastic limit 11
Plasticity Index 20

File ref 1197 5350 / P
Date tested 11/02/21
Date reported 26/02/21
Date received 02/02/21

Signed :- M.J. Green C. Driver
Director

Certificates of sampling when submitted are retained by the Laboratory and is available upon request
Samples will normally be kept for 14 days from the date reported

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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58469 / 01 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location BH2-2
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 02/02/21
Client sample No BH2-2
Sampled by SIS Sample point Bore hole
Delivery No Sample Depth 11-11.5

Determination of grading
Test method BS 1377 Part 2 1990 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	100	0	0	1	77	0	0
31.5	100	0	0	0.5	61	0	0
20	94	0	0	0.25	27	0	0
16	93	0	0	0.125	15	0	0
8	92	0	0	0.063	2.9	0	
4	89	0	0				
2	84	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 11/02/21
Date reported 19/02/21
Date received 02/02/21

Signed :- M.J. Green C. Driver
Director

Test results detailed in this report relate only to the materials submitted to the laboratory.
BS EN 933-1 1997 Test method includes sample reduction passing 20mm test sieve.
Certificate of sampling when submitted is retained by the Laboratory and available upon request
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Appropriate methods and sieve sizes have been used where no instruction has been provided

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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58470 / 01 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location BH2-6
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 02/02/21
Client sample No BH2-6
Sampled by SIS Sample point Bore hole
Delivery No Sample Depth 14-14.5

Determination of grading
Test method BS 1377 Part 2 1990 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	91	0	0	1	63	0	0
31.5	83	0	0	0.5	51	0	0
20	81	0	0	0.25	26	0	0
16	78	0	0	0.125	17	0	0
8	75	0	0	0.063	8.4	0	
4	72	0	0				
2	68	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 11/02/21
Date reported 19/02/21
Date received 02/02/21

Signed :- M.J. Green C. Driver
Director

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SOIL CLASSIFICATION TESTS

Sample Ref S 58471

Client D Brown Building Cntrcs
Seas End Road
Moulton Seas End
Spalding
Lincolnshire
PE12 6JX

Site Land between Seagate Rd and B1359, Long Sutton
Location BH2-10
Date/Time sampled 02/02/21
Client sample No BH2-10
Sampled by SIS Sample point Bore hole

Trial pit / Bore hole No BH2
Depth of sample 18-18.45 m Sample type Small Bulk
Description Soft/Firm Grey CLAY with Coarse to fine Chalk Gravels

comments

Determination of moisture content
Test method BS 1377 Part 2 1990 - Clause 4.4 Single Point / Definitive Method Clause 4.3 (As Below)

Portion No 02
Method Oven dried

% Moisture 17

Determination of liquid limit, Plastic limit and Plasticity index
Test method BS 1377 Part 2 1990

Portion No 01
Test condition Sieved
Method Single point cone pen
% retained 0.425mm sieve 7

Liquid limit 38

% passing 0.425mm sieve 93

Plastic limit 9
Plasticity Index 29

File ref 1197 5350 / P
Date tested 11/02/21
Date reported 19/02/21
Date received 02/02/21

Signed :- M.J. Green C. Driver
Director

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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58207 / 02 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location TP28-1
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 10/12/20
Client sample No TP28-1
Sampled by D. Driver Sample point
Delivery No Sample Depth 0.5-1.0

Determination of grading
Test method BS EN 933-1: 2012 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	100	0	0	1	100	0	0
31.5	100	0	0	0.5	99	0	0
20	100	0	0	0.25	98	0	0
16	100	0	0	0.125	97	0	0
8	100	0	0	0.063	52.1	0	
4	100	0	0				
2	100	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 08/01/21
Date reported 08/02/21
Date received 10/12/20

Signed :- M.J. Green C. Driver
Director

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BS EN 933-1 1997 Test method includes sample reduction passing 20mm test sieve.
Certificate of sampling when submitted is retained by the Laboratory and available upon request
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58220 / 01 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location WS3-2
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 09/12/20
Client sample No WS3-2
Sampled by RL & MBP (HML) Sample point
Delivery No Sample Depth 0.6-1.4

Determination of grading
Test method BS EN 933-1: 2012 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	100	0	0	1	98	0	0
31.5	100	0	0	0.5	97	0	0
20	100	0	0	0.25	96	0	0
16	100	0	0	0.125	95	0	0
8	100	0	0	0.063	61.2	0	
4	100	0	0				
2	99	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 08/01/21
Date reported 08/02/21
Date received 09/12/20

Signed :- M.J. Green C. Driver
Director

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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Sample Ref S / 58221 / 01 Client D Brown Building Cntrcs

Site Land between Seagate Rd and B1
Location WS5-3
Material Soil / Sand Material

Supplier Not applicable

Date/Time sampled 09/12/20
Client sample No WS5-3
Sampled by RL & MBP (HML) Sample point
Delivery No Sample Depth 0.9-1.5

Determination of grading
Test method BS EN 933-1: 2012 Wet Sieving method
Tested As recieved

Material Specification
Aggregate n/a

Sieve Size mm	% Passing	Specification		Sieve Size mm	% Passing	Specification	
125	100	0	0			0	0
90	100	0	0			0	0
63	100	0	0			0	0
40	100	0	0	1	96	0	0
31.5	100	0	0	0.5	93	0	0
20	100	0	0	0.25	90	0	0
16	100	0	0	0.125	73	0	0
8	100	0	0	0.063	44.9	0	
4	100	0	0				
2	100	0	0				

Remarks

File ref 1197 / 5350 / P
Date Tested 08/01/21
Date reported 08/02/21
Date received 09/12/20

Signed :- M.J. Green C. Driver
Director

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Linear Shrinkage

Sample Ref **S/58222-01** **Client** D Brown Building Contractors

Site:	Land Between Seagate Road and B1359, Long Sutton
Location:	WS7-2
Material:	Soft Brown sandy SILT
Date sampled:	09/12/2021.
Sampled by:	RL (HML Ltd)
Client sample no.:	WS7-2
Sample depth (m):	0.8-1.5

Linear Shrinkage

Test method BS 1377

Material Passing 0.425mm (%)	-	**100%**
Linear Shrinkage (%)	-	**6.1%**

Comments

Estimated plasticity index = 2.14 x 6.1% = 13% (to 2 s.f.)

File ref	1197/5350
Date tested	09/12/2021.
Date reported	08/02/2021.

Signed: - M.J. Green C. Driver
Director

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Linear Shrinkage

Sample Ref **S/58225-01** **Client** D Brown Building Contractors

Site:	Land Between Seagate Road and B1359, Long Sutton
Location:	WS9-2
Material:	Soft Brown sandy SILT
Date sampled:	09/12/2021.
Sampled by:	RL (HML Ltd)
Client sample no.:	WS9-2
Sample depth (m):	0.7-0.9

Linear Shrinkage

Test method BS 1377

Material Passing 0.425mm (%)	-	**100%**
Linear Shrinkage (%)	-	**8.7%**

Comments

Estimated plasticity index = 2.14 x 6.1% = 19% (to 2 s.f.)

File ref	1197/5350
Date tested	09/12/2021.
Date reported	08/02/2021.

Signed: - M.J. Green C. Driver
Director

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Linear Shrinkage

Sample Ref **S/58466-01** **Client** D Brown Building Contractors

Site:	Land Between Seagate Road and B1359, Long Sutton
Location:	BH1-1
Material:	Grey slightly silty medium Sand
Date sampled:	02/02/2021.
Sampled by:	SIS Ltd
Client sample no.:	BH1-1
Sample depth (m):	4.0-10.0

Linear Shrinkage

Test method BS 1377

Material Passing 0.425mm (%)	-	**100%**
Linear Shrinkage (%)	-	**N/A%**

Comments

No Shrinkage recorded.

File ref	1197/5350
Date tested	03/02/2021.
Date reported	04/03/2021.

Signed: - M.J. Green C. Driver
Director

Certificate of sampling when submitted is retained by the Laboratory and available upon request.
Samples will normally be kept for 14 days from the date reported.

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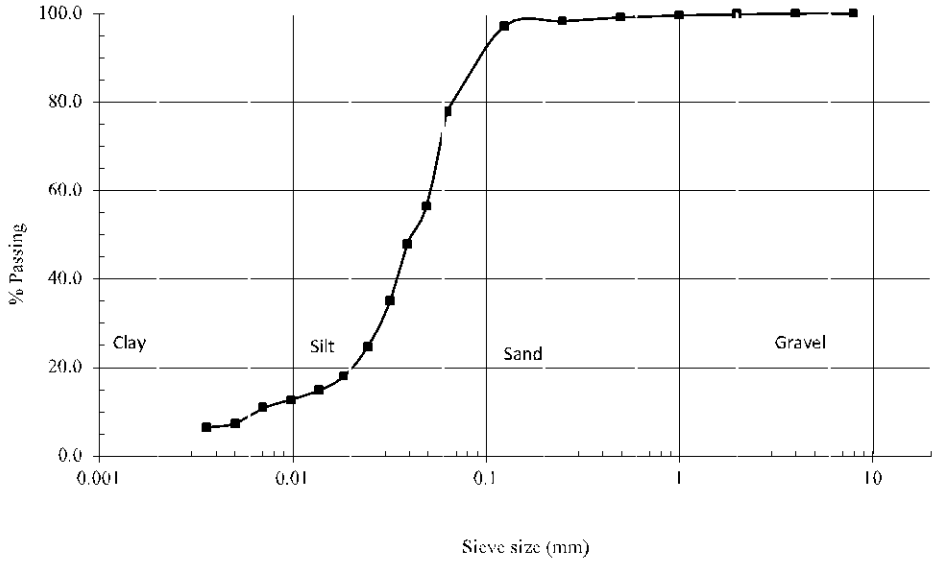
Particle Size Distribution

Sample Ref **S/58194/02** **Client** D Brown Building Contractors

Site	Land Between Seagate Road & B1359, Long Sutton		
Location	WS15-1		
Material	Soft Brown Silt/Clay		
Date/Time sampled	09/12/2021	TP/BH	15
Client sample No	WS15-1	Depth	0.5-1.0
Sampled by	RL (HML Ltd)	Sample Type	Bulk

Determination of Particle size distribution - Sedimentation method

Test method BS 1377 Part 2 1990



	%
Clay	1
Silt	77
Sand	22
Gravel	0

Comments

File ref	1197/5350
Date tested	10/12/2020
Date reported	08/02/2021

Signed M.J. Green C. Driver
Director

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Atherton Way, Brigg
North Lincs, DN21 4DT
Tel & Fax 01652 652753

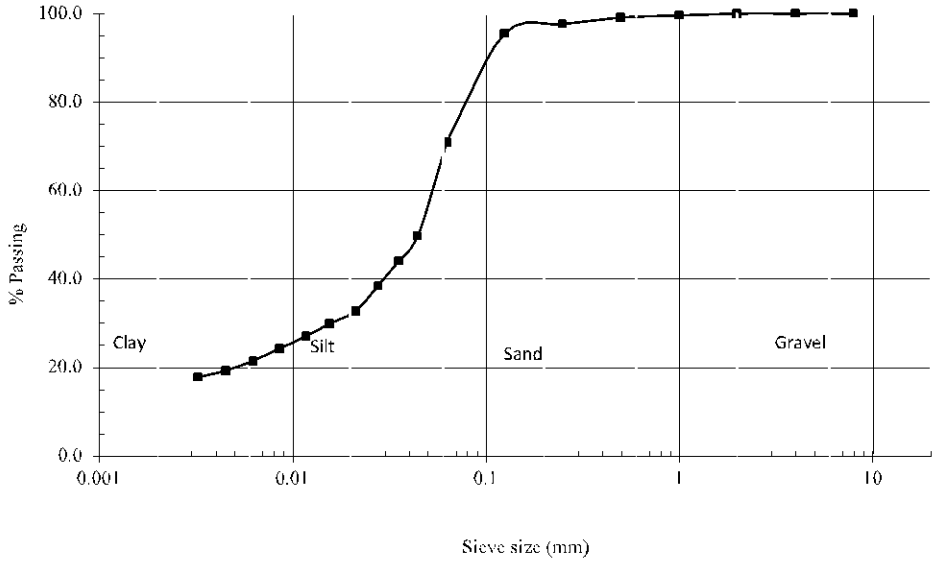
Particle Size Distribution

Sample Ref **S/58222/02** **Client** D Brown Building Contractors

Site	Land Between Seagate Road & B1359, Long Sutton		
Location	WS7-2		
Material	Soft Brown Silt/Clay		
Date/Time sampled	09/12/2021	TP/BH	7
Client sample No	WS7-2	Depth	0.8-1.5
Sampled by	RL (HML Ltd)	Sample Type	Bulk

Determination of Particle size distribution - Sedimentation method

Test method BS 1377 Part 2 1990



	%
Clay	23
Silt	48
Sand	29
Gravel	0

Comments

File ref 1197/5350
Date tested 10/12/2020
Date reported 08/02/2021

Signed M.J. Green C. Driver
Director

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SOIL CLASSIFICATION TESTS

Sample Ref S 58224

Client D Brown Building Cntrcs
Seas End Road
Moulton Seas End
Spalding
Lincolnshire
PE12 6JX

Site Land between Seagate Rd and B1359, Long Sutton
Location WS8-5
Date/Time sampled 09/12/20
Client sample No WS8-5
Sampled by RL & MBP (HML) Sample point

Trial pit / Bore hole No WS8
Depth of sample 3.0-3.5 m Sample type
Description Soft Brown black mottled Sitl/Clay

comments

Determination of moisture content
Test method BS 1377 Part 2 1990 - Clause 4.4 Single Point / Definitive Method Clause 4.3 (As Below)

Portion No 02
Method Oven dried

% Moisture 28

Determination of liquid limit, Plastic limit and Plasticity index
Test method BS 1377 Part 2 1990

Portion No 01
Test condition Sieved
Method Single point cone pen
% retained 0.425mm sieve 0

Liquid limit 49

% passing 0.425mm sieve 100

Plastic limit 29
Plasticity Index 20

File ref 1197 5350 / P
Date tested 08/01/21
Date reported 08/02/21
Date received 09/12/20

Signed :- M.J. Green C. Driver
Director

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SOIL CLASSIFICATION TESTS

Sample Ref S 58227

Client D Brown Building Cntrcs
Seas End Road
Moulton Seas End
Spalding
Lincolnshire
PE12 6JX

Site Land between Seagate Rd and B1359, Long Sutton
Location WS11-5
Date/Time sampled 09/12/20
Client sample No WS11-5
Sampled by RL & MBP (HML) Sample point

Trial pit / Bore hole No WS11
Depth of sample 3.0-3.5 m Sample type
Description Soft Brown black mottled Silt/Clay

comments

Determination of moisture content
Test method BS 1377 Part 2 1990 - Clause 4.4 Single Point / Definitive Method Clause 4.3 (As Below)

Portion No 02
Method Oven dried

% Moisture 20

Determination of liquid limit, Plastic limit and Plasticity index
Test method BS 1377 Part 2 1990

Portion No 01
Test condition Natural state
Method Single point cone pen
% retained 0.425mm sieve 0

Liquid limit 42

% passing 0.425mm sieve 100

Plastic limit 23
Plasticity Index 19

File ref 1197 5350 / P
Date tested 08/01/21
Date reported 08/02/21
Date received 09/12/20

Signed :- M.J. Green C. Driver
Director

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SOIL CLASSIFICATION TESTS

Sample Ref S 58471

Client D Brown Building Cntrcs
Seas End Road
Moulton Seas End
Spalding
Lincolnshire
PE12 6JX

Site Land between Seagate Rd and B1359, Long Sutton
Location BH2-10
Date/Time sampled 02/02/21
Client sample No BH2-10
Sampled by SIS Sample point Bore hole

Trial pit / Bore hole No BH2
Depth of sample 18-18.45 m Sample type Small Bulk
Description Soft/Firm Grey CLAY with Coarse to fine Chalk Gravels

comments

Determination of moisture content
Test method BS 1377 Part 2 1990 - Clause 4.4 Single Point / Definitive Method Clause 4.3 (As Below)

Portion No 02
Method Oven dried

% Moisture 17

Determination of liquid limit, Plastic limit and Plasticity index
Test method BS 1377 Part 2 1990

Portion No 01
Test condition Sieved
Method Single point cone pen
% retained 0.425mm sieve 7

Liquid limit 38

% passing 0.425mm sieve 93

Plastic limit 9
Plasticity Index 29

File ref 1197 5350 / P
Date tested 11/02/21
Date reported 19/02/21
Date received 02/02/21

Signed :- M.J. Green C. Driver
Director

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DETERMINATION OF CALIFORNIA BEARING RATIO

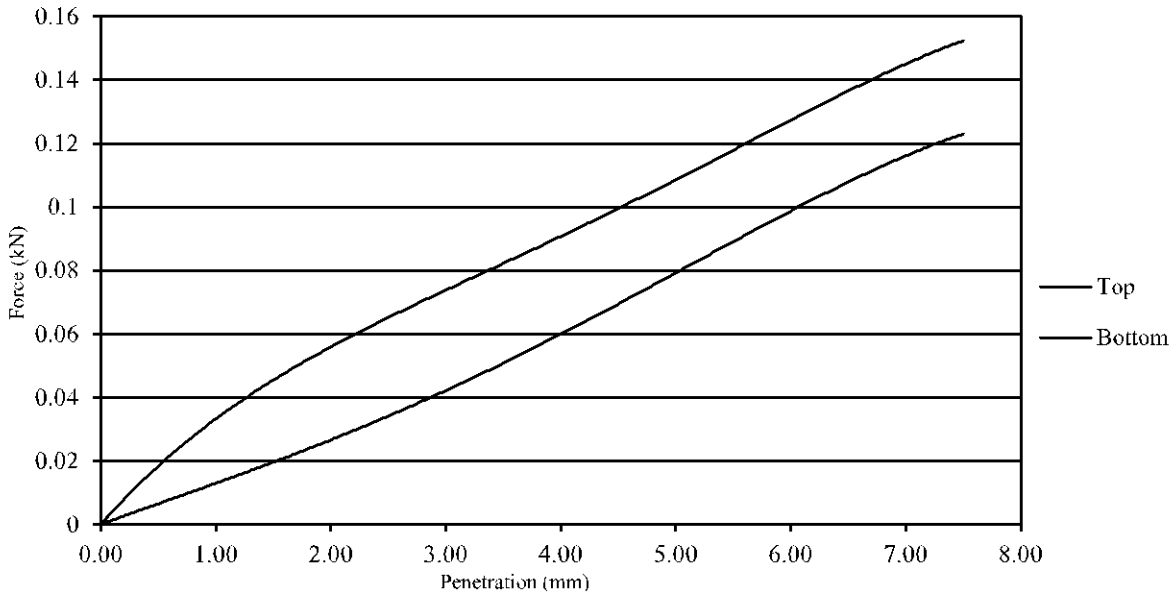
Sample Ref S/58192/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359		
Location	TP13-1		
Date/Time sampled	10/12/2020	TP/BH	TP13
Sample No	1	Depth (m)	0.51-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft, sandy silt/clay with occasional clayey pockets

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.91 Mg/m^3	Moisture (%)	24	24	24
Dry density	1.54 Mg/m^3	**C.B.R. (%)**	**0.6**	**0.4**	**0.5**



Comments

Water seepage from base of sample during loading
Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 22/01/2021
Date reported 29/01/2021

Signed M.J. Green C. Driver
Director

Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported

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DETERMINATION OF CALIFORNIA BEARING RATIO

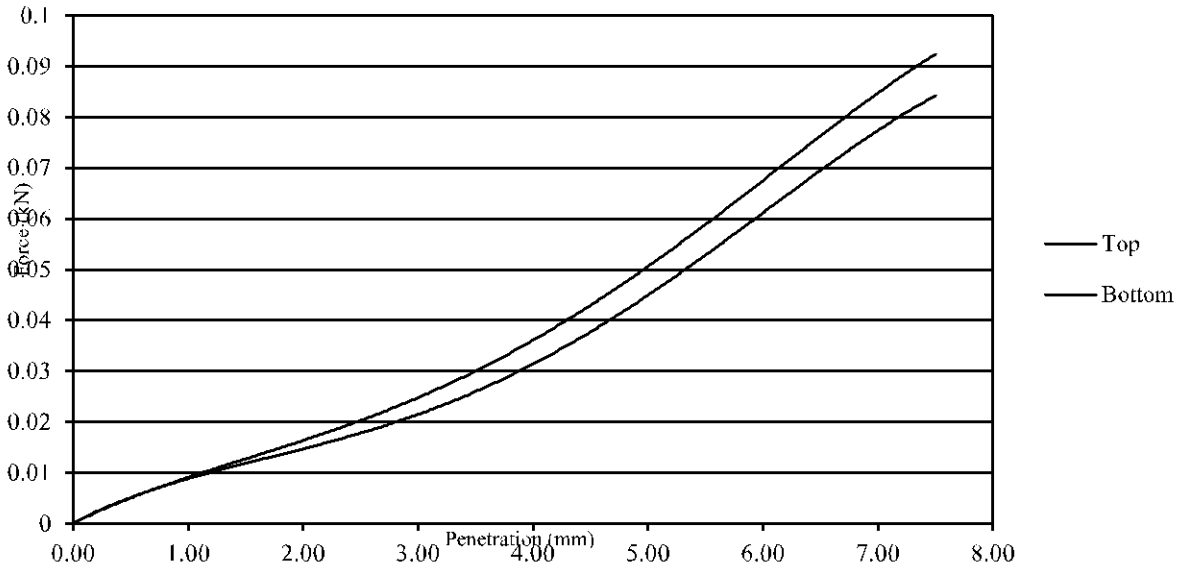
Sample Ref S/58193/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359		
Location	TP14-1		
Date/Time sampled	10/12/2020	TP/BH	TP14
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft, light brown silt/clay with occasional dark mottling.

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.88 Mg/m^3	Moisture (%)	24	24	24
Dry density	1.51 Mg/m^3	**C.B.R. (%)**	**0.2**	**0.3**	**0.2**



Comments

Some water seepage during loading
Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 22/01/2021
Date reported 29/01/2021

Signed M.J. Green C. Driver
Director

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DETERMINATION OF CALIFORNIA BEARING RATIO

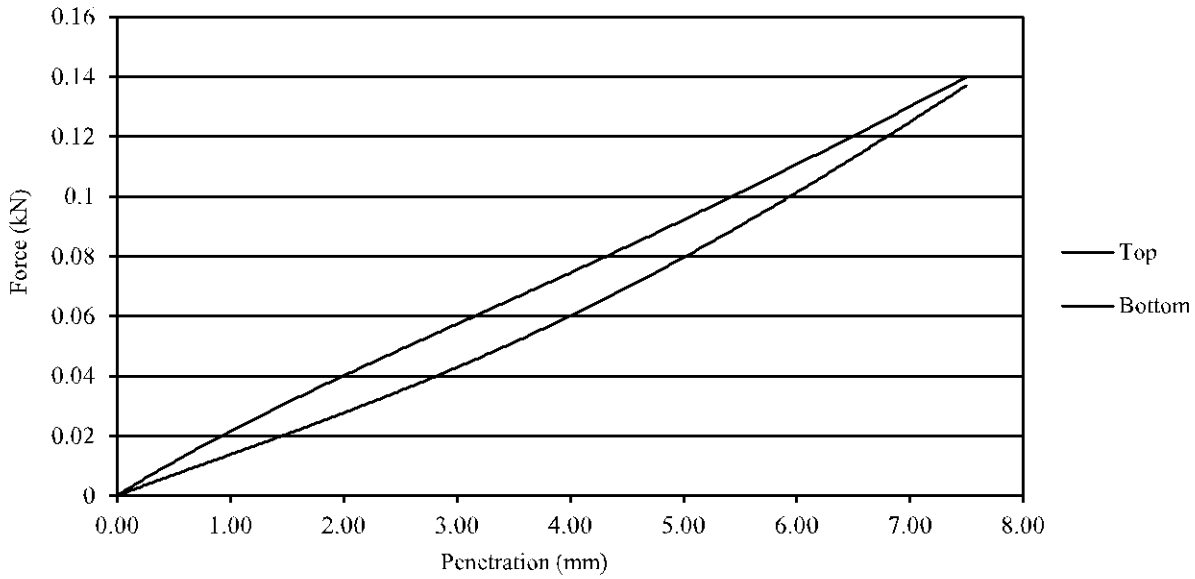
Sample Ref S/58194/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359		
Location	TP15-1		
Date/Time sampled	10/12/2020	TP/BH	TP15
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft, light brown silt/clay with occasional rootlets and dark mottling.

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.95 Mg/m^3	Moisture (%)	23	22	23
Dry density	1.59 Mg/m^3	**C.B.R. (%)**	**0.5**	**0.4**	**0.4**



Comments

Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 22/01/2021
Date reported 29/01/2021

Signed M.J. Green C. Driver
Director

Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported

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DETERMINATION OF CALIFORNIA BEARING RATIO

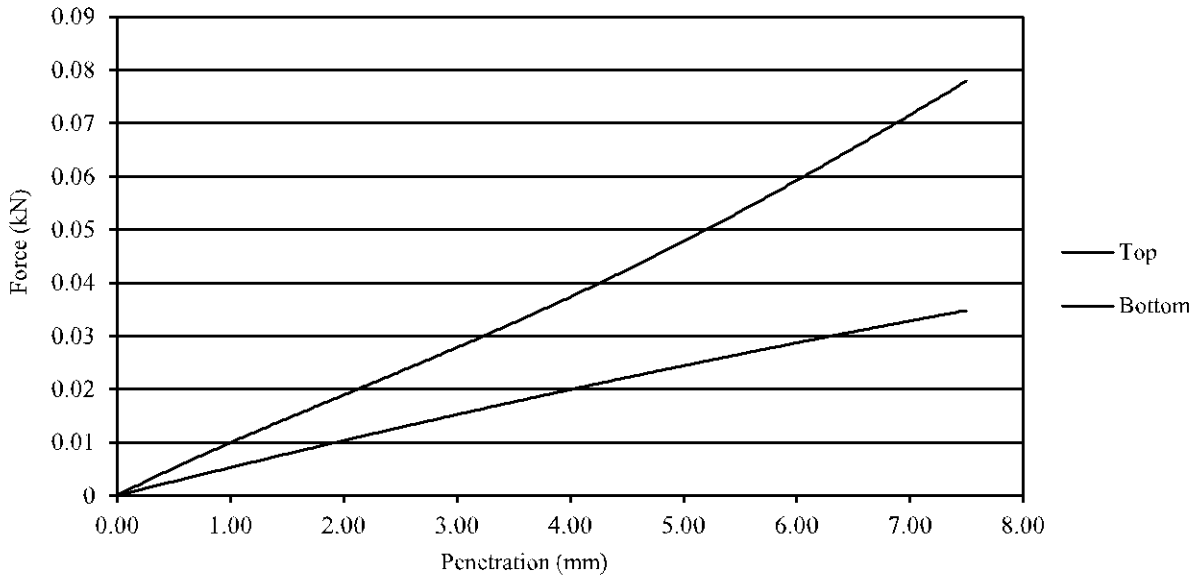
Sample Ref S/58195/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359		
Location	TP16-1		
Date/Time sampled	10/12/2020	TP/BH	TP16
Sample No	1	Depth (m)	0.58-0.95
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very Soft, light brown silt/sandy clay

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.88 Mg/m^3	Moisture (%)	27	27	27
Dry density	1.48 Mg/m^3	**C.B.R. (%)**	**0.2**	**0.1**	**0.2**



Comments

Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 22/01/2021
Date reported 29/01/2021

Signed M.J. Green C. Driver
Director

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DETERMINATION OF CALIFORNIA BEARING RATIO

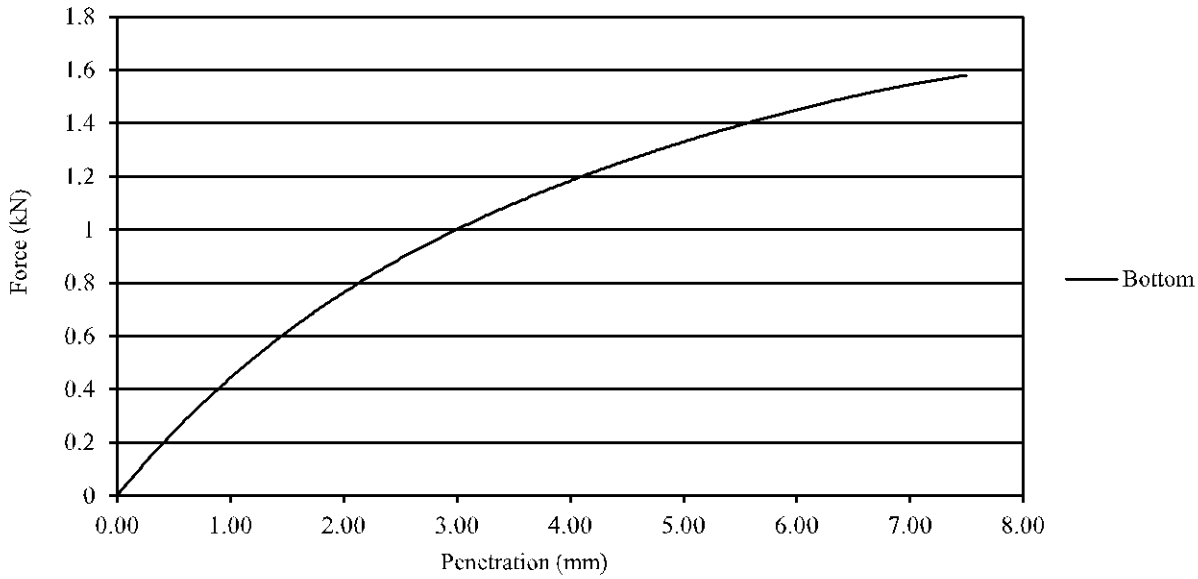
Sample Ref S/58196/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359		
Location	TP17-1		
Date/Time sampled	10/12/2020	TP/BH	TP17
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Firm to stiff, dark brown grey mottled slightly sandy CLAY

				Top	Bottom	Mean
Compaction method	2.5kg rammer					
Surcharge wt.	12kg					
Bulk density	1.86 Mg/m^3	Moisture (%)		25	26	26
Dry density	1.48 Mg/m^3	**C.B.R. (%)**			**6.8**	



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
Date tested 22/01/2021
Date reported 29/01/2021

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DETERMINATION OF CALIFORNIA BEARING RATIO

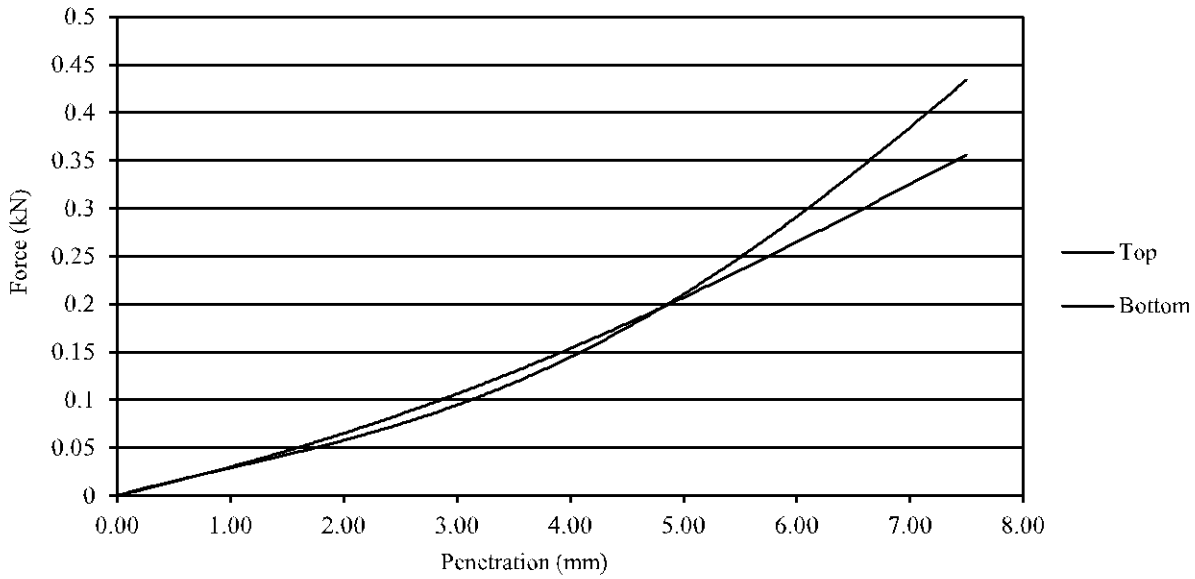
Sample Ref S/58197/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP18-1		
Date/Time sampled	10/12/2020	TP/BH	TP18
Sample No	1	Depth (m)	0.55-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very soft silty sandy CLAY with very occasional rootlets

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.96 Mg/m^3	Moisture (%)	21	21	21
Dry density	1.62 Mg/m^3	**C.B.R. (%)**	**1.0**	**1.1**	**1.1**



Comments

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Sample tested in unsoaked condition

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DETERMINATION OF CALIFORNIA BEARING RATIO

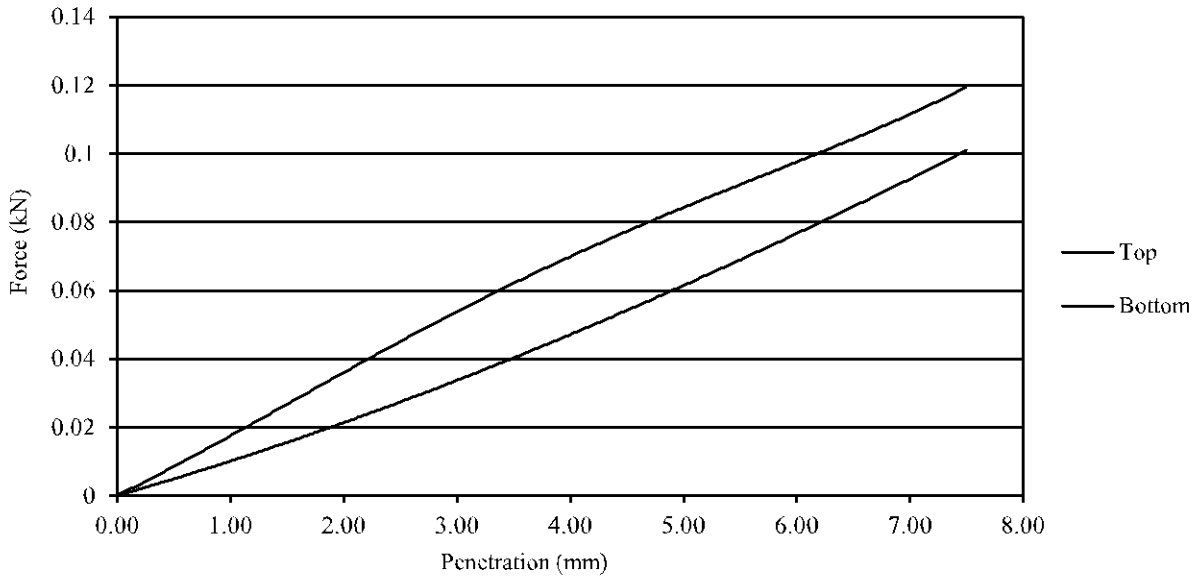
Sample Ref S/58198/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP19-1		
Date/Time sampled	10/12/2020	TP/BH	TP19
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft, light brown SILT/CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.92 Mg/m^3	Moisture (%)	26	28	27
Dry density	1.51 Mg/m^3	**C.B.R. (%)**	**0.4**	**0.3**	**0.4**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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DETERMINATION OF CALIFORNIA BEARING RATIO

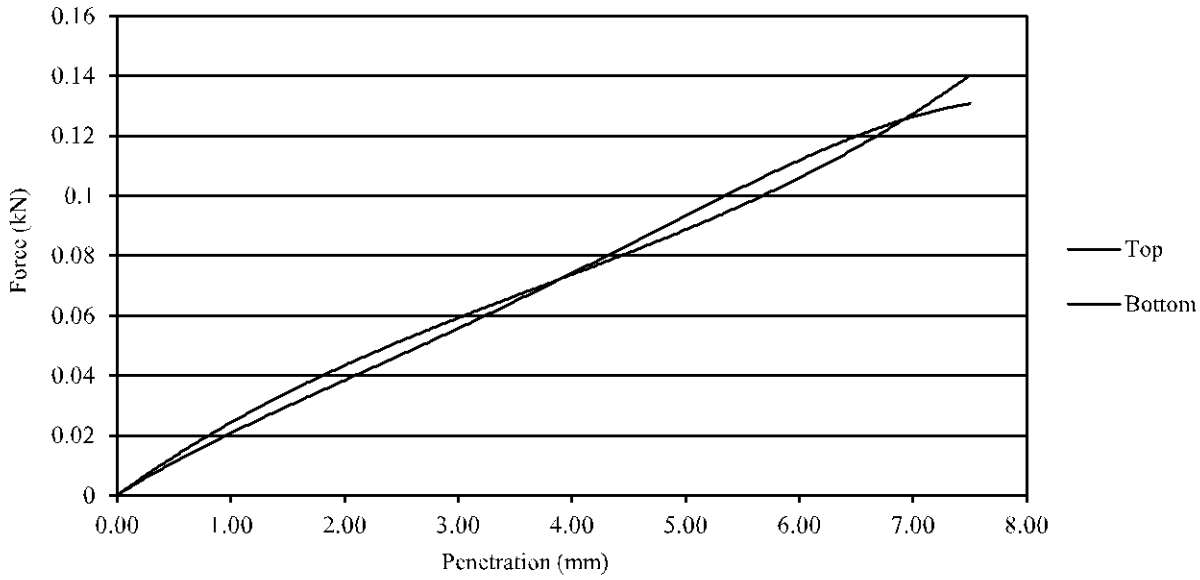
Sample Ref S/58199/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP20-1		
Date/Time sampled	10/12/2020	TP/BH	TP20
Sample No	1	Depth (m)	0.65-1.0
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft, light brown SILT/CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.92 Mg/m^3	Moisture (%)	25	25	25
Dry density	1.53 Mg/m^3	**C.B.R. (%)**	**0.5**	**0.5**	**0.5**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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DETERMINATION OF CALIFORNIA BEARING RATIO

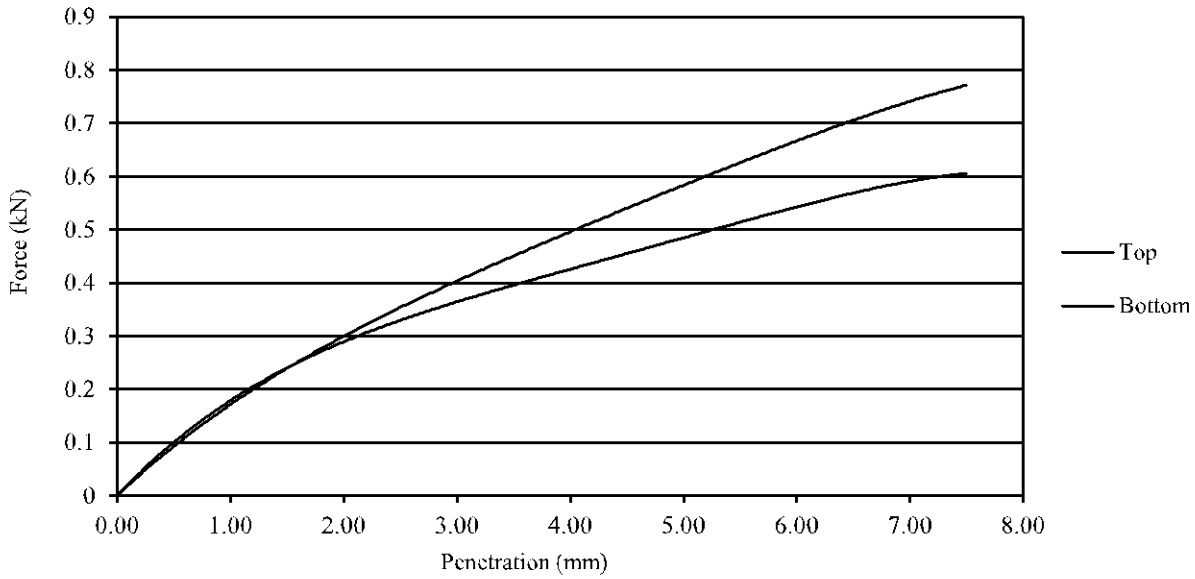
Sample Ref S/58200/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP21-1		
Date/Time sampled	10/12/2020	TP/BH	TP21
Sample No	1	Depth (m)	0.65-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Firm, dark brown occasionally grey mottled, slightly sandy CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.97 Mg/m^3	Moisture (%)	25	25	25
Dry density	1.58 Mg/m^3	**C.B.R. (%)**	**2.9**	**2.5**	**2.7**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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Date reported 29/01/2021

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DETERMINATION OF CALIFORNIA BEARING RATIO

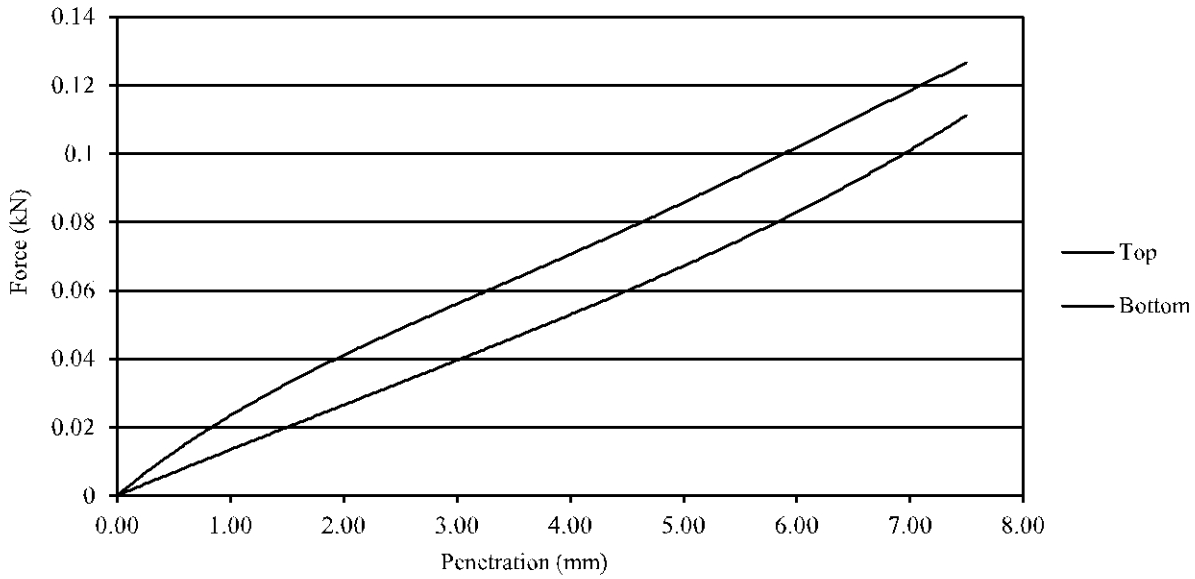
Sample Ref S/58201/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP22-1		
Date/Time sampled	10/12/2020	TP/BH	TP22
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very soft, SAND with clayey pocketss

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.87 Mg/m^3	Moisture (%)	29	28	29
Dry density	1.45 Mg/m^3	**C.B.R. (%)**	**0.4**	**0.3**	**0.4**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
Date tested 22/01/2021
Date reported 29/01/2021

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DETERMINATION OF CALIFORNIA BEARING RATIO

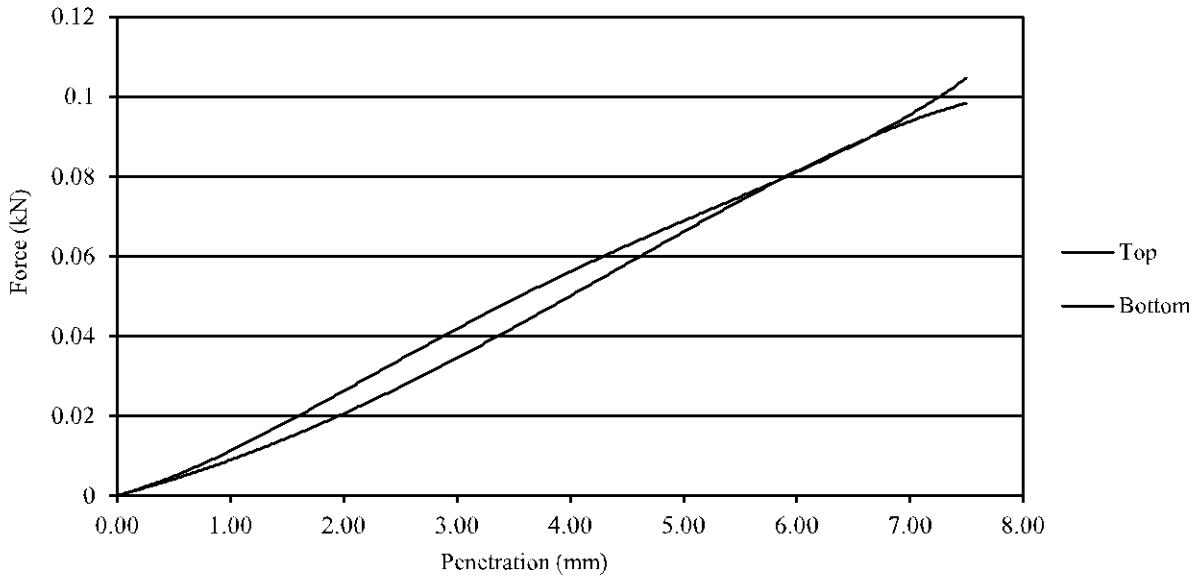
Sample Ref S/58202/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP23-1		
Date/Time sampled	10/12/2020	TP/BH	TP23
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very soft, SAND with silty clay pockets

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.93 Mg/m^3	Moisture (%)	26	25	25
Dry density	1.54 Mg/m^3	**C.B.R. (%)**	**0.4**	**0.3**	**0.3**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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DETERMINATION OF CALIFORNIA BEARING RATIO

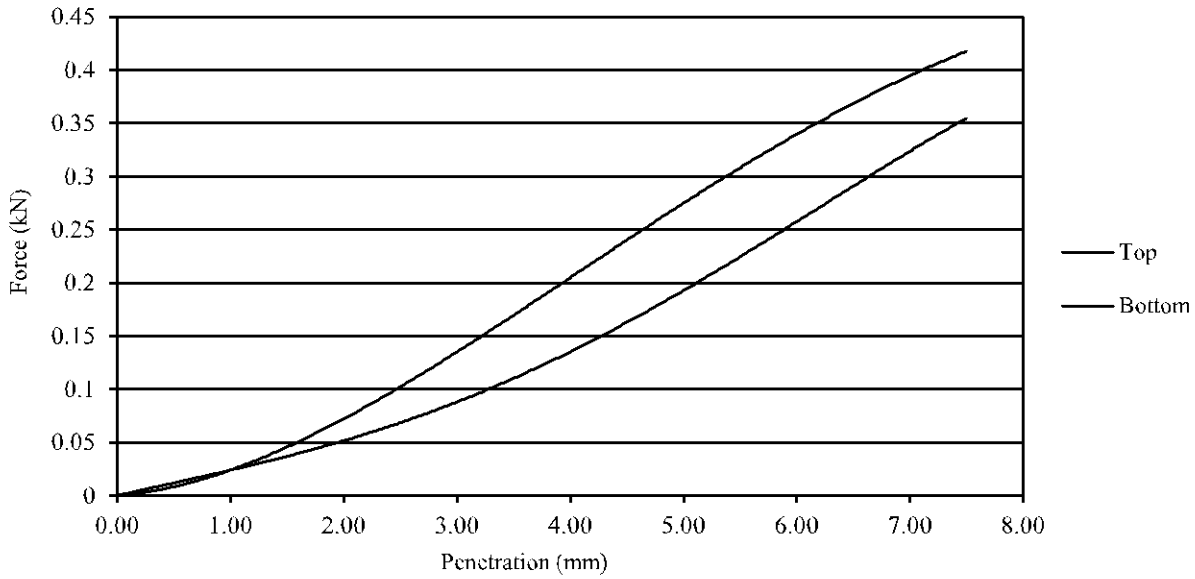
Sample Ref S/58203/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP24-1		
Date/Time sampled	10/12/2020	TP/BH	TP24
Sample No	1	Depth (m)	0.62-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft, brown slightly sandy occasionally black mottled SILT/CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.88 Mg/m^3	Moisture (%)	25	25	25
Dry density	1.51 Mg/m^3	**C.B.R. (%)**	**0.9**	**1.4**	



Comments

seepage from sample during loading
Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 20/01/2021
Date reported 30/01/2021

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DETERMINATION OF CALIFORNIA BEARING RATIO

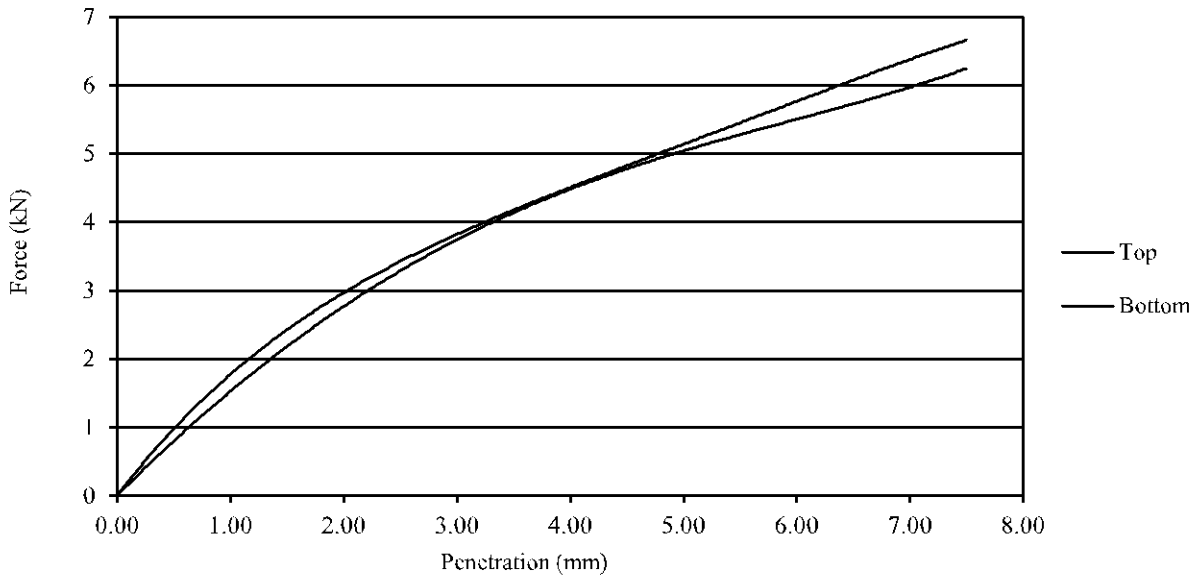
Sample Ref S/58204/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP25-1		
Date/Time sampled	10/12/2020	TP/BH	TP25
Sample No	1	Depth (m)	0.65-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Firm, light brown red brown and grey mottled SILT/CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.99 Mg/m^3	Moisture (%)	23	22	22
Dry density	1.62 Mg/m^3	**C.B.R. (%)**	**25**	**26**	**26**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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Date reported 30/01/2021

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DETERMINATION OF CALIFORNIA BEARING RATIO

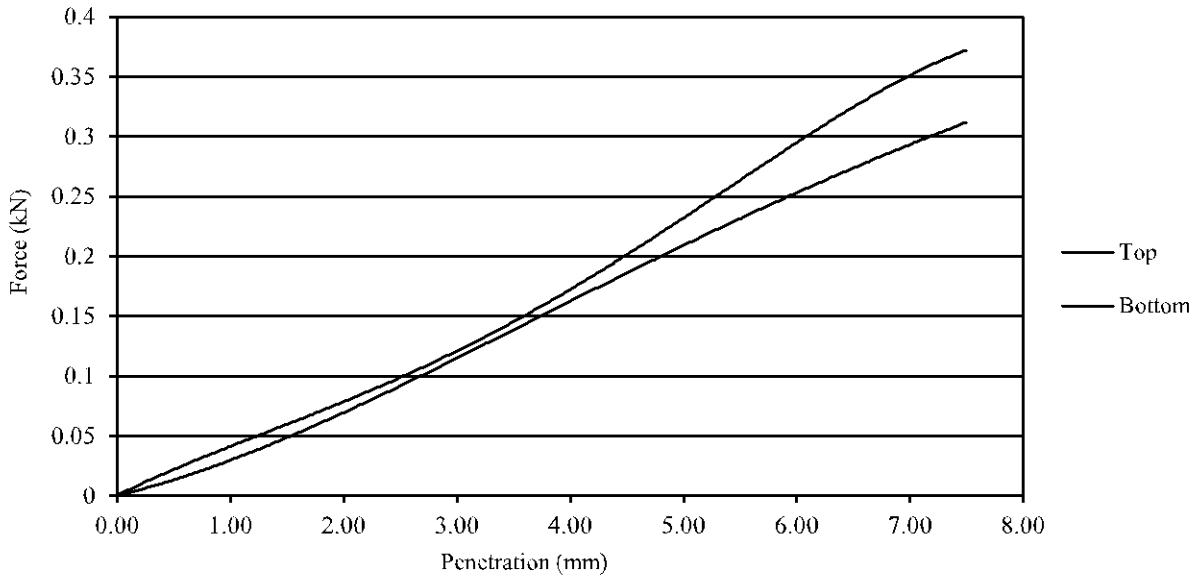
Sample Ref S/58205/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP26-1		
Date/Time sampled	10/12/2020	TP/BH	TP26
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very soft brown silty SAND

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.94 Mg/m^3	Moisture (%)	21	21	21
Dry density	1.60 Mg/m^3	**C.B.R. (%)**	**1.1**	**1.1**	**1.1**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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DETERMINATION OF CALIFORNIA BEARING RATIO

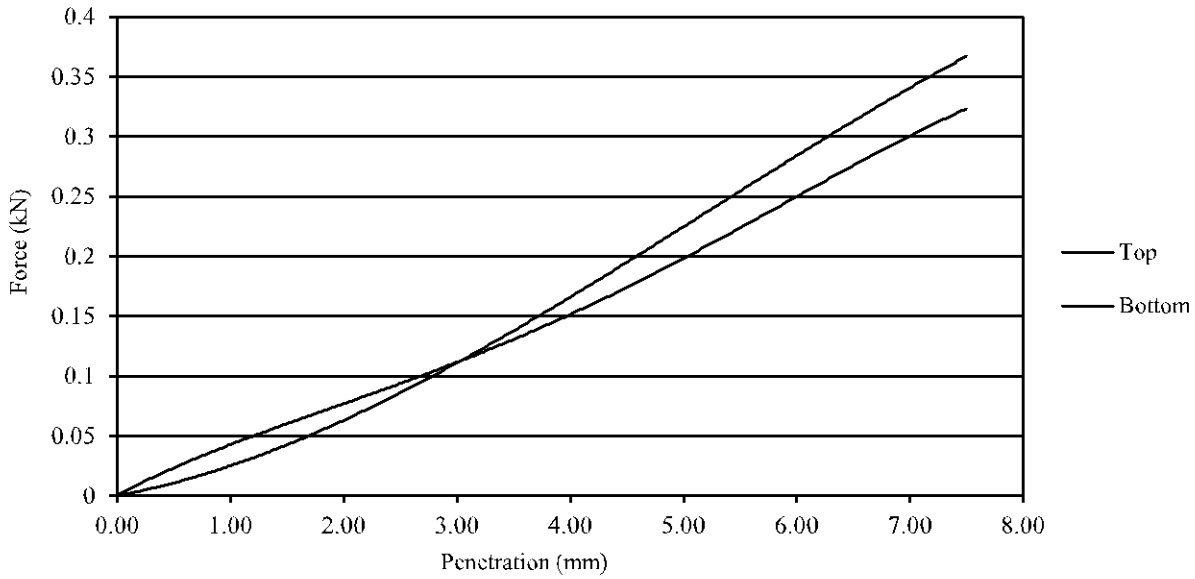
Sample Ref S/58206/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP27-1		
Date/Time sampled	10/12/2020	TP/BH	TP27
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very soft brown SAND with pockets of silt/clay

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.96 Mg/m^3	Moisture (%)	21	21	21
Dry density	1.62 Mg/m^3	**C.B.R. (%)**	**1.0**	**1.1**	**1.0**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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Date reported 30/01/2021

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DETERMINATION OF CALIFORNIA BEARING RATIO

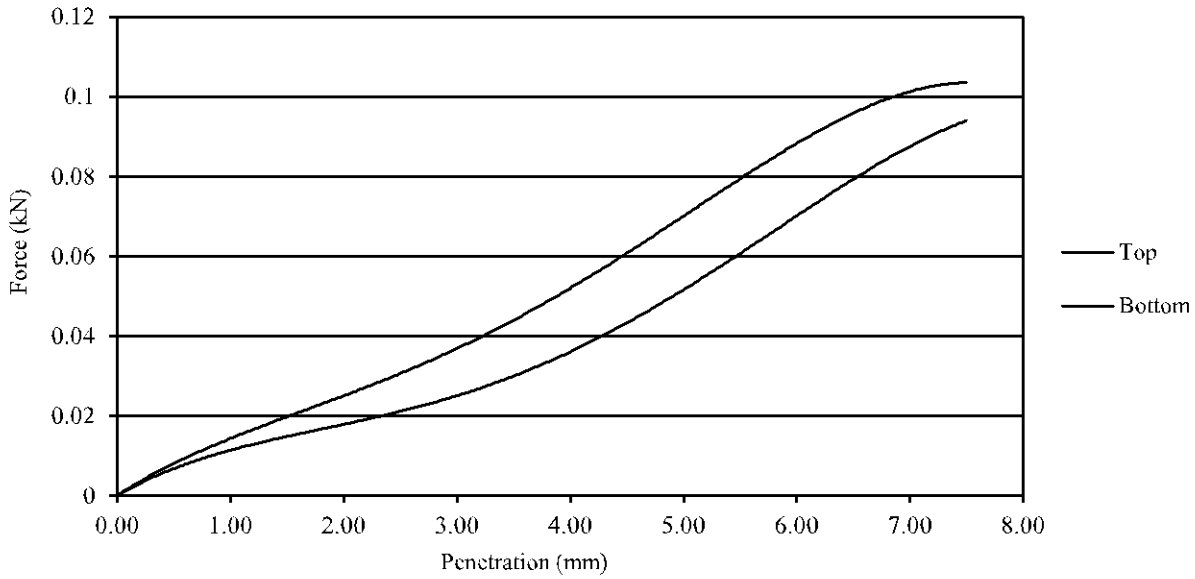
Sample Ref S/58207/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP28-1		
Date/Time sampled	10/12/2020	TP/BH	TP28
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very soft light brown sandy CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.88 Mg/m^3	Moisture (%)	22	24	23
Dry density	1.53 Mg/m^3	**C.B.R. (%)**	**0.4**	**0.2**	



Comments

Water seepage during loading.
Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 20/01/2021
Date reported 30/01/2021

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DETERMINATION OF CALIFORNIA BEARING RATIO

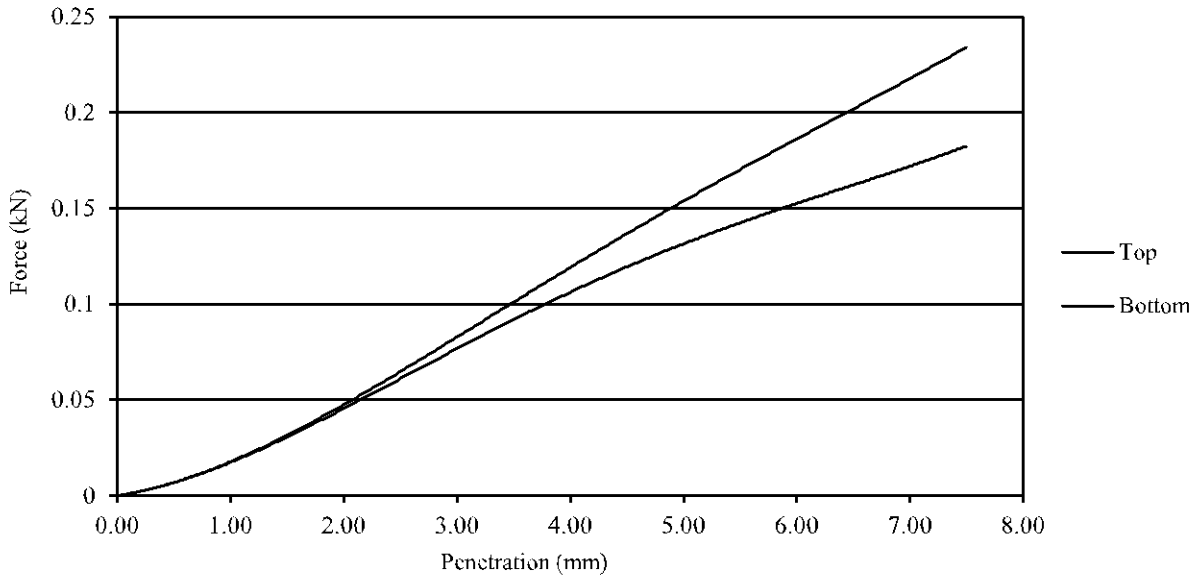
Sample Ref S/58208/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP29-1		
Date/Time sampled	10/12/2020	TP/BH	TP29
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very soft light brown SAND with occasional clay pockets

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.94 Mg/m^3	Moisture (%)	22	21	22
Dry density	1.59 Mg/m^3	**C.B.R. (%)**	**0.7**	**0.8**	**0.7**



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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DETERMINATION OF CALIFORNIA BEARING RATIO

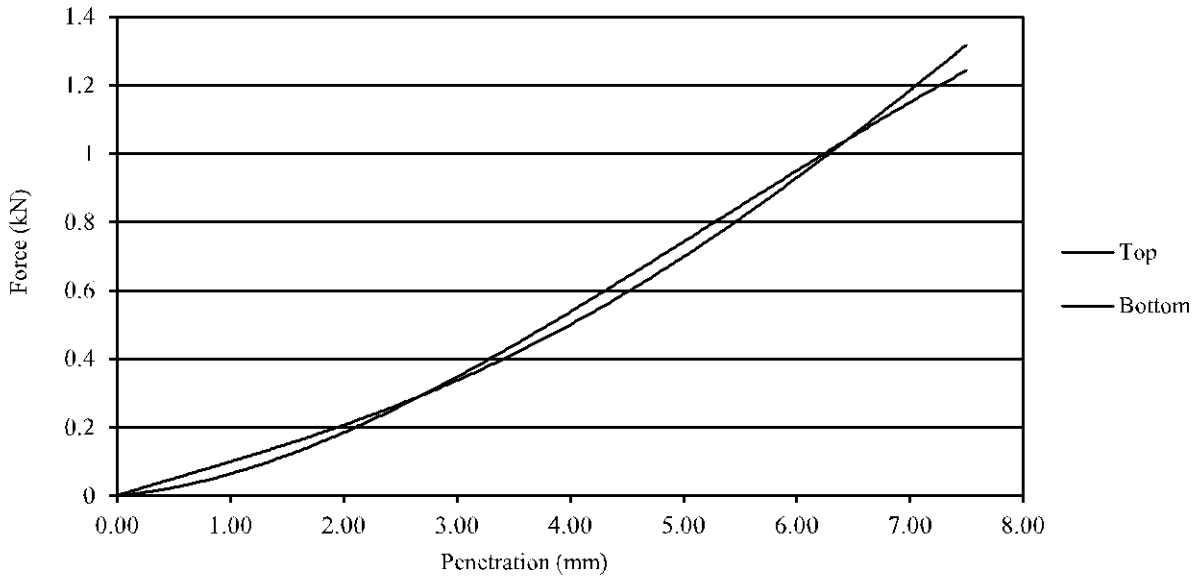
Sample Ref S/58209/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP30-1		
Date/Time sampled	10/12/2020	TP/BH	TP30
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very soft light brown SAND with occasional clay pockets

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.98 Mg/m^3	Moisture (%)	20	19	19
Dry density	1.66 Mg/m^3	**C.B.R. (%)**	**3.5**	**3.7**	**3.6**



Comments

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Sample tested in unsoaked condition

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DETERMINATION OF CALIFORNIA BEARING RATIO

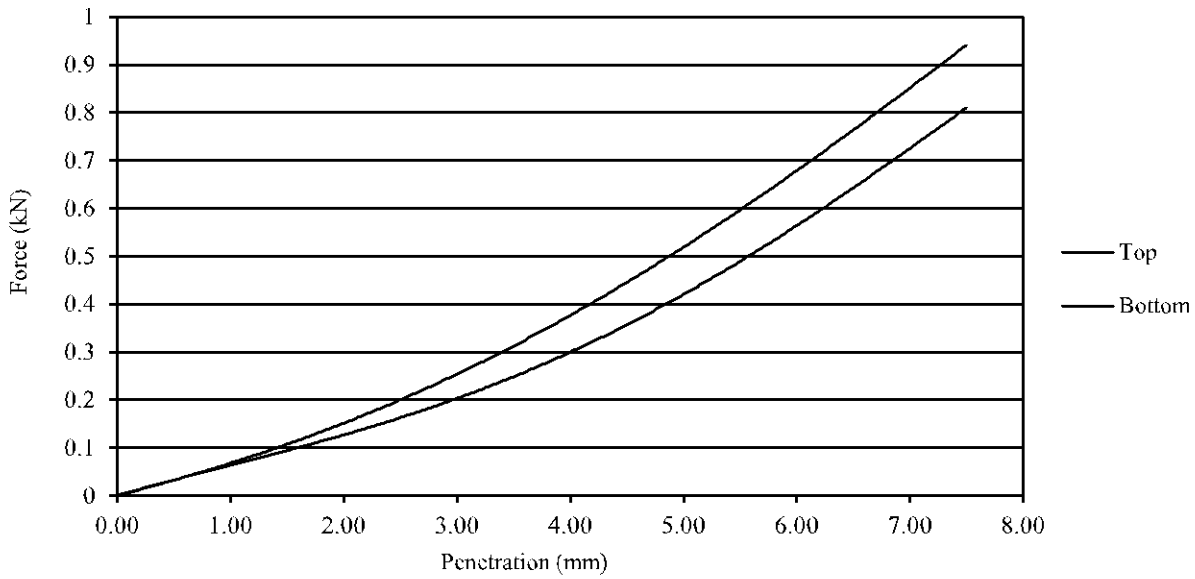
Sample Ref S/58210/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP31-1		
Date/Time sampled	10/12/2020	TP/BH	TP31
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft light brown occasionally black mottled SILT/CLAY with occasional rootlets

Compaction method	2.5kg rammer					
Surcharge wt.	12kg			Top	Bottom	Mean
Bulk density	1.91 Mg/m^3	Moisture (%)		21	21	21
Dry density	1.57 Mg/m^3	**C.B.R. (%)**		**2.1**	**2.6**	



Comments

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Sample tested in unsoaked condition

File ref 1197/5350
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DETERMINATION OF CALIFORNIA BEARING RATIO

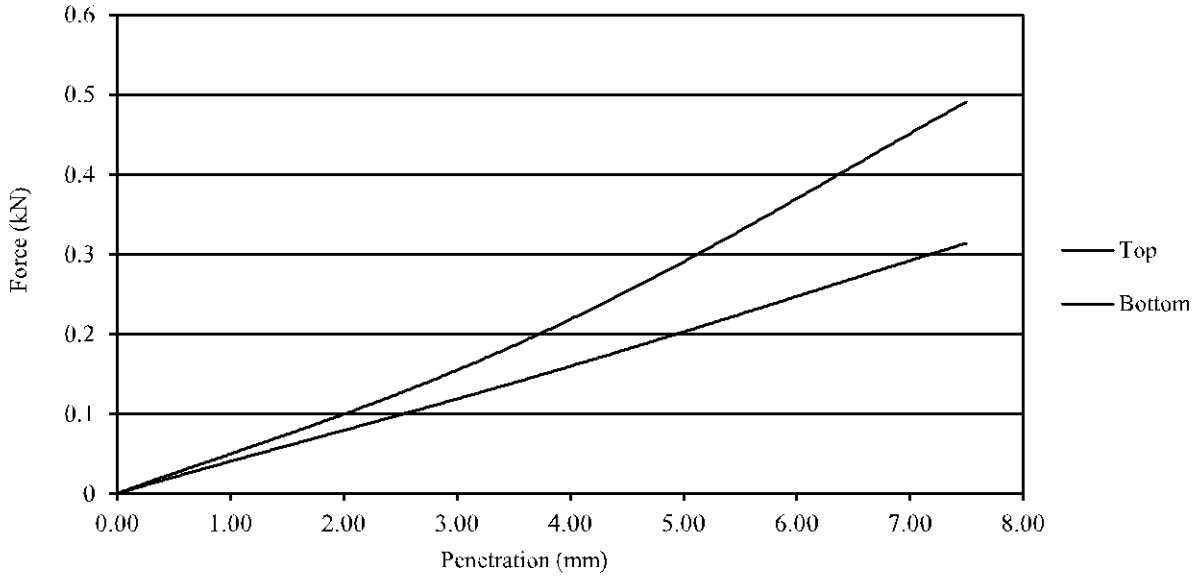
Sample Ref S/58211/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP32-1		
Date/Time sampled	10/12/2020	TP/BH	TP32
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft light brown occasionally black mottled SILT/CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.93 Mg/m^3	Moisture (%)	22	22	22
Dry density	1.57 Mg/m^3	**C.B.R. (%)**	**1.0**	**1.4**	



Comments

Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 20/01/2021
Date reported 30/01/2021

Signed M.J. Green C. Driver
Director

Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported

Humberside Materials Laboratory
Atherton Way, Brigg
North Lincolnshire, DN20 8AR

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DETERMINATION OF CALIFORNIA BEARING RATIO

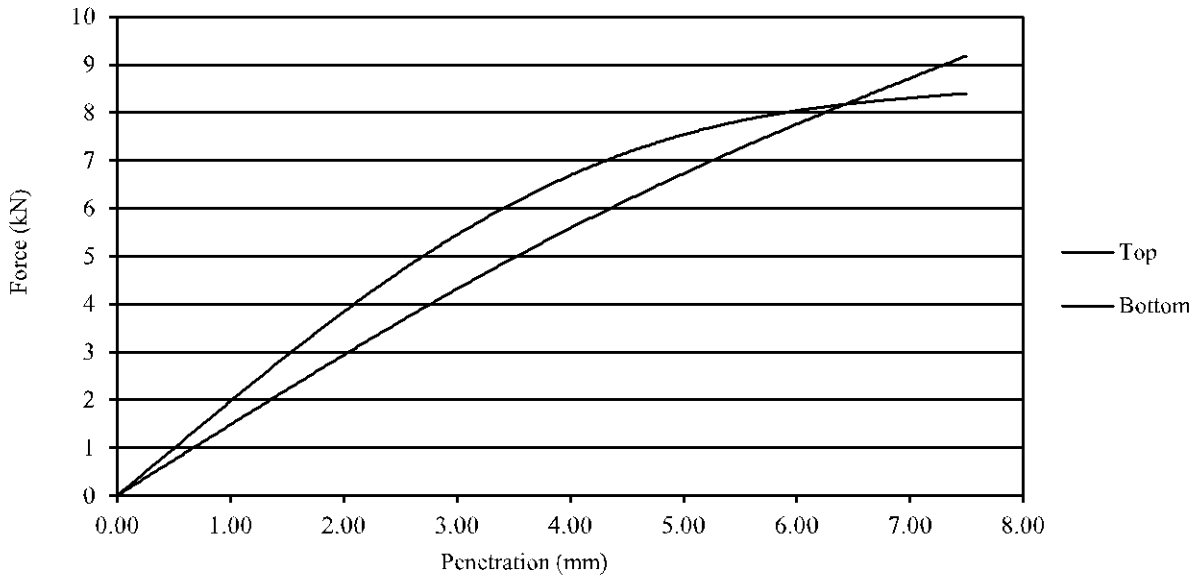
Sample Ref S/58212/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP33-1		
Date/Time sampled	10/12/2020	TP/BH	TP33
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Firm light brown very sandy occasionally black mottled SILT/CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.90 Mg/m^3	Moisture (%)	19	19	19
Dry density	1.60 Mg/m^3	**C.B.R. (%)**	**37**	**34**	**35**



Comments

Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 20/01/2021
Date reported 30/01/2021

Signed M.J. Green C. Driver
Director

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DETERMINATION OF CALIFORNIA BEARING RATIO

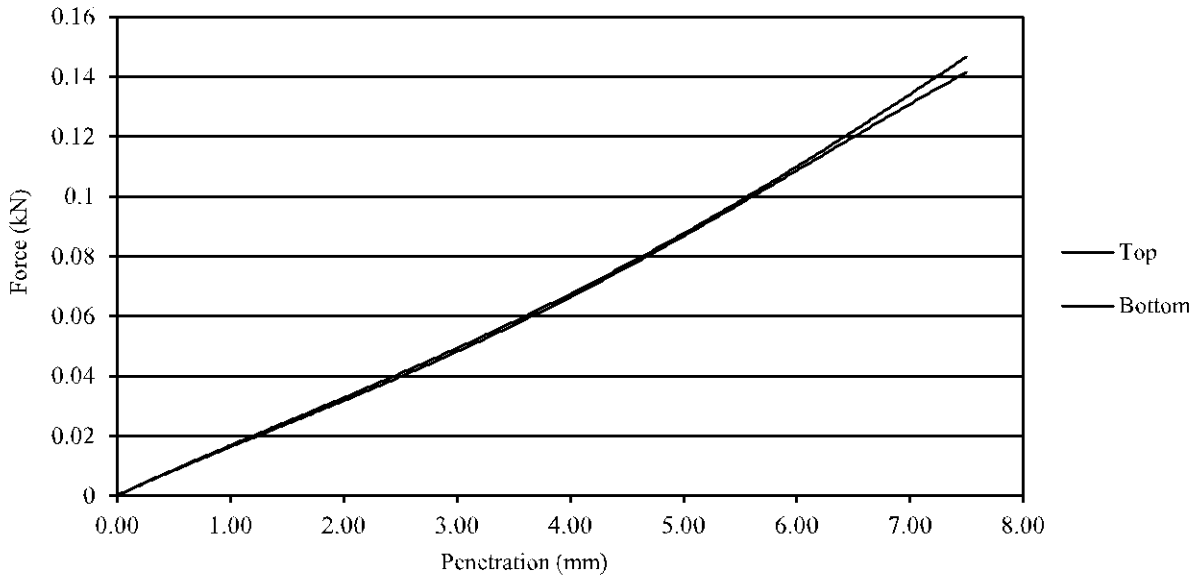
Sample Ref S/58213/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP34-1		
Date/Time sampled	10/12/2020	TP/BH	TP34
Sample No	1	Depth (m)	0.50-0.95
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft, dark brown very sandy CLAY (subsoil) with coarse to fine gravels

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.89 Mg/m^3	Moisture (%)	28	25	27
Dry density	1.49 Mg/m^3	**C.B.R. (%)**	**0.4**	**0.4**	**0.4**



Comments

Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 20/01/2021
Date reported 30/01/2021

Signed M.J. Green C. Driver
Director

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North Lincolnshire, DN20 8AR

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DETERMINATION OF CALIFORNIA BEARING RATIO

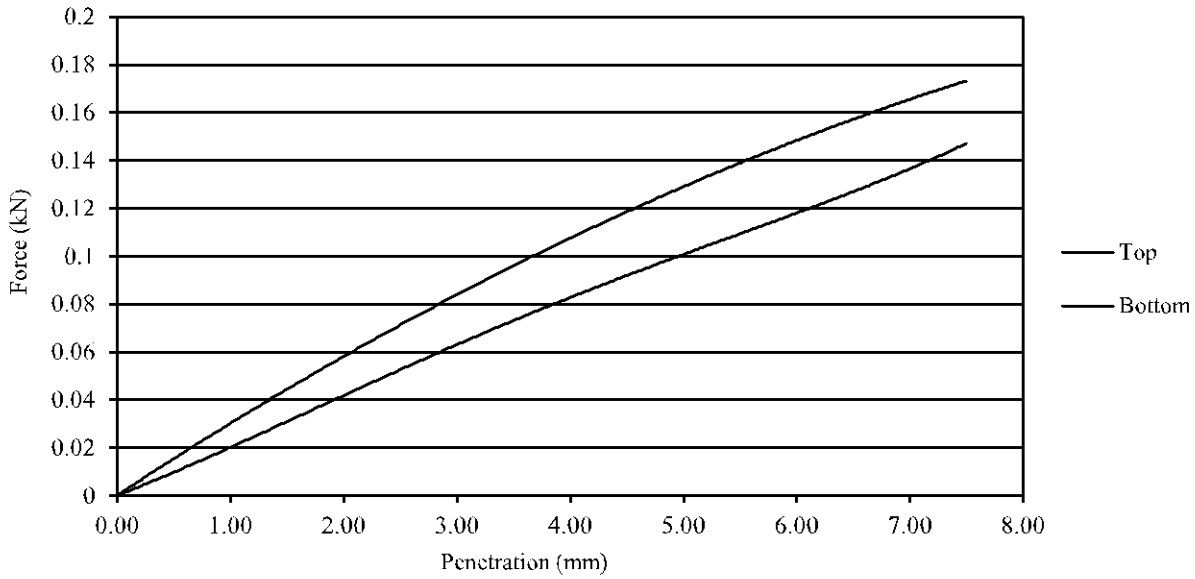
Sample Ref S/58214/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP35-1		
Date/Time sampled	10/12/2020	TP/BH	TP35
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very Soft, brown silty/clayey SAND with very occasional clay pockets

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.86 Mg/m^3	Moisture (%)	23	23	23
Dry density	1.51 Mg/m^3	**C.B.R. (%)**	**0.5**	**0.7**	**0.6**



Comments

Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 24/01/2021
Date reported 31/01/2021

Signed M.J. Green C. Driver
Director

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North Lincolnshire, DN20 8AR

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DETERMINATION OF CALIFORNIA BEARING RATIO

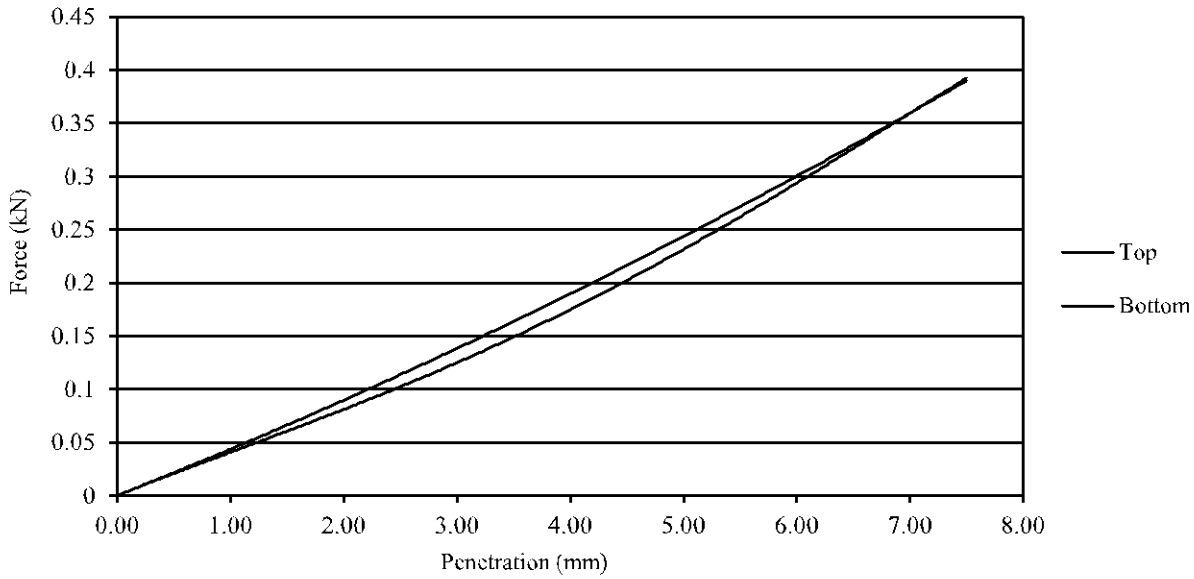
Sample Ref S/58215/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP36-1		
Date/Time sampled	10/12/2020	TP/BH	TP36
Sample No	1	Depth (m)	0.50-0.80
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Very Soft, brown silty/clayey SAND with very occasional clay pockets

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.97 Mg/m^3	Moisture (%)	18	17	18
Dry density	1.67 Mg/m^3	**C.B.R. (%)**	**1.3**	**1.2**	**1.2**



Comments

Percent retained 20mm test sieve and removed - 0.0%
Sample tested in unsoaked condition

File ref 1197/5350
Date tested 24/01/2021
Date reported 31/01/2021

Signed M.J. Green C. Driver
Director

Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported

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North Lincolnshire, DN20 8AR

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DETERMINATION OF CALIFORNIA BEARING RATIO

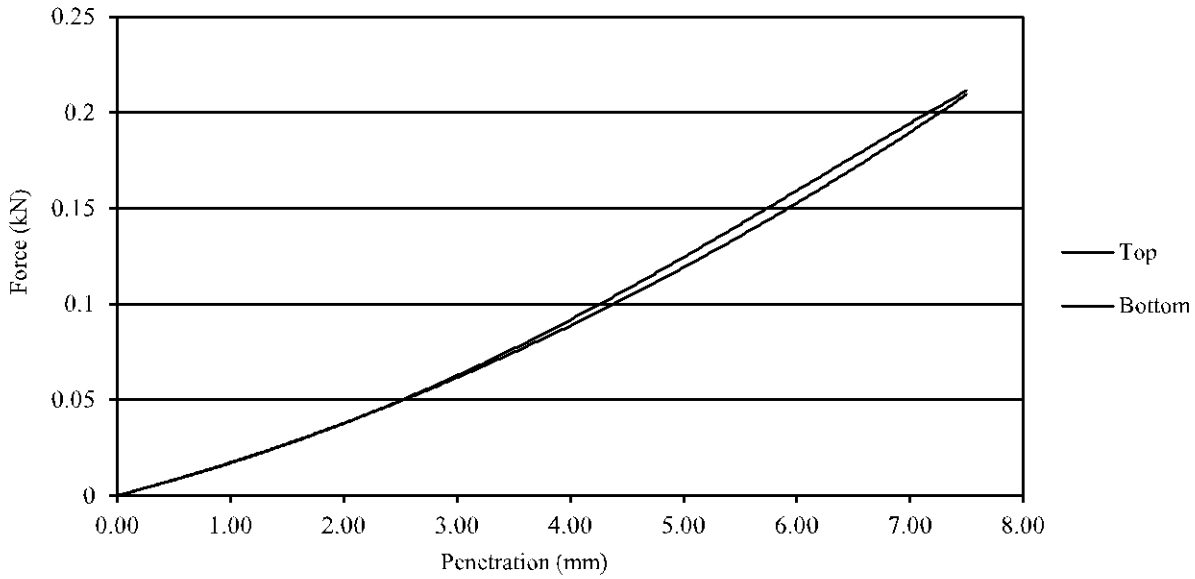
Sample Ref S/58216/01 **Client** D. Brown Contracts

Site	Land between seagate Rd and the B1359, Long Sutton		
Location	TP37-1		
Date/Time sampled	10/12/2020	TP/BH	TP37
Sample No	1	Depth (m)	0.50-1.00
Sampled by	HML Ltd	Sample Type	Bulk

Determination of California Bearing Ratio Test method BS 1377 Part 4 1990

Description Soft, light brown SILT/CLAY

Compaction method	2.5kg rammer				
Surcharge wt.	12kg		Top	Bottom	Mean
Bulk density	1.97 Mg/m^3	Moisture (%)	18	17	18
Dry density	1.67 Mg/m^3	**C.B.R. (%)**	**0.6**	**0.6**	**0.6**



Comments

Percent retained 20mm test sieve and removed - 0.0%
Tested in an unsoaked condition.

File ref 1197/5350
Date tested 24/01/2021
Date reported 31/01/2021

Signed M.J. Green C. Driver
Director

Certificate of sampling when submitted is retained by the Laboratory and available upon request
Samples will normally be kept for 14 days from the date reported

2531

ANALYTICAL TEST REPORT

Contract no: 92468

Contract name: Land between Seagate Road & B1359, Long Sutton

Client reference: 1197/5350/P

Clients name: Humberside Materials Laboratory

Clients address: Atherton Way
Brigg
North Lincolnshire
DN20 8AR

Samples received: 14 January 2021

Analysis started: 14 January 2021

Analysis completed: 19 January 2021

Report issued: 20 January 2021

Notes:
Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key:
U UKAS accredited test
M MCERTS & UKAS accredited test
$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing

Approved by:

Sam Rogerson
Customer Support Hero

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
92468-1	S/58217	0.60-0.90	Clayey Sand with Gravel	-	-	18.7
92468-2	S/58218	2.10-2.60	Clay with Gravel	-	-	19.6
92468-3	S/58219	0.50-1.00	Clay with Gravel	-	-	19.6

Chemtech Environmental Limited

SOILS

Lab number			92468-1	92468-2	92468-3
Sample id			S/58217	S/58218	S/58219
Sample location			WS2-2	WS9-4	WS10-2
Depth (m)			0.60-0.90	2.10-2.60	0.50-1.00
Date sampled			09/12/2020	09/12/2020	09/12/2020
Test	**Method**	**Units**			
pH	CE004 [M]	units	8.4	7.9	8.3
Magnesium (2:1 water soluble)	CE061	mg/l Mg	5.6	55	17
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	9.0	6.8	11
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	2.3	<1	1.6
Nitrite (2:1 water soluble)	CE049	mg/l NO_2	<1	<1	<1
Sulphate (2:1 water soluble)	CE061 [M]	mg/l SO_4	16	538	213
Sulphate (total)	CE062 [M]	mg/kg SO_4	260	1517	719
Sulphur (total)	CE119	mg/kg S	105	9123	1929

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO_3
CE049	Nitrite (2:1 water soluble)	Aqueous extraction, IC-COND	Dry		1	mg/l NO_2
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO_4
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	M	100	mg/kg SO_4
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
92468-1	S/58217	0.60-0.90	Y	pH (EHT), Chloride (EHT), Nitrate (EHT), Nitrite (EHT), Sulphate (EHT), Sulphur (EHT)
92468-2	S/58218	2.10-2.60	Y	pH (EHT), Chloride (EHT), Nitrate (EHT), Nitrite (EHT), Sulphate (EHT), Sulphur (EHT)
92468-3	S/58219	0.50-1.00	Y	pH (EHT), Chloride (EHT), Nitrate (EHT), Nitrite (EHT), Sulphate (EHT), Sulphur (EHT)

UKAS TESTING 2531

MCERTS

CHEMTECH

ANALYTICAL TEST REPORT

Contract no: 93484

Contract name: Seahate Road, Long Sutton

Client reference: 1197/5350/P

Clients name: Humberside Materials Laboratory

Clients address: Atherton Way
Brigg
North Lincolnshire
DN20 8AR

Samples received: 16 February 2021

Analysis started: 16 February 2021

Analysis completed: 23 February 2021

Report issued: 23 February 2021

Notes:
Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key:
U UKAS accredited test
M MCERTS & UKAS accredited test
$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing

Approved by:
Rachael Burton
Customer Support Squad Leader

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
93484-1	B/58470	14.00-14.50	Sand with Gravel	-	-	14.4

Chemtech Environmental Limited

SOILS

Lab number			93484-1
Sample id			B/58470
Location			BH2-6
Depth (m)			14.00-14.50
Date sampled			02/02/2021
Test	**Method**	**Units**	
pH	CE004 [M]	units	8.6
Magnesium (2:1 water soluble)	CE061	mg/l Mg	9.3
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	22
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	<1
Nitrite (2:1 water soluble)	CE049	mg/l NO_2	<1
Sulphate (2:1 water soluble)	CE061	mg/l SO_4	86
Sulphate (total)	CE062	mg/kg SO_4	596
Sulphur (total)	CE119	mg/kg S	917

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO_3
CE049	Nitrite (2:1 water soluble)	Aqueous extraction, IC-COND	Dry		1	mg/l NO_2
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		10	mg/l SO_4
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry		100	mg/kg SO_4
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
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Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
93484-1	B/58470	14.00-14.50	N	