Ground and Environmental Services Limited

Unit 2 Montpelier Business Park
Dencora Way
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Kent
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18 Linksway, Northwood, Middlesex, HA6 2XB

Report on Ground Investigation

On behalf of Tope Osazee

Document Reference: 12848 **May 2022**

Site: 18 Linksway, Nonrthway, Middlesex HA6 2XB

Document Reference No: 12848

Quality Management

Prepared by:	**JM**
Reviewed by:	**CSS**
Authorised by:	**KM**
Date	**May 2022**
Revision	**0**

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1 INTRODUCTION

Ground and Environmental Services Ltd (GES) was commissioned by Tope Osazee to undertake a Ground Investigation at 18 Linksway, Northwood, Middlesex HA6 2XB.

The proposed development is understood to comprise the demolition of an existing detached house and the construction of a replacement house over an enlarged footprint. The new house will also have a basement structure complete with a basement swimming pool.

The principal objective of the the Ground Investigation was to ascertain the nature of the ground beneath the site in order to provide recommendations with regard to foundation, ground floor slab, retaining wall and temporary works design. In addition parameters for use in the design of the surface water drainage design have been presented.

It should be noted that the scope of the ground investigation did not extend to cover discussion of potential contamination or pollution risks associated with the proposed development.

2 SITE LOCATION

The site is located off Linksway, Northwood and is centred on approximate ordnance survey grid reference centre: TQ 08467 90753.

The site is rectangular in shape composing of a large two-storey detached property with hardstanding to the East (front) and soft landscaping to the South (rear). The ground level across the site slightly sloped gently upwards to the north. The large rear garden area contained a lawn area interspersed with large mature trees.

The following features surround the site:

- To the North and South, the site is bound by residential properties.
- To the East the site is bound by the Linksway.
- To the West the site is bound by a small patch of woodland beyond which were residential properties.

3 GEOLOGY

Reference to the British Geological Survey geological mapping of the area indicates that the solid geology in the area is comprised of the Lambeth Group. The Lambeth Group in the West London basin is underlain by chalk of the Seaford Chalk Formation.

The geological memoir for the area described these strata as follows:

Lambeth Group - Composed of Vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones and lignites and occasional sandstone and conglomerate.

Seaford Chalk Formation - Chalk with flints. With discrete marl seams, nodular chalk, sponge-rich and flint seams throughout.

4 INTRUSIVE INVESTIGATION

4.1 FIELDWORK

The site works were carried out between the 4th and the 31st May 2022 and comprised of the following:

- Cable Percussive Drilling;
- Window Sampling;
- Falling Head Testing;
- Soil Gas and Groundwater Monitoring.

The test locations are shown on Figure 1, Exploratory Hole Location Plan.

Cable Percussion Drilling

One borehole (BH1) was excavated using cable percussion boring methods to a depth of 25.0m below existing ground level. During boring, temporary steel casing (150mm diameter) was used to support the sides of the bore.

Disturbed (D) soil samples were recovered at regular intervals throughout the borehole for description and subsequent laboratory testing purposes. Standard Penetration tests were also carried out at regular intervals using the split spoon attachment.

Upon completion the borehole was backfilled with arisings.

An engineering log of the borehole is presented in Appendix 1.

Window Sample Holes

Two window sample holes (WS1 and WS2) were excavated using a Premier 110 track mounted window sampling rig to depths ranging from of 5.0mbegl to 5.5mbegl (metres below existing ground level).

The soils and materials encountered in the test holes were logged and representative samples recovered for laboratory analysis. Standard Penetration tests was also carried out at one metre intervals using the split spoon attachment or solid cone attachment where appropriate.

Upon completion of window sample holes both were installed with 35mm dual purpose ground water and gas monitoring pipes.

Window sample hole logs and installation details are presented in Appendix 2.

Falling Head Soakage Testing

Falling head soakage testing was undertaken in the standpipes installed in window sample holes WS1 and WS2. The test involved recording the drop in water level with respect to time.

The field test data is summarised below in Section 7.4 below and the results presented in Appendix 3.

Soil Gas and Groundwater Level Monitoring

A soil vapour survey was undertaken across the site and comprised the monitoring of the atmosphere within the window sample hole standpipes installed at the site. Portable gas monitoring equipment (GA 5000) was used to monitor the standpipe for concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2).

The gas and groundwater level monitoring results are presented in Appendix 4.

4.2 GROUNDWATER

Groundwater was not encountered during excavation of the window sample holes. Additionally, groundwater was not encountered during the post fieldwork monitoring visit. Water was recorded at12m in the borehole upon completion of drilling on day 1. The borehole was dry upon completion therefore the water observation may have been as a result of the water added to aid drilling through the dense sands.

It should be noted that groundwater levels may vary due to seasonal fluctuations in rainfall, but in the shorter term, can be affected by antecedent weather conditions or other causes.

5 LABORATORY TESTING

The following range of laboratory tests were scheduled and the results are presented in Appendix 5.

i. Determination of Particle Size Distribution (6 No.)
ii. Determination of Natural Moisture Content (8 No.)
iii. Determination of Atterberg Limits (8 No.).
iv. Determination of Density and Saturation Moisture Content of Chalk (2 no.).
v. Determination of pH (8 No.)
vi. Determination of water-soluble sulphate (8 No.).

6 GROUND CONDITIONS AND ENGINEERING PROPERTIES

6.1 GROUND PROFILE

The ground investigation found beneath a surface layer of Made Ground soils typical of the Lambeth Group with chalk of the underlying Seaford Chalk Formation found at depth.

Made Ground

Made Ground was found to depths ranging between 0.3mbgl (BH1) and 0.5mbgl (WS2). The Made Ground materials consisted of tarmac (BH1) or Concrete paving slab (WS1 & WS2) over light tan sand over solid concrete, concrete and red brick fragments.

Lambeth Group

Underlying the Made Ground at all locations were soils typical of the Lambeth Group.

The Lambeth Group soils comprised an upper horizon of cohesive soils and a lower horizon of granular soils.

Upper Horizon

The upper horizon comprised slightly sandy silty clays which were found to depths ranging between 3.0m at the location of BH1 to 4.2m at the location of WS2.

Lower Horizon

The lower horizon of the Lambeth Group soils predominantly comprised locally silty fine to medium sands. At the top of the soil sequence at the location of BH1 between 3.0m and 4.0m and between 3.9m and 4.1m in WS1 was a silty clayey sand. At the base of the sequence between 12m and 13.3m in BH1 was a gravelly sand with the gravel comprising fine to coarse sub rounded and rounded flints.

The base of the granular soil sequence was not proven at the locations of WS1 and WS2 due to the density of the ground encountered.

Seaford Chalk Formation

Beneath the Lambeth Group at the location of BH1 at a depth of 13.3m were chalk materials typical of the Seaford Chalk Formation. The material encountered comprised of white chalk recovered as a structureless melange comprising of fine to coarse gravel in a comminuted chalk matrix. Scattered flints were noted throughout. The chalk was found to the base of the borehole with a maximum depth of excavation of 25m achieved during this ground investigation.

6.2 ENGINEERING PROPERTIES

The engineering properties of the materials encountered during this ground investigation were assessed based upon a combination of the in situ and laboratory test results. A summary of the engineering properties is given below:

Lambeth Group

Upper Horizon

In situ SPT's indicated the cohesive materials of the upper horizon to be firm to stiff becoming very stiff with N values in the range 9 to 37 recorded. See Figure 2, SPT v Depth Profile. Figure 3 provides a plot of corrected N_{60} values against depth. The N_{60} value taking into account an energy ratio (Er) of 70% (BH) and 74% (WS) for the test equipment used.

Classification tests indicated intermediate to high plasticity with plasticity indices in the range 26% to 42% recorded. With reference to the NHBC standards these soils have a medium to high shrink/swell potential.

Lower Horizon

In situ SPT's indicated the granular soils of the lower horizon to be dense and very dense with N values in the range 34 to 95 recorded. A number of tests met refusal with only partial penetration achieved due to the density of the ground.

These are tabulated below:

SPTs achieving partial penetration		
Test Location	**Test depth**	**Test Result**
WS1	4.0	50 blows for 150mm penetration
WS1	5.0	55 blows for 150mm penetration
WS2	4.0	50 blows for 285mm penetration
BH1	6.5	75 blows for 35mm penetration
BH1	8.0	75 blows for 35mm penetration
BH1	9.5	75 blows for 40mm penetration

Particle size distribution testing on the lower horizon soils generally classified the material as fine to medium sand with silt/clay fractions in the range 4.3% to 12.0%.

A sample tested from BH1 at 3.75m recorded a silty sand with clay lenses. Hydrometer testing on this sample recorded a fine fraction silt content of 30.6% and a clay content of 20.6%.

A sample recovered from 12.5m in BH1 recorded a sandy fine to medium gravel with a silt/clay content of 3%.

For preliminary foundation design purposes the following parameters may be used for consideration of foundations:

Cohesive Upper Horizon:

Undrained shear strength:	Su = 75 kN/m^2 (stiff)
Coefficient of Compressibility:	m_v = 0.15 m²/MN (estimated)
Bulk density	ρ_B = 18 - 19 kN/m^3
Volume Change Potential (VCP)	Medium

Granular Lower Horizon (found at depths ranging between 3.0m and 4.2m):

SPT N	=	50 (dense) (lower bound)
Angle of shearing resistance	=	41^0 (lower bound)
Bulk density	ρ_B =	18 - 19 kN/m^3

Seaford Chalk Formation

In situ SPT's indicated this material to be weak with N values in the range 26 to 60 recorded (Weak).

Laboratory testing on samples of the chalk recovered from BH1 found that the chalk was low density with dry densities of 1.44 Mg/m^3 and 1.46 Mg/m^3 and saturation moisture contents of 31.4% and 32.2% recorded.

7 ENGINEERING DESIGN

7.1 OUTLINE FOUNDATION DESIGN

At the time of reporting, applied structural loads were unknown. However, it is known that the proposed development will comprise the construction of a replacement house over an enlarged footprint. The new building will also have a basement structure. A swimming pool is also proposed within the basement area. A basement level of 3.5m below existing ground level has been assumed with the swimming pool base at 5.5m below existing ground level.

For preliminary foundation design purposes, a maximum line load of 100kN/m run has therefore been adopted.

In deliberation of suitable remedial foundation options consideration was given to the geotechnical hazards and risks as presented below

Geotechnical Hazard	Qualitative Risk & Consequences	Possible Risk Reduction Measures
Ground disturbance from existing underground structures such as service runs and old footings.	**Very high** Implication for foundation depth and economic feasibility of shallow foundations.	New foundations to be constructed in undisturbed ground or alternatively disturbed ground to be removed and replaced with suitable engineering fill.
Shrinkage/swelling of foundation soils due to action of tree roots.	**Medium to high** Foundation movement and cracking of brickwork.	Comply with NHBC recommendations for medium shrinkability soils.
Variations in stiffness of ground below foundation depth that could give rise to unacceptable total and differential settlement.	**Low** Terraced housing particularly sensitive to differential settlement. Would result in cracking of superstructure if conventional brickwork or brick cladding.	Calculate likely magnitude of settlement and determine if within acceptable tolerances. Make foundations act as reinforced beams.

Based upon the findings of the ground investigation and the development proposals initial consideration has been given to conventional strip foundations.

Shallow Foundations

Foundation depths

As discussed above a basement level of 3.5m below existing ground level has been assumed. At this depth the ground conditions generally comprised of the granular soils of the Lambeth group Stratum. Based on the results of this ground investigation the granular soils would be a suitable foundation material. It is recommended that strip foundations are extended into the granular soils by a minimum of 0.3m therefore locally a founding level approximately 4.5m (1.0m below basement level) would be required.

Foundation depths would also need to consider ground disturbance from the existing development of the site.

Allowable Bearing Pressures

Based on field observations, in situ testing and laboratory test results, a maximum allowable bearing of 250 kN/m^2 is recommended for foundations placed in the lower horizon granular soils of the Lambeth group. Adopting a line load of 100 kN/m run a minimum practicable foundation width of 0.45 m is therefore recommended..

Settlement

Preliminary settlement calculations indicated total settlements would be less than 15 mm. Immediate settlement would be approximately 50% of the total settlement, the remainder being long term consolidation settlement.

7.2 GROUND FLOORS

The NHBC guidance advises that suspended ground floors should be adopted when the plasticity index (PI) of the founding soils is greater than 10%. In addition, where the depth of fill would be greater than 600mm within a self-contained area, the floor construction over the whole of that area is required to be self-supporting and independent of the fill.

Based upon the findings of this ground investigation and assuming a basement level 3.5m below existing ground level a ground bearing floor slab maybe utilised.

Prior to construction the formation should be inspected and proof rolled with any soft or loose, organic or otherwise deleterious soils either stabilised or removed and replaced with granular fill.

The remains of any former substructures should be removed and replaced with well compacted granular fill. Excavation and replacement with granular fill should be extended to areas where cohesive soils are encountered at formation level within the zone of influence of trees and where tree roots are observed at formation level.

7.3 TEMPORARY WORKS

Excavations in excess of 1.2m depth will be required in connection with the proposed development on this site. If there is a requirement for personnel to enter into excavations, then the need for trench side support should be considered for any depth of excavation and, therefore, appropriate equipment should be available on site prior to excavation proceeding. A site specific risk assessment should be carried out where man entry into excavations is required.

Based on the ground profile found during this ground investigation short term support of excavations using traditional sheeting methods would be suitable for this site.

The base of foundation excavations should be inspected and any soft loose, organic or otherwise deleterious material at foundation level removed and replaced with lean mix concrete. The soils encountered will be liable to softening/loosening when exposed to surface water infiltration. In order to avoid deterioration of the prepared formation the base of foundations should be blinded with concrete as soon as practical after excavation and particularly if there is delay before placing foundation concrete.

7.4 SOAKAWAYS

The results from the falling head tests undertaken in the standpipes installed in WS1 and WS2 indicated a good soakage potential in WS1 with infiltration rates in the range 1.8 x 10^{-3} to 4.3 x 10^{-4} m/s calculated and a moderate soakage potential at the location of WS2 with an infiltration rate of 5.6 x 10^{-5} m/s calculated.

Based on this result the use of shallow chamber type soakaways discharging into the granular soils of the Lambeth Group is a viable option for the disposal of surface water.

7.5 RETAINING WALL PARAMETERS

Based upon the results of the ground investigation the following parameter set is recommended for use in the design of retaining structures on the site:

Material	Bulk density	Angle of shearing resistance		Effective cohesion
	(δb kN/m³)	ϕ'max (°)	ϕ'crit (°)	c'
Lambeth Group (silty clays)	18	29	27	0
Lambeth Group (sands)	19	40	35	0

Seaford Chalk Formation

Material	Bulk density	Angle of shearing resistance (after CIRIA C574)		Effective cohesion
	(δb kN/m³)	ϕ' (°) moderately conservative (mc)	ϕ'crit (°) Worst credible (wc)	c'
Chalk	20	33	31	0

No groundwater was encountered in the standpipes installed to 5m and 5.5m during this ground investigation. The only water observation made was observed at 12m in borehole BH1 at the end of the first days drilling. As discussed above this may have been influenced by the use of water to aid the drilling process through the dense sands.

7.6 CHEMICAL ATTACK ON BURIED CONCRETE

The results of the chemical testing indicated a concentration of water-soluble sulphate in the range 12 to 543 mg/l as SO_4. pH values were within a range between 6.5 and 7.5 pH units.

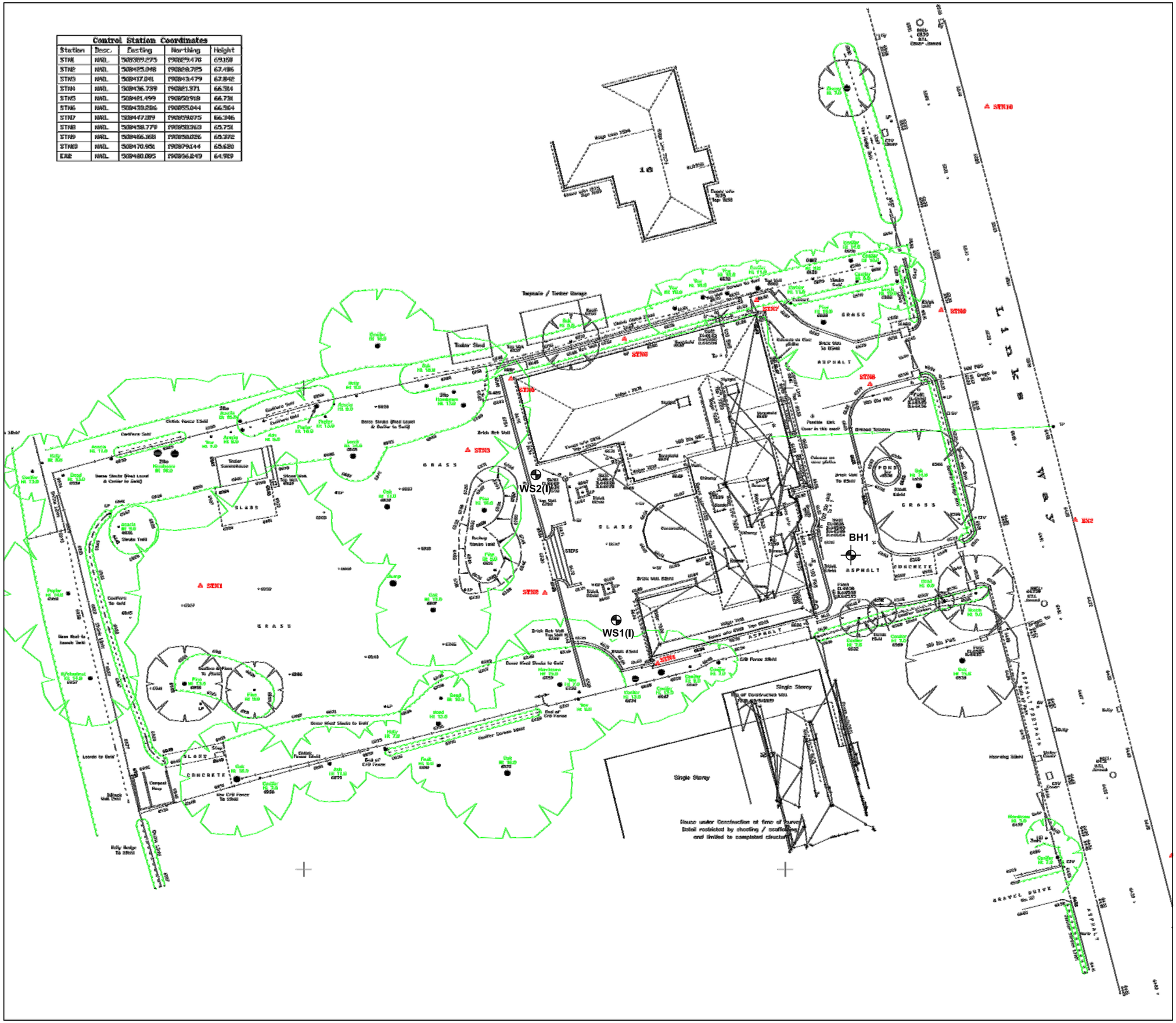
In accordance with BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground' a design sulphate class for the site of DS-1 is recommended. Using SD1 an ACEC (Aggressive Chemical Environment for Concrete) class of AC-1 is recommended.

8 CONCLUSIONS AND RECOMMENDATIONS

Based on the intrusive works the following conclusions and recommendations have been drawn up in respect of the site at 18 Linksway, Northwood, Middlesex HA6 2XB.

- The ground profile encountered at the site comprised a thin layer of Made Ground over soils of the Lambeth Group with chalk of the Seaford Chalk Formation found at depth in BH1.
- The development was understood to comprise a two storey replacement dwelling with full basement structure. A swimming pool is also proposed within the basement. A basement floor level and swimming pool basement level of 3.5m and 5.5m below exiting ground levels has been assumed respectively.
- Structural loads were unknown at the time of reporting however for preliminary foundation design purposes a line load of 100kN/m run was adopted.
- A maximum allowable bearing of 250kN/m^2 was recommended for foundations placed within the granular soils of the Lambeth Group which were found at the assumed basement level of 3.5m below existing ground level.
- For a typical line load of 100kN/m a minimum practicable foundation width of 0.45m was recommended.
- Total settlements would be less than 15mm.
- Based on the results of the falling head tests the use of shallow soakaways discharging into the granular soils of the Lambeth Group would be a viable option for disposal of surface water. Full scale BRE DG365 testing is recommended at enabling stage to obtain final design parameters.
- A design sulphate class for the site of DS-1 and an ACEC class of AC-1 is recommended.

Control Station Coordinates				
Station	Desc.	Easting	Northing	Height
STN1	NAIL	508389.275	190829.478	69.158
STN2	NAIL	508425.048	190828.785	67.486
STN3	NAIL	508417.041	190843.479	67.842
STN4	NAIL	508436.739	190821.371	66.504
STN5	NAIL	508481.499	190850.918	66.731
STN6	NAIL	508439.586	190855.044	66.564
STN7	NAIL	508447.089	190839.875	66.346
STN8	NAIL	508458.779	190858.363	65.751
STN9	NAIL	508466.368	190858.026	65.372
STN10	NAIL	508470.958	190879.144	65.620
ER2	NAIL	508480.095	190836.249	64.919



KEY:

- WS - WINDOW SAMPLE
- BH - BOREHOLE
- (I) - INSTALLATION
- TP - TRIAL PIT
- HDTP - HAND DUG TRIAL PIT
- SP - SOAKAGE PIT
- DCP - DYNAMIC CONE PENETRATION
- DP - DYNAMIC PROBE
- HA - HAND AUGER
- PT - PERCOLATION TEST
- GM - GAS MONITORING STANDPIPE
- S - SAMPLE LOCATION

CLIENT:
TOPE OSAZEE

SITE ADDRESS:
18 LINKSWAY
NORTHWOOD
MIDDLESEX

DRAWING NO.:
FIGURE 1

DRAWING TITLE:
EXPLORATORY HOLE LOCATION PLAN

PROJECT NO.:
12848

DATE:
05/2022

DRAWN:
PJ

REVISION:
00

GROUND AND ENVIRONMENTAL SERVICES (GES) LIMITED
UNIT 2
MONTPELIER BUSINESS PARK
DENCORA WAY
ASHFORD
KENT TN23 4FG
TEL: 01233 646 237

Figure 2: 18 Linksway, Northwood
SPT N-Depth Profile

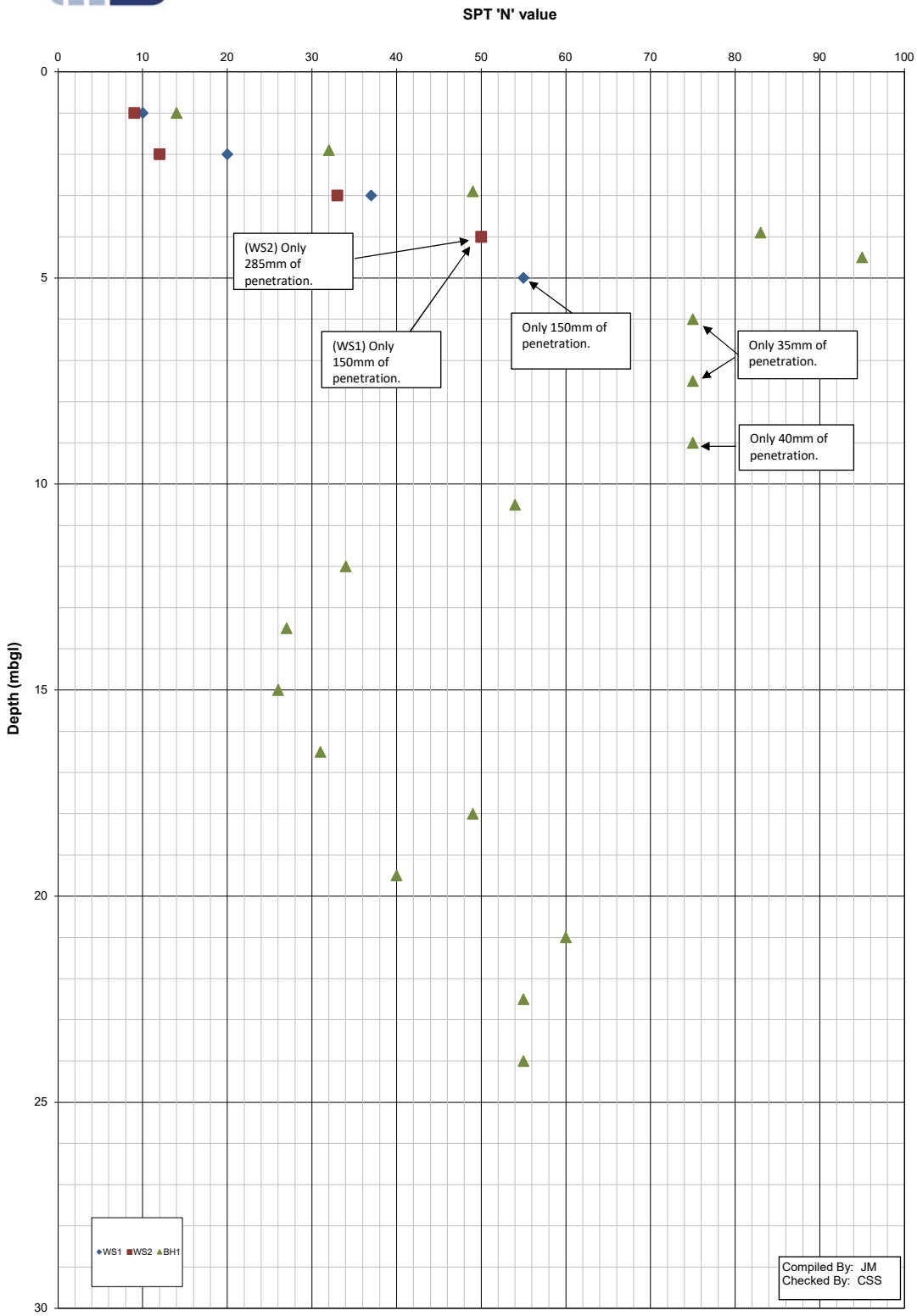
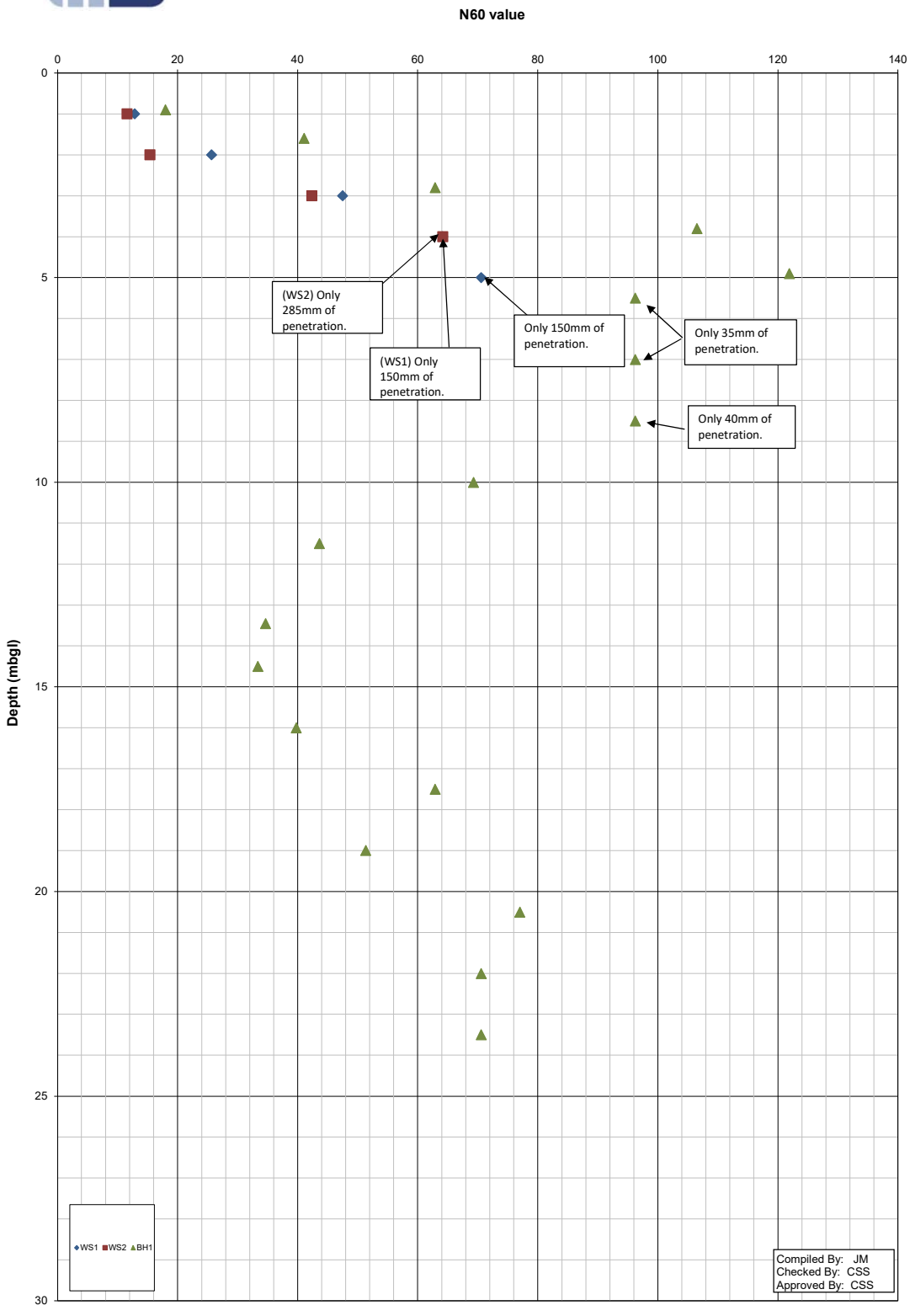


Figure 3: 18 Linksway, Northwood
N60-Depth Profile



APPENDIX 1

BOREHOLE LOG

Ground and Environmental Services Limited

Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG
Tel: 01233 646237

Borehole No. BH1

Sheet: 1 of 3

Equipment & Methods. Dando 2500 _Backfill: Arisings	Project Name: 18 Linksway Project Location: Northwood, Middlesex HA6 2XB Client: Tope Osazee	Job No: 12848
Co-ordinates: E: N:	Ground Level (m):	Date Started:04/05/2022 Date Completed:05/05/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.30		D			MADE GROUND: Tarmac surface.	-0.10		(0.10)
0.50		D			MADE GROUND: Reinforced concrete slab.	-0.30		(0.20)
			SN=14	2,2/3,3,4,4	Firm becoming stiff orange green silty CLAY. **(Lambeth Group)**			
1.20- 1.65		D						
1.75		D						
			SN=32	5,6/7,8,8,9				(2.00)
2.00- 2.45		D						
2.75		D						
			SN=49	6,8/10,12,12,15		-3.00		3.00
3.00- 3.45		D			Dense orange clayey silty SAND. **(Lambeth Group)**			
3.75		D						(1.00)
			SN=83	7,12/16,20,22,25	Dense and very dense yellowish brown fine to medium SAND. **(Lambeth Group)**	-4.00		4.00
4.00- 4.45		D						
4.75		D						
			SN=95	8,10/20,25,25,25				
5.00- 5.45		D						(3.30)
6.00		D						
			SN=50	4,16/25,25				
6.50- 6.95		D						
						-7.00		7.00
7.50		D			Dense and very dense olive green fine to medium SAND **(Lambeth Group)**			
			SN=50	5,18/25				
8.00- 8.45		D						
9.00		D						
			SN=50	6,15/23,25				(5.00)
9.50- 9.95		D						
10.50		D						
			SN=54	7,7/9,11,14,20				
11.00- 11.45		D						
12.00		D				-12.00		12.00
			CN=34	5,6/7,8,9,10	Dense greenish brown gravelly SAND. gravel is fine to coarse sub rounded and rounded flint. **(Lambeth Group)**			
12.50- 12.95		D						(1.30)
13.50		D				-13.30		13.30
			SN=26	6,6/7,7,5,7	Weak white partially weathered CHALK. Chalk recovered as structureless melange comprising fine to coarse chalk gravel in a comminuted silt matrix. Scattered flints throughout. **(Seaford Chalk Formation)**			
14.00- 14.45		D						
15.00		D						

Remarks:

Logged By:	Checked By:
JP	CSS
Scale: 1:75	Approved By:
FIG No. .1	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG
Tel: 01233 646237

Borehole No. BH1

Equipment & Methods. Dando 2500 _Backfill: Arisings	Project Name: 18 Linksway Project Location: Northwood, Middlesex HA6 2XB Client: Tope Osazee	Job No: 12848
Co-ordinates: E: N:	Ground Level (m):	Date Started:04/05/2022 Date Completed:05/05/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
15.50- 15.95		D	SN=26	5,5/6,6,7,7				
16.50		D						
17.00- 17.50		D	SN=31	5,6/7,8,8,8				
18.00		D						
18.50- 18.95		D	SN=49	5,5/8,8,12,11				
19.50		D						(11.70)
20.00- 20.45		D	SN=40	5,7/8,9,11,12				
21.00		D						
21.50- 21.95		D	SN=60	6,15/18,20,12,10				
22.50		D						
23.00- 23.45		D	SN=55	4,7/9,11,16,19				
24.00		D						
24.55- 25.00		D	SN=55	5,6/8,12,15,20		-25.00		25.00

End of Borehole 25.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: JP	Checked By: CSS
Scale: 1:75	Approved By:
FIG No. .2	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG
Tel: 01233 646237

Borehole No. BH1

Equipment & Methods. Dando 2500 _Backfill: Arisings	Project Name: 18 Linksway Project Location: Northwood, Middlesex HA6 2XB Client: Tope Osazee	Job No: 12848
Co-ordinates: E: N:	Ground Level (m):	Date Started:04/05/2022 Date Completed:05/05/2022

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
4-5-22	00:00	13.50	13.00	12.00	end of shift
5-5-22	00:00	25.00	17.00	dry	end of borehole

Hole Diameter by Depth Table

Depth of Hole (m)	Diameter of Hole (mm)	Diameter of Casing (mm)	Depth of Casing (m)
25.00	150	250	17.00

Water Added During Boring

From (m)	To (m)
3.00	12.00

Remarks:

Logged By:	Checked By:
JP	CSS
Scale: 1:75	Approved By:
FIG No. .3	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

APPENDIX 2

WINDOW SAMPLE HOLE LOGS AND INSTALLATION DETAILS

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park Tel: 01233 646237
Dencora Way, Ashford
Kent TN23 4FG

Window
Sampler Log No. WS1
Sheet: 1 of 1

Equipment & Methods.
Premier Compact 110
_Backfill: 35mm Standpipe

Project Name: 18 Linksway
Project Location: Northwood, Middlesex HA6 2XB
Client: Tope Osazee

Job No: 12848

Co-ordinates:
E:
N:

Ground Level (m):

Date Started:04/05/2022
Date Completed:04/05/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADEGROUND: Concrete paving slab.	-0.02		(0.02)
0.30		D			MADEGROUND: Light tan sand with concrete and red brick fragments with whole bricks.	-0.40		(0.38) 0.40
0.70		D			Dry firm light orangish tan with light grey mottling silty CLAY with frequent fine roots.			(0.60)
			SN=10	2,3/2,3,2,3		-1.00		1.00
1.20		D			Dry stiff to very stiff mottled dark reddish orange with dark greenish grey occasional white silt inclusions silty CLAY.			
1.80		D						
			SN=20	2,3/3,5,5,7				
2.50		D						(2.90)
			SN=37	3,5/7,9,9,12				
3.50		D						
			CN=50	7,15/25,25 Only 150mm of penetration achieved	Dry very dense dark orange tan clayey SAND	-3.90		3.90 (0.20)
					Dry very dense dark tannish orange ffine to medium SAND.	-4.10		4.10
4.50		D						(0.90)
			CN=55	14,15/24,31 Only 150mm of penetration achieved		-5.00		5.00

End of W/S 5.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: JM
Checked By: CSS
Scale: 1:40
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG
T: 01233 646237

Hole ID. WS1

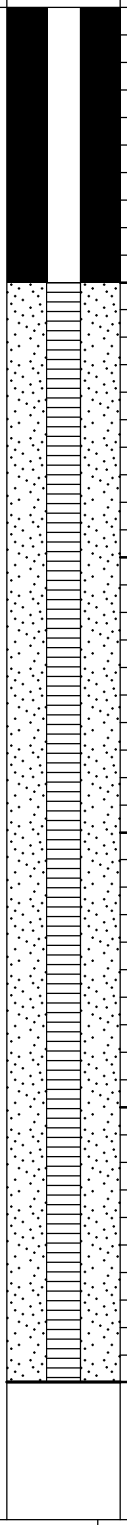
Installation Details & Readings

Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Backfill: 35mm Standpipe	Project Name: 18 Linksway Project Location: Northwood, Middlesex HA6 2XB Client: Tope Osazee	Job No: 12848
Co-ordinates: E: N:	Ground Level (m):	Date Started:04/05/2022 Date Completed:04/05/2022

Installation Date : 04/05/2022
Installation Type : SP

Depth to TOP Response Zone : 1 (m)
Depth to BASE Response Zone : 5 (m)



Depth	Depth Related Remarks (Elevation)
	bentonite seal
1	(-1.00)
	slotted standpipe with gravel annulus
	End of Hole 5.00 m
	(-5.00)

Compiled By:	Checked By:
JM	CSS
Scale:	Approved By:
FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG PIEZO/STANDPIPE LOG LOGS.GPJ GSG-AGS3-STD TEMPLATE.GDT 31/5/22

Ground and Environmental Services Limited

Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG
Tel: 01233 646237

Window
Sampler Log No. WS2
Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Backfill: 35mm Standpipe	Project Name: 18 Linksway Project Location: Northwood, Middlesex HA6 2XB Client: Tope Osazee	Job No: 12848
Co-ordinates: E: N:	Ground Level (m):	Date Started:04/05/2022 Date Completed:04/05/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADEGROUND: Concrete paving slab.	-0.02		(0.02)
0.30		D			MADEGROUND: Light tan sand over solid concrete, frequent concrete and red brick fragments.			(0.48)
0.70		D			Dry firm light orangish tan with light grey mottling slightly sandy silty CLAY with frequent fine roots.	-0.50		0.50 (0.50)
1.20		D	SN=9	1,1/2,2,2,3		-1.00		1.00
1.80		D			Dry very stiff mottled dark reddish orange with dark greenish grey occasional white silt inclusions silty CLAY.			
2.50		D	SN=12	1,2/2,3,3,4				(3.20)
3.50		D	SN=33	3,4/5,7,10,11				
4.30		D	SN=50	4,5/7,11,15,16 Only 60mm of penetration on final value	Dry very dense dark orange fine to medium SAND	-4.20		4.20
5.00		D	SN=50	10,12/12,12,13,13				(1.30)
						-5.50		5.50

Remarks:

Logged By:	Checked By:
JM	CSS
Scale: 1:40	Approved By:
FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG
T: 01233 646237

Hole ID. WS2

Installation Details & Readings

Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Backfill: 35mm Standpipe	Project Name: 18 Linksway Project Location: Northwood, Middlesex HA6 2XB Client: Tope Osazee	Job No: 12848
Co-ordinates: E: N:	Ground Level (m):	Date Started:04/05/2022 Date Completed:04/05/2022

Installation Date : 04/05/2022
Installation Type : SP

Depth to TOP Response Zone : 1 (m)
Depth to BASE Response Zone : 5.5 (m)

Installation Diagram	Depth Related Remarks (Elevation)
	bentonite seal
1	(-1.00)
	slotted standpipe with gravel annulus
5.5	(-5.50)

Compiled By:	Checked By:
JM	CSS
Scale:	Approved By:
FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG PIEZO/STANDPIPE LOG LOGS.GPJ GSG-AGS3-STD TEMPLATE.GDT 31/5/22

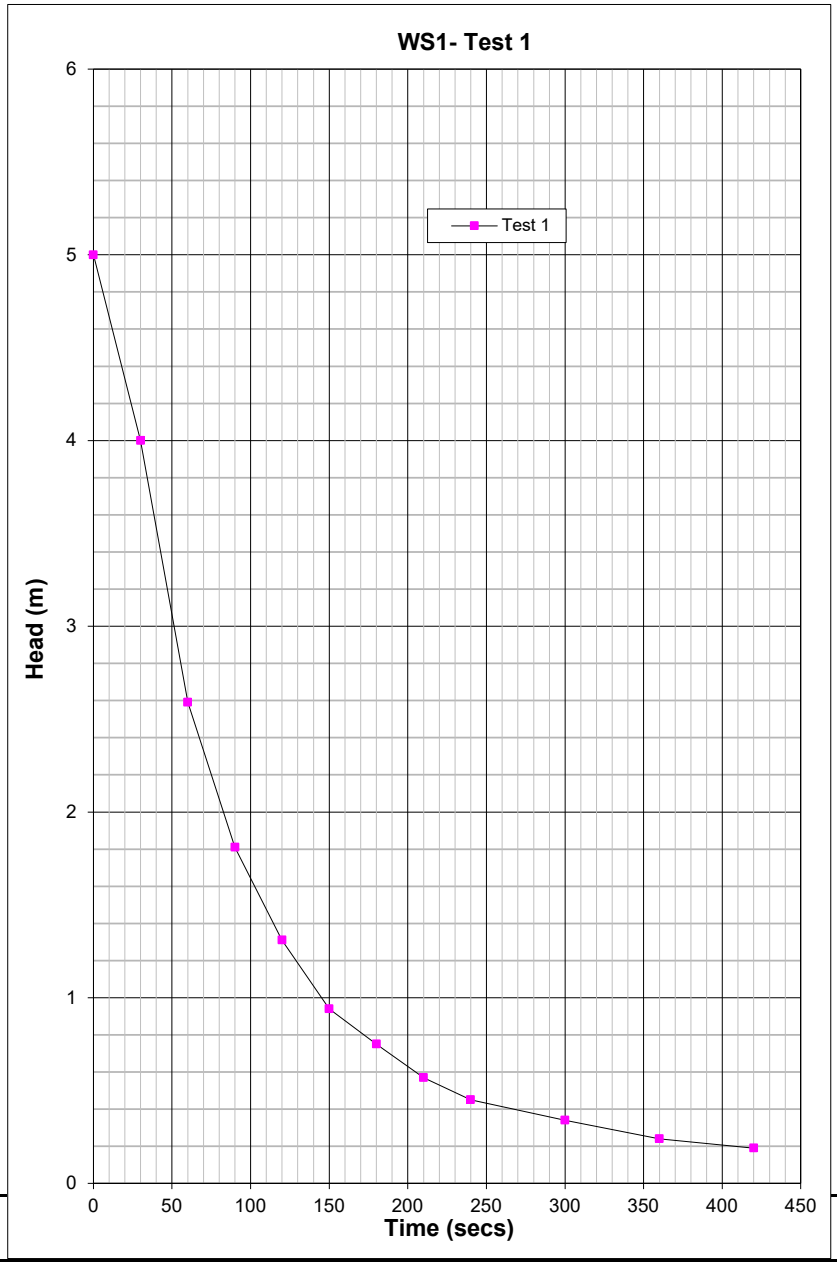
APPENDIX 3

FALLING HEAD TEST RESULTS

	18 Linksway, Northwood	WS 1

Top section	1	m	Centre section	3	m	Diameter of Hole	0.075	m
Bottom section	5	m	Diameter of test section	0.075	m	Length of test section	4	m
Water Level	DRY	m						

Time (Seconds)	Depth	Head
0	0	5
30	1	4
60	2.41	2.59
90	3.19	1.81
120	3.69	1.31
150	4.06	0.94
180	4.25	0.75
210	4.43	0.57
240	4.55	0.45
300	4.66	0.34
360	4.76	0.24
420	4.81	0.19



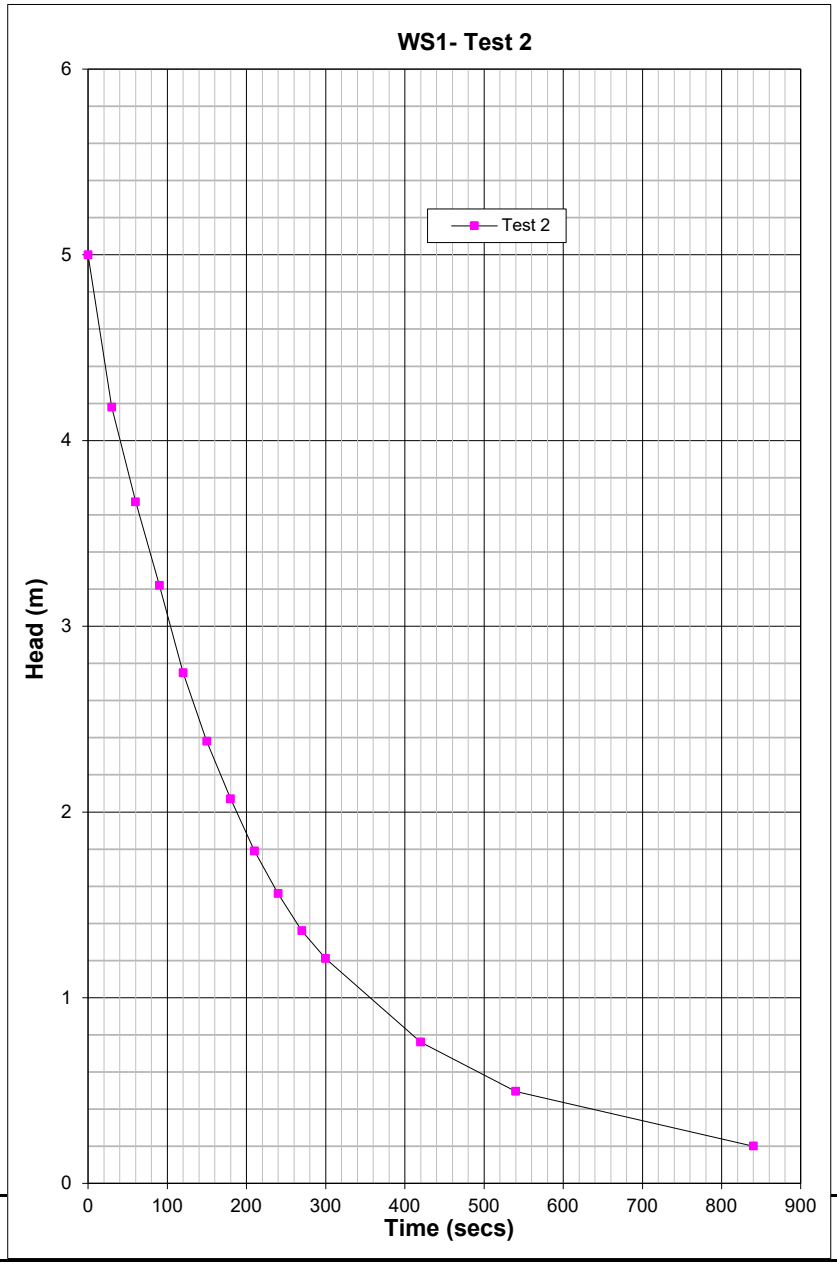
GOOD SOAKAGE

After BS5930:1999 k(approx) = 1.8×10^{-3} m/s

	18 Linksway, Northwood						**WS 1**	

Top section	**1**	m	Centre section	**3**	m	Diameter of Hole	**0.075**	m
Bottom section	**5**	m	Diameter of test section	**0.075**	m	Length of test section	**4**	m
Water Level	DRY	m						

Time (Seconds)	Depth	Head
0	0	5
30	0.82	4.18
60	1.33	3.67
90	1.78	3.22
120	2.25	2.75
150	2.62	2.38
180	2.93	2.07
210	3.21	1.79
240	3.44	1.56
270	3.64	1.36
300	3.79	1.21
420	4.24	0.76
540	4.505	0.495
840	4.8	0.2



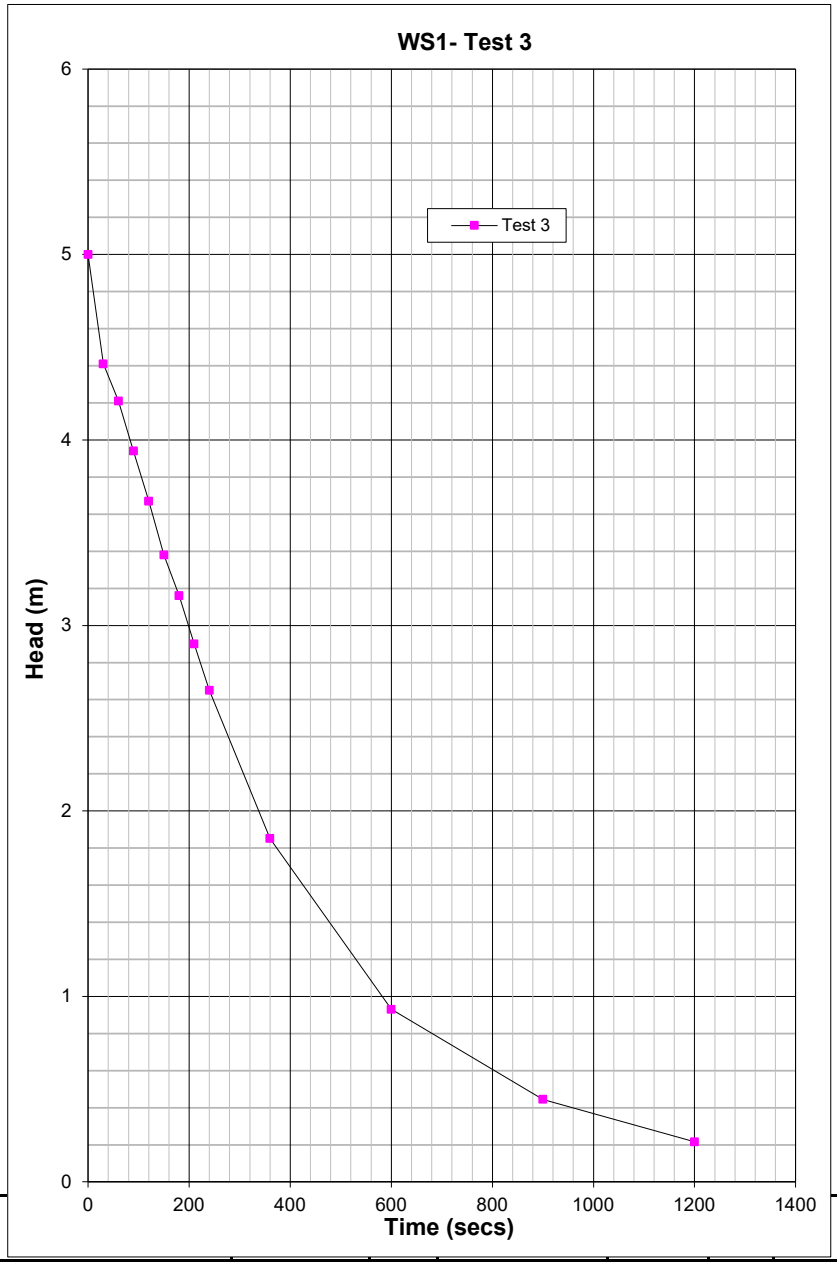
GOOD SOAKAGE

After BS5930:1999 **k(approx) = 7.7 x 10^{-4} m/s**

	18 Linksway, Northwood	WS 1

Top section	1	m	Centre section	3	m	Diameter of Hole	0.075	m
Bottom section	5	m	Diameter of test section	0.075	m	Length of test section	4	m
Water Level	DRY	m						

Time (Seconds)	Depth	Head
0	0	5
30	0.59	4.41
60	0.79	4.21
90	1.06	3.94
120	1.33	3.67
150	1.62	3.38
180	1.84	3.16
210	2.1	2.9
240	2.35	2.65
360	3.15	1.85
600	4.07	0.93
900	4.555	0.445
1200	4.785	0.215



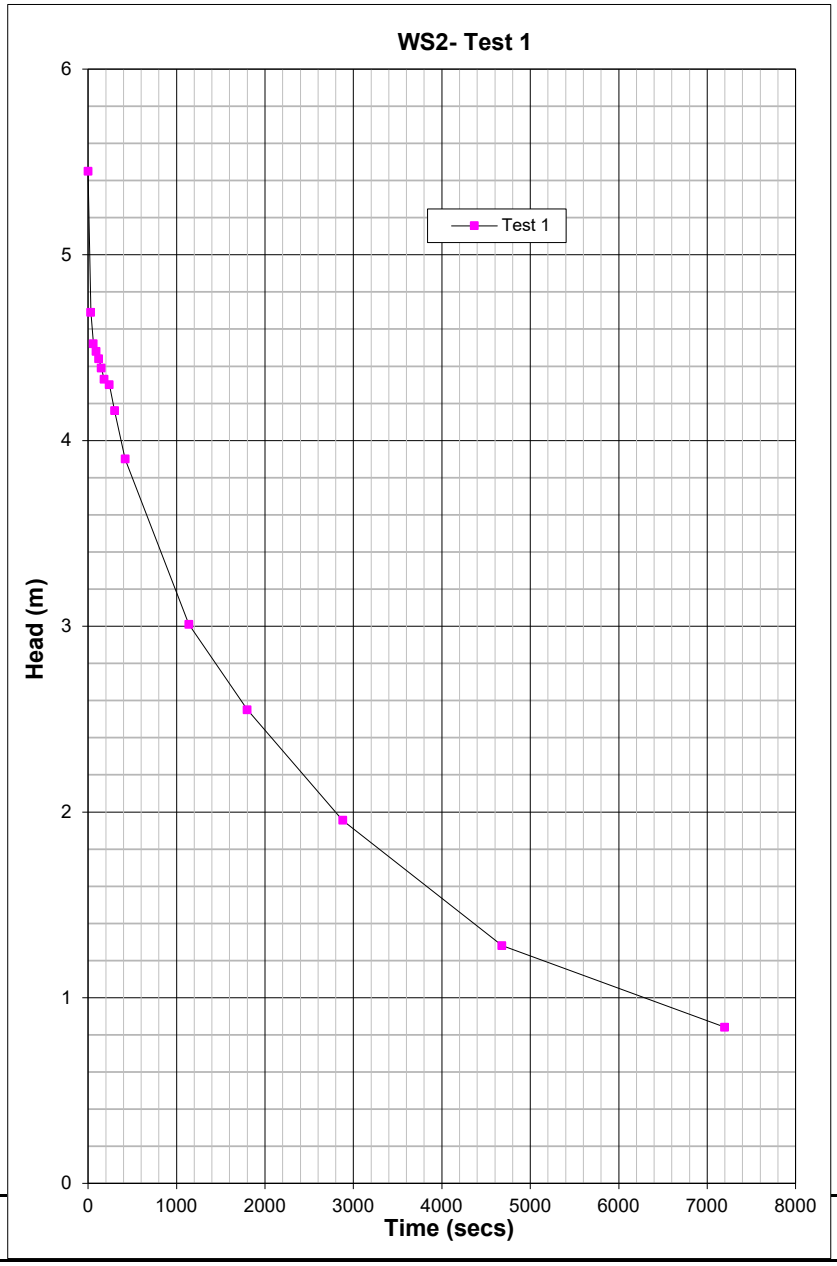
GOOD SOAKAGE

After BS5930:1999 k(approx) = 4.3 x 10^{-4} m/s

	18 Linksway, Northwood		WS 2

Top section	1	m	Centre section	3.225	m	Diameter of Hole	0.075	m
Bottom section	5.45	m	Diameter of test section	0.075	m	Length of test section	4.45	m
Water Level	DRY	m						

Time (Seconds)	Depth	Head
0	0	5.45
30	0.76	4.69
60	0.93	4.52
90	0.97	4.48
120	1.01	4.44
150	1.06	4.39
180	1.12	4.33
240	1.15	4.3
300	1.29	4.16
420	1.55	3.9
1140	2.44	3.01
1800	2.9	2.55
2880	3.495	1.955
4680	4.17	1.28
7200	4.61	0.84



MODERATE SOAKAGE

After BS5930:1999 **k(approx) = 5.6 x 10^{-5} m/s**

APPENDIX 4

SOIL GAS AND GROUNDWATER MONITORING RESULTS

SOIL GAS SURVEY

Project:	18 Linksway			Date:	09/05/2022				Equipment Used:	GA 5000, Dipmeter		
Location:	Northwood			Weather:	Dry 1/8 cloud							
Job No.	12848			Temp:	18°C							

Monitoring Point No.	Time	O2 (% v/v)	CO2 (% v/v)	CH4 (% v/v)	H2S (PPM)	CO (PPM)	PID (PPM)	Flow (l/hr)	Differential Pressure (mbar)	Water (mbgl)	Site Observations/ Comments	
WS1	11:41	19.4	1.6	0.2	0	0		<0.1		Dry at 5.0m		Barometric Pressure
WS2	11:45	19.7	1.1	0.1	0	0		<0.1		Dry at 5.5m	Time	
											11:41	1016mb
											Datum:	

Tested by: CSS

Checked by: KM

mbgl = metres below ground level

Ground and Environmental Services Limited

Accuracy and range of Gas Analyser 5000 (GA5000)

	Accuracy			Range
Gas	Gas Concentrations			
	0-5%	5-15%	0-FS	
CH_4	+/-0.5%	+/-3%		0-70% to specification, 0-100% reading
CO_2	+/-0.5%	+/-3%		0-40% to specification, 0-100% reading
O_2	+/-1%	+/-1%		0-25%
CO			+/-10%FS	0-500ppm
H_2S			+/-10%FS	0-200ppm
B.P.	+/- 5 mBar			700-1200 mBar
Flow:				

Notes:

CH4: methane in percent volume per volume (% v/v)

CO2: carbon dioxide in %v/v

O2: oxygen in % v/v

H2S: hydrogen sulphide in part per million (ppm)

CO: carbon monoxide in ppm

B.P.: Barometric pressure in mBar

Flow: Gas flow in litre per hour (l/h)

APPENDIX 5

LABORATORY TEST RESULTS

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way
Ashford
Kent
TN23 4FG

www.genvs.com
E: info@genvs.com
T: 01233 646237

Site: 18 Linksway

Project No: 12848

Client: Tope Osazee

Date 11/05/2022

Date Received: 05/05/2022

Date Tested: 10/05/2022

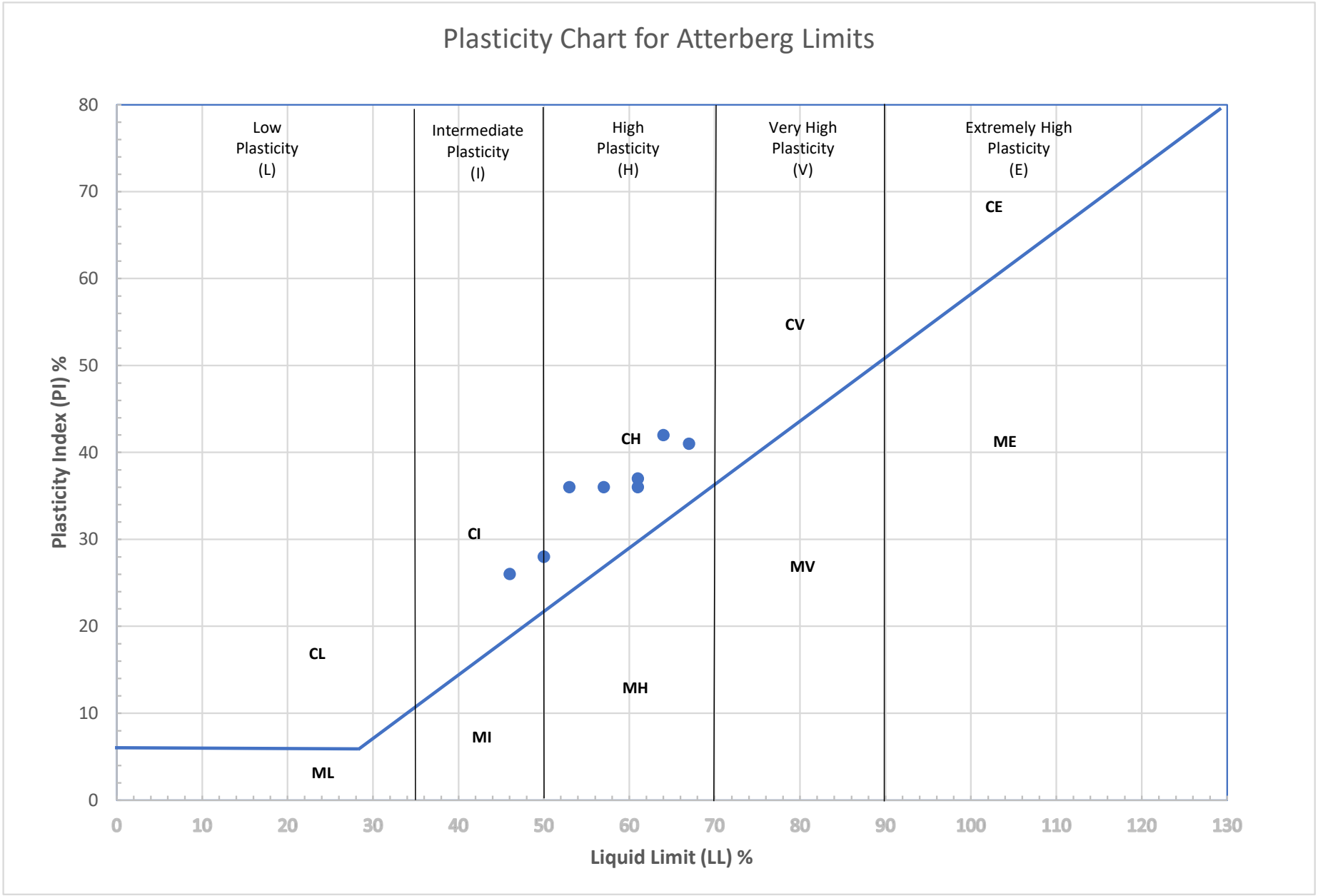
Test Results

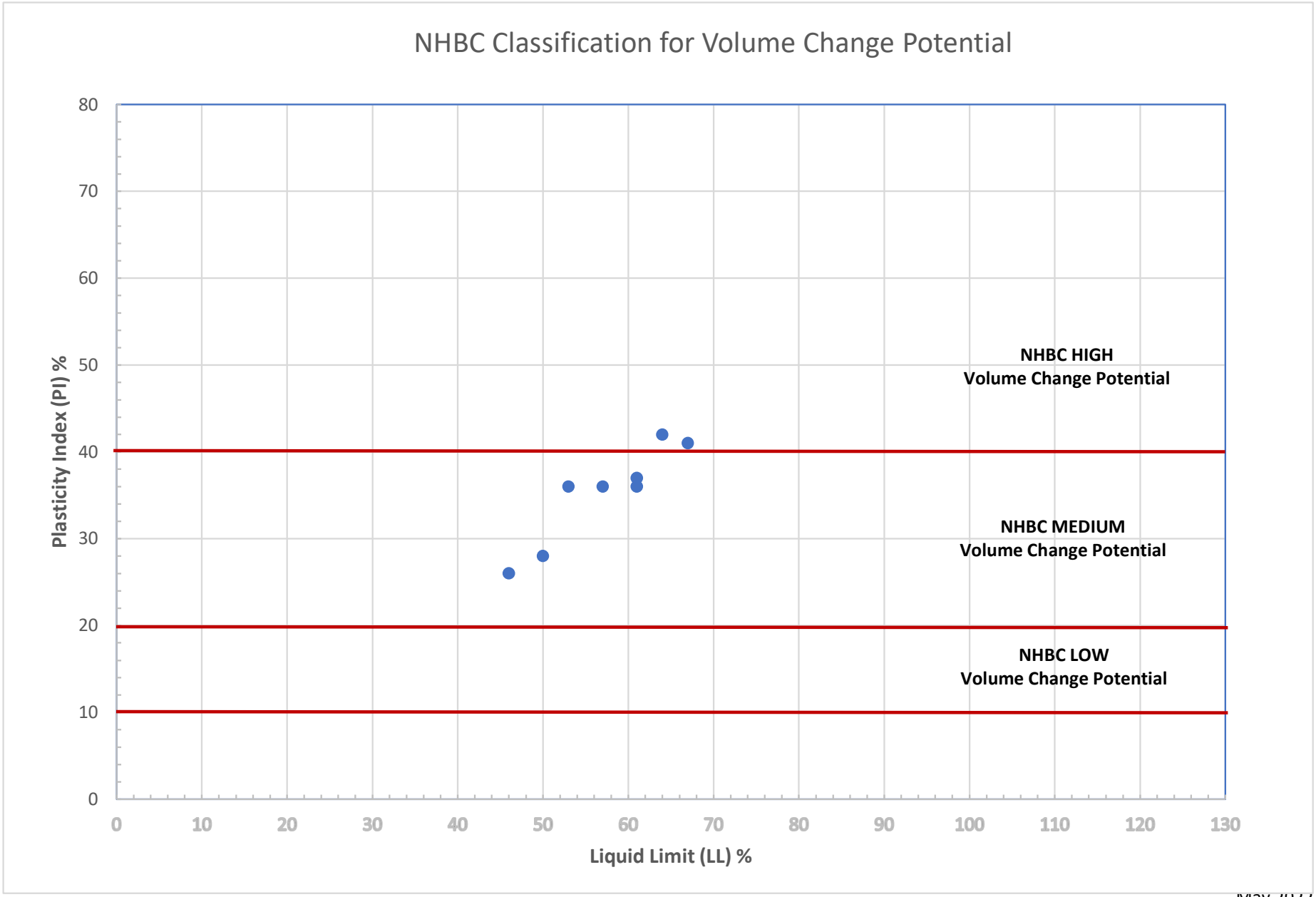
Location ID	Depth (m)	MC (%)	LL (%)	PL (%)	PI (%)	% passing 425 µm sieve	Classification	Sample type
WS 1	0.7	24	64	22	42	98	CH	D
WS 1	1.8	20	61	24	37	98	CH	D
WS 1	3.5	18	50	22	28	98	CI/CH	D
WS 2	0.7	25	57	21	36	98	CH	D
WS 2	1.2	18	46	20	26	98	CI	D
WS 2	2.5	20	63	27	36	98	CH	D
BH 1	1.75	27	67	26	41	98	CH	D
BH 1	2.75	21	61	25	36	98	CH	D

Visual Descriptions

Location ID	Depth	Description
WS 1	0.7	Light orangeish tan with light grey silty CLAY
WS 1	1.8	Dark reddish orange with dark greenish grey silty CLAY
WS 1	3.5	Dark reddish orange with dark greenish grey silty CLAY
WS 2	0.7	Light orangeish tan with light grey silty CLAY
WS 2	1.2	Dark reddish orange with dark greenish grey silty CLAY
WS 2	2.5	Dark reddish orange with dark greenish grey silty CLAY
BH 1	1.75	Orange green silty CLAY
BH 1	2.75	Orange green silty CLAY

Tested by: STP Checked by: CSS Approved by: CSS


Plasticity Chart for Atterberg Limits
Low Plasticity (L)
Intermediate Plasticity (I)
High Plasticity (H)
Very High Plasticity (V)
Extremely High Plasticity (E)
CE
CV
CH
ME
CI
MV
CL
MH
MI
ML
Plasticity Index (PI) %
Liquid Limit (LL) %
0
10
20
30
40
50
60
70
80
90
100
110
120
130

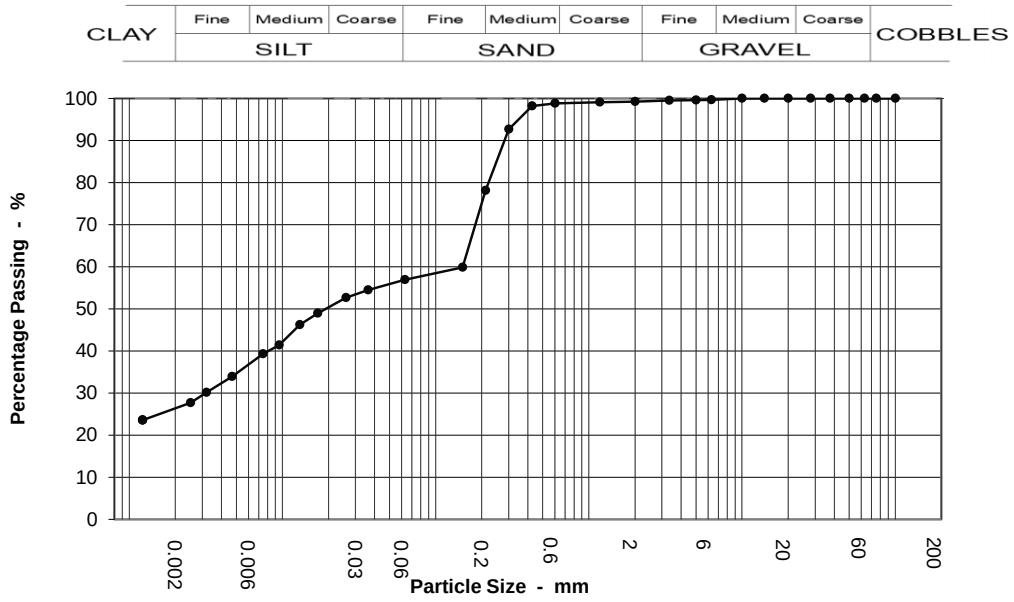

NHBC Classification for Volume Change Potential
Plasticity Index (PI) %
Liquid Limit (LL) %
0
10
20
30
40
50
60
70
80
90
100
110
120
130
NHBC HIGH
Volume Change Potential
NHBC MEDIUM
Volume Change Potential
NHBC LOW
Volume Change Potential

May 2022

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**12848**
		Borehole / Pit No	BH 1
Project	**18 Linksway**	Sample No	
		Depth	3.75 m
Soil Description	Orange brown silty fine SAND with some soft clay lenses	Sample type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.036	54
63	100	0.026	53
50	100	0.017	49
37.5	100	0.013	46
28	100	0.010	41
20	100	0.007	39
14	100	0.005	34
10	100	0.003	30
6.3	100	0.003	28
5	100	0.001	24
3.35	100		
2	99		
1.18	99		
0.6	99		
0.425	98		
0.3	93		
0.212	78		
0.15	60		
0.063	57		

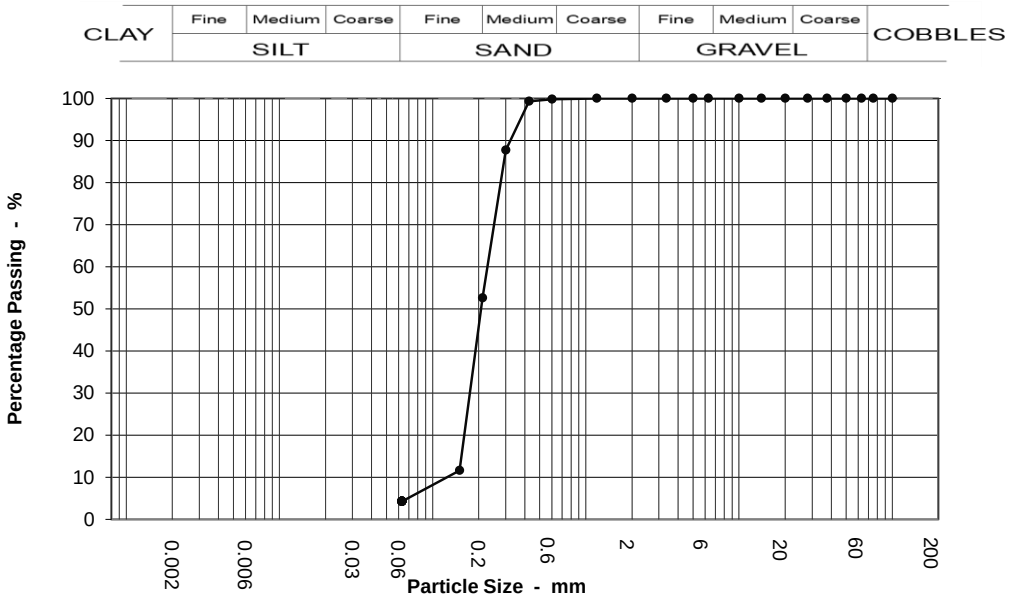
Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	0.7
Sand	42.6
Silt	30.6
Clay	26.1

Grading Analysis	
D100	3.35
D60	0.150
D10	
Uniformity Coefficient	N/A

Operator	Checked	Approved	Remarks
STP	KM	CSS	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	12848
		Borehole / Pit No	BH 1
Project	18 Linksway	Sample No	
		Depth	6.00 m
Soil Description	Golden brown fine to medium SAND	Sample type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	88		
0.212	53		
0.15	12		
0.063	4		

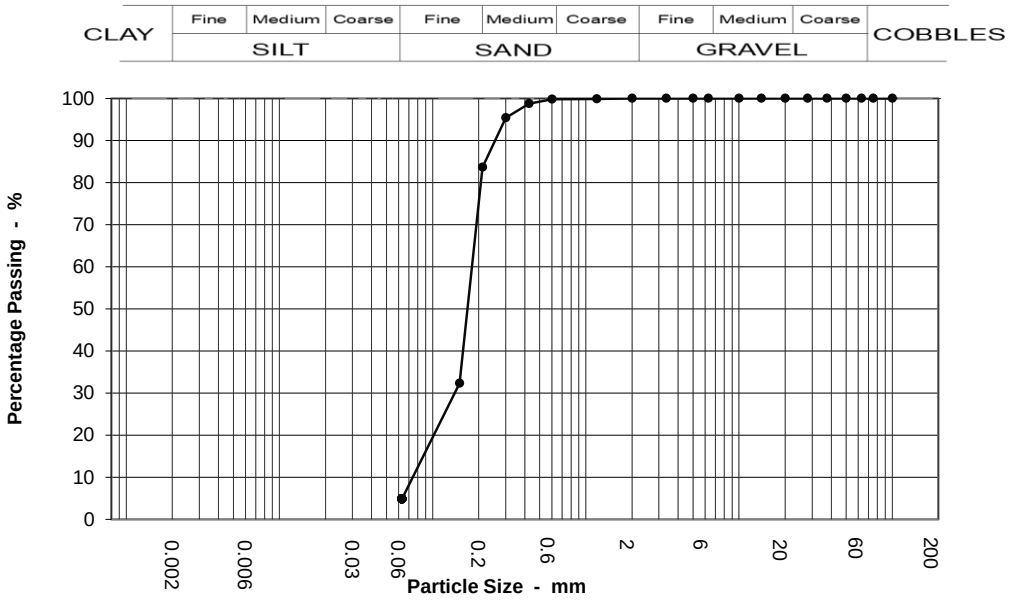
Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	95.7
Silt & Clay	4.3

Grading Analysis	
D100	0.600
D60	0.231
D10	0.131
Uniformity Coefficient	2

Operator	Checked	Approved	Remarks
STP	KM	CSS	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	12848
		Borehole / Pit No	BH 1
Project	18 Linksway	Sample No	
		Depth	9.00 m
Soil Description	light olive green fine to medium SAND	Sample type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	95		
0.212	84		
0.15	32		
0.063	5		

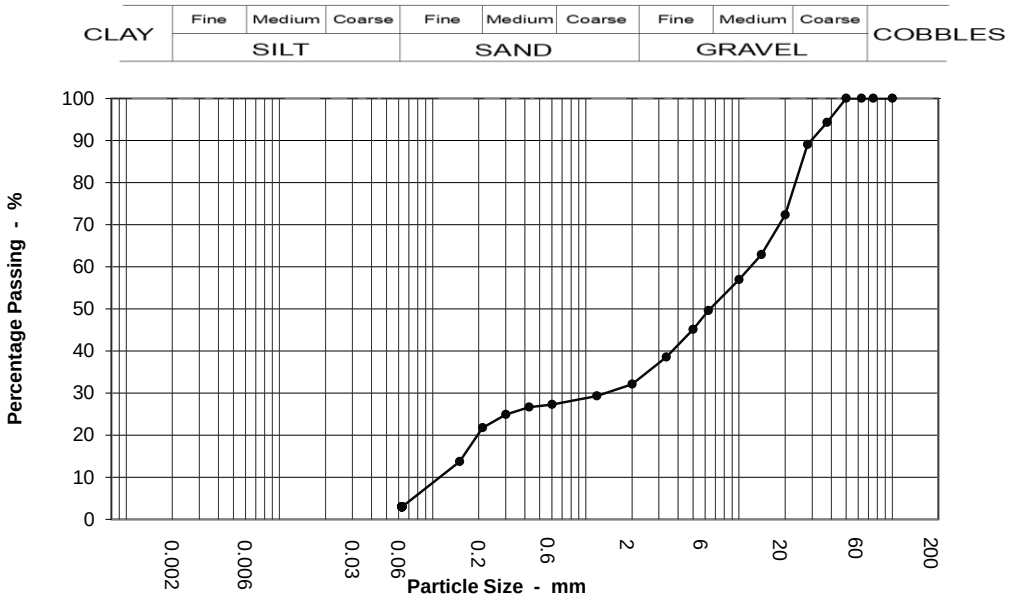
Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	95.2
Silt & Clay	4.8

Grading Analysis	
D100	0.600
D60	0.183
D10	0.079
Uniformity Coefficient	2

Operator	Checked	Approved	Remarks	
STP	KM	CSS		

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	12848
		Borehole / Pit No	BH 1
Project	18 Linksway	Sample No	
		Depth	12.5-12.95 m
Soil Description	Light olive green sandy fine to coarse GRAVEL	Sample type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	94		
28	89		
20	72		
14	63		
10	57		
6.3	50		
5	45		
3.35	39		
2	32		
1.18	29		
0.6	27		
0.425	27		
0.3	25		
0.212	22		
0.15	14		
0.063	3		

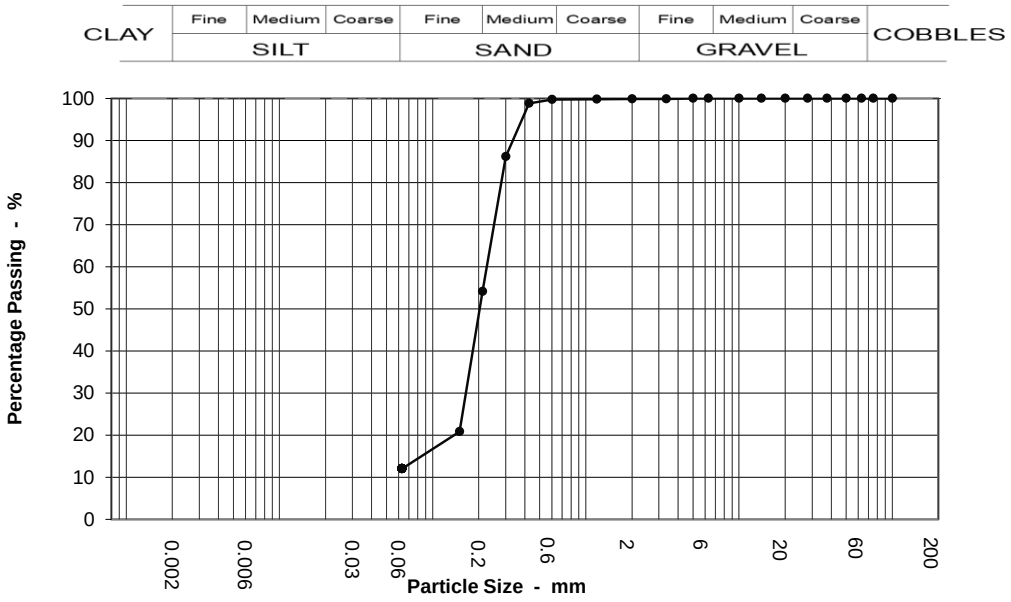
Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	67.9
Sand	29.2
Silt & Clay	3.0

Grading Analysis	
D100	50.0
D60	12.085
D10	0.120
Uniformity Coefficient	101

Operator	Checked	Approved	Remarks
STP	KM	CSS	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	12848
		Borehole / Pit No	WS 1
Project	18 Linksway	Sample No	
		Depth	4.50 m
Soil Description	Orange brown slightly clayey fine to medium SAND	Sample type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	86		
0.212	54		
0.15	21		
0.063	12		

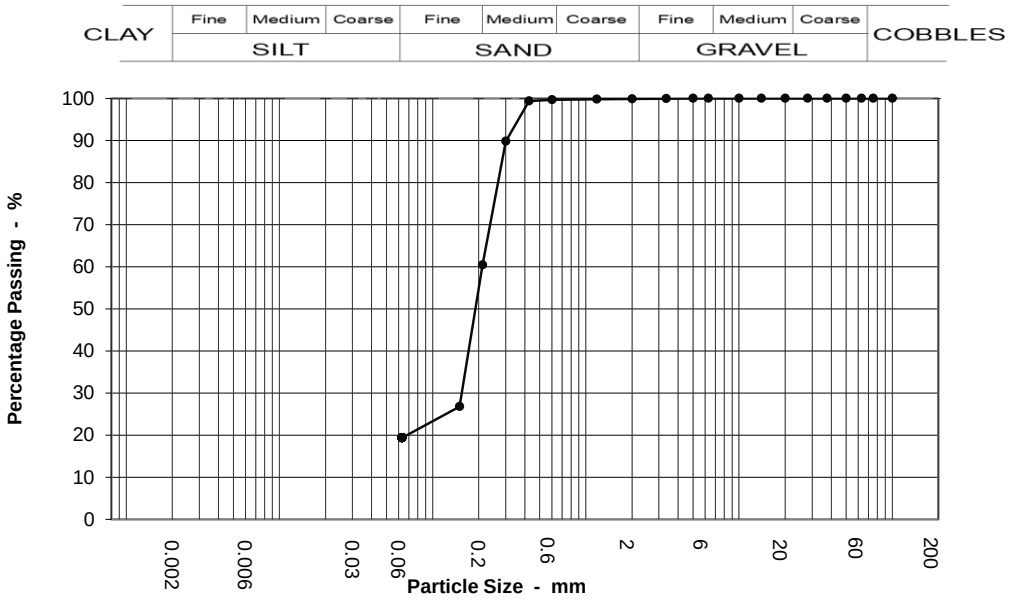
Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.1
Sand	87.8
Silt & Clay	12.0

Grading Analysis	
D100	0.600
D60	0.228
D10	
Uniformity Coefficient	N/A

Operator	Checked	Approved	Remarks	
STP	KM	CSS		

	PARTICLE SIZE DISTRIBUTION **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**12848**
		Borehole / Pit No	WS 2
Project	**18 Linksway**	Sample No	
		Depth	5.00 m
Soil Description	Orange brown slightly clayey fine to medium SAND	Sample type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	90		
0.212	60		
0.15	27		
0.063	19		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.1
Sand	80.5
Silt & Clay	19.4

Grading Analysis	
D100	0.600
D60	0.211
D10	
Uniformity Coefficient	N/A

Operator	Checked	Approved	Remarks	
STP	KM	CSS		

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way
Ashford
Kent
TN23 4FG

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Site: 18 Linksway

Project No: 12848

Client: Tope Osazee

Date 18/05/2022

Date Received: 10/05/2022

Date Tested: 17/05/2022

Test Results

Location ID	Depth (m)	Saturation Moisture Content SMC (%)	Bulk Density (mg/m^3)	Dry Density (mg/m^3)	Sample type
BH 1	13.5	32.2	1.90	1.44	D
BH 1	16.5	31.4	1.91	1.46	D

Visual Descriptions

Location ID	Depth	Description
BH 1	13.5	Off white gravel of CHALK
BH 1	16.5	Off white gravel of CHALK

Tested by: STP Checked by: CSS Approved by: CSS

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Derwentside Environmental Testing Services Ltd
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ME17 2JN
t: 01622 850410

DETS Report No: 22-04057

Site Reference:	18 Linksway
Project / Job Ref:	12848
Order No:	GES/4787.12848
Sample Receipt Date:	06/05/2022
Sample Scheduled Date:	06/05/2022
Report Issue Number:	1
Reporting Date:	12/05/2022

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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

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Soil Analysis Certificate						
DETS Report No: 22-04057	**Date Sampled**	05/05/22	05/05/22	05/05/22	05/05/22	
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 18 Linksway	**TP / BH No**	WS1	WS1	WS2	WS2	
Project / Job Ref: 12848	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: GES/4787.12848	**Depth (m)**	0.70	3.50	1.20	2.50	
Reporting Date: 12/05/2022	**DETS Sample No**	597013	597014	597015	597016	

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.9	7.7	7.8	7.8	
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	176	543	108	207	
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.18	0.54	0.11	0.21	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

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Soil Analysis Certificate - Sample Descriptions
DETS Report No: 22-04057
Ground & Environmental Services Ltd
Site Reference: 18 Linksway
Project / Job Ref: 12848
Order No: GES/4787.12848
Reporting Date: 12/05/2022

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
597013	WS1	None Supplied	0.70	16.8	Brown sandy clay
597014	WS1	None Supplied	3.50	12.3	Brown sandy clay
597015	WS2	None Supplied	1.20	13.2	Brown clay
597016	WS2	None Supplied	2.50	12.2	Brown sandy clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 22-04057
Ground & Environmental Services Ltd
Site Reference: 18 Linksway
Project / Job Ref: 12848
Order No: GES/4787.12848
Reporting Date: 12/05/2022

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

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DETS Report No: 22-04248

Site Reference:	18 Linksway
Project / Job Ref:	12848
Order No:	None Supplied
Sample Receipt Date:	12/05/2022
Sample Scheduled Date:	12/05/2022
Report Issue Number:	1
Reporting Date:	17/05/2022

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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Soil Analysis Certificate						
DETS Report No: 22-04248	**Date Sampled**	10/05/22	10/05/22	10/05/22	10/05/22	
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 18 Linksway	**TP / BH No**	BH 1	BH 1	BH 1	BH 1	
Project / Job Ref: 12848	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	**Depth (m)**	1.20 - 1.65	4.00 - 4.45	8.00 - 8.45	14.00 - 14.45	
Reporting Date: 17/05/2022	**DETS Sample No**	597652	597653	597654	597655	

Determinand	Unit	RL	Accreditation				(n)	
pH	pH Units	N/a	MCERTS	6.8	8.3	8.3	8.2	
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	115	12	14	39	
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.11	0.01	0.01	0.04	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)
(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation

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Soil Analysis Certificate - Sample Descriptions
DETS Report No: 22-04248
Ground & Environmental Services Ltd
Site Reference: 18 Linksway
Project / Job Ref: 12848
Order No: None Supplied
Reporting Date: 17/05/2022

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
597652	BH 1	None Supplied	1.20 - 1.65	18.9	Light brown clay
597653	BH 1	None Supplied	4.00 - 4.45	2.3	Orange sandy clay
597654	BH 1	None Supplied	8.00 - 8.45	14.4	Green sandy clay
597655	BH 1	None Supplied	14.00 - 14.45	21	White chalk

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 22-04248
Ground & Environmental Services Ltd
Site Reference: 18 Linksway
Project / Job Ref: 12848
Order No: None Supplied
Reporting Date: 17/05/2022

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received