

Intended for  
**St William Homes LLP**

Document type  
**Report**

Date  
**September 2020**

[W408-RAM-SW-XX-REP-900-003](#)

# **FORMER GASWORKS, MARSHGATE DRIVE, HERTFORD GROUND INVESTIGATION REPORT**

# FORMER GASWORKS, MARSHGATE DRIVE, HERTFORD GROUND INVESTIGATION REPORT

Revision: **R02**  
Date: **09/10/2020**  
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Description: **Ground Investigation Report**

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Revision	Date	Purpose / Status	Document Ref.	Comments
R01	25/09/2020	For Information / Final	1620009115-RAM-XX-XX-RP-CG-001	
R02	09/10/2020	For Information / Final	1620009115-RAM-XX-XX-RP-CG-002	Updates to Sections 5.3.1 and 8.1.2. Inclusion of cross sections

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## 1. INTRODUCTION

Ramboll UK Limited (Ramboll) has been appointed by St William Homes LLP (St William) to undertake a geotechnical and geo-environmental assessment in connection with the proposed development of the former Hertford Gasworks site, located at Marshgate Drive, Hertford. The redevelopment of the site is for a proposed mixed-use development comprising buildings and external civil works for residential and commercial end-use.

This report is a Geotechnical Ground Investigation Report, as defined by "Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing". This report details the adopted ground models and defines the recommended characteristic geotechnical material parameters based on the findings of the 2020 Ground Engineering Limited (GEL) ground investigation, in line with the principles in Part 2 of EN 14688, "Geotechnical investigation and testing – Identification and classification of soil".

In order to undertake the assessment, Ramboll designed and provided technical management of a combined geo-environmental and geotechnical ground investigation. The purpose of this investigation was to obtain information on the ground and groundwater conditions of the underlying strata to assist with the proposed redevelopment.

Based on the findings of the ground investigation this report also includes outline geotechnical recommendations in relation to the proposed development.

### 1.1 Development Proposals

The proposed development scheme is split into two sites; the North Site and the South Site. At the time of writing the North Site comprises a mix of varying size and height residential structures, whilst the South Site comprises structures with a residential end use and an area of commercial end use in the south of the site.

A proposed development plan is provided in Appendix A.

### 1.2 Scope and Objectives

The scope of this report includes the determination of geotechnical aspects of the proposed works. The report is issued predominantly based on the data and information presented in the 2020 GEL Hertford Gas Works Ground Investigation Factual Report (report ref: 35880). The exploratory hole logs and geotechnical laboratory test results are presented in Appendix B.

The report has been written in order to satisfy the following objectives:

- To summarise the findings of the ground investigation;
- Provide an interpretation of ground conditions encountered with respect to substructure design;
- To provide design ground models including characteristic values of geotechnical parameters based on the available factual information; and
- Provide outline recommendations based on interpretation of the available geotechnical information.

This report should be read in conjunction with the Ramboll Ground Contamination Report (Ref R1620009115\_Hertford\_ESA\_01).

### 1.3 Limitations and Constraints

This report has been prepared solely for St William LLP and shall not be relied upon by any third party unless that party has been granted a contractual right to rely on this report for the purpose for which it was prepared.

Ramboll has endeavoured to assess all information provided to them but makes no guarantees or warranties for the completeness or accuracy of information relied upon derived from third party sources.

The geotechnical risk register presented in Section 9 of this report captures risks relating to the proposed development at the time of writing this report. Any significant changes to the proposed design may require a re-assessment of the risks identified.

The ground investigation was designed and carried out utilising various ground investigation techniques. The exploratory holes were strategically positioned taking into consideration:

- Existing known structures and utilities (both above ground and subsurface)
- Site history
- Proposed location of future development works
- Expected ground conditions
- Current investigation standards

It should be noted that as the ground conditions encountered during the ground investigation are only a known detail at each exploratory hole location, the ground conditions detailed on sections between holes have been interpolated and therefore the actual nature of the ground may differ from the interpretation provided by Ramboll. In addition, groundwater levels will vary seasonally and with changes in weather and climate.

## 2. SITE DESCRIPTION

The site is located approximately 0.8 km north-east of the centre of Hertford. The overall site is approximately 3.5 hectares (8.8 acres) and is under the jurisdiction of the East Hertfordshire District Council (EHDC).

River Lea bounds the site to the North, Marshgate Road bounds the site to the West, Mead Lane/bounds the site to the South and Mead Business Centre bounds the site to the South/East. Hertford East railway station and the railway line is situated on the southern side of Mead Lane.

The site comprises of two rectangular shaped parcels of land situated in a mixed residential and commercial area. The North Site is approximately 2.5 hectares and has a central grid reference of 533287(E) and 213281(N). The South Site is approximately 1.0 hectares, with a central grid reference of 5331 73(E), 213101(N). Both sites are bounded by either steel fencing or masonry walls with access to both sites via Marshgate Drive.

### 3. GEOLOGY AND GROUND CONDITIONS

The British Geological Survey (BGS) map, 1:50,000 series, 1978, Sheet 239 – Hertford (Drift and Solid) indicates that the site is immediately underlain by Flood Plain Gravel, which is now classified as Kempton Park Gravel Member (KPGM). The superficial deposits are underlain by solid geology comprising of Upper Chalk, which is now called the White Chalk Subgroup.

A review of the online British Geological Survey (geology viewer) corroborates that the superficial deposits comprise sand and gravel of the KPGM. The solid geology consists of undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation, which forms part of the White Chalk Subgroup.

There are no records of any mineral extraction or coal mining activity occurring on or within 1km of the site (Landmark Information Group, 2002).

#### 3.1 Third Party Site Investigation Data

A Desk Study and Ground Investigation Report was produced by John Newton and Partners (jnpgroup) in January 2019 (ref: M41973 R001 Rev I). The report comprises two phases intrusive investigation, laboratory testing and gas and groundwater level monitoring.

- The intrusive fieldwork:
  - 2 No. cable percussion drilled boreholes to a maximum depth of 20.0 metres below ground level mbgl;
  - 40 No. mechanically excavated trial pits to a maximum depth of 3.40 mbgl;
  - 2 No. hand excavated pits to a maximum depth of 0.45 mbgl;
  - 14 No. dynamic sampler boreholes to a maximum depth of 5.0 mbgl; and
  - Six return gas and groundwater level monitoring visits were undertaken during a period from 28 September to 1 November 2017. Groundwater level monitoring was also undertaken from 29 May to 30 May 2018.
- Geotechnical laboratory testing – Moisture content and Atterberg limits, Particle Size Distribution tests, Water Soluble Sulphate and pH tests.
- In situ geotechnical testing – SPT tests and Hand Shear Vane tests.
- Geochemical analysis – BRE SD1 Suite for assessment of aggressive ground. In accordance with BRE SD1 (2005) "Concrete in aggressive ground" a Design Sulphate Class of DS1 with an ACEC of AC-1 has been recommended for buried concrete.
- Geological summary - Made Ground was found at the ground surface typically underlain by the Kempton Park Gravel Member, although in several locations across both sites the Made Ground is situated directly on the Lewes Nodular Chalk Formation. On the North site the Chalk was encountered at depths ranging from 2.0 to 5.0 metres below existing ground level. On the south site the Chalk was encountered at depths ranging from 3.95 metres to 6.0 metres below existing ground level. The base of the Chalk was not proven.

## 4. GROUND INVESTIGATION INFORMATION

An intrusive ground investigation was designed by Ramboll and undertaken by Geotechnical Engineering Limited (GEL) during June 2020. The purpose of the investigation was to characterise the ground and groundwater conditions at the site and evaluate potential geotechnical risks.

The ground investigation was undertaken in general accordance with:

- i. BS 5930:1999, Amendment 2: Code of Practice for Site Investigations (BSI, 2010);
- ii. BS5930:2015, Code of Practice for Ground Investigation<sup>1</sup>;
- iii. BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites. Code of Practice (BSI, 2011)<sup>2</sup>; and
- iv. BS EN ISO 1997-2:2007, "Eurocode 7 – Geotechnical design – Part 2: Ground investigation and testing".

The GEL ground investigation factual report (*ref: 35880*) is presented as Appendix B and includes all exploratory hole logs as well as an exploratory hole location plan. A copy of the exploratory hole location plan is presented as Figure 2, Appendix A.

The geotechnical element of the investigation was designed to provide site specific information on:

- The presence, thickness and composition of any recent and superficial deposits beneath the proposed development areas;
- Depth to and information on the solid geology to allow characterisation of the Chalk mass;
- The strength and stiffness of the underlying soils;
- Chemical composition of soils for buried concrete design; and
- Information with respect to the existing groundwater levels.

The scope of works comprised the following:

North Site:

- 5No. Rotary boreholes to a maximum depth of 7.0 metres below ground level (mbgl);
- 4No. Rotary boreholes to a maximum depth of 25.0 mbgl;
- 7No. Rotary boreholes to a maximum depth of 12.0 mbgl;
- 1No. hollow stem auger to a maximum depth of 12.0 mbgl, installed in the Chalk (BH06);
- 6No. windowless sample boreholes to a maximum depth of 4.0 mbgl;
- 17No. Trial Pits up to 3.0 to 4.0 mbgl;
- Monitoring of groundwater; and
- In situ and laboratory geotechnical testing.

South Site:

- 3No. Rotary boreholes to a maximum depth of approximately 7.0 mbgl;
- 1No. Rotary boreholes to a maximum depth of 25.0 mbgl;
- 5No. Rotary boreholes to a maximum depth of approximately 12.0 mbgl;
- 5No. windowless sample boreholes a maximum depth of 4.0 mbgl;
- 10No. Trial Pits from 3.0 to 4.0 mbgl;
- Monitoring of groundwater; and
- In situ and laboratory geotechnical testing.

<sup>1</sup> British Standards Institute (2015) BS 5930:2015 Code of Practice for Ground Investigation

<sup>2</sup> British Standards Institute (2013) BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites – Code of Practice

Groundwater monitoring standpipes or standpipe piezometers were installed and monitored within the rotary boreholes. Refer to Section 6.0 for further groundwater information.

## 5. GEOTECHNICAL FINDINGS

The ground conditions encountered during the 2020 GEL investigation comprised Made Ground, which in turn were underlain by further superficial soils comprising granular Kempton Park Gravel Member. Underlying the superficial deposits, the undifferenced Lewes Nodular Chalk Formation and Seaford Chalk Formation solid geology was encountered. Geological cross sections of the ground conditions encountered across both the North and South sites are presented in Appendix A.

The ground level varies from 35.1 mAOD to 39.1 mAOD in the North Site, and from 36.7 mAOD to 38.5 mAOD in the South site.

A summary of the ground conditions encountered in the exploratory holes is given in Table 5.0.1 and Table 5.0.2. The results of the geotechnical laboratory testing carried out during the 2020 ground investigation are presented Appendix B. Recommended geotechnical parameters are given in Table 7.1.

**Table 5.0.1 Summary of ground conditions encountered in the North Site**

Geological Stratum	Depth to Base of Stratum (mbgl)	Thickness (metres)	Description
Made Ground	0.20 – 3.45	0.20 – 3.45	Concrete and Tarmacadam Soft to stiff greyish brown and black gravelly sandy clay / silt. Gravel is angular to rounded fine and medium flint, concrete, brick, Chalk, quartzite and clinker. Frequent rootlets and occasional organic matter. Brown to black clayey silty gravelly fine to coarse sand / silty sandy angular to rounded fine to coarse gravel. Gravel is angular to rounded fine and medium flint, concrete, brick, Chalk, quartzite and clinker.
Kempton Park Gravel Member	1.80 – 7.60	0.95 – 7.50	Loose to dense orangish brown sandy angular to rounded fine to coarse flint and rare quartzite gravel. With occasional layers of soft to stiff greyish brown gravelly sandy silty clay / clayey silt. Gravel is angular to rounded fine and medium flint, Chalk quartzite.
Structureless Chalk	4.40 – 10.4	2.15 – 6.70	Light grey and white gravelly clayey silt. Gravel is subangular to rounded fine to coarse extremely weak low density white Chalk and flint (Grade Dm). White silty subangular to subrounded fine to coarse Chalk gravel. Clasts are extremely weak low to medium density white with black spots (Grade Dc).
Structured Chalk	Unproven	Unproven	Extremely weak to very weak low and medium density Chalk with white with rare black specks (Grade A to C).

**Table 5.0.2 Summary of ground conditions encountered in the South Site**

Geological Stratum	Depth to Base of Stratum (mbgl)	Thickness (metres)	Description
Made Ground	0.9 – 4.65	0.9 – 4.65	Concrete and Tarmacadam Soft to stiff brown gravelly sandy silt / gravelly sandy silty clay. Gravel is angular to rounded fine and medium flint, concrete, brick, Chalk, quartzite and clinker.

Geological Stratum	Depth to Base of Stratum (mbgl)	Thickness (metres)	Description
			Dark brownish black silty very sandy gravel / silty gravelly sand. Gravel is angular to rounded fine and medium flint, concrete, brick, Chalk, quartzite and clinker. Occasional layer of subangular cobbles with silty sand matrix. Occasional slight hydrocarbon odour.
Kempton Park Gravel Member	3.0 – 5.9	0.35 – 4.90	Loose to dense brown sandy angular to rounded flint and rare quartzite gravel. With occasional layers of soft to firm greenish brown gravelly sandy clayey silt / gravelly sandy clay. Gravel is angular to rounded fine to coarse flint.
Structureless Chalk	4.0 – 10.30	2.20 – 6.30	Light grey and white gravelly clayey silt. Gravel is subangular to rounded fine to coarse extremely weak low density white Chalk and flint (Grade Dm). White silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low and medium density white with black specks Chalk (Grade Dc).
Structured Chalk	Unproven	Unproven	Extremely weak to very weak low and medium density Chalk with white with rare black specks (Grade A to C).

## 5.1 Made Ground

### *Classification Description*

Made Ground was encountered in all exploratory holes (except BH02, BH09, TP08 within the North site) during the 2020 GEL investigation. The deposit was encountered from ground level across both sites to a maximum depth of 3.45 mbgl in SBH03 in the South site, and 4.65 mbgl in BH04 in the North site.

The exploratory hole records indicate that typically the Made Ground encountered was concrete / tarmac hardstanding underlain by both granular and cohesive material.

Concrete and/or tarmac was encountered within exploratory holes TP03, TP05, TP14, TP17, TP16, WS06, BH10, BH11 and BH14 within the North site and SBH02 to SBH06, STP01 to SPT07 and SWS01 to SWS03 in the South site. The hardstanding was encountered from ground level across both sites with a maximum thickness of 0.22 metres in the North site and 0.35 metres in the South site. In BH11 concrete was encountered to a depth of 1.35 mbgl with a recorded thickness of 0.50 metres, whilst in SBH02 it was encountered to 0.6 mbgl with a proven thickness of 0.20 metres.

The cohesive Made Ground thickness ranged from 0.10 metres to 2.60 metres in the North site and 0.20 metres to 3.60 metres in the South site. The material was generally described as soft to stiff brown and black gravelly sandy clay or silt. Gravel is angular to rounded fine and medium flint, concrete, brick, Chalk, quartzite and clinker. Frequent rootlets and occasional organic matter was recorded in the North site.

The granular Made Ground thickness ranged from 0.10 metres to 1.80 metres in the North site and 0.10 metres to 4.30 metres in the South site. The material was generally described as either a brown or black silty gravelly fine to coarse sand or silty sandy angular to rounded fine to coarse gravel. Gravel is angular to rounded fine and medium flint, concrete, brick, Chalk, quartzite and

clinker. Occasional layers of subangular brick cobbles with silty sand matrix. Localised hydrocarbon odours were also noted.

#### *In Situ Testing*

Twenty-nine standard penetration tests (SPTs) were carried out within the Made Ground. Eighteen tests were carried out on cohesive samples recording corrected  $N_{60}$  values ranging from 3 blows to 43 blows for 300 mm with a mean  $N_{60}$  value of 16. Results of the SPTs indicate to a material of variable strength.

A further eleven tests were carried out in the granular Made Ground and recorded corrected  $N_{60}$  values ranging from 3 blows to refusal (i.e. 50 blows for less than 300mm penetration), with an average  $N_{60}$  value of 28. The results indicate to a material of variable relative density ranging from very loose to very dense.

Twenty-seven in situ hand shear vane tests were undertaken on cohesive samples of Made Ground. The recorded peak shear strength ranged from 35 kPa to 150 kPa with a mean value of 78 kPa, indicating a material of medium to high strength. The residual shear strength results varied from 18 kPa to 88 kPa with a mean value of 39 kPa.

#### *Geotechnical Laboratory Testing*

Geotechnical laboratory testing comprising classification, compaction and chemical tests were carried out on selected samples of the cohesive Made Ground. The results of the classification and chemical tests are summarised in Table 5.1.1.

**Table 5.1.1 Summary of geotechnical laboratory results - Made Ground**

Test	Granular		Cohesive	
	Range of Results	Mean	Range of Results	Mean
Moisture Content (%)	3 - 29	10	9 - 59	21
Liquid Limit (%)	25 - 36	29	27 - 80	46
Plasticity Index (%)	4 - 12	8	12 - 37	26
pH	8.4 - 8.7	8.6	7.9 - 8.4	8.2
Water soluble sulphate g/l)	0.1 - 0.29	0.18	0.05 - 0.68	0.28
Total sulphur (%)	0.03 - 0.1	0.06	0.1 - 1.3	0.43

Modified plasticity index derived from the Atterberg Limit tests indicates to the cohesive soils being of predominately low volume change potential.

Geotechnical laboratory testing comprising fourteen particle size distribution tests (PSD) was carried out on selected samples of granular Made Ground, with the results summarised in Table 5.1.2.

**Table 5.1.2 Summary of geotechnical laboratory results - Made Ground**

Exploratory Hole	Depth (mbgl)	Gravel (%)	Sand (%)	Silt and Clay (%)	Uniformity Coefficient
BH04	1.0	49	39	12	
SBH03	3.2	75	24	2	70
SBH05	3.8	71	27	3	20
STP02	0.4	55	37	8	90

Exploratory Hole	Depth (mbgl)	Gravel (%)	Sand (%)	Silt and Clay (%)	Uniformity Coefficient
STP03	2.5	71	23	7	80
STP07	1.2	48	34	18	
TP01	0.5	18	69	13	
TP02	0.7	49	36	15	
TP04	0.6	23	65	12	
TP05	0.2	60	35	6	40
TP06	0.2	18	68	14	
TP09	0.3	31	50	19	
TP09	1.6	24	56	20	
TP13	0.6	28	51	21	

## 5.2 Kempton Park Gravel Member

### *Classification Description*

Underlying the Made Ground, the Kempton Park Gravel Member (KPG) was encountered. The KPG was recorded as being predominantly granular in nature with localised horizons of cohesive soils being recorded in exploratory holes BH03, BH09, TP05, TP06, TP08, TP22, TP16, TP17, WS05A within the North site and SBH06, STP01, SBH02, SWS02 and SBH08A within the South site.

Where encountered, the cohesive material was found to overlie the granular KPG and ranged in thickness from 0.40 metres to greater than 1.70 metres (base unproven in STP01) in the South site. The thickness ranged from 0.20 metres to 1.40 metres in the North site. A single exploratory hole, SPT01, was terminated within the cohesive KPG. The cohesive soils were generally described as soft to stiff greyish brown gravelly sandy silty clay or clayey silt. Gravel was angular to rounded fine and medium flint, Chalk and quartzite.

Granular KPG was encountered within the majority of exploratory holes at depths ranging from 2.20 mbgl to 4.65 mbgl in the South site and from ground level to 3.50 mbgl in the North site. Where proven, the granular KPG underlying the site was typically found to have a thickness ranging from 0.40 metres to 3.60 metres in the South site and a thickness of between 0.30 metres and 7.50 metres in the North site.

Eighteen exploratory holes (TP01, TP02, TP03, TP05, TP06, TP08, TP09, TP11, TP14, TP16, WS01, WS05A, WS06, BH06, STP09, SWS02, SWS03 and SWS05) terminated within the granular KPG.

The granular KPG was typically described as loose to dense, orangish brown, sandy angular to rounded flint fine to coarse and rare quartzite gravel.

### *In Situ Testing*

Forty-one SPTs were carried out in the Kempton Park Gravel Member. Thirty-seven tests were carried out in the granular soils and recorded corrected  $N_{60}$  values ranging from 3 blows to refusal (i.e. 50 blows for less than 300 mm), with an average  $N_{60}$  value of 30. The N values generally indicate to the granular material being of loose increasing to very dense relative density.

Two tests were carried out on cohesive samples and recorded corrected  $N_{60}$  values ranging from 9 blows to 31 (blows for less than 300 mm), with an average  $N_{60}$  value of 20. The N values generally indicate to the cohesive material is low to medium strength.

Six in situ hand shear vane tests were undertaken on cohesive samples of KPGM. The peak shear strength varied from 57 kPa to 94 kPa with a mean value of 78 kPa indicating a material of medium to high strength. The residual vane strength varied from 26 kPa to 58 kPa with a mean value of 37 kPa.

### *Geotechnical Laboratory Testing*

Geotechnical laboratory testing was carried out on selected samples of the Kempton Park Gravel Member. These included moisture content tests, Atterberg Limit tests, particle size distribution tests and chemical tests.

The results of the classification and chemical tests are summarised in Table 5.2.1 with gradings presented in Table 5.2.2.

**Table 5.2.1 Summary of geotechnical laboratory results – Kempton Park Gravels**

<b>Test</b>	<b>Granular</b>		<b>Cohesive</b>	
	<b>Range of Results</b>	<b>Mean</b>	<b>Range of Results</b>	<b>Mean</b>
Moisture Content (%)	1 - 15 (outlier of 48)	6	9 - 24	17
Liquid Limit (%)	24	24	29 - 55	44
Plasticity Index (%)	7	7	14 - 36	26
pH	8.0 - 8.7	8.4	8.2	8.2
Water soluble sulphate g/l	<0.01 0 0.49	0.17	<0.01	<0.01
Total sulphur (%)	0.05 - 0.29	0.17	0.02	0.02

Modified plasticity derived from the Atterberg Limit tests indicates to the cohesive KPGM being of low volume change potential.

Geotechnical laboratory testing comprising twenty-four particle size distribution (PSD) was carried out on selected samples of granular KPG, with the results summarised in Table 5.2.2.

**Table 5.2.2 Summary of geotechnical laboratory results – Kempton Park Gravels**

<b>Exploratory Hole</b>	<b>Depth (mbgl)</b>	<b>Gravel (%)</b>	<b>Sand (%)</b>	<b>Silt and Clay (%)</b>	<b>Uniformity Coefficient</b>
BH01	3.2	78	17	5	80
BH02	1.0	27	60	13	
BH02	2.2	68	28	4	50
BH02	5.2	91	9	0	8.0
BH03	3.2	75	22	3	30
BH07	0.5	64	25	11	
BH10	0.9	71	26	3	40
BH10	4.2	79	19	2	40
BH13	2.2	72	26	2	60
BH15	1.0	45	42	13	
BH17	2.2	94	5	1	6.0
BH17	4.2	61	37	2	90
SBH06	3.2	86	12	2	20
SBH07	4.2	87	13	1	20
SBH09	3.2	68	19	12	

Exploratory Hole	Depth (mbgl)	Gravel (%)	Sand (%)	Silt and Clay (%)	Uniformity Coefficient
SBH10	3.2	71	24	5	200
TP01	2.0	74	23	4	50
TP02	1.1	78	19	3	20
TP03	0.3	80	19	1	20
TP03	2.2	74	24	2	40
TP05	1.3	77	14	9	60
TP07	1.8	70	20	10	300
TP09	1.9	80	16	5	50
TP11	1.3	68	19	7	300

### 5.3 Chalk (Undifferenced Lewes Nodular Chalk Formation and Seaford Chalk Formation)

Solid geology of the undifferenced Lewes Nodular Chalk Formation and Seaford Chalk Formation was encountered underlying the Kempton Park Gravels in twenty-one exploratory holes within the North site and ten exploratory holes within the South site.

In accordance with the CIRIA grading presented in CIRIA C574 and based on a visual assessment, the Chalk encountered within the exploratory holes comprised both matrix (Grade Dm) and clast dominated (Grade Dc) structureless material underlain by a structured Chalk mass material also being recorded. The structured Chalk mass changes from Grade C to Grade A as the depth increases.

Within the North site, the structureless Chalk had a top depth ranging from 1.80 mbgl to 7.60 mbgl, and a thickness ranging from 2.15 metres to 6.70 metres. Within the South site, the structureless Chalk had a top depth ranging from 3.80 mbgl to 5.90 mbgl, and a thickness ranging from 2.20 metres to 6.30 metres.

The material recovered as matrix dominated structureless Chalk was generally described as light brown gravelly clayey silt. Gravel was subangular to rounded fine to coarse extremely weak low-density white Chalk and flint.

The Grade Dc structureless Chalk was generally described as silty subangular and subrounded fine to coarse gravel. Clasts were extremely weak low and medium density white with frequent black speckling.

The structured Chalk mass was encountered underlying the structureless material at depths ranging from 4.40 mbgl to 10.40 mbgl in the North site and from 7.90 mbgl to 10.30 mbgl in the South site. The base of the unit was unproven with a maximum recorded thickness of 18.50 metres in BH09. The structured Chalk was generally classified as Grade A to C material comprising, extremely weak to very weak white low and medium density Chalk with rare black specks. Fractures were subhorizontal to 20 to 30 degree and 70 to 80 degree to subvertical, extremely closely to closely spaced, planar smooth and occasionally infilled (up to 3mm) with white silty clay. Medium and widely spaced bands of coarse subrounded rinded black nodular flint were also noted.

#### *In Situ Testing*

A total of seventy-two SPTs were undertaken within the structureless material and sixty-seven tests within the structured Chalk mass.

The SPT N<sub>60</sub> values for the structureless Chalk ranged from 3 to refusal (i.e. 50 blows for less than 300 mm), with an average N<sub>60</sub> value of 12. The wide range of test results either indicate to the Chalk being of variable grade and density or have possibly been influenced by the presence of flints.

Tests undertaken within the structured Chalk mass recorded corrected N<sub>60</sub> values ranging from 9 blows to refusal (i.e. 50 blows for less than 300 mm), with N<sub>60</sub> values typically greater than 10 and generally increasing with depth, possibly indicating to an increase in Chalk grade with depth. However, it should be noted, that nodular flints were recorded within the structured Chalk and these may have influenced the higher N<sub>60</sub> values.

**Table 5.3.1 Summary of SPT N results – Chalk**

<b>SPT N<sub>60</sub></b>	<b>Structureless Chalk</b>		<b>Extremely Weak Chalk</b>
	<b>Grade</b>	<b>Dc</b>	<b>Dm</b>
Minimum Value	3	4	9
Maximum Value	35	50	50
Average Value	11	13	31

#### *Geotechnical Laboratory Testing*

- Structureless Chalk (Grades Dm and Dc)

Geotechnical laboratory testing was carried out on selected samples of the Structureless Chalk. These included moisture content tests, Atterberg limit tests, particle size distribution tests and chemical tests. The results of the tests are summarised in Table 5.3.2 and Table 5.3.3.

**Table 5.3.2 Summary of geotechnical laboratory results – Structureless Chalk**

<b>Test</b>	<b>Structureless Chalk</b>	
	<b>Range of Results</b>	<b>Mean</b>
Moisture Content (%)	13 - 29	23
Plastic Index (%)	6 - 18	11
Liquid Limit (%)	22 - 42	33

Geotechnical laboratory testing comprising three particle size distribution (PSD) was carried out on selected samples of the Structureless Chalk (Grade Dm), with the results summarised in Table 5.3.3.

**Table 5.3.3 Summary of particle size distribution tests – Structureless Chalk**

<b>Exploratory Hole</b>	<b>Depth (mbgl)</b>	<b>Gravel (%)</b>	<b>Sand (%)</b>	<b>Silt and Clay (%)</b>
BH02	9.7	31	17	52
BH09	4.2	35	22	43
BH13	4.2	53	14	33

- Structured Chalk

Select Chalk samples were scheduled for geotechnical laboratory testing comprising intact dry density (IDD), saturated moisture content (SMC), point load and unconfined compressive strength (UCS) tests, however, only a limited amount of testing was completed following various abortive test notices due to samples being unsuitable for testing.

Based on Table 3.2 from CIRIA C574, the results of the SMC, IDD and porosity tests indicate to the Chalk being typically composed of low density material. The test results are summarised in Table 5.3.4.

**Table 5.3.4 Summary of geotechnical laboratory results – Chalk**

<b>Test</b>	<b>Extremely Weak Chalk</b>	
	<b>Range of Results</b>	<b>Mean</b>
Saturation Moisture Content (%)	27 - 34	31
Intact Dry Density (Mg/m <sup>3</sup> )	1.4 – 1.56	1.47
Point Index Is(50) (MPa)	0.01 – 0.14	0.08
Porosity (%)	44 - 46	45
pH	8.2 - 8.4	8.3
Water soluble sulphate	0.07	0.07
Total sulphur (%)	0.02 - 0.04	0.03

### 5.3.1 Risk of Solution Features within the Chalk

In areas where the underlying ground conditions encounter Chalk there is a risk of the presence of dissolution features such as swallow holes or sink holes. A dissolution feature could potentially cause ground instability resulting in high settlements or collapse of any structures above.

The data obtained during the ground investigation suggests the top of the Chalk in the North site was recorded between 1.80 mbgl and 7.60 mbgl, i.e. at elevations between 30.60 mAOD and 34.20 mAOD. The top of the Chalk in South site was recorded between 3.80 mbgl and 5.90 mbgl, corresponding to levels of between 31.60 mAOD and 33.60 mAOD. Refer to Figures 5a, 5b and 5c in Appendix A.

Whilst no visual evidence of ground depressions were witnessed during the fieldwork, the cross sections indicate to the interface between the base of the KPG and top of structureless chalk varying across the site possibly due to mechanical weathering / erosion of the chalk surface. In the vicinity of BH17 the depth to the KPG / chalk interface deepens and is encountered at a level of 30.60 mAOD. Given that the exploratory hole was located near the southern boundary of the North site no other exploratory hole information is available south of this exploratory hole to determine whether this is a localised subsurface feature or a consistent deepening of the chalk boundary towards the south.

Where structures are proposed it is recommended that the design should consider the risk of dissolution features. Where piled foundations are proposed the final toe levels and design of the piles would need to ensure that the risk of potential dissolution features have been mitigated against.

## 6. GROUNDWATER

At the time of writing, four rounds of groundwater monitoring had been carried out between 10<sup>th</sup> July 2020 to 30<sup>th</sup> July 2020. In the North site, the groundwater was encountered at depths ranging between 0.92 mbgl in BH14 and 4.64 mbgl in BH02. The groundwater level ranged between 33.14 m AOD and 35.65 m AOD. Over the monitoring period, the ground water level varied between 0.09 metres in BH03 and 1.04 metres in BH14.

On the South site, groundwater was encountered at depths between 2.27 mbgl in SBH02 and 3.67 mbgl in SBH08 (levels ranging between 33.66 mAOD and 35.18 mAOD). Results of the groundwater monitoring undertaken to date have recorded water at depths typically between 0.2 metres in SBH10 and 0.98 metres in SBH03.

The groundwater strikes noted during the GEL ground investigation within the North site range from 1.15 mbgl and 2.0 mbgl (33.75 m AOD and 34.85 mAOD). The groundwater strikes in the South site range from 2.90 mbgl and 3.30 mbgl (33.4 m AOD and 34.9 mAOD).

**Table 6.1 Exploratory Hole Water Strikes**

Location	Borehole	Geology	Strike Depth after 20 minutes (mbgl)	Strike Depth after 20 minutes (mAOD)
North Site	BH13	Granular Made Ground	1.15	34.85
North Site	BH15	Granular KPGM	1.15	34.5
North Site	BH17	Granular KPGM	1.2	34.4
North Site	BH18	Cohesive Made Ground	1.3	34.25
North Site	WS02	Granular Made Ground	1.64	34.11
North Site	WS03	Cohesive Made Ground	1.9	34.4
North Site	WS04	Cohesive Made Ground	2.0	33.75
South Site	SWS02	Granular and cohesive KPGM	2.7	34.85
South Site	SWS03	Cohesive Made Ground	2.9	34.9
South Site	SWS05	Granular KPGM	3.3	33.4

To conclude, within the North site the highest groundwater depth recorded was 0.92 mbgl and the highest groundwater level was 35.65 m AOD. Within the South site, the highest groundwater depth recorded was 2.27 mbgl and the highest groundwater level was 35.18 m AOD.

Refer to the Ramboll Ground Contamination Report (Ref R1620009115\_Hertford\_ESA\_01) for further information on the groundwater strikes and monitoring.

### Permeability Tests

Variable head permeability tests comprising falling head tests were carried out within boreholes BH03, BH09, BH10, BH13 and SBH05, in general accordance with the procedures given in BS EN ISO 22282 Parts 1 and 2:2012. The details of the tests undertaken within either the Kempton Park Gravels or the Lewes Chalk Formation are provided in Table 6.2.

**Table 6.2 Permeability Results**

Borehole	Geology	Borehole depth (mbgl)	Permeability ms <sup>-1</sup> (k)	
			Hvorslev method	Velocity graph method

BH03	Chalk	12.70	1.0E-06	9.7E-07
BH09	Structureless Chalk	4.20	6.9E-06	2.6E-06
BH09	Chalk	9.70	4.3E-07	4.2E-07
BH10	Kempton Park Gravel	3.20	2.4E-05	2.6E-05
BH10	Structureless Chalk	6.20	-	4.1E-07
BH13	Kempton Park Gravel	3.20	3.7E-05	3.8E-05
BH13	Kempton Park Gravel	3.20	1.8E-05	1.8E-05
BH13	Kempton Park Gravel	8.0	5.6E-06	3.1E-06
SBH05	Structureless Chalk	5.20	2.1E-04	2.4E-04
SBH05	Chalk	9.70	1.5E-05	1.4E-05

## 7. DERIVATION OF GEOTECHNICAL PARAMETERS

The data presented in this section is based upon the results of the 2020 GEL investigation designed by Ramboll.

The characteristic values of geotechnical parameters and ground model recommendations provided have been selected for the purposes of permanent works design. If these parameters are to be adopted for any temporary works design the Temporary Works Designer should be satisfied that the parameter selected is appropriate for the load case being considered.

The derivation of characteristic values of geotechnical parameters is described for the soils that are expected to be encountered. Where direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values for design. Material data plots are presented in Appendix C.

Characteristic values are defined as a cautious estimate of the value affecting the occurrence of a limit state based on Clause 2.4.5.2, from BS EN 1997-1: 2004 (Eurocode 7). Characteristic values should be used with appropriate partial factors or to achieve appropriate factors of safety, as required.

### SPT N

The energy ratio has been used to produce corrected SPT  $N_{60}$  values. Energy losses are induced by the SPT hammer assembly due to frictional and other parasitic effects, which cause the hammer velocity at impact to be less than the free fall velocity. Therefore, SPT results should be corrected to give values equivalent to some standard energy input. For general design purposes, the N values are adjusted to a reference energy ratio of 60%, by the following equation:

$$N_{60} = (E_r/60) \times N$$

Where:

$N$  is the blow count

$E_r$  is the energy ratio of the specific test equipment (provided by the specialist investigation contractor)

Corrections are applied following BS EN ISO 22476-3:2005+A1:2011 – Annex A (Geotechnical Investigation and Testing – Field testing. Part 3: Standard Penetration Test).

### Weight Density

Adopted characteristic weight density values have been based on empirical values presented in Figure 1 and Figure 2 from BS 8002:2015.

### Strength

#### *Cohesive Soils – Undrained Strength Parameters*

Characteristic undrained shear strength ( $c_u$ ) for normally and over consolidated cohesive soils will be assessed from laboratory testing, in situ testing and from material descriptions from boreholes, based on British Standard (BS) 5930:2015 and BS EN:1997 (2007).

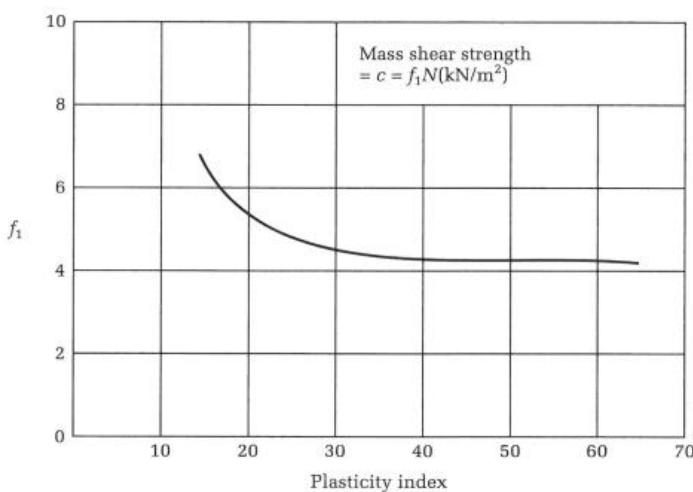
For over consolidated clays the characteristic undrained shear strength,  $c_u$  can be derived from SPT N values (where available) using the correlation recommended by Stroud and Butler (1975):

$$c_u = f_1 \times N_{60} (\text{kN/m}^2)$$

Where:

$N_{60}$  is the SPT N corrected for hammer energy;

$f_1$  is dependent on Plasticity Index as per Figure 12 reproduced by Tomlinson, 2001. Based on the data obtained during the various phases of investigation,  $f_1$  value of 4.5 has been adopted for the cohesive Kempton Park Gravels and an  $f_1$  value of 6.0 has been adopted for the cohesive Structureless Chalk (Grade Dm).



**Figure 12 Derivation of  $f_1$  from Plasticity Index as reproduced by Tomlinson**

Eq. (1)

Using the given method, the undrained shear strength of the cohesive Made Ground derived values range from 11 kPa and 130 kPa, with an average value of 63 kPa. The undrained shear strength values of the cohesive Kempton Park Gravels range from 41 kPa and 225 kPa, with an average value of 135 kPa.

The representative value for an undrained strength vs depth plot will be a value (or line) giving a cautious estimate of the strength, excluding any extreme values. Extreme values will be investigated, as appropriate, as they may indicate a different soil type or other anomaly that needs to be accounted for in the design.

#### Cohesive Soils - Effective Stress Strength Parameters

Effective stress (drained) strength parameters for cohesive soils are determined from interpretation of the relationship between  $\phi'$  and PI proposed by Kenney (1959). A conservative value of  $\phi'$  will be derived based on an upper bound value of PI.

The angle of internal friction determined for the cohesive Made Ground typically ranges from 22 degrees to 32 degrees. The angle of internal friction determined for the cohesive Kempton Park Gravels typically ranges from 22 degrees to 31 degrees.

In the absence of effective stress strength tests undertaken on cohesive soils a drained cohesion ( $c'$ ) of 0 kN/m<sup>2</sup> has been recommended for design.

### *Granular Soils*

Laboratory testing for the shear strength of the granular soils has not been carried out on samples taken from the exploratory holes as indirect methods for determination of strength are deemed acceptable. For soils described as sands and/or gravels, the constant volume effective angle of shearing resistance ( $\phi'_{cv,k}$ ) and the peak effective angle of shearing resistance ( $\phi'_{pk,k}$ ) will be interpreted using the methods described in BS 8002 (2015) as follows:

$$\phi'_{cv,k} = 30 + \phi'_{ang} + \phi'_{PSD}$$

$$\phi'_{pk,k} = \phi'_{cv,k} + \phi'_{dil}$$

Where:

$\phi'_{ang}$  = angularity of the particles,

$\phi'_{PSD}$  = grading of the soil from particle size distribution tests.

$\phi'_{dil}$  = soil dilatancy based on SPT N Value, for fines content <15% (where fines are more than 25% this value is 0; linear interpolation can be carried out for fines contents between 15% and 25%).

Values of  $\phi'_{ang}$ ,  $\phi'_{PSD}$  and  $\phi'_{dil}$  are given in Table 7.0.

**Table 7.0 'Table 1' from BS 8002:2015**

$\phi'_{ang}$	Parameter (degrees)
Rounded to well-rounded	0
Sub-angular to sub-rounded	2
Very angular to angular	4
$\phi'_{PSD}$	Parameter (degrees)
$C_u$ (Uniformity Coefficient) < 2	0
$2 \leq C_u < 6$	2
$C_u \geq 6$	4
$\phi'_{dil}$ as SPT N Value (modified from BS EN 1997-2)	Parameter (degrees)
< 3	0
3 – 8	0
8 – 25	3
25 – 42	6
> 42	9

The method derived angle of internal friction values for the granular Kempton Park Gravels ranging from 32 degrees to 41 degrees. The angle of internal friction derived for Granular Made Ground ranges from 34 degrees to 43 degrees.

Generally, for sands and gravels, a value of  $c' = 0$  kN/m<sup>2</sup> will be recommended for design.

### *Chalk*

The engineering parameters of the Chalk have been assessed from the results of the ground investigation and the recommendations given in CIRIA C574 and CIRIA C143. An estimation of the unconfined compressive strength (UCS) has been derived from results of the laboratory point load tests along with the relationship between intact dry density and UCS as presented in Table 4.17 from CIRIA C574. Parameters for CFA pile design have been derived using CIRIA PR86.

## Stiffness and Compressibility

### *Cohesive Soils*

Where determination of settlement of foundations on cohesive soils is required then stiffness will be assessed from SPT N values using the relationship described in CIRIA Report 143 (1995).

Stiffness based on Young's Modulus (E) has been assessed using:

For normally consolidated cohesive material (following Bowles):

- $E_u = c_u \times 250$  (kN/m<sup>2</sup>) for undrained stiffness
- $E' = E_u \times 0.6$  (kN/m<sup>2</sup>) for drained stiffness

The settlements calculated from soil modulus values interpreted following the guidance in CIRIA Report 143 are likely to represent conservative settlements.

Stiffness parameters are stress and strain dependent, and where possible the adopted parameter will be selected for large stress and strain conditions (Jardine *et al*, 1985) associated with the settlement of pad foundations or gravity retaining structures.

### *Granular Soils*

Where settlement calculations for foundations in granular soils are required, settlement of granular soils will be determined using semi-empirical methods based on Standard Penetration Test N values following C143.

Where:

$$E' = N_{60} \times 1000 \text{ (kPa)} \quad (\text{where } N_{60} \text{ is the SPT N corrected for hammer energy})$$

It should be noted that most of the total settlement of foundations on granular soils is likely to take place almost immediately upon the application of load to the soil, therefore the majority of the settlement will be built out as construction proceeds and foundation load is applied.

### *Chalk Formation*

The drained stiffness of structured Chalk is estimated using CIRIA Report 143 (1995);

$$E_v' = 5000 \times \text{SPT N} \text{ (kN/m}^2\text{).}$$

## **7.1 Geotechnical Parameters**

Table 7.1 provides a summary of the recommended characteristic values of geotechnical soil parameters for the site.

The engineering parameters of the Chalk have been assessed from the results of the ground investigation and the recommendations given in CIRIA C574 and CIRIA C143. Parameters for CFA and driven pile design have been based on recommendations given in CIRIA PR86 (CFA only) and CIRIA PR11.

**Table 7.1 Geotechnical parameters**

Stratum		Geotechnical Parameters				UCS (MN/m <sup>2</sup> )
		Bulk Density* (kN/m <sup>2</sup> )	Undrained Shear Strength (kN/m <sup>2</sup> )	Angle of Shearing Resistance (Φ')	Young's Modulus (MPa)	
Made Ground	Cohesive	18	50	26	E <sub>u</sub>	E'
	Granular	18	-	35	-	20
Kempton Park Gravel	Cohesive	19	60	26	15	9
	Granular	18	-	35	-	30
Structureless Chalk		19	-	29 <sup>1</sup>	-	8 (Grade Dm) <sup>1</sup> 50 (Grade Dc) <sup>1</sup>
Structured Chalk (Grade A-C)		20	-	33 <sup>1</sup>	-	100 < 3.0

1 CIRIA C574

## 8. RECOMMENDATIONS

The following section summarises geotechnical recommendations for the proposed development based on information provided by St William (refer to the Proposed Development drawing in Appendix A). At the time of writing it is understood that the redevelopment will comprise the redevelopment of the former gas works site for a mix of residential and commercial end use.

Whilst information presented in drawing 2 indicates to variable structure heights for the proposed development, no information regarding the proposed structure loadings has been supplied to Ramboll and therefore the following only provides outline geotechnical recommendations.

The recommendations presented should be read in conjunction with the Ramboll Ground Contamination Report (Ref R1620009115\_Hertford\_ESA\_01).

### 8.1 Foundation Options

#### 8.1.1 Shallow Foundation Solution

##### *Made Ground*

From a review of the ground investigation data available, the near surface soils consist of variable Made Ground underlain by the Kempton Park Gravel Member.

Given the variable nature of the existing Made Ground these are not considered suitable for shallow foundations without some form of ground improvement given their potential for high total and differential settlement.

##### *Kempton Park Gravel Member*

A shallow foundation solution founding in the underlying medium dense KPGM may be suitable to support the structure (subject to the imposed load). Based on the information obtained during the GEL investigation and the adopted material parameters, the design bearing resistance for granular KPGM is 250 kN/m<sup>2</sup>. If the occasional layer of cohesive KPGM is encountered, the cohesive soil design bearing resistance is in the order of 230 kN/m<sup>2</sup>.

The resistance values have been calculated based on the strip shallow foundations bearing at 1.0 mbgl. The analysis is in line with Design Approach 1, Combination 2 partial factors. Serviceability Limit State analysis will need to be checked once imposed foundation size and load has been scoped to ensure the predicted settlement meets the design criteria.

However, as the Made Ground thickness varies significantly across the site (up to 4.65 metres), the depth to a suitable founding stratum may exceed 2.5 metres. Therefore, localised deepening of excavations may be required and may prove to be uneconomic given the volume of material excavated and replaced.

Monitoring data indicates to potentially high groundwater levels, and therefore where granular formation is within the zone of influence of groundwater the calculated bearing capacity should be halved.

##### *Chalk*

Recommendations given in CIRIA C574 advise that the lower bound allowable bearing pressure for Grade Dc Structureless Chalk is 225 kN/m. Guidelines for Dc Chalk in CIRIA C574 recommend

that a stress of 225 kN/m<sup>2</sup> would approximate to a settlement ratio of,  $\rho/D \leq 0.2\%$  (where  $\rho$  is settlement and D is the foundation width). Where Grade Dm Chalk is present at formation, CIRIA C574 recommends that the allowable bearing pressure should be selected only after in situ testing.

### 8.1.2 Piled Foundation

Given the depth to the structured Chalk mass, if the imposed load exceeds the bearing resistance of the Kempton Park Gravel Member or structureless Chalk, then a piled foundation solution should be utilised to support the proposed structures. The piles would be embedded into the Chalk where the strength of the material would be adequate to support the required loads. Either bored or Continuous Flight Auger (CFA) piles could be used. Driven piles could also be used, however, it should be noted that shaft resistance for driven piles will be reduced due to disturbance of the Chalk as a result of pile driving. Furthermore, the use of driven piles will be dependent upon noise level restrictions imposed by the local authority particularly given the close proximity to existing commercial units and the surrounding residential properties along with any other environmental constraints.

To determine outline pile capacities, shaft friction and end bearing have been estimated using the following methods outlined in CIRIA C574 and CIRIA PR86 Shaft friction of CFA piles in Chalk (2003).

For ultimate shaft friction ( $\tau_{sf}$ ) in low density Chalk the following empirical relationship:

$$\tau_{sf} = \beta \cdot \sigma_v'$$

Where:

$\beta$  = effective stress pile friction coefficient for Chalk.

$\sigma_v'$  = average effective vertical stress (kN/m<sup>2</sup>)

Note: the  $\beta$  value is dependent on the method of installation and Chalk density.

Geotechnical test results indicate to low density Chalk clasts whilst the in situ SPT N values indicate to a Chalk mass of potentially higher density. Given the variation in results, a conservative lower bound  $\beta$  value of 0.45 for CFA piles has been adopted when calculating preliminary pile capacities. The  $\beta$  value may be increased if results of any preliminary pile tests indicate that a higher  $\beta$  value of 0.8 for CFA piles maybe applicable and therefore higher working capacities achievable. Alternatively, should bored piles be considered then a  $\beta$  value of 0.8 can be adopted although any contribution to the ultimate shaft resistance from the Made Ground should be omitted.

For ultimate end bearing ( $q_b$ ) resistance in Chalk:

$$q_b = 240.N \text{ (kN/m}^2\text{) for } N < 30$$

$$q_b = 200.N \text{ (kN/m}^2\text{) for } N > 40$$

Where:

N = SPT N value at the base of the pile.

Using the design ground profiles for the North site and the South site and material parameters presented in Table 7.1, estimations of preliminary pile safe working capacity for CFA piles are presented in Table 8.1 (for the North site) and Table 8.2 (for the South site) based on a governing

factor of safety (FoS) of 2.5 applied to both the ultimate shaft and base resistance (as per CIRIA PR86).

**Table 8.1 Estimated safe working loads for CFA piles - North Site**

<b>Founding Stratum</b>	<b>Depth of Embedment (metres below existing ground level)</b>	<b>Pile safe working capacity for CFA Piles (kN)</b>		
		<b>300 mm Diameter Pile</b>	<b>450 mm Diameter Pile</b>	<b>600 mm Diameter Pile</b>
Chalk	15.0	350	675	1105
	17.5	455	870	1410
	20.0	525	980	1560

**Table 8.2 Estimated safe working loads for CFA piles - South Site**

<b>Founding Stratum</b>	<b>Depth of Embedment (metres below existing ground level)</b>	<b>Pile safe working capacity for CFA Piles (kN)</b>		
		<b>300 mm Diameter Pile</b>	<b>450 mm Diameter Pile</b>	<b>600 mm Diameter Pile</b>
Chalk	15.0	340	665	1095
	17.5	445	860	1400
	20.0	520	970	1545

Where groundwater is present there is a risk that Chalk sediment may remain at the base of the pile when constructing bored piles underwater unless the concrete is placed with a tremie. The presence of sediment is likely to increase the settlement of the pile and therefore for bored piles below the water table FoS of 2.5 (shaft) and 5.0 (base) should be applied. For CFA piles below the water table there is no risk of Chalk sediment at the base of the pile.

## 8.2 Floor Slabs

Generally, the site is underlain by Made Ground of variable nature which in turn is underlain by predominantly medium dense granular gravels from the Kempton Park Gravel Member. Due to the potential for excessive total settlement or damaging differential settlement it is recommended that ground bearing slabs are not utilised unless the cohesive Made Ground or cohesive Kempton Gravels are either removed and replaced with a suitably engineered granular fill, or are subject to ground improvement such as soil stabilisation techniques.

If granular KPG or Chalk is encountered near surface ground bearing floor slabs are likely to perform satisfactorily. In accordance with Interim Technical Note 11 'The Design of Ground Supported Concrete Industrial Floor Slabs', 1998 a modulus of sub-grade reaction (K) for the near surface KPG or Chalk deposits can be taken as 54 MN/m<sup>3</sup> or 27 MN/m<sup>3</sup> respectively which is considered appropriate for the design of the floor slabs.

## 8.3 Infilling of Gas Holder Bases

Where infilling of former gas holder bases forms part of the redevelopment, it is recommended that in order to prevent a potential high magnitude of settlement occurring over a long period, any fill material used to infill the gas holder base conforms to a Class 6F1/6F2 as per Table 6/1 of the Specification for Highways Works (SHW) Series 600 Earthworks.

Materials to be placed as part of filling operations should be compacted in accordance with the requirements of the SHW Series 600. The Class 6F1/6F2 material shall be placed by method compaction.

Where piled foundations are adopted then the potential effects of negative skin friction should be considered for any piles constructed through the fill material within the former gas holder.

#### **8.4 Volume Change Potential**

Modified Plasticity Index values have been derived for the cohesive layers using the Atterberg Limit tests. The modified PI for cohesive Kempton Park Gravels suggests that the soil has a low volume change potential.

Should spread foundations be deemed a suitable foundation solution then any design should be undertaken in with the NHBC guidance for 'Building near trees' (Part 4, Chapter 4.2 of the NHBC Standards 2016). Heave protection will only be required if new foundations are to be constructed within the zone of influence of existing trees (either to remain or be removed as part of the development).

A comparison of moisture content against liquid limit indicates the clays are not susceptible to desiccation.

#### **8.5 Pavement Design**

Ten Plate Loading tests were carried out to determine California Bearing Ratio (CBR) values during the 2020 GEL Investigation (refer to the Exploratory Hole Location Plan in Appendix A). A further five CBR tests were carried out during laboratory testing, using a dynamic compaction with a 2.5kg rammer.

The reported CBR values range from 2% to 19%, with an outlier results of 152%. Values are typically 3% or higher. Based on the in situ CBR test undertaken, a lower bound design CBR value of 3% is recommended. All test results are summarised in Table 8.5.

**Table 8.5 In situ CBR values**

Location	Test Location	Depth (mbgl)	CBR (%)	Stratum	Description
CBR01	In situ	0.5	7.0	Made Ground	Sandy gravel with tarmac chippings
CBR02	In situ	0.3	14.0		Sand gravel
CBR03	In situ	0.9	3.0		Sandy gravel
CBR04	In situ	1.0	2.0		Sandy gravel
CBR05	In situ	0.2	8.0		Sandy gravel
CBR06	In situ	1.0	152.0		Sandy gravel
CBR07	In situ	0.3	3.0		Sandy gravel
SCBR01	In situ	0.5	5.0		Gravelly slightly sandy clay
SCBR02	In situ	0.1	19.0		Sand and Gravel
SCBR03	In situ	0.2	14.0		Slightly gravelly clay

Location	Test Location	Depth (mbgl)	CBR (%)	Stratum	Description
STP07	Lab test	0.35	3.8 - 8.1	MG	Clayey gravelly sand
STP08	Lab test	1.0	36 - 29	MG	Gravelly sandy silt
TP04	Lab test	0.6	34 - 27	MG	Clayey gravelly sand
TP06	Lab test	0.2	23 - 24	KPGM	Clayey gravelly sand
TP09	Lab test	0.3	19 - 30	MG	Silty gravelly sand

## 8.6 Buried Concrete

Chemical testing in accordance with BRE SD1 (reduced suite) were undertaken on select samples of all soils encountered during the 2020 GEL investigation. The characteristic values for each soil type have been derived based on the size of data set and guidance given in BRE Special Digest 1:2005 – Concrete in Aggressive Ground (3<sup>rd</sup> Edition).

The range of chemical analysis results for pH value, water soluble sulphate content (2:1 water extract as SO<sub>4</sub>) and total sulphur of the soils are presented in Table 8.6.1. The results will be used to assess the aggressivity of the ground against buried concrete.

**Table 8.6.1 pH and sulphate results**

Stratum	pH Range	Characteristic Sulphate SO <sub>4</sub> 2:1 Value (mg/l) *	Total Potential Sulphate (SO <sub>4</sub> %)
Made Ground – granular	8.4 - 8.7	100 - 290	0.03 - 0.1
Made Ground – cohesive	7.9 - 8.4	50 - 680	0.1 - 1.3
Kempton Park Gravels - granular	8.0 - 8.7	<10 - 409	0.05 - 0.29
Kempton Park Gravels – cohesive	8.2	<10	0.02
Chalk	8.2 - 8.4	70	0.02 - 0.04

\*Mean of either highest two results (data set of five to nine tests) or highest 20% (data set of ten or more tests).

The design ACEC class has been derived based on Table C2 Brownfield Site from the BRE Special Digest 1. Due to the presence of granular material underlying the site groundwater has been taken as mobile. The design ACEC class is presented in Table 8.6.2.

**Table 8.1.2 Concrete design class**

Stratum	ACEC Class	DS Class
Made Ground – granular	AC-1s	DS-1
Made Ground – cohesive	AC-3s	DS-4
Kempton Park Gravels - granular	AC-1s	DS-2
Kempton Park Gravels – cohesive	AC-1s	DS-1
Chalk	AC-1s	DS-1

## 9. RISK REGISTER

Risk	Description	Impact (1-5)	Probability (1-5)	Level of Risk	Mitigation
Unexpected / unfavourable Ground Conditions	Risk of deep Made Ground, lateral and vertical variation in the superficial deposits.	3	2	6	<p>Ensure foundations are constructed to a sufficient depth to be stable in all possible geologies.</p> <p>Designer contacted immediately if ground conditions differ from what was anticipated.</p> <p>Use experienced site geotechnical personnel to provide advanced warning of potential problems.</p>
Obstructions to construction due to existing foundations	Risk of delay where former foundations or gasholder bases are encountered.	2	4	8	<p>Specification of demolition works to include the removal of existing foundations and replacement with compacted granular fill</p> <p>Review archive information and drawings for the existing buildings and identify possible locations of foundations.</p> <p>Contractor to develop and implement necessary measures to minimise the impact of relic foundations on construction.</p>
Obstructions within the Made Ground	Plant/equipment damaged during foundation installation	2	2	4	<p>Design to be based on the ground investigation data.</p> <p>Utilise suitable foundation system (e.g. bored piles)</p>
Variable Made Ground thickness	Within both sites the thickness of the Made Ground varies significantly. Shallow foundation depth may be affected.	2	5	10	The depth to the Kempton Park Gravel Member stratum may exceed 2.5 metres. Therefore, localised deepening of excavations may be required which may prove to be uneconomic.
Encountering uncharted buried services	Risk of delay where uncharted services are encountered. Costs of repair, injury to personnel.	4	1	4	If, during foundation construction, an unexpected obstruction is discovered, cease immediately until it can be established what the obstruction is. CAT scanning must take place during foundation construction to mitigate this risk. Walkover surveys and stats searches will also lessen the likelihood of unknown services.
Unexpectedly high groundwater levels adversely affecting foundation/ formation levels	Groundwater encountered shallower than anticipated resulting in a decrease in working pile capacity / reduction in FoS, or reduced bearing capacity for shallow foundations bearing on granular soils.	4	2	8	<p>Utilise suitable foundation system (e.g. increase founding depth).</p> <p>Dependent upon site observations</p> <p>Designer contacted immediately if ground conditions differ from what was anticipated</p>

Risk	Description	Impact (1-5)	Probability (1-5)	Level of Risk	Mitigation
Geological features, fissures, faults, dissolution features, etc which impact on design/ construction	Presence of such geological features pose a risk to integrity / stability of proposed foundations. Site is situated on Lewes Nodular Chalk, therefore there is a risk of dissolution features.	4	2	8	Neither historical reports or GEL investigation makes reference to geological features likely to impact on any future design or construction. Use experienced site geotechnical personnel to provide advanced warning of potential problems. Contact designer in the event of encountering dissolution features.
Pollution of watercourses	Pollution of watercourses caused by release of high levels of suspended solids during earthworks due to construction operations	3	1	3	Store all construction materials in a safe manner away from watercourses. Contractor to develop and implement necessary mitigation measures.
Pavement design	Risk of low strength formation soils.	3	2	6	In situ testing to be undertaken during construction to verify design CBR; excavate and remove low strength materials
Contaminated ground / groundwater	Environmental risks and / or H&S risk to operatives / public. Delay to programme while material is disposed of/ remediated.	3	4	12	Refer to Ramboll Geo-environmental report (ref: R1620009115_Hertford_ESA_01).
Shrink Swell effects from clays present.	Structural damage unlikely as lab test results indicates low volume change potential.	3	1	3	Foundations to be found in granular materials. Void to be left underground beam to account for any swelling. Foundations to be designed in accordance with NHBC guidelines Chapter 4.2 'Building near trees'.
Sulphates in ground attacking and weakening concrete buried structures	Reduction in strength of below ground concrete structures - potential failure of foundations.	3	3	9	Concrete classification design to be based on the ground investigation results. Concrete to be designed in accordance with guidelines given in BRE Special Digest1. Consideration to be given to construction sequencing to minimise risk of ground disturbance.
Encountering UXO	Risk of injury or fatality to site operatives. Risk of additional construction cost and programme delays	2	2	4	A review of the available information classified the site as 'low' risk. No anomalies encountered during GI but UXO may be present on site and any future intrusive works should be appropriately risk assessed as per the guidelines in CIRIA C681.

\

		Probability (P)				
		1	2	3	4	5
Impact (I)	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

	Impact	Probability
1	Very Low	Highly Unlikely
2	Low	Unlikely
3	Medium	Possible
4	High	Likely
5	Very High	Highly Likely

LOW - Normal Risk (rectified through standard procedures)

MEDIUM - Requires Special Attention / Measures

HIGH - Unacceptable Risk



## 10. REFERENCES

- BGS British Geological Survey Map, 1:50,000 scale, Sheet 239 Hertford
- BRE Special Digest 1:2005 Concrete in Aggressive Ground 3<sup>rd</sup> Edition
- BS 8004:2015 Code of Practice for Foundations
- BS 5930:2015 Code of Practice for Ground Investigations
- BS EN 1997-1:2004 Eurocode 7: Geotechnical design – Part 1: General Rules
- BS EN 1997-1:2004 Eurocode 7: Geotechnical design – Part 2: Ground Investigation and Testing
- CC Ground Investigations Ltd Lea Bridge Gas Works Factual Report (ref C6554, 2020)
- CIRIA C143 The Standard Penetration Test (SPT): Methods and Use
- Highways Agency IAN 73/06 Revision 1 (2009) Design Guidance for Road Pavement Foundations
- Highways Agency Manual of Contract Documents for Highways Works, Volume 1, Specification for Highways Works (1998:2009 amendment)
- NHBC Standards Chapter 4.2: Building Near Trees (2016)
- CIRIA C574 Engineering in Chalk

## APPENDIX A DRAWINGS

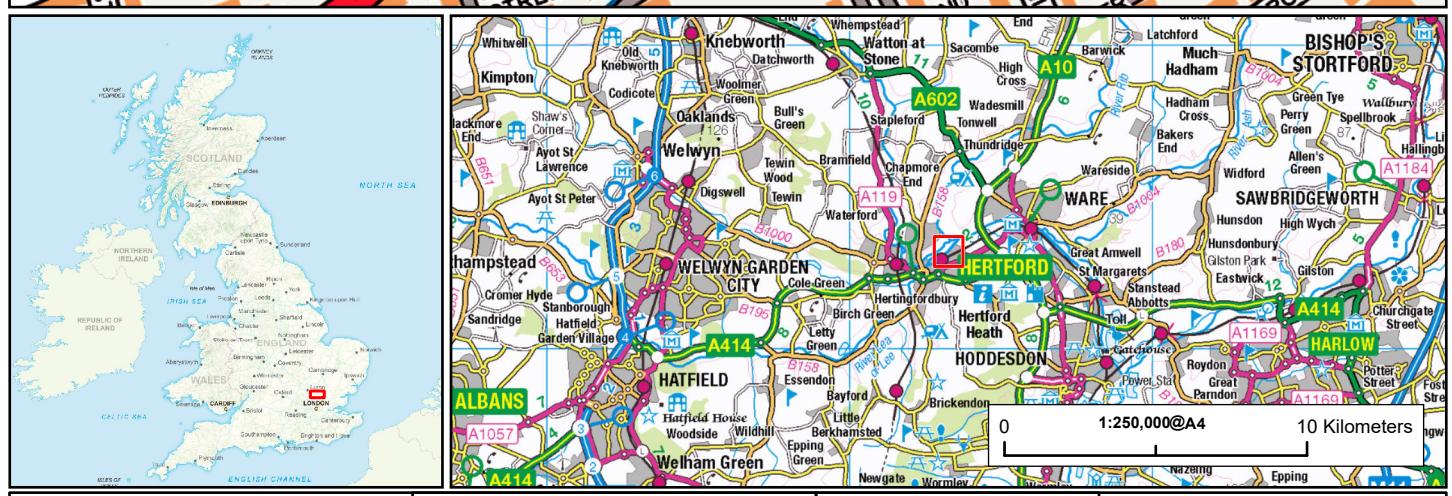


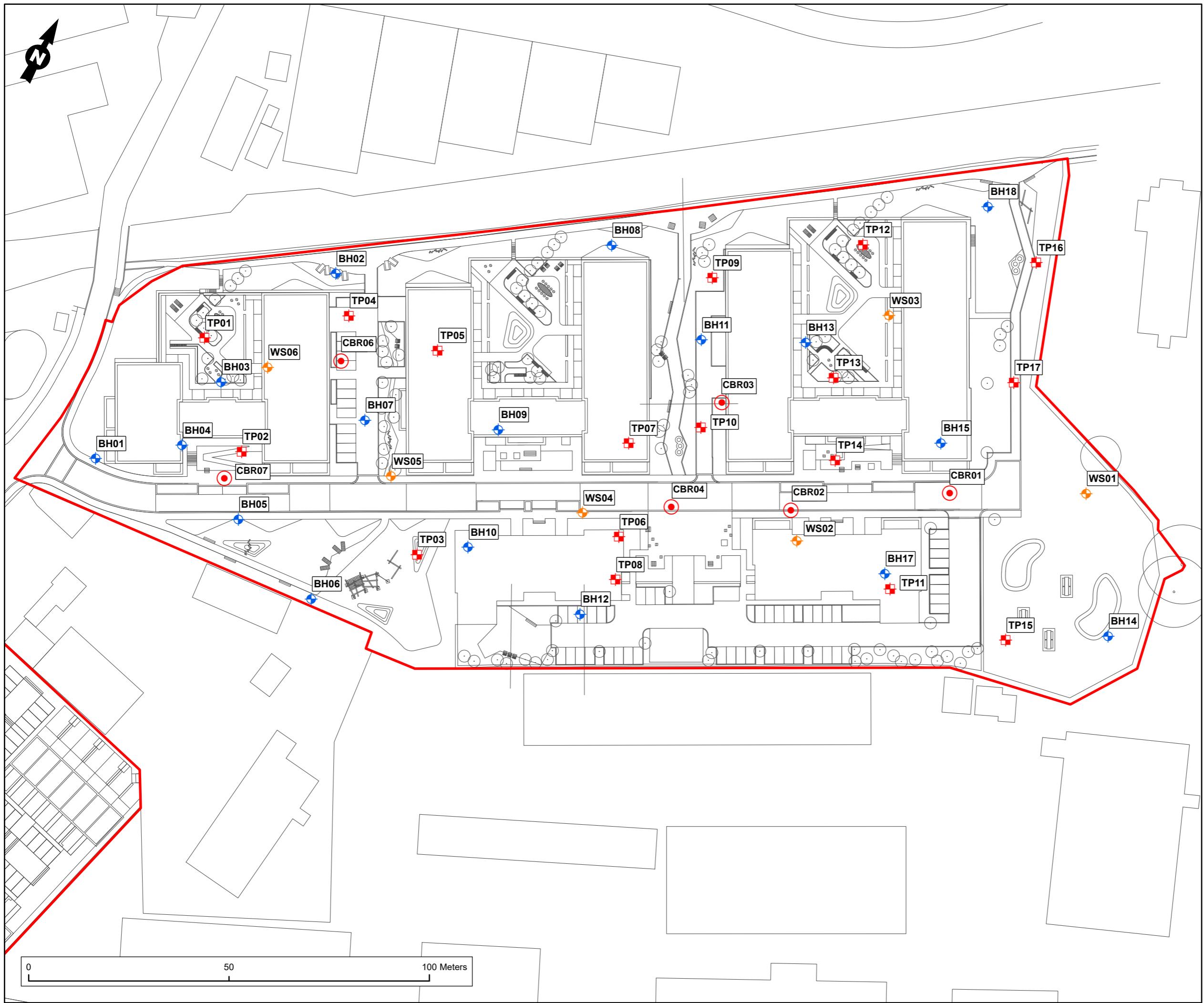
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Project Number 1620009115	Client St. William	Scale As shown	
Issue 1			RAMBOLL



## Legend

Car club spaces

Figure Title :	Proposed Development Plan
Project Name	Hertford Gas Works
Project Number	1620009115
Date:	September 2020
Scale:	A3
Prepared by:	L D A DESIGN



**Legend**

**Ramboll Actual Investigation Locations**

◆	Rotary Borehole
■	Trial Pit
○	Window Sample
●	CBR
[Red Box]	Site Boundary

**Figure Title**  
Actual Surveyed Investigation Locations - North Section

**Project Name**  
Hertford Gas Works

---

Project Number 1620009115	Figure No. 2A
Date August 2020	Prepared By AK
Scale 1:900 @A3	Issue 1
Client St. William	

**RAMBOLL**



Legend	
<b>Ramboll Actual Investigation Locations</b>	
Rotary Borehole	
Trial Pit	
Window Sample	
CBR	
Site Boundary	
Figure Title	
Actual Surveyed Investigation Locations - South Section	
Project Name	
Hertford Gas Works	
Project Number	Figure No.
1620009115	2B
Date	Prepared By
August 2020	AK
Scale	Issue
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Client	
St. William	

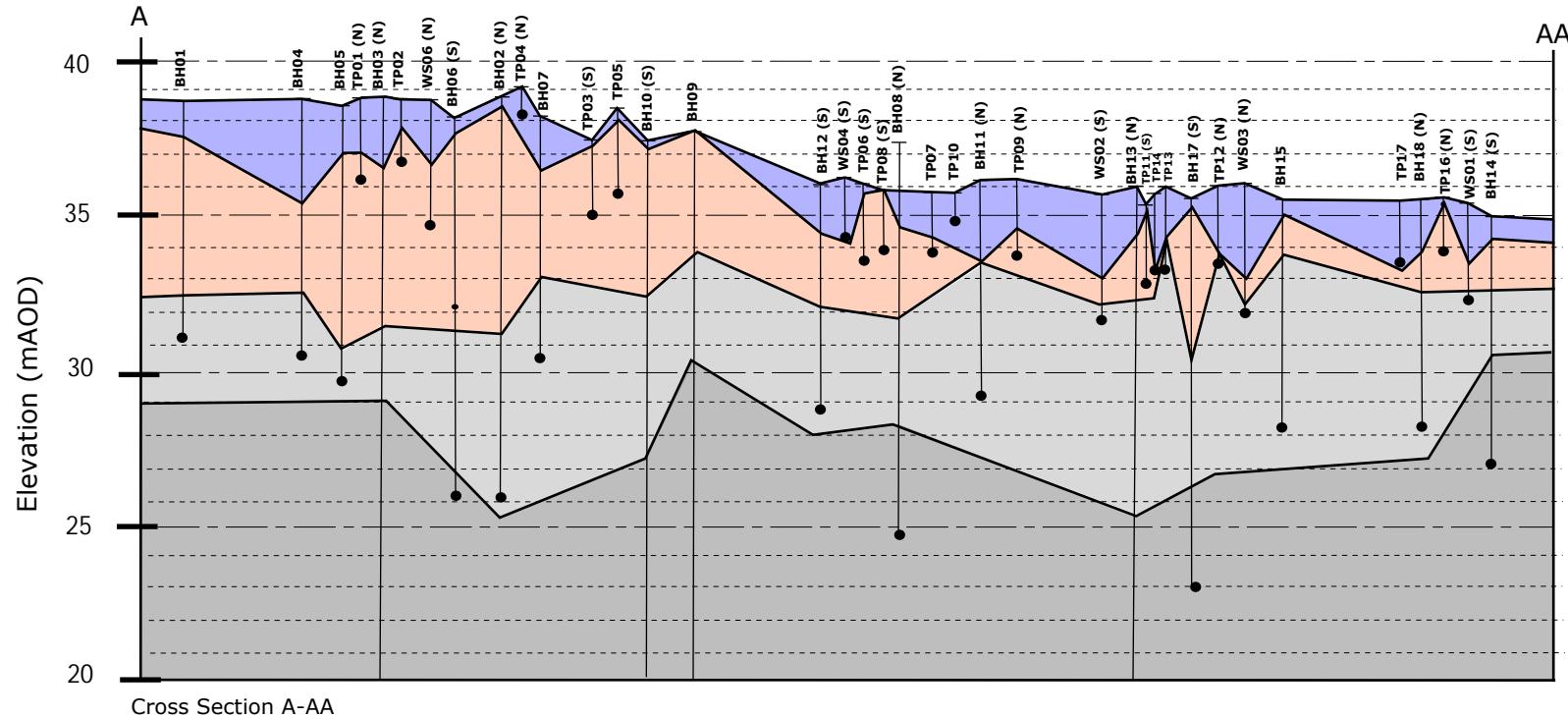


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**5a**

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**North Site Geological Cross Section**

Revision  
**R01**

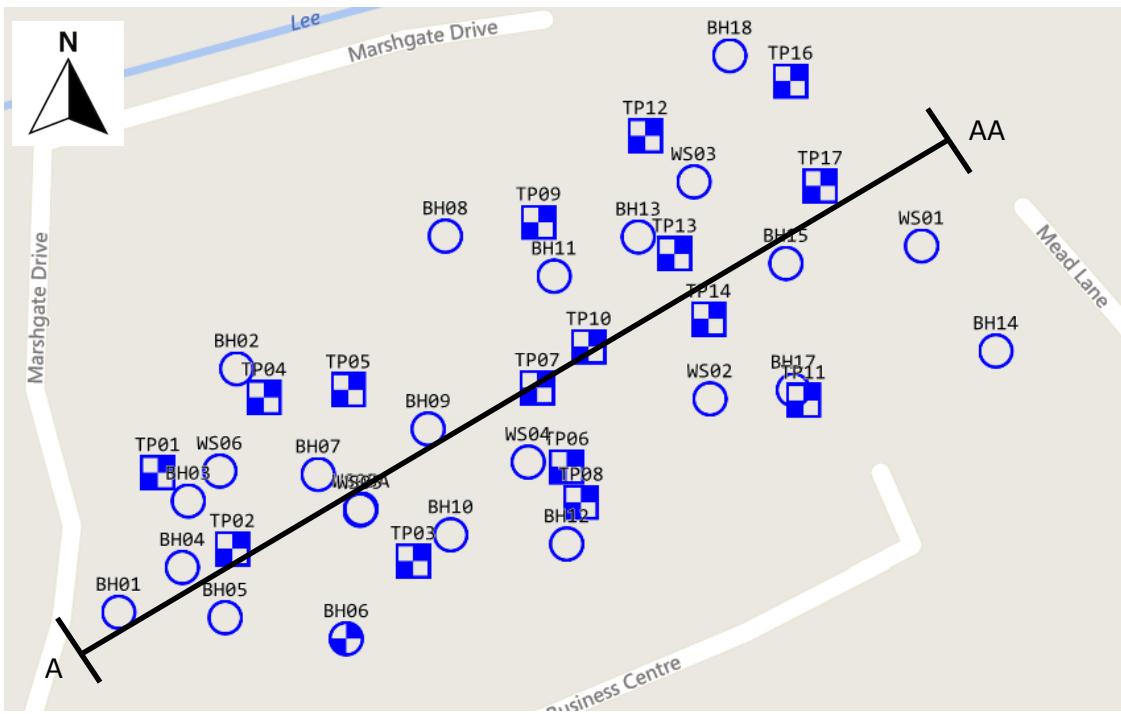
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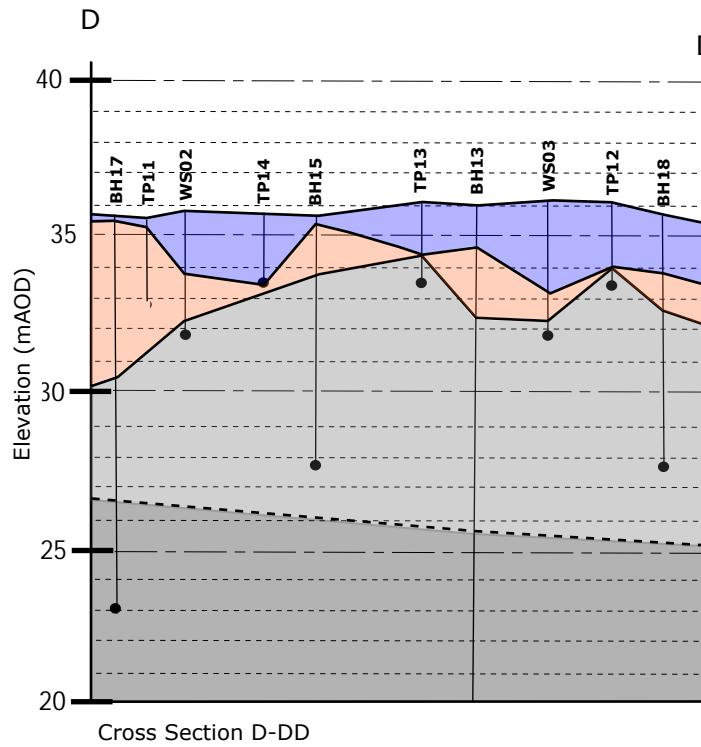
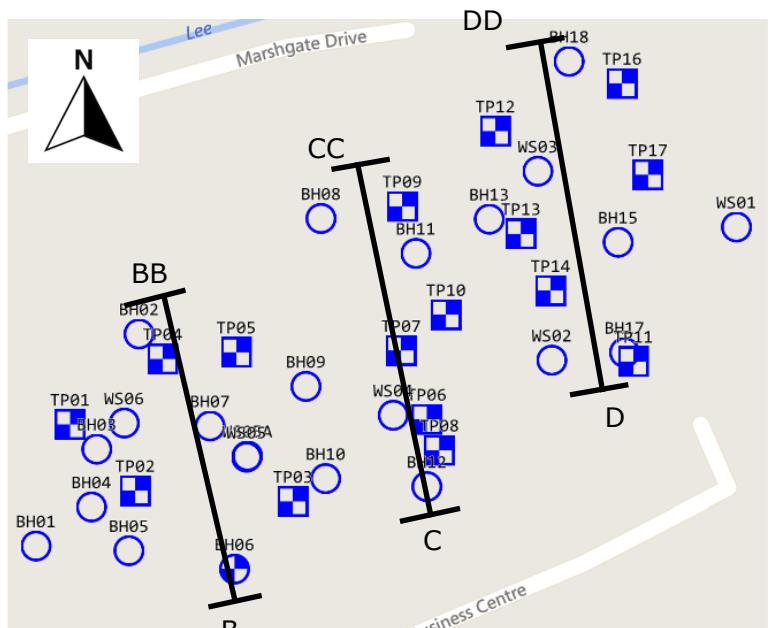
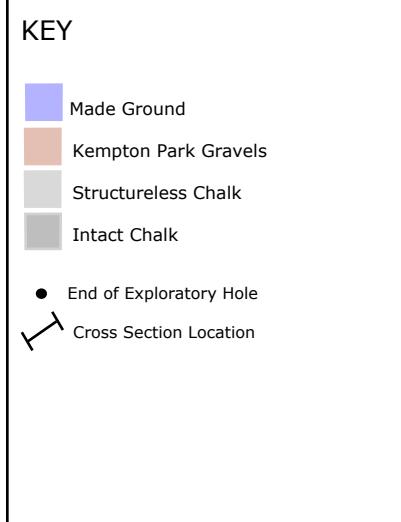
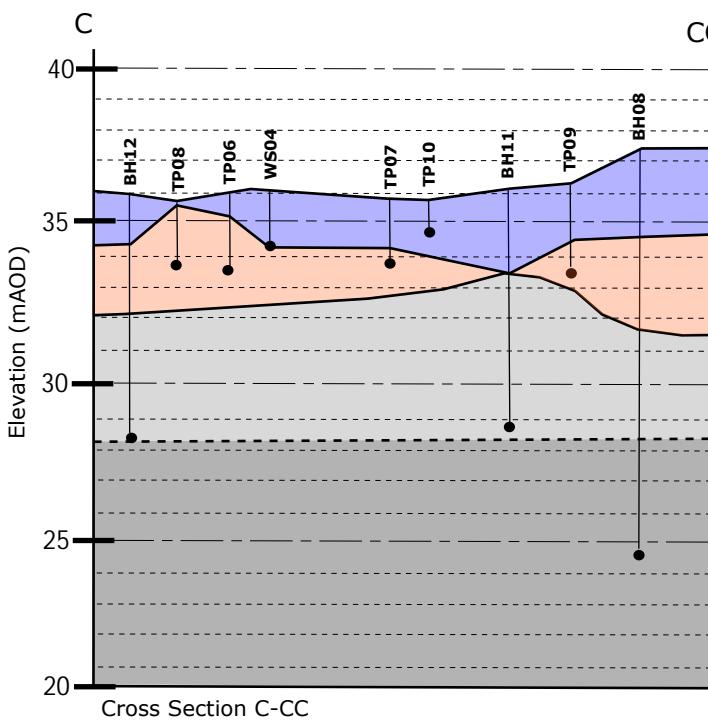
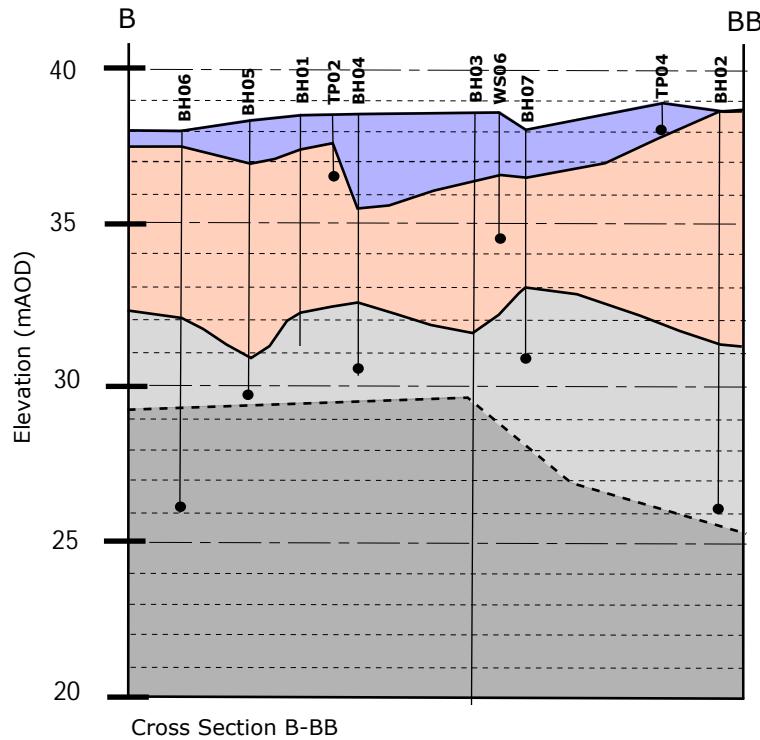
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**1620009115**

Project Name  
**Hertford Former Gasworks**

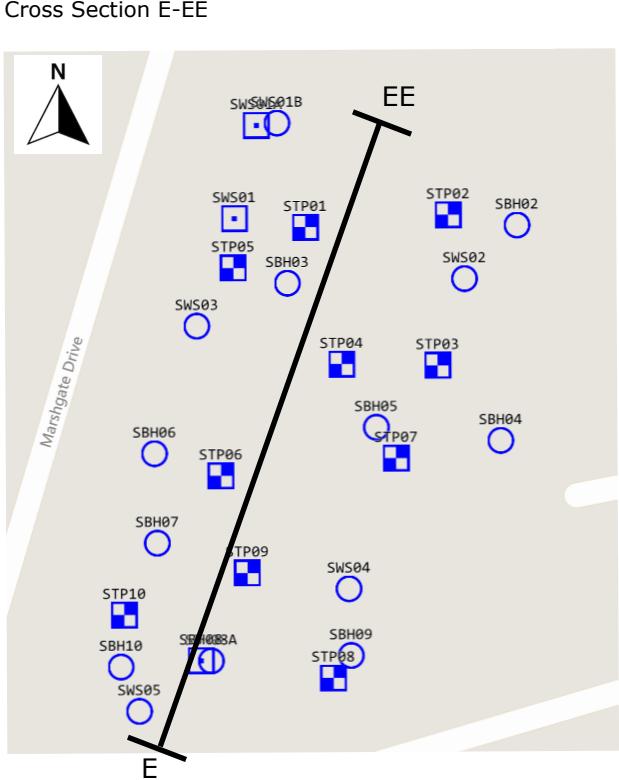
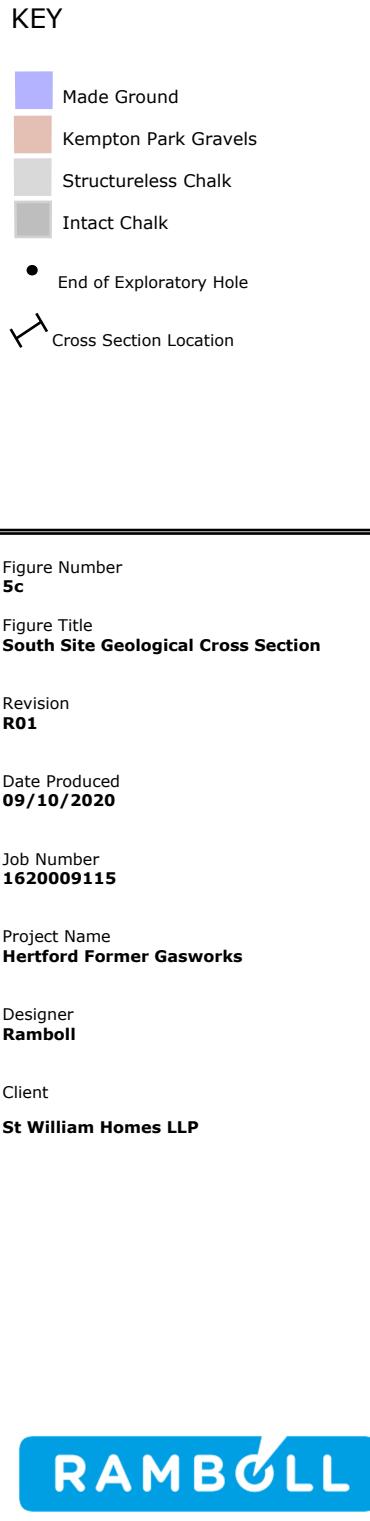
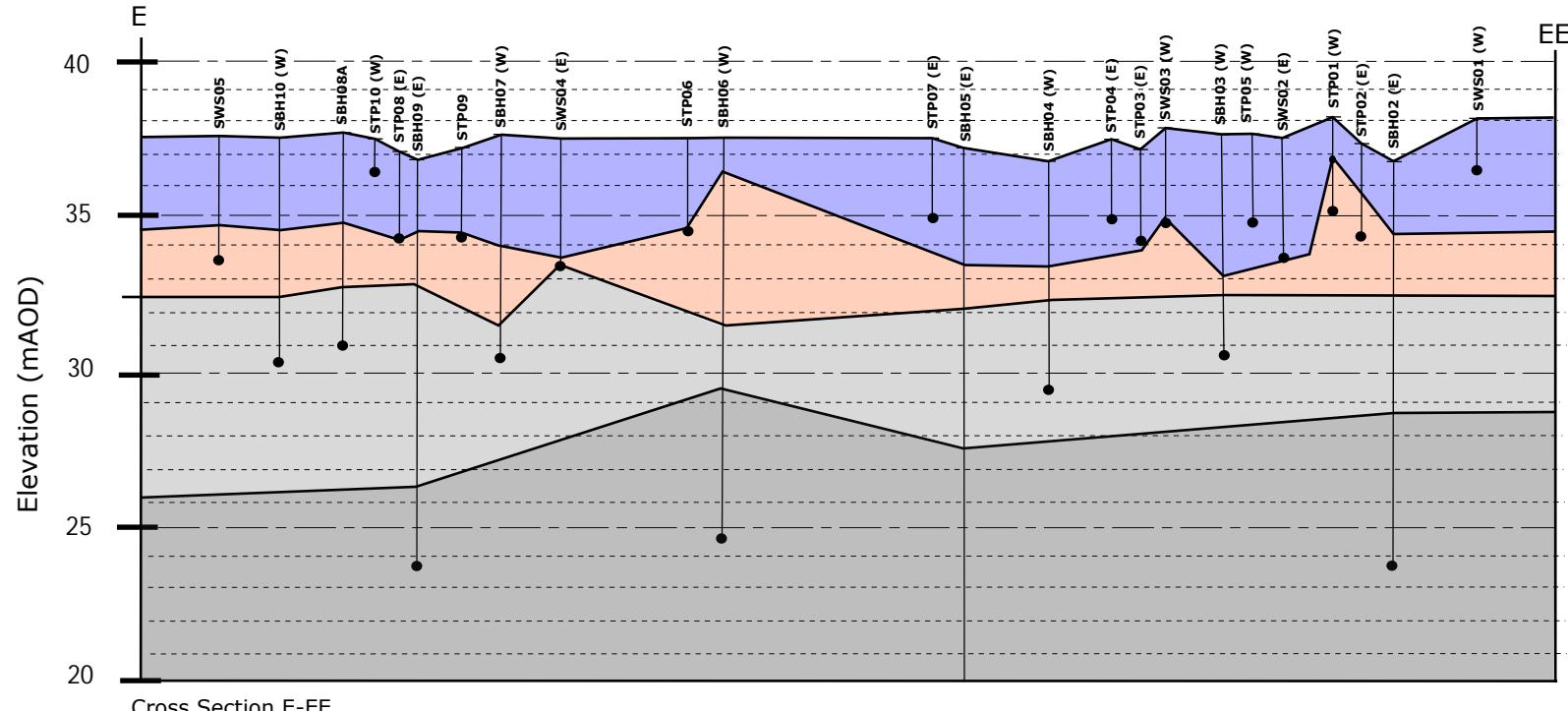
Designer  
**Ramboll**

Client  
**St William Homes LLP**

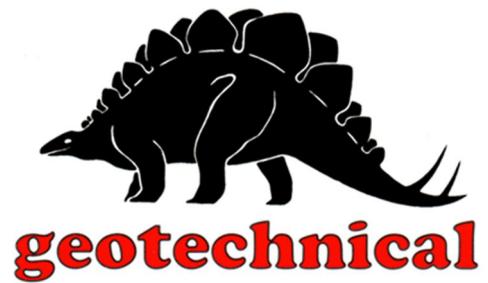




**RAMBOLL**



**APPENDIX B  
GEOTECHNICAL FACTUAL REPORT**



# HERTFORD GASWORKS GROUND INVESTIGATION

FACTUAL REPORT ON  
GROUND INVESTIGATION

Prepared for ST WILLIAM LLP

Report Ref: 35880

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# HERTFORD GASWORKS GROUND INVESTIGATION

## FACTUAL REPORT ON GROUND INVESTIGATION

Prepared for ST WILLIAM LLP

Report Ref: 35880

PROJECT: Redevelopment comprising the erection of residential blocks, apartment block and commercial block

CONSULTANT: Ramboll UK Ltd

VOLUME - VERSION	STATUS	ORIGINATOR	CHECKER	APPROVED	DATE
1 of 1 - A	DRAFT	JB	CT/EC	-	15/09/2020
ORIGINATOR	APPROVER				
J BOWYER Engineering Geologist					

The report is not to be used for contractual or engineering purposes unless this sheet is signed and the report designated "Final".

The report has been prepared for the sole use and reliance by St. William LLP. GEL accepts no liability as a result of the use or reliance of this report by any other parties.



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APPENDIX B	LABORATORY TESTING



## 1. INTRODUCTION

It is proposed to undertake redevelopment of land at the former Hertford Gasworks site, Hertford. Geotechnical Engineering Limited (GEL) was instructed by Ramboll UK Ltd (the Consultant) acting on behalf of St. William LLP (the Client) to carry out an investigation to determine the ground conditions.

The scope of works and terms and conditions of appointment were specified by the Consultant and GEL correspondence reference T31179 dated 6<sup>th</sup> March 2020. The investigation was carried out under direction and supervision of the Consultant.

This report describes the investigation and presents the findings.

## 2. SITE LOCATION AND GEOLOGY

The site is situated at the Former Hertford Gasworks site, off Marshgate Drive, Hertford, Hertfordshire, SG13 7JY and may be located by its National Grid co-ordinates TL 3328 1329. The site is split into two plots of land. The north plot (adjacent to the River Lea) and south plot.

British Geological Survey (BGS) England and Wales (Sheet No. 239 Hertford, 1:50,000, 1978) and the BGS online geology (1:50,000) indicate that both the plots are underlain by Kempton Park Gravel Member comprising sand and gravel with localised lenses of clay. Solid bedrock geology at both plots are shown to comprise Lewes Nodular Chalk Seaford Formation.

Made Ground associated with historical and current site uses is anticipated across both plots.



### 3. GROUND INVESTIGATION

#### 3.1 Fieldwork

The fieldwork was carried out in general accordance with BS5930:2015 during the period 8<sup>th</sup> June to 8<sup>th</sup> July 2020 and comprised twenty-seven boreholes, fourteen windowless sample boreholes, twenty-six trial pit excavations and ten plate loading tests.

The exploratory hole locations were selected by the Consultant and set out by this Company and are shown on Figure. The ground level and co-ordinates at each exploratory hole were established by this Company using GPS techniques.

The contamination status of the site was classified as RED by the Consultant in reference to the British Drilling Association (BDA) guidelines. A decontamination unit was provided and respiratory apparatus and other personal equipment was utilised accordingly.

The boreholes, referenced BH01 to BH05, BH07 to BH15, BH17, BH18, SBH02 to SBH07, SBH08A, SBH09 and SBH10 (Appendix A), were formed using a track-mounted Geotechnical Pioneer Rig. Initially, hardstanding comprising concrete at locations BH10 and BH14 and tarmacadam at locations SBH02 to SBH06 was rotary core drilled to a maximum depth of 0.40m in SBH03. An inspection pit was hand excavated at each borehole location to a maximum depth of 1.30m to check for buried services. Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars. The borehole referenced SBH08 was terminated at 1.10m and relocated as SBH08A on account of being unable to progress the inspection pit through cobbles. Heavy duty dynamic sampling techniques were then employed to produce a continuous disturbed sample of 112mm nominal diameter reducing to 97mm when required, as the borehole was advanced. The samples were recovered in semi-rigid plastic liner. Rotary core methods were employed from the base of the inspection pit at BH11 prior to commencing with heavy duty dynamic sampling techniques.



On refusal to dynamic sampling boreholes at locations BH03, BH04, BH09, BH10, BH13 and SBH05 were continued by rotary core drilling techniques utilising a water/polymer flush. A double-tube swivel core barrel with semi-rigid plastic liner was utilised to recover a continuous sample of 107mm (SBH05) and 90mm (BH03, BH04, BH09 and BH13) diameter. Where appropriate, dynamic sampling techniques were carried out to recover dropped core or where rotary core drilling was not suitable.

The dynamic samples and rotary core were extracted horizontally from the sampler and core barrel respectively, the semi-rigid liner was cut to length and caps placed at each end to retain moisture content. All samples and core were retained in sequence in labelled, wooden coreboxes.

Clean drilling techniques were required to protect the underlying formation at locations BH03, BH08, BH09, BH13, BH18 and SBH02. Initially, 200mm and 168mm diameter casing was installed in each borehole and a bentonite seal (between 1.70 to 2.70m thickness) placed within the casing. The bentonite was allowed to cure for an hour prior to sampling through the bentonite with a reduced diameter casing string and advancing the borehole.

The borehole referenced BH06 was formed using hollow stem auger techniques (200mm diameter). Initially, an inspection pit was hand excavated to 1.20m depth to check for buried services. Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars.

The boreholes, referenced WS01 to WS05, WS05A, WSO6, SWS01, SWS01A, SWS01B, SWS02 to SWS05 (Appendix A), were formed using a Terrier 2000 rig. Initially, an inspection pit was hand excavated at each borehole location to a maximum depth of 1.20 m to check for buried services. The boreholes referenced SWS01, SWS01A and WS05 were terminated on account of encountering concrete at the base of the inspection pit at SWS01 (0.20m) and SWS01A



(0.20m) and on encountering an unknown service at SWS05 (0.90m). Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars. Dynamic sampling techniques were then employed to produce a continuous disturbed sample of 97mm diameter. The samples were recovered in semi-rigid plastic liner.

The samples were extracted horizontally from the sampler, labelled and caps placed each end to retain moisture.

Standard penetration tests (SPT) were carried out in general accordance with BS EN ISO 22476-3:2005+A1:2011. A split barrel or a solid cone was used depending upon the materials encountered and the split barrel samples retained in airtight jars. The SPT N value was taken as the number of blows to penetrate the 300mm test drive following a 150mm seating drive. Where low penetration was recorded the seating drive was terminated at 25 blows and the test drive completed after a further 50 blows. Detailed SPT results, together with the energy ratio ( $E_r$ ), are presented in Appendix A and summarised as uncorrected N values on the borehole logs.

Boreholes were monitored for groundwater ingress as dynamic sampling proceeded. Upon encountering water, sampling was temporarily stopped to allow the level to stabilise. Water levels were also recorded at the start and finish of each day's work and are presented on the relevant log.

Variable head permeability tests were carried out in BH03, BH09, BH10, BH13 and SBH05 in general accordance with the procedures given in BS EN ISO 22282-2:2012. Falling head tests were carried out by topping up the borehole with clean water. Coefficients of permeability were calculated using the BS EN ISO 22282-2:2012 Hvorslev method and/or the Velocity Graph method. Intake factors have been derived from Hvorslev and are presented along with the results in Appendix A.



On completion standpipe piezometers were installed in BH03, BH09, BH10, BH13, SBH05. The standpipe piezometers consisted of a 19mm ID PVC access tube with a porous tip set in a filter response zone of washed sand. The response zone was sealed above and below with a bentonite plug. The installations were protected at the surface by a lockable, steel borehole helmet cover set in concrete. Installation details are given on the relevant borehole log. Subsequent water level readings are tabulated in Appendix A.

On completion gas/water monitoring standpipes were installed in BH01 to BH07, BH08 (dual installation), BH09 to BH14, BH15 (dual installation), BH17 (dual installation), BH18, SBH02 to SBH07, SBH08A, SBH09, SBH10, WS01 to WS04, WS05A, WS06, SWS01B and SWS02 to SWS05. Each installation consisted of a 50mm ID HDPE slotted tube set in a granular filter response zone. The installation was sealed above and below (except at BH02, BH11, BH12, BH15, BH17 SBH03, SBH04, WS04 and SWS01B) with a bentonite plug and accessed via a valve assembly. The installations were protected at the surface by a lockable, galvanised steel borehole helmet cover set in concrete. Installation details are given on the relevant borehole log.

On completion, SBH08, SWS01, SWS01A and SWS05 were backfilled with arisings to surface.

The trial pits, referenced TP01 to TP14, TP16, TP17 and STP01 to STP10 (Appendix A), were formed by a wheeled excavator with a 0.60m wide backactor bucket.

The ground surface at TP03, TP05, TP14, TP16, TP17 and STP01 to STP07 consisted of hardstanding which required breaking out prior to excavation.

Representative disturbed samples were taken and retained in sealed plastic bags and airtight containers to retain moisture content.



Hand vane tests were carried out in suitable cohesive material. The results are presented on the trial pit logs and tabulated in Appendix A.

Photographs of the trial pit profile and spoil heap were taken and are presented separately.

On completion all trial pits were backfilled with arisings compacted in suitable layers by the excavator bucket. The ground surface was left slightly proud to accommodate the future inevitable settlement of the backfill.

Plate loading tests, referenced CBR01 to CBR06 and SCBR07 to SCBR01 to SCBR03, were carried out to determine equivalent California Bearing Ratio (CBR) values. The tests were carried out in general accordance with BS1377: Part 9:1990:4.1 and the equivalent CBR value determined in accordance with HA interim Advice Note 73/06 (2009). A 295mm and 300mm diameter plate was used with load transmitted to the plate by jacking against the underside of an eight tonne wheeled excavator. Sequential loads were applied to produce a penetration range of 0 to 2mm at approximately 0.25-0.50mm intervals. The load determined from a plate penetration of 1.25mm enabled the calculation of the equivalent CBR value. The testing was undertaken by Hixtra Limited and the results are presented in Appendix A.

On completion of fieldwork all samples were brought to this Company's laboratory for testing and storage. During fieldwork samples for chemical analyses were collected and handled under the care of the Consultant.

### **3.2 Logging**

The logging of soils and rocks was carried out by an Engineering Geologist in general accordance with BS5930:2015 and CIRIA C574. A key to the exploratory hole logs is presented in Appendix A.



Detailed descriptions of the core and samples are given in the borehole logs, Appendix A, along with details of sampling, in situ testing, groundwater ingress, installations and relevant comments on drilling techniques.

Suitable core subsamples were selected by the Consultant. The core was carefully logged and prepared prior to preserving the subsample by wrapping in clingfilm/aluminium foil and coating with at least three layers of wax. The sample was further protected by a covering of waxed cheesecloth, labelled and transported horizontally in padded, wooden coreboxes.

Prior to logging, photographs of the core were taken and are presented separately.

The trial pits were logged in situ to a depth of approximately 1.20m and thereafter from the surface. Detailed descriptions are given in the trial pit logs, Appendix A, along with details of sampling and in situ testing, groundwater ingress and relevant comments on stability and excavability.

### **3.3     Laboratory Testing**

A schedule of laboratory tests was prepared by the Consultant, the following tests being carried out in accordance with BS1377:1990, unless stated otherwise. The number in brackets refers to the test number given in that standard. Given the contaminated nature of certain samples, geotechnical testing was subcontracted to the laboratories of i2 Analytical Limited (Watford). The results are presented in Appendix B.

The natural water content was determined on seventy-seven selected samples in accordance with BS EN ISO 17892-1:2014.

Liquid limit, plastic limit and plasticity index tests [Part 2:4.2 to 4.6 and 5.2 to 5.4] were carried out on thirty-one selected samples. Atterberg line plots have also been presented.



The saturated moisture content [Part 2:3.3] was determined on fifteen selected samples.

The bulk density was determined on seven samples by the immersion in fluid method in accordance with BS EN ISO 17892-2:2014-5.2.

Particle size distributions were determined in accordance with BS EN ISO 17892-4:2016 for forty-one samples by wet sieving [5.2]. The results are presented as grading curves.

The California Bearing Ratio (CBR) test [Part 4:7] was carried out on five recompacted samples. The results are presented as graphs of force against penetration.

Point load index tests were carried out on five selected lengths of core in accordance with IRSM (2007).

The BRE SD1 (2005) reduced suite; water soluble sulphate, total sulphate and total sulphur, together with pH were determined for seventeen samples by Chemtest (Newmarket) using in-house methods.

Four samples were despatched to Chemtest (Newmarket), where loss on ignition was determined to in-house methods.

#### **GEOTECHNICAL ENGINEERING LIMITED**



#### 4. REFERENCES

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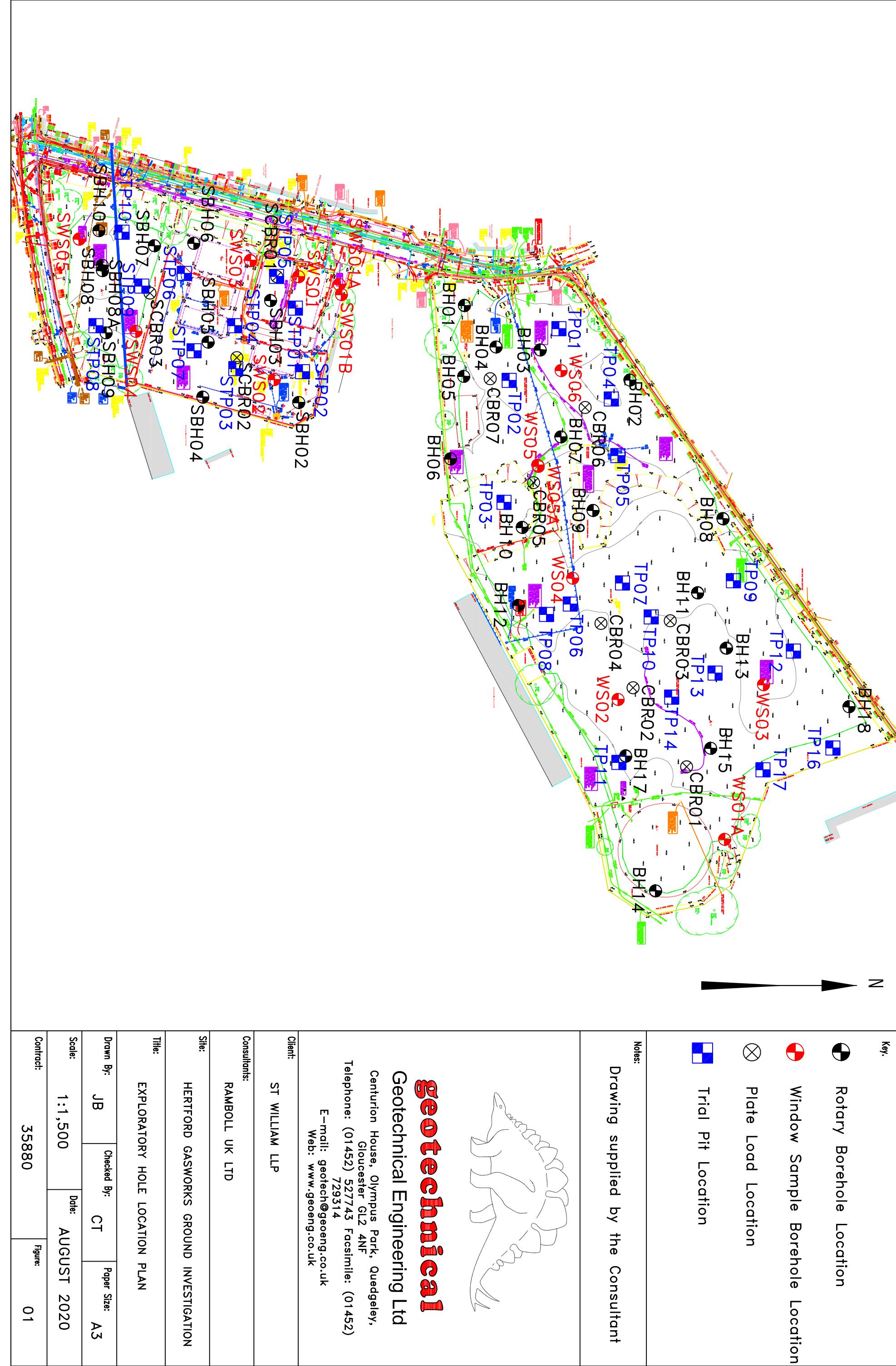
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Lord J A, Clayton C R I and Mortimore R N (2002): Engineering in Chalk. CIRIA Report No. C574.





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## APPENDIX A

### FIELDWORK DATA

# KEY TO EXPLORATORY HOLE LOGS

**Sample type**

D Small disturbed	U Undisturbed	L Dynamic	ES Environmental - soil	Cs Core subsample (prepared)
B Bulk disturbed	UT Undisturbed thin wall	C Core	EW Environmental - water	Ls Dynamic subsample (prepared)
LB Large bulk disturbed	P Piston	W Water		

**Test type**

- S SPT - Split spoon sampler followed by uncorrected SPT 'N' Value  
 C SPT - Solid cone followed by uncorrected SPT 'N' Value  
 (\*250 - Where full test drive not completed, linearly extrapolated 'N' value reported, \*\* - Denotes no effective penetration)  
 H Hand vane - direct reading in kPa - not corrected for BS1377 (1990). Re\* denotes refusal  
 M Mackintosh probe - number of blows to achieve 100mm penetration  
 Mx Mexe cone - average reading of equivalent CBR value in %  
 PP Pocket penetrometer - direct reading in kg/sq.cm  
 Vo Headspace vapour reading, uncorrected peak values in ppm, using a PID (calibrated with Isobutylene, using a 10.6eV bulb)

**Sample/core range/l,**

- | Dynamic sample
- █ Undisturbed sample - open drive including thin wall. Symbol length reflects recovery

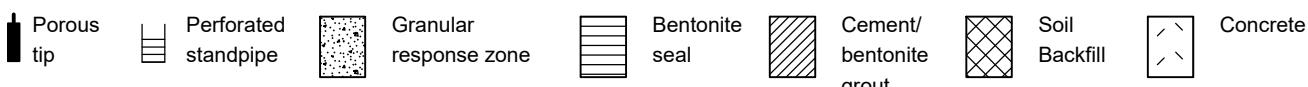
x x = Total Core Recovery (TCR) as percentage of core run

y y = Solid Core Recovery (SCR) as percentage of core run. Assessment of core is based on full diameter.

z z = Rock Quality Designation (RQD). The amount of solid core greater than 100mm expressed as percentage of core run.

Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment.

I<sub>f</sub> - fracture spacing - the modal fracture spacing (mm) over the indicated length of core. Where spacing varies significantly, the minimum, mode and maximum values are given. NI = non-intact core NA = not applicable

**Instrumentation****Stratum boundaries**

----- Estimated boundary ----- Grading boundary

**Logging**

The logging of soils and rocks has been carried out in general accordance with BS 5930:2015.

Chalk is logged in general accordance with Lord et al (2002) CIRIA C574. Where possible, dynamic samples in chalk have been logged in accordance with CIRIA C574; descriptions and gradings (if presented) should be treated with caution given the potential for sample disturbance.

For rocks the term fracture has been used to identify a mechanical break within the core. Where possible incipient and drilling induced fractures have been excluded from the assessment of fracture state. Where doubt exists, a note has been made in the descriptions. All fractures are considered to be continuous unless otherwise reported.

Made Ground is readily identifiable when, within the material make up, man made constituents are evident. Where Made Ground appears to be reworked natural material the differentiation between in situ natural deposits and Made Ground is much more difficult to ascertain. The interpretation of Made Ground within the logs should therefore be treated with caution.

The descriptors "topsoil" and "tarmacadam" are used as generic terms and do not imply conformation to any particular standard or composition.

Rootlets are defined as being less than 2mm in diameter, roots are defined as in excess of 2mm diameter.

**General Comments**

The process of drilling and sampling will inevitably lead to disturbance, mixing or loss of material in some soil and rocks.

Indicated water levels are those recorded during the process of drilling or excavating exploratory holes and may not represent standing water levels.

All depths are measured along the axis of the borehole and are related to ground level at the point of entry. All inclinations are measured normal to the axis of the core.

Where provided, the stratigraphic names/geological rock units are for guidance only and may not be wholly accurate.



## BOREHOLE LOG

BH01

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 10 June 2020

Easting 533176.1

Scale 1 : 50

End Date 11 June 2020

Northing 213213.7

Ground level

38.70mOD

Depth 7.15 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	If	instru-ment	description			depth (m)	reduced level (m)	legend
10/06/20 1130hrs 0.00m	1D 1ES	0.05 0.10				/	/	Soft dark brown very sandy gravelly CLAY with a low cobble content. Gravel is subangular and subrounded fine to coarse flint, sandstone, clinker, cinder and brick. Rare roots (up to 5mm). Frequent rootlets. (MADE GROUND)					
	2B	0.50 - 0.70						Brown sandy subangular to rounded fine to coarse flint, cinder and brick GRAVEL. (MADE GROUND)			0.80	37.90	
	3B 2ES	0.80 - 1.00 0.80	Nil	S 14				Medium dense light brown and brown slightly silty sandy angular to rounded fine to coarse flint and quartzite GRAVEL.			1.20	37.50	
	4D 5L	1.20 - 1.65 1.20 - 2.20											
	6D 7L 8D	2.20 - 2.65 2.20 - 3.20 2.30 - 2.40	2.20	S 20									
10/06/20 1640hrs 2.00m	3ES	2.90											
11/06/20 0830hrs Dry	9L	3.20 - 4.20	3.20					3.20 - 3.90m: Sand is dark brown becoming black					
CT	10L 11D 4ES	4.20 - 4.65 4.20 - 5.20 4.25 - 4.35 4.50	4.20	C 12				3.90 - 4.05m: Gravel is moderately contaminated with hydrocarbons.			4.05	34.65	
	12L	5.20 - 5.65 5.20 - 6.70	5.20	C 17				Medium dense dark green stained black slightly clayey fine SAND. heavily contaminated with hydrocarbons.			4.90	33.80	
	13D	6.70 - 7.15	6.70	S 10				4.70 - 4.90m: Sand is light greyish green.			5.20	33.50	
11/06/20 1115hrs 2.65m								Black silty medium SAND. Highly contaminated with hydrocarbons.					
								Limited recovery. Medium dense black subangular and angular, medium and coarse grading to fine and medium, flint and quartzite GRAVEL. Moderately contaminated with hydrocarbons.					
								Structureless CHALK. composed of light grey gravelly SILT. Gravel is subrounded and rounded fine and medium white with rare black specks chalk. (Probably CIRIA Grade Dm)			6.40	32.30	
								Borehole completed at 7.15m.			7.15	31.55	
											{8.00}		

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-6.70m.

CASING: 168mm diam to 6.70m.

BACKFILL: On completion, borehole backfilled with bentonite 7.15-6.00m. A slotted standpipe (50mm) was installed to 6.00m, granular response zone 6.00-4.00m, bentonite seal 4.00-0.30m, concrete and raised helmet cover 0.30-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



## BOREHOLE LOG

BH02

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 11 June 2020

Easting 533207.4

Scale 1 : 50

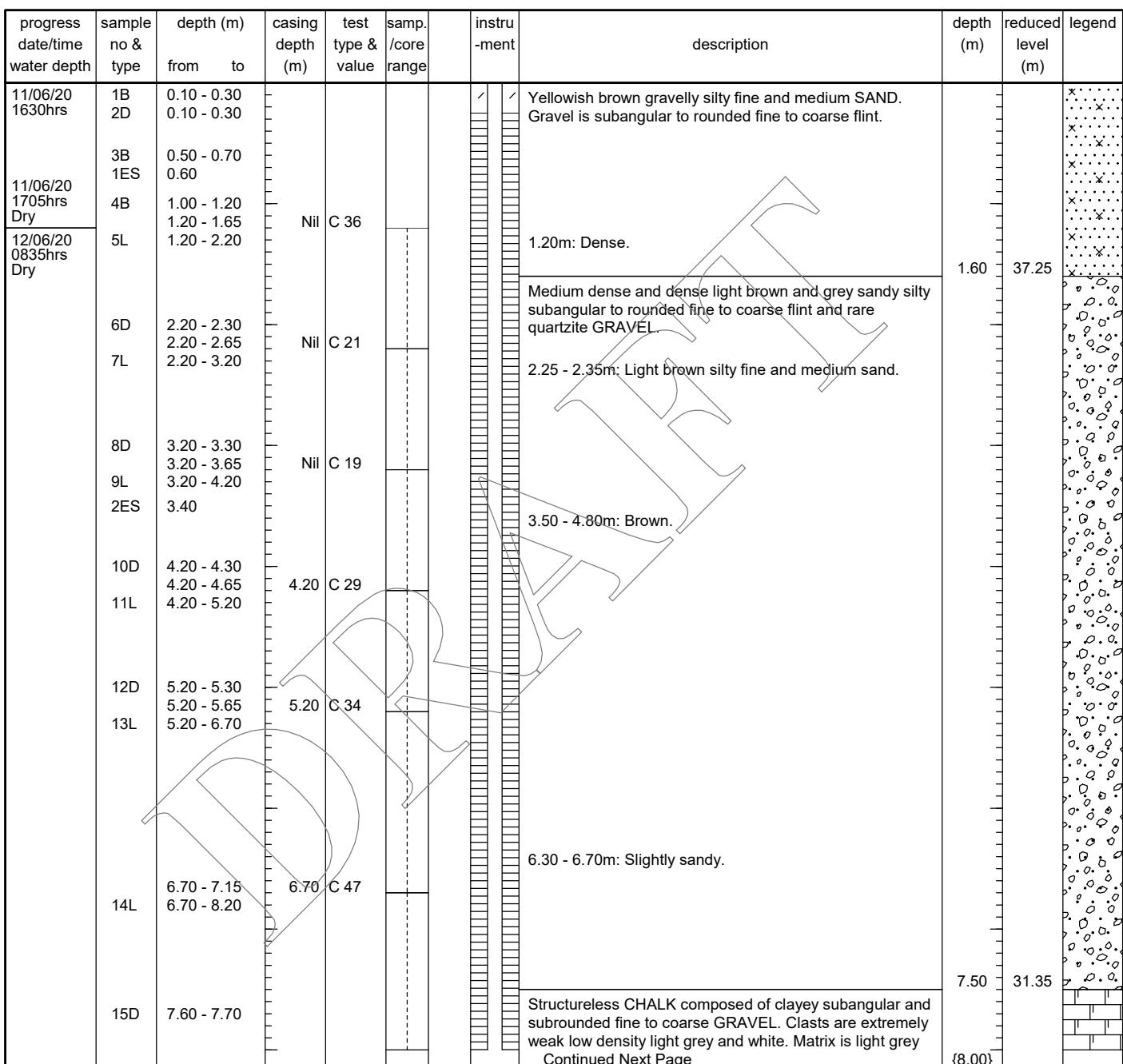
End Date 12 June 2020

Northing 213282.6

Ground level

38.85mOD

Depth 12.65 m



EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-11.20m and (113mm) 11.20-12.20m.

CASING: 168mm diam to 9.70m.

BACKFILL: On 15/06/20, a slotted standpipe (50mm) was installed to 12.00m, granular response zone 12.20-8.80m, bentonite seal 8.80-0.25m, concrete and helmet cover 0.25-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



## BOREHOLE LOG

BH02

CLIENT ST WILLIAM LLP

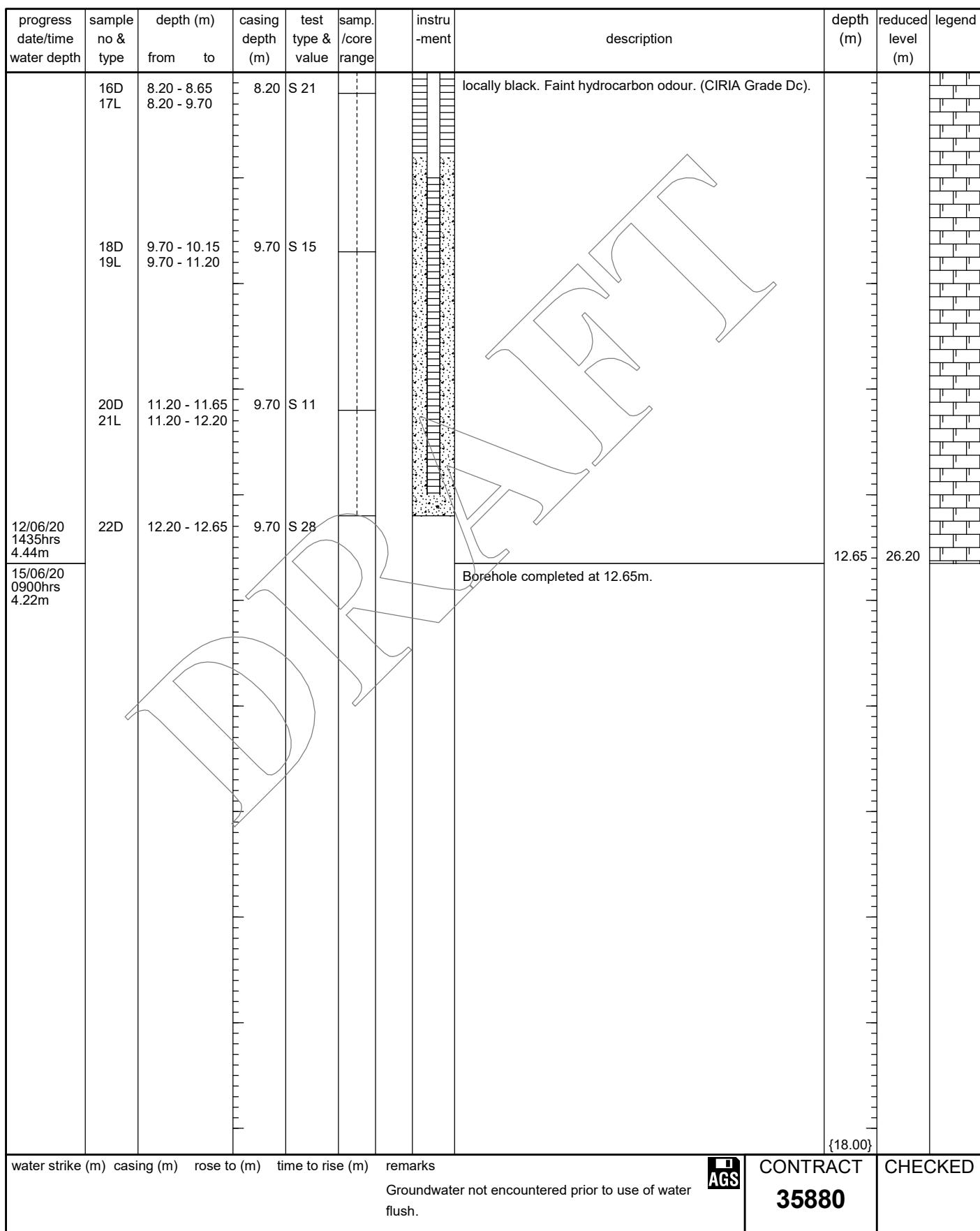
SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 11 June 2020 Easting 533207.4

Scale 1 : 50

End Date 12 June 2020 Northing 213282.6 Ground level 38.85mOD Depth 12.65 m





## BOREHOLE LOG

BH03

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 3

Start Date 8 June 2020

Easting 533194.8

Scale 1 : 50

End Date 10 June 2020

Northing 213245.3

Ground level

38.80mOD

Depth 25.75 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	If	instru-ment	description			depth (m)	reduced level (m)	legend
08/06/20 1250hrs	1D	0.05						Brown silty very gravelly fine and medium SAND. Gravel is angular and subangular fine to coarse limestone and concrete. (MADE GROUND)			0.30	38.50	
	2B	0.10 - 0.30						Firm grey silty CLAY. (MADE GROUND)			0.45	38.35	
	3B	0.30 - 0.45											
	4D	0.30 - 0.45											
	5B	0.50 - 0.70											
	6D	0.50 - 0.70											
	7B	1.00 - 1.25											
		1.25 - 1.70		Nil C 20									
	8L	1.25 - 2.20											
	1ES	0.30											
	2ES	1.10											
	9D	1.80 - 1.90											
		2.20 - 2.53		Nil C*83									
	10L	2.20 - 3.20											
	11B	2.20 - 2.50											
	3ES	2.70											
		3.20 - 3.48		3.20 C*100									
	12L	3.20 - 4.20											
	13B	3.20 - 3.50											
	4ES	4.00											
		4.20 - 4.65		4.20 C 49									
	14L	4.20 - 5.20											
	15D	4.20											
		5.20 - 5.65		5.20 C 38									
	16L	5.20 - 6.70											
	17D	5.20											
		6.70 - 7.15		6.70 S 19									
	18D	6.70 - 8.20											
	19L												
	20D	7.70											
	5ES	7.90											

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.25m. Dynamic sampled (128mm) 1.25-12.70m and (113mm) 12.70-20.00m. Waterflush rotary core drilled (116mm) 20.00-25.30m.

CASING: 200mm diam to 7.90m, 168mm diam to 7.00m and 140mm diam to 17.00m.

BACKFILL: On completion, borehole backfilled with bentonite 25.30-24.50m. A slotted standpipe (50mm) was installed to 24.10m, granular response zone 24.50-18.80m, bentonite seal 18.80-6.50m. A standpipe piezometer (19mm) was installed with tip at 6.00m, granular response zone 6.50-4.50m, bentonite seal 4.50-0.25m, concrete and helmet cover 0.25-0.00m.

REMARKS: Bentonite seal for aquifer protection installed 8.20-6.40m. Seal cured overnight prior to progressing hole through seal at reduced casing diameter. Falling head test undertaken. Results reported separately. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks	AGS	CONTRACT 35880	CHECKED
				Groundwater not encountered prior to use of water flush.			



## BOREHOLE LOG

BH03

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 3

Start Date 8 June 2020

Easting 533194.8

Scale 1 : 50

End Date 10 June 2020

Northing 213245.3

Ground level

38.80mOD

Depth 25.75 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	If	instru-ment	description			depth (m)	reduced level (m)	legend			
10/06/20 0805hrs 4.70m	21D	8.20 - 8.65	7.00	S 7				7.00 - 7.20m: Stained dark grey.								
	22L	8.20 - 9.70	8.30					Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak to very weak low density light greyish white with frequent black specks. Matrix is light greyish white. Faint hydrocarbon odour. (Probably CIRIA Grade Dc).			8.90	29.90				
	23D	9.70 - 10.15	8.30	S 28				Extremely weak low density light grey and grey rarely stained black CHALK with rare subangular and subrounded fine to coarse black nodular flint. Fractures are subhorizontal to 30° and subvertical very closely and closely spaced planar smooth locally infilled (up to 5mm) with grey silty clay. Faint hydrocarbon odour. (Probably CIRIA Grade C4)			9.75	29.05				
	24L	9.70 - 11.20						10.50 - 12.20m: Frequently stained black with a moderate hydrocarbon odour.								
	25D	11.20 - 11.65	8.30	S 16												
	26L	11.20 - 12.70	8.50													
	27D	12.70 - 13.15	12.70	S 15												
	28L	12.70 - 14.20														
	29D	14.20 - 14.65	14.20	S 11												
	30L	14.20 - 15.70														
	31D	15.70 - 16.15	15.70	S 22												
	32L	15.70 - 17.20														
	33D	17.20 - 17.65	17.00	S 29												
	34L	17.20 - 18.70														
Continued Next Page												{18.00}				
water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks	Groundwater not encountered prior to use of water flush.								AGS			
													CONTRACT <b>35880</b>			
													CHECKED			



## BOREHOLE LOG

BH03

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 3 of 3

Start Date 8 June 2020

Easting 533194.8

Scale 1 : 50

End Date 10 June 2020

Northing 213245.3

Ground level

38.80mOD

Depth 25.75 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	lf	instru-ment	description	depth (m)	reduced level (m)	legend
10/06/20 1700hrs 3.48m	35D 36L	18.70 - 19.15 18.70 - 20.00	17.00	S 28				18.10 - 20.00m: Low black subrounded nodular rinded flint cobble content.			
11/06/20 0850hrs 4.22m	37D 38C	20.00 - 20.45 20.00 - 21.50	17.00	S 34	100 32 0			20.00 - 20.70m: Frequent black subangular fine to coarse nodular rinded flint.	20.70	18.10	
	39C	21.50 - 23.00			93 68 24			Very weak low density white with rare black specks CHALK with rare black nodular flint. Fractures are subhorizontal to 30° and 80° extremely closely to closely spaced planar smooth clean frequently stained light grey. Faint hydrocarbon odour. (CIRIA Grade A4)	21.60	17.20	
	40D 41C	23.00 - 23.45 23.00 - 23.50	17.00	S 42	76 0 0			Very weak low-density white with rare black specks CHALK. Fractures are subhorizontal to 20° and 70-80° very closely and closely spaced planar smooth clean locally stained grey. Faint hydrocarbon odour. (CIRIA Grade A4)			
	42C	23.50 - 24.00			50 0 0			22.10 - 22.35m: Stained grey with frequent subangular and subrounded fine to coarse black rinded flint gravel.			
	43C	24.00 - 25.30			92 49 36			23.00 - 24.00m: Drilling disturbed due to flint cobble. 23.00 - 24.15m: Low subrounded black nodular flint cobble content.			
	44Cs	24.40									
11/06/20 1530hrs 4.86m	45D	25.30 - 25.75	17.00	S 37				Borehole completed at 25.75m.	25.75	13.05	
									{28.00}		
Geotechnical Engineering Ltd, Tel. 01452 527743	water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks			Groundwater not encountered prior to use of water flush.	AGS	CONTRACT <b>35880</b>	CHECKED



# BOREHOLE LOG

BH04

**CLIENT ST WILLIAM LLP**

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 8 June 2020 Easting 533193.6

Scale 1 : 50

End Date 9 June 2020 Northing 213226.7 Ground level 38.85mOD Depth 8.20 m

progress date/time water depth	sample no & type	depth (m) from      to	casing depth (m)	test type & value	samp. /core range	If	instru- ment	description		depth (m)	reduced level (m)	legend
08/06/20 1355hrs	1D	0.05					/	Soft dark brown sandy gravelly CLAY with a low cobble content. Gravel is subangular and subrounded fine to coarse flint, sandstone, clinker, cinder and brick. (MADE GROUND)		0.10	38.75	X
	2B	0.10 - 0.30					/	Firm bluish grey CLAY. (MADE GROUND)		0.50	38.35	X
	3B	0.30 - 0.50										
	4B	0.50 - 0.70										
	5B	0.70 - 0.90										
	6B	1.00 - 1.20										
	7D	1.20 - 1.65										
	8L	1.20 - 2.20										
	1ES	0.10						Stiff brown gravelly sandy CLAY. Gravel is angular to subrounded fine to coarse flint, chalk and brick. Rare glass (up to 30mm) and plastic (up to 70mm) fragments. (MADE GROUND)				
			Nil	S 20				1.00 - 1.20m: Tending to clayey very sandy gravel.				
08/06/20 1725hrs 1.75m	9D	2.20 - 2.65										
	10L	2.20 - 3.20										
	2ES	2.30										
09/06/20 0840hrs GL	11D	2.70 - 2.80						Dense dark brown slightly sandy clayey GRAVEL. Gravel is angular to rounded fine to coarse flint, clinker, sandstone, brick and concrete. (MADE GROUND)		2.55	36.30	X
	12D	3.20 - 3.64										
	13L	3.20 - 3.45										
09/06/20 0840hrs GL	14C	3.45 - 4.20						Dense to very dense dark bluish grey angular to rounded fine to coarse flint GRAVEL.		3.45	35.40	X
			Nil	S*52								
								No recovery.				
09/06/20 1605hrs	15L	4.20 - 4.49						Very dense dark bluish grey angular to rounded fine to coarse flint GRAVEL. Heavily contaminated with hydrocarbon.		4.20	34.65	O
		4.20 - 5.20						Dark bluish grey sandy angular to rounded fine to coarse flint GRAVEL.		4.45	34.40	O
								Medium dense dark bluish grey angular to rounded fine to coarse flint GRAVEL becoming slightly sandy.		5.00	33.85	O
09/06/20 1605hrs	16L	5.20 - 5.65						Medium dense dark bluish grey sandy angular to rounded fine to coarse flint GRAVEL. Heavily contaminated with hydrocarbon.		5.55	33.30	O
		5.20 - 6.70										
	3ES	6.00										
09/06/20 1605hrs	17L	6.70 - 7.15						Drilling disturbed. Interpreted as: Structureless CHALK composed of white slightly gravelly sandy SILT. Gravel is subangular and subrounded fine to coarse very weak low density white with rare black specks chalk. Rare angular coarse flint. (CIRIA Grade Dm)		6.40	32.45	T
		6.70 - 8.20						6.70 - 6.85m: No recovery (due to flint jamming in barrel).				

#### EQUIPMENT: Geotechnical Pioneer rig

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-3.45m and 4.20-8.20m. Waterflush rotary core drilled (116mm) 3.45-4.20m

CASING: 168mm diam to 6.70m

**BACKFILL:** On completion, a bentonite seal was installed to 8.20-6.00m, slotted standpipe (50mm) to 6.00m, granular response zone 6.00-3.50m, bentonite seal 3.50-0.30m, concrete and raised helmet cover 0.30-0.00m.

REMARKS: Rotary cored 3.45-4.20m to clear obstruction. Dynamic sampled 3.20-4.20m to clean out run/dropped core. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.



CONTRACT  
**35880**



# BOREHOLE LOG

BH04

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 8 June 2020 Easting 533193.6

Scale 1 : 50

End Date 9 June 2020

Northing 213226.7 Ground level 38.85mOD Depth 8.20 m

progress date/time water depth	sample no & type	depth (m) from      to	casing depth (m)	test type & value	samp. /core range	If	instru- ment	description	depth (m)	reduced level (m)	legend
4.20m		8.20 - 8.65	6.70	C 39				8.15 - 8.20m: Subangular black nodular flint. Borehole completed at 8.20m.	8.20	30.65	
{18.00}											
water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks							
Groundwater not encountered prior to use of water flush.											



## BOREHOLE LOG

BH05

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 11 June 2020

Easting 533206.0

Scale 1 : 50

End Date 12 June 2020

Northing 213213.0

Ground level

38.50mOD

Depth 8.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	If	instru-ment	description			depth (m)	reduced level (m)	legend
11/06/20 1425hrs	1D	0.05				/	/	Brown silty sandy angular to rounded fine to coarse flint, quartzite brick, clinker and concrete GRAVEL. Rare glass fragments (up to 13mm diam). (MADE GROUND)					
	2B	0.50 - 0.70						0.60m: Jagged metal skirting fragment (up to 100mm long).					
	1ES	0.70											
	3B	1.00 - 1.20											
	4D	1.20 - 1.65											
	5L	1.20 - 2.20											
11/06/20 1650hrs 2.00m	6D	2.20 - 2.65	2.20	S 13				Medium dense locally dense orangish brown becoming brown slightly silty very sandy GRAVEL. Gravel is angular to rounded fine to coarse flint and quartzite.			1.50	37.00	
12/06/20 0835hrs Dry	7L	2.20 - 3.20		S 23									
	2ES	2.80											
	8D	3.20 - 3.30											
	9L	3.20 - 3.65	3.20	C 48									
		3.20 - 4.20											
	10L	4.20 - 4.65	4.20	C 38				3.20 - 4.20m: Dense.					
		4.20 - 5.20											
	11D	5.20 - 5.30						3.95 - 4.80m: Colour change to greyish brown with slight hydrocarbon contamination.					
	12L	5.20 - 5.65											
		5.20 - 6.70	5.20	C 20									
	3ES	6.60						5.20 - 5.60m: Limited recovery.					
	13D	6.70 - 6.80						5.20 - 6.70m: Flush turns black with some minor oil slick.					
		6.70 - 7.15						5.20 - 7.60m: Gravel is stained black with moderate hydrocarbon contamination.					
	14L	6.70 - 8.20	6.70	C 31									
12/06/20 1305hrs								6.70 - 7.10m: Limited recovery.					
								Structureless CHALK composed of light grey slightly gravelly SILT. Gravel is subangular to rounded fine to					
								Continued Next Page					

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-8.20m.

CASING: 168mm diam to 8.20m.

BACKFILL: On completion, borehole backfilled with bentonite 8.65-7.00m. A slotted standpipe (50mm) was installed to 7.00m, granular response zone 7.00-2.00m, bentonite seal 2.00-0.30m, concrete and raised helmet cover 0.30-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

Approximate coordinates and level taken from topographical drawing.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks	AGS	CONTRACT 35880	CHECKED
				Groundwater not encountered prior to use of water flush.			

**BOREHOLE LOG****BH05**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 11 June 2020 Easting 533206.0

Scale 1 : 50

End Date 12 June 2020 Northing 213213.0 Ground level 38.50mOD

Depth 8.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	lf	instru-ment	description			depth (m)	reduced level (m)	legend
2.50m	4ES	8.00						coarse very weak low density white chalk and frequently subrounded and rounded medium and coarse flint. Pockets of dark brown and black hydrocarbons (up to 30mm). (Probably CIRIA Grade Dm)					
	15D	8.20 - 8.65	8.20	S 6				7.60 - 7.75m: Abundant rounded coarse flint.			8.65	29.85	
								Borehole completed at 8.65m.					



# BOREHOLE LOG

BH06

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 29 June 2020      Easting 533240.1

Scale 1 : 50

End Date 29 June 2020

Northing 213208.0 Ground level 38.10mOD Depth 12.00 m

#### EQUIPMENT: Geotechnical Pioneer rig

METHOD: Hand dug inspection pit 0.00-1.20m. Hollow stem augers (200mm) 1.20-12.00m

CASING: None used

**BACKFILL:** On 30/06/2020, borehole backfilled with settlement 12.00-11.80m, bentonite 11.80-11.60m. A slotted standpipe (50mm) was installed to 11.50m, granular response zone 11.60-8.80m, bentonite seal 8.80-0.25m, concrete and helmet cover 0.25-0.00m.

**REMARKS:** Testing not required below 1.20m. Driller notes very little returns from auger 6.00-12.00m.

Environmental sampling undertaken by the Consultant

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks



CONTRACT  
35880



# BOREHOLE LOG

BH06

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 29 June 2020 Easting 533240.1

Scale 1 : 50

End Date 29 June 2020

Northing 213208.0 Ground level 38.10mOD Depth

Depth 12.00 m



# BOREHOLE LOG

BH07

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 15 June 2020 Easting 533231.0

Scale 1 : 50

End Date 16 June 2020

Northing 213253.7 Ground level 38.10mOD Depth 7.15 m

progress date/time water depth	sample no & type	depth (m) from      to	casing depth (m)	test type & value	samp. /core range	instru- ment	description		depth (m)	reduced level (m)	legend
15/06/20 1035hrs  15/06/20 1625hrs 3.75m  16/06/20 1430hrs 2.70m  16/06/20 1555hrs 3.30m	1D	0.05				/	Dark brown very sandy silty GRAVEL. Gravel is angular to rounded fine and medium flint, quartzite, brick and clinker. Rare rootlets and roots (up to 30mm). (MADE GROUND) 0.00 - 0.55m: High demolition rubble cobble content.				
	1ES	0.40				/	1.20 - 1.40m: Limited recovery.				
	2B	0.50 - 0.70					1.50 - 2.50m: Slight hydrocarbon odour.				
	3B	1.10 - 1.20					2.20 - 2.30 2.20 - 2.65 2.20 - 3.20				
	4D	1.20 - 1.65	Nil	S 22			Dense becoming very dense orangish brown slightly silty sandy angular to rounded fine to coarse flint and quartzite GRAVEL.				
	5L	1.20 - 2.20	1.20				2.50 - 3.00m: Gravel is dark greyish brown with moderate hydrocarbon contamination.				
	6D	2.20 - 2.30					3.00 - 4.90m: Gravel is stained bluish black with heavy hydrocarbon contamination.				
	7L	2.20 - 2.65	2.20	C 41			4.70m: Flush begins to turn black with hydrocarbon odour.				
	8L	2.20 - 3.20					Structureless CHALK composed of very silty subangular to rounded GRAVEL. Clasts are extremely weak low density white and rare subrounded coarse flints. Matrix is white. (probably CIRIA Grade Dc) 5.20m: Flush begins to turn white.				
	9D	3.20 - 3.55	3.20	C*77			5.20 - 5.80m: Limited recovery.				
	2ES	3.20 - 4.20					5.20 - 6.50m: Slight hydrocarbon contamination.				
	10L	3.50 - 3.60					6.50 - 6.70m: Frequent pockets of dark brown hydrocarbon contamination.				
	11D	4.00					Borehole completed at 7.15m.				
	12D	4.20 - 4.64									
	13L	4.20 - 5.20	4.20	C*53							
	14D	5.20 - 5.30									
	12D	5.20 - 5.65	5.20	S 9							
	13L	5.20 - 6.70									
	14D	6.70 - 7.15	6.70	S 9							
							{8.00}				

#### EQUIPMENT: Geotechnical Pioneer rig

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-6.70m

CASING: 168mm diam to 6.70m

**BACKFILL:** On completion, borehole backfilled with bentonite 7.15-4.50m. A slotted standpipe (50mm) was installed to 4.50m, granular response zone 4.50-2.00m, bentonite seal 2.00-0.30m, concrete and raised helmet cover 0.30-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush



**CONTRACT  
35880**

CHECKED



## BOREHOLE LOG

BH08

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 16 June 2020

Easting 533264.9

Scale 1 : 50

End Date 17 June 2020

Northing 213321.2

Ground level

37.30mOD

Depth 12.45 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
16/06/20 1130hrs	1B 2D	0.20 - 0.40 0.20 - 0.40					Dark brown silty gravelly fine to coarse SAND with a low subangular concrete cobble content. Gravel is angular to subrounded fine to coarse flint, quartzite, clinker and rare concrete. Frequent rootlets and roots (up to 3mm diam). (MADE GROUND)					
	3B 1ES	0.60 - 0.80 0.70 - 2.10					Soft dark brown frequently stained black slightly gravelly sandy clayey SILT. Gravel is angular to rounded fine to coarse flint, wood, brick and clinker. Faint hydrocarbon odour. (MADE GROUND)			1.20	36.10	
	4L	1.20 - 1.65 1.20 - 2.20	1.20	C 4								
	5D 6D 7L	2.00 - 2.20 2.20 - 2.30 2.20 - 2.65 2.20 - 3.20	2.20	C 23						2.60	34.70	
	8D 9L	3.20 - 3.30 3.20 - 3.65 3.20 - 4.20	3.20	C 5			Loose brown and grey stained black sandy subangular to rounded fine to coarse flint GRAVEL. Moderate hydrocarbon odour. 3.20 - 5.90m: Limited recovery.					
	10L	4.20 - 4.65 4.20 - 5.20	4.20	C 4								
	11L	5.20 - 5.65 5.20 - 6.70	5.20	C 6						5.40	31.90	
	12D	5.70 - 5.80					Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low density white and light grey frequently stained black. Matrix is white and light grey. Rare zones of orange hydrocarbon contamination (up to 40mm). Faint hydrocarbon odour. (probably CIRIA Grade Dc).					
16/06/20 1510hrs 2.56m												
17/06/20 0805hrs NR	13D 14L	6.70 - 7.15 7.20 - 8.50	6.70	S 7						{8.00}		

Continued Next Page

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-12.00m.

CASING: 200mm diam to 6.30m, 168mm diam to 6.70m and 140mm diam to 12.00m.

BACKFILL: On completion, borehole backfilled with bentonite 12.00-5.70m. A slotted standpipe (50mm) was installed to 5.50m, granular response zone 5.70-3.30m, bentonite seal 3.30-2.10m. A second slotted standpipe (50mm) was installed to 2.00m, granular response zone 2.10-0.35m, bentonite seal 0.35-0.20m concrete and raised helmet cover 0.20-0.00m.

REMARKS: Bentonite seal for aquifer protection installed 5.00-6.70m. Seal cured overnight prior to progressing hole through seal at reduced casing diameter. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED

**BOREHOLE LOG****BH08**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 16 June 2020

Easting 533264.9

Scale 1 : 50

End Date 17 June 2020

Northing 213321.2

Ground level

37.30mOD

Depth 12.45 m

progress date/time water depth	sample no & type	depth (m) from      to	casing depth (m)	test type & value	samp/ core range	instru -ment	description	depth (m)	reduced level (m)	legend
	15D 16L	8.50 - 8.95 8.50 - 10.00	8.50	S 6					9.00	28.30
	17D 18L	10.00 - 10.45 10.00 - 11.00	10.00	S 7			Extremely weak low density white with rare black specks CHALK with rare subrounded coarse nodular black rinded flint. Fractures are subhorizontal to 30° and 80° to subvertical extremely closely and very closely spaced planar smooth frequently infilled (up to 3mm) with white silt. (probably CIRIA Grade C4 to C5).			
	19D 20L	11.00 - 11.45 11.00 - 12.00	11.00	S 12						
17/06/20 1130hrs 3.04m	21D	12.00 - 12.45	12.00	S 13			Borehole completed at 12.45m.	12.45	24.85	
								{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks										
Groundwater not encountered prior to use of water flush.								AGS	CONTRACT <b>35880</b>	CHECKED



## BOREHOLE LOG

BH09

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 3

Start Date 17 June 2020

Easting 533261.5

Scale 1 : 50

End Date 22 June 2020

Northing 213267.2

Ground level

37.75mOD

Depth 26.05 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	If	instru-ment	description			depth (m)	reduced level (m)	legend
17/06/20 0940hrs								Brown and orangish brown gravelly fine to coarse SAND. Gravel is subangular to rounded fine to coarse flint and rare quartzite.					
	1B	0.50 - 0.70						1.20m: Medium dense.					
	2D	0.50 - 0.70											
	3B	1.00 - 1.20											
	1ES	1.00											
	4D	1.20 - 1.65											
	5L	1.20 - 2.20											
	6D	2.20 - 2.30						Medium dense brown and grey very sandy angular to rounded fine to coarse flint and quartzite GRAVEL.					
	7L	2.20 - 2.65											
	2ES	2.90											
		3.20 - 3.65											
		3.20 - 4.20											
	8L	3.60 - 3.70											
	9D	3.60 - 3.70						Soft greyish brown silty CLAY.					
	10L	4.20 - 4.65						Structureless CHALK composed of white gravelly clayey SILT. Gravel is subrounded and rounded fine to coarse extremely weak low density white locally mottled orangish brown rarely subangular black nodular flint. (probably CIRIA Grade Dm).					
		4.20 - 5.20											
	11L	5.20 - 5.65											
		5.20 - 6.70											
	12D	6.70 - 7.15						Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low density white with rare black specks rarely rinded black nodular flint. Matrix is white locally stained orange and black. Faint hydrocarbon odour. (probably CIRIA Grade Dc).					
	13L	6.70 - 8.20											
								Extremely weak low density with rare black specks CHALK. Fractures are subhorizontal to 30° and 70° to subvertical extremely closely and very closely spaced					
								Continued Next Page					
								{8.00}					

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-5.20m and 15.70-17.20m and (113mm) 5.20-15.70m. Waterflush rotary core drilled (116mm) 17.20-25.60m.

CASING: 200mm diam to 4.50m, 168mm diam to 5.20m and 140mm diam to 17.20m.

BACKFILL: On completion, borehole backfilled with bentonite 26.05-19.00m. A standpipe piezometer (19mm) was installed with tip at 17.00m, granular response zone 19.00-15.00m, bentonite seal 15.00-11.00m. A slotted standpipe (50mm) was then installed to 11.00m, granular response zone 11.00-7.50m, bentonite seal 7.50-0.30m concrete and raised helmet cover 0.30-0.00m. REMARKS: Bentonite seal for aquifer protection installed 5.20-3.00m. Seal cured overnight prior to progressing hole through seal at reduced casing diameter. Falling head test undertaken. Results reported separately. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks	AGS	CONTRACT 35880	CHECKED
				Groundwater not encountered prior to use of water flush.			



## **BOREHOLE LOG**

BH09

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 3

Start Date 17 June 2020 Easting 533261.5

Scale 1 : 50

End Date 22 June 2020

Northing 213267.2 Ground level 37.75mOD Depth 26.05 m



## **BOREHOLE LOG**

BH09

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 3 of 3

Start Date 17 June 2020 Easting 533261.5

Scale 1 : 50

End Date 22 June 2020

Northing 213267.2 Ground level 37.75mOD Depth

Depth 26.05 m



## BOREHOLE LOG

BH10

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 3

Start Date 23 June 2020

Easting 533268.6

Scale 1 : 50

End Date 26 June 2020

Northing 213237.8

Ground level

37.30mOD

Depth 26.15 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	If	instru-ment	description			depth (m)	reduced level (m)	legend
23/06/20 1555hrs	C 1B 2D	0.00 - 0.20 0.20 - 0.30 0.20			100			MADE GROUND comprising grey and brown CONCRETE.			0.20	37.10	
23/06/20 1710hrs Dry	3B 1ES 4D 5L	0.90 - 1.00 0.95 1.20 - 1.65 1.20 - 2.20		Nil S 29				Light brown slightly clayey very sandy subangular to rounded fine to coarse flint GRAVEL with a medium subangular flint cobble content.			1.00	36.30	
24/06/20 0840hrs Dry	6D 7L 8L 2ES 9L	2.20 - 2.65 2.20 - 3.20 3.20 - 3.65 3.20 - 4.20 4.10 4.20 - 4.65 4.20 - 5.20	2.20 S 46 3.20 C 28					Medium dense locally dense brown silty very sandy subangular and subrounded fine to coarse flint GRAVEL.  2.20m: Dense.					
24/06/20 1635hrs 2.20m	10D 11L 12L 13L	5.20 - 5.65 5.20 - 6.20 6.20 - 6.65 6.20 - 7.70 7.70 - 8.15 7.70 - 9.20	5.20 S 12 6.20 S 7 7.70 S 5					3.80 > 4.90m: Stained dark grey with a faint hydrocarbon odour.  Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low density light grey and white chalk, rarely rinded black nodular flint. Matrix is white rarely orangish brown. (Probably CIRIA Grade Dc).			4.90	32.40	
25/06/20 0755hrs 3.15m													

Continued Next Page

{8.00}

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Rotary cored 0.00-0.20m (300mm). Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-5.20m and (113mm) 5.20-15.20m.

Waterflush rotary core drilled (116mm) 15.20-25.60m.

CASING: 168mm diam to 5.20m and 140mm diam to 15.20m.

BACKFILL: On 30/06/2020, borehole backfilled with bentonite 26.15-13.00m. A standpipe piezometer (19mm) was installed with tip at 11.00m, granular response zone 13.00-9.00m, bentonite seal 9.00-4.80m. A slotted standpipe (50mm) was then installed to 4.80m, granular response zone 4.80-2.80m, bentonite seal 2.80-0.30m, concrete and helmet cover 0.30-0.00m.

REMARKS: Falling head test undertaken. Results reported separately. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



# BOREHOLE LOG

BH10

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 3

Start Date 23 June 2020      Easting 533268.6

Scale 1 : 50

End Date 26 June 2020

Northing 213237.8 Ground level 37.30mOD Depth 26.15 m



## **BOREHOLE LOG**

BH10

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 3 of 3

Start Date 23 June 2020      Easting 533268.6

Scale 1 : 50

End Date 26 June 2020

Northing 213237.8 Ground level 37.30mOD Depth 26.15 m



## BOREHOLE LOG

BH11

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 15 June 2020

Easting 533295.7

Scale 1 : 50

End Date 16 June 2020

Northing 213310.8

Ground level

36.15mOD

Depth 7.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description		depth (m)	reduced level (m)	legend
15/06/20 1130hrs	1B 2D	0.10 - 0.30				/	Brown slightly gravelly silty fine and medium SAND with a high angular and subangular fine to coarse concrete and brick cobble content. Gravel is angular to rounded fine to coarse brick, concrete, metal and flint. Frequent roots (up to 3mm diam). (MADE GROUND)				
	3B 1ES	0.80 - 1.00 0.90		1.20 C**		65	Grey slightly sandy angular to subrounded fine to coarse concrete, brick, quartzite, flint and wood GRAVEL. (MADE GROUND)		1.20	34.95	
	4C 5D	1.20 - 1.29 1.20 - 2.20 1.20 - 1.30					MADE GROUND comprising light grey CONCRETE. NO RECOVERY.		1.35	34.80	
	6D 7L	2.20 - 2.30 2.20 - 2.65 2.20 - 3.20	1.20 2.20	C 24			Medium dense brown locally stained black very gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint and rare concrete. Faint hydrocarbon odour. (MADE GROUND)		1.85	34.30	
	8D 9L	3.20 - 3.30 3.20 - 3.65 3.20 - 4.20	3.20	C 7			Structureless CHALK composed of light grey and white locally stained grey slightly gravelly silty CLAY. Gravel is subrounded and rounded fine to coarse extremely weak low density chalk, frequent subangular and subrounded fine to coarse black nodular flint. Faint hydrocarbon odour. (probably CIRIA Grade Dm).		2.20	33.95	
	15/06/20 1710hrs 1.84m						Structureless CHALK composed of silty subangular and subrounded fine to coarse gravel with a low subrounded cobble content and frequent pockets of black and orange hydrocarbon contamination. Clasts are extremely weak and very weak low density light grey and white. Matrix is light grey. Rare subangular and subrounded fine to coarse flint gravel. Moderate hydrocarbon odour (probably CIRIA Grade Dm).		2.55	33.60	
CT	2ES 10D	3.90 4.20 - 4.65	4.20	S 3			Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low density white with frequent black specks chalk. Matrix is white and grey locally mottled orangish brown. (Probably CIRIA Grade Dc).		3.60	32.55	
16/06/20 0845hrs 1.59m	11L	4.20 - 5.20							5.00	31.15	
	12D 13L	5.20 - 5.65 5.20 - 6.20		S 6							
	14D 15L	6.20 - 6.65 6.20 - 7.20		S 5							
	16D	7.20 - 7.65	7.20	S 6			Borehole completed at 7.65m.		7.65	28.50	
							{8.00}				

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Waterflush rotary core drilled (116mm) 1.20-2.20m. Dynamic sampled (113mm) 2.20-7.20m.

CASING: 140mm diam to 7.20m.

BACKFILL: On completion, a slotted standpipe (50mm) was installed to 7.00m, granular response zone 7.20-3.80m, bentonite seal 3.80-0.25m, concrete and raised helmet cover 0.25-0.00m. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



## BOREHOLE LOG

BH12

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 26 June 2020

Easting 533301.2

Scale 1 : 50

End Date 26 June 2020

Northing 213236.1

Ground level

36.05mOD

Depth 7.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description		depth (m)	reduced level (m)	legend
26/06/20 0950hrs	1B	0.10 - 0.30				/	Brown sandy very gravelly SILT. Gravel is subrounded and rounded fine and medium flint and quartzite. (MADE GROUND)		0.30	35.75	
	2B	0.50 - 0.70				/	Dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine flint, quartzite and brick. (MADE GROUND)				
	3B	1.00 - 1.20				/	0.50 - 0.55m: Thin layer of light grey chalk silt.				
	4B	1.20 - 1.60				/	1.10m: 90mm diam brick cobble.				
	5L	1.20 - 1.65	1.20	C 11		/	1.20m: Medium dense.				
		1.20 - 2.20				/	1.40 - 1.70m: Silt is light brown.				
	6B	2.20 - 2.60	2.20	C 18		/	Medium dense grey and brown slightly silty gravelly fine and coarse SAND. Gravel is subangular to rounded fine and medium flint and quartzite.		1.70	34.35	
	7L	2.20 - 2.65				/	1.70 - 3.85m: Slight hydrocarbon odour.				
	8B	2.20 - 3.20				/					
	9L	3.20 - 3.60	3.20	C 16		/					
		3.20 - 3.65				/					
		3.20 - 4.20				/					
	10D	4.20 - 4.65	4.20	S 8		/	Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low density white with rare black specks. Matrix is light grey. Rare subrounded coarse nodular flint. (Probably CIRIA Grade Dc).				
	11L	4.20 - 5.20				/					
	12D	5.20 - 5.65	5.20	S 5		/					
	13L	5.20 - 6.20				/					
	14D	6.20 - 6.65	6.20	S 10		/					
	15L	6.20 - 7.20				/					
	16D	7.20 - 7.65	7.20	S 15		/	Borehole completed at 7.65m.		7.65	28.40	
							Continued Next Page		{8.00}		

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-7.20m.

CASING: 140mm diam to 7.20m.

BACKFILL: On 29/06/2020, a slotted standpipe (50mm) was installed to 7.00m, granular response zone 7.65-4.30m, bentonite seal 4.30-0.25m, concrete and helmet cover 0.25-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



# BOREHOLE LOG

BH12

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 26 June 2020 Easting 533301.2

Scale 1 : 50

End Date 26 June 2020

Northing 213236.1 Ground level 36.05mOD Depth 7.65 m

progress date/time water depth	sample no & type	depth (m)	casing depth (m)	test type & value	samp. /core range		instru- ment	description	depth (m)	reduced level (m)	legend
1.52m											
water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks	{18.00}						
Groundwater not encountered prior to use of water flush.								CONTRACT <b>35880</b>	CHECKED		



## BOREHOLE LOG

BH13

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 3

Start Date 17 June 2020

Easting 533319.0

Scale 1 : 50

End Date 19 June 2020

Northing 213322.4

Ground level

36.00mOD

Depth 25.43 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	If	instru-ment	description			depth (m)	reduced level (m)	legend
17/06/20 1610hrs	1B 2D	0.10 - 0.30 0.10 - 0.30						Light brown gravelly fine to coarse SAND with a high subangular brick cobble content. Gravel is angular to subrounded fine to coarse flint, concrete, clinker and brick. (MADE GROUND)			0.50	35.50	
17/06/20 1705hrs Dry	3B 4D 1ES	0.60 - 0.80 0.60 - 0.80 0.70						Dark brown slightly gravelly silty fine to coarse SAND. Gravel is angular to rounded fine to coarse, flint, brick, concrete, clinker and glass. (MADE GROUND)					
18/06/20 0800hrs Damp	5D 6L	1.30 - 2.00 1.30 - 2.20	1.20 1.30	S<1				Very loose black slightly gravelly silty slightly organic fine to coarse SAND. Gravel is angular to rounded fine to coarse flint. Frequent rootlets. Moderate hydrocarbon odour.			1.50	34.50	
	7D 8L	2.20 - 2.65 2.20 - 3.20	2.20	S 16				Medium dense becoming dense brown and grey frequently stained black very sandy subangular to rounded fine to coarse flint GRAVEL. Faint hydrocarbon odour.			2.20	33.80	
	9D 10L	3.20 - 3.30 3.20 - 3.65 3.20 - 4.20	3.20	C 34							3.70	32.30	
	11D 12D 13L	4.20 - 4.30 4.20 - 4.65 4.20 - 5.20	4.20	S 3				Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low density white. Matrix is white. (probably CRIA Grade Dc). 3.70 - 3.90m: Locally orangish brown.					
	14D 15L	5.20 - 5.65 5.30 - 6.50	5.20 5.30	S 4									
	16D 17L	6.50 - 6.95 6.50 - 8.00	6.50	S 10									
	18D	8.00 - 8.45	8.00	S 9				7.30 - 8.40m: Frequent subrounded coarse and rarely cobble sized black flint (up to 98mm).			{8.00}		

Continued Next Page

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.30m. Dynamic sampled (128mm) 1.30-5.20m and (113mm) 5.20-15.50m. Waterflush rotary core drilled (116mm) 15.50-25.10m.

CASING: 200mm diam to 4.70m, 168mm diam to 5.30m and 140mm diam to 15.50m.

BACKFILL: On 22/06/20, borehole backfilled with bentonite 25.10-18.00m. A standpipe piezometer (19mm) was installed with tip at 16.00m, granular response zone 18.00-14.00m, bentonite seal 14.00-9.15m. A slotted standpipe (50mm) was then installed to 9.00m, granular response zone 9.15-4.80m, bentonite seal 4.80-0.25m, concrete and raised helmet cover 0.25-0.00m.

REMARKS: Bentonite seal for aquifer protection installed 5.20-3.00m. Seal cured for 1hr prior to progressing hole through seal at reduced casing diameter. Falling head test undertaken. Results reported separately. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks	AGS	CONTRACT 35880	CHECKED
1.31	1.30	1.15	20				



## **BOREHOLE LOG**

BH13

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 3

Start Date 17 June 2020 Easting 533319.0

Scale 1 : 50

End Date 19 June 2020

Northing 213322.4 Ground level 36.00mOD Depth 25.43 m



# BOREHOLE LOG

BH13

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 3 of 3

Start Date 17 June 2020 Easting 533319.0

Scale 1 : 50

End Date 19 June 2020

Northing 213322.4 Ground level 36.00mOD Depth 25.43 m



## BOREHOLE LOG

BH14

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 24 June 2020

Easting 533420.1

Scale 1 : 50

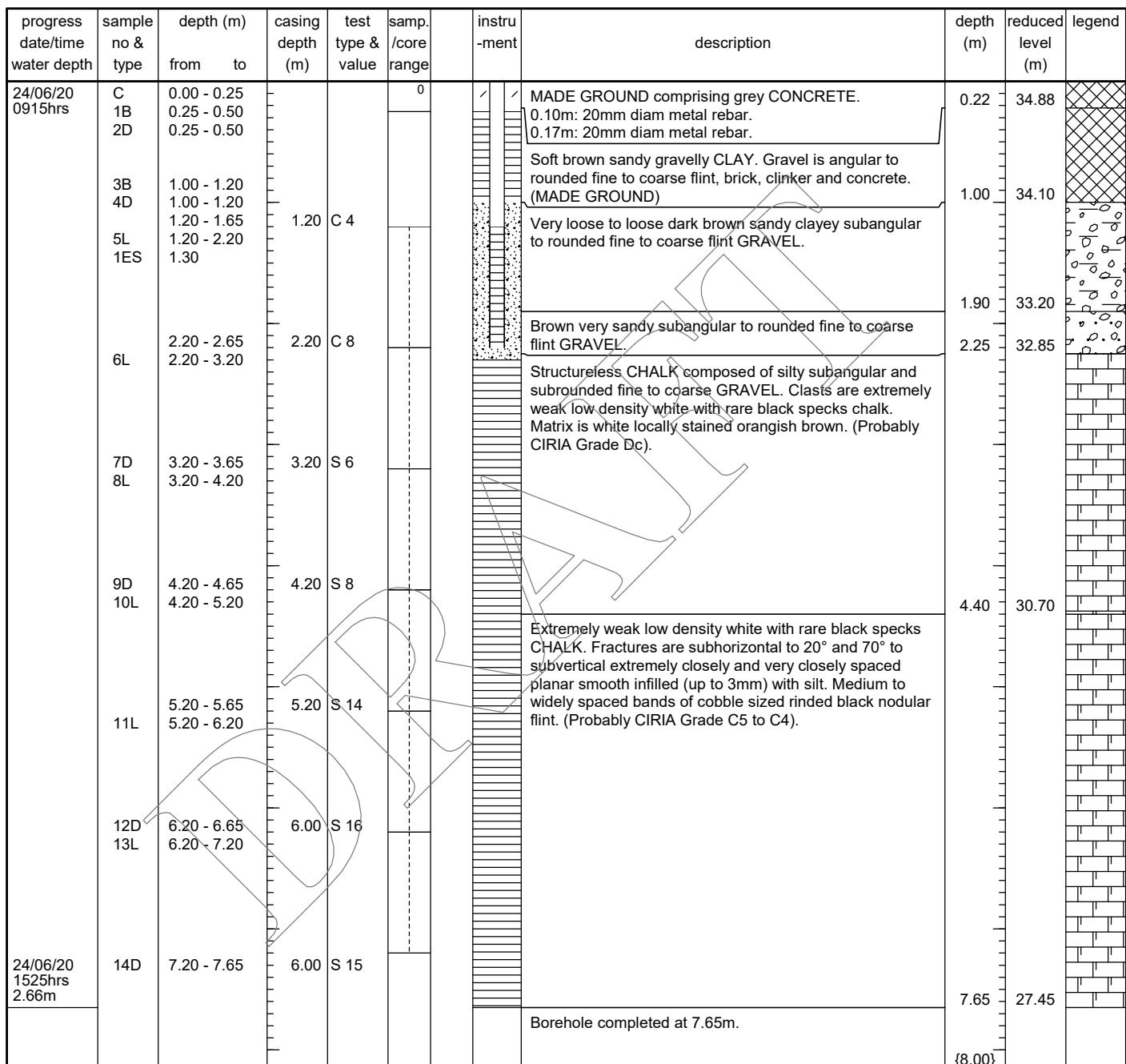
End Date 24 June 2020

Northing 213293.2

Ground level

35.10mOD

Depth 7.65 m



EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Rotary cored (300mm) 0.00-0.25m. Hand dug inspection pit 0.25-1.20m. Dynamic sampled (128mm) 1.20-7.20m.

CASING: 168mm diam to 6.00m.

BACKFILL: On completion, borehole backfilled with bentonite 7.65-2.30m. A slotted standpipe (50mm) was installed to 2.20m, granular response zone 2.30-1.00m, bentonite seal 1.00-0.25m, concrete and helmet cover 0.25-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



## **BOREHOLE LOG**

BH15

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 23 June 2020      Easting 533360.6

Scale 1 : 50

End Date 23 June 2020 Northing 213316.1 Ground level 35.55mOD Depth 7.65 m

progress date/time water depth	sample no & type	depth (m)	casing depth (m)	test type & value	samp. /core range	instru- ment	description		depth (m)	reduced level (m)	legend
23/06/20 1215hrs	1B	0.10 - 0.30					Brown slightly clayey gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint, brick, clinker and concrete. (MADE GROUND)		0.50	35.05	X
	2D	0.10 - 0.30					Brown and orangish brown slightly clayey (organic) very sandy subangular to rounded fine to coarse flint GRAVEL. Rare wood fragments. Frequent rootlets.		1.35	34.20	.
	3B	0.50 - 0.70					Very loose brown and white sandy subangular to rounded fine to coarse flint and chalk GRAVEL.		1.80	33.75	.
	4D	0.50 - 0.70					Structureless CHALK composed of white gravelly clayey SILT. Gravel is subangular and subrounded fine to coarse extremely weak low density white chalk, rarely subrounded coarse flint. (Probably CIRIA Grade Dm).				.
	1ES	0.60									.
	5B	1.00 - 1.30	1.30	C 2							.
		1.30 - 1.75									.
	6L	1.30 - 2.20									.
	7D	2.20 - 2.30	2.20	S 7							.
		2.20 - 2.65									.
	8L	2.20 - 3.20									.
	9D	3.20 - 3.30	3.20	S<1							.
		3.20 - 3.67									.
	10L	3.20 - 4.20									.
	11D	4.20 - 4.30	4.20	S 4							.
		4.20 - 4.65									.
	12L	4.20 - 5.20									.
	13D	5.20 - 5.30	5.20	S 2							.
		5.20 - 5.65									.
	14L	5.20 - 6.20									.
	15D	6.20 - 6.65	6.00	S 5							.
		6.20 - 7.20									.
	16L										.
	17D	7.20 - 7.65	6.00	S 6							.
23/06/20 1525hrs 1.63m							Borehole completed at 7.65m.		7.65	27.90	{8.00}

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.30m. Dynamic sampled (128mm) 1.30-7.20m.

CASING: 168mm diam to 6.00m.

**BACKFILL:** On completion, a slotted standpipe (50mm) was installed to 7.00m, granular response zone 7.65-3.80m, bentonite seal 3.80-1.30m. A second slotted standpipe (50mm) was installed to 1.20m, granular response zone 1.30-0.40m, bentonite seal 0.40-0.20m, concrete and helmet cover 0.20-0.00m.

**REMARKS:** Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
1.30	Nil	1.30	20	



CONTRAC  
**35880**

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## BOREHOLE LOG

BH17

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 25 June 2020

Easting 533363.6

Scale 1 : 50

End Date 25 June 2020

Northing 213280.8

Ground level

35.65mOD

Depth 12.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
25/06/20 0815hrs	1D	0.10 - 0.30					Firm grey silty CLAY with rare fragments of shell (up to 60mm). Frequent rootlets. (MADE GROUND)					
	2B	0.10 - 0.30								0.50	35.15	
	3D	0.50 - 0.50										
	1ES	0.50										
	4B	0.50 - 0.70										
	5B	1.00 - 1.20								1.20	34.45	
		1.20 - 1.65	1.20	C 12								
	6L	1.20 - 2.20										
	7L	2.20 - 2.65										
	8B	2.20 - 3.20	2.20	C 14								
		2.20 - 2.70										
	9L	3.20 - 3.65								3.60	32.05	
		3.20 - 4.20	3.20	C 15								
	10L	4.20 - 4.65								5.00	30.65	
		4.20 - 5.20	4.20	C 5								
	11D	5.20 - 5.73								5.20	30.45	
	12L	5.20 - 6.70	5.20	S 6								
	13D	6.70 - 7.15								6.70	28.95	
	14L	6.70 - 8.20	6.70	S 5								
Continued Next Page											{8.00}	

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-6.70m and (113mm) 6.70-12.20m.

CASING: 168mm diam to 5.20m and 140mm to 12.20m.

BACKFILL: On completion, a slotted standpipe (50mm) was installed to 12.00m, granular response zone 12.20-8.80m, bentonite seal 8.80-4.70m, a slotted standpipe (50mm) was installed to 4.50m, granular response zone 4.70-2.30m, bentonite seal 2.30-0.25m, concrete and helmet cover 0.25-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
1.20	Nil	1.15	20	

CONTRACT  
35880

CHECKED



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

BH17

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 25 June 2020

Easting 533363.6

Scale 1 : 50

End Date 25 June 2020

Northing 213280.8

Ground level 35.65mOD

Depth 12.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description	depth (m)	reduced level (m)	legend
	15D 16L	8.20 - 8.65 8.20 - 9.70	8.20	S 6						
	17D 18L	9.70 - 10.15 9.70 - 11.20	9.70	S 10			Extremely weak low density white with rare black specks CHALK. Fractures are subhorizontal to 30° and 80° to subvertical extremely closely to closely spaced planar smooth rarely infilled (up to 2mm) with silt. Widely spaced bands of coarse subangular rinded black nodular flint. (Probably CIRIA Grade B3 to B5).	8.80	26.85	
	19D 20L	11.20 - 11.65 11.20 - 12.20	11.20	S 20						
25/06/20 1705hrs 2.46m	21D	12.20 - 12.65	12.20	S 17			11.70 - 12.20m: Recovered as structureless chalk composed of white slightly gravelly silt. Gravel is angular fine to coarse chalk.  Borehole completed at 12.65m.	12.65	23.00	
water strike (m) casing (m) rose to (m) time to rise (m) remarks										
{18.00}										
							AGS	CONTRACT 35880	CHECKED	



## **BOREHOLE LOG**

BH18

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 22 June 2020      Easting 533343.3

Scale 1 : 50

End Date 23 June 2020

Northing 213373.7 Ground level 35.60mOD Depth 7.65 m

progress date/time water depth	sample no & type	depth (m) from      to	casing depth (m)	test type & value	samp. /core range	instru- ment	description		depth (m)	reduced level (m)	legend			
22/06/20 1335hrs  NR	1B	0.10 - 0.30	1.25	C 2		/ /	Firm grey locally mottled orangish brown silty CLAY with rare shells (up to 40mm). Frequent roots (up to 8mm) and rootlets. (MADE GROUND)		0.50	35.10				
	2D	0.10 - 0.30					Soft light brown slightly gravelly very sandy CLAY. Gravel is subangular to rounded fine to coarse flint, concrete and rare brick. (MADE GROUND)							
	3B	0.50 - 0.70					1.00 - 1.20: Greyish brown frequently stained black with a moderate hydrocarbon odour.							
	4D	0.50 - 0.70					Very soft dark brown locally black slightly gravelly sandy highly organic CLAY. Gravel is angular to subrounded fine to coarse wood, glass, ceramic and flint. (MADE GROUND)							
	5B	1.00 - 1.20					Dense brown frequently stained black very gravelly fine to coarse SAND. Gravel is subangular to rounded fine to coarse flint.							
	1ES	1.10					2.60 - 2.90m: Dark brown and yellowish brown.							
	6L	1.25 - 1.70					Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low density white with frequent black specks chalk. Matrix is white locally mottled orangish brown. (Probably CIRIA Grade Dc).							
	7D	1.25 - 2.20												
	2ES	1.50 - 1.60												
	8B	2.00												
22/06/20 1715hrs  NR	9L	2.20 - 2.70	3.20	S 7		/ /			1.80	33.80				
	10D	2.20 - 2.65												
	11L	2.20 - 3.20												
23/06/20 0750hrs  NR	12D	3.20 - 3.65	4.00	S 5		/ /			2.90	32.70				
	13L	3.20 - 4.20												
23/06/20 0925hrs 2.96m	14L	4.20 - 4.65	5.20	S 5		/ /			2.90	32.70				
	15L	4.20 - 5.20												
	16D	5.20 - 5.65												
23/06/20 0925hrs 2.96m	14L	5.20 - 6.20	6.20	S 3		/ /			2.90	32.70				
	15L	6.20 - 6.65												
23/06/20 0925hrs 2.96m	16D	6.20 - 7.20	7.20	S 4		/ /			2.90	32.70				
							Borehole completed at 7.65m.							
							{8.00}							

EQUIPMENT: Geotechnical Pioneer rig.

**METHOD:** Hand dug inspection pit 0.00-1.25m, Dynamic sampled (128mm) 1.25-4.20m and (113mm) 4.20-7.20m.

CASING: 200mm diam to 3.30m, 168mm diam to 4.20m and 140mm diam to 7.20m.

**BACKFILL:** On completion, borehole backfilled with bentonite 7.65-2.90m. A slotted standpipe (50mm) was installed to 2.80m, granular response zone 2.90-1.60m, bentonite seal 1.60-0.25m, concrete and helmet cover 0.25-0.00m.

**REMARKS:** Bentonite seal for aquifer protection installed 4.20-2.50m. Seal cured overnight prior to progressing hole through seal at reduced casing diameter. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks  
 1.20 Nil 1.20 20 Groundwater encountered in base of inspection pit



CONTRACT  
35880

CHECKED



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SBH02

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 7 July 2020

Easting 533216.7

Scale 1 : 50

End Date 8 July 2020

Northing 213144.7

Ground level

36.80mOD

Depth 12.95 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
07/07/20 1015hrs	C 1B	0.00 - 0.12 0.20 - 0.40	Nil		100	/	MADE GROUND comprising black TARMACADAM.			0.10	36.70	X
	2B 1ES	0.90 - 1.00 0.90					Dark brown slightly gravelly sandy SILT. Gravel is angular to rounded fine to coarse flint, clinker, brick and coal.			0.60	36.20	X
	3L 4D	1.20 - 1.65 1.20 - 2.20 1.20 - 1.30	1.20	C 5			Frequent fragments of metal (up to 110mm) glass (up to 20mm) and fabric (up to 60mm). Faint hydrocarbon odour. (MADE GROUND)			0.80	36.00	X
	5L 6D 2ES	2.20 - 2.65 2.20 - 3.20 2.20 - 2.30 2.30	2.20	C 11			0.10 - 2.20m: Faint hydrocarbon odour.			2.50	34.30	X
	7L 8D	3.20 - 3.65 3.20 - 4.20 3.20 - 3.30	3.20	C 2			MADE GROUND comprising grey CONCRETE.			3.20	33.60	X
	9L	4.20 - 4.65 4.20 - 5.20	4.20	C 19			Loose black sandy slightly gravelly SILT. Gravel is angular to rounded fine and medium flint, clinker and brick.			4.25	32.55	X
	10D 11L	5.20 - 5.65 5.20 - 6.70	5.20	S 8			Frequent fragments of glass (up to 20mm) and fabric (up to 60mm). Faint hydrocarbon odour. (MADE GROUND)			5.90	30.90	X
07/07/20 1535hrs 2.40m	12D 13L	6.70 - 7.15 6.70 - 8.20	6.70	S 9			2.10 - 2.20m: Brick cobble recovered as angular coarse gravel sized fragments.			7.90	28.90	X
08/07/20 0900hrs 2.84m							2.20 - 2.50m: Moderate hydrocarbon odour and black oily stain.			{8.00}		
Continued Next Page												

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Rotary core drilled (300mm) 0.00-0.12m. Hand dug inspection pit 0.12-1.20m. Dynamic sampled (113mm) 1.20-12.50m.

CASING: 200mm diam to 5.00m, 168mm diam to 6.70m and 140mm diam to 11.20m.

BACKFILL: On completion, borehole backfilled with bentonite 12.95-4.10m. A slotted standpipe (50mm) was installed to 4.00m, granular response zone 4.10-2.30m, bentonite seal 2.30-0.25m, concrete and helmet cover 0.25-0.00m.

REMARKS: Bentonite seal for aquifer protection installed 4.00-6.70m. Seal cured overnight prior to progressing hole through seal at reduced casing diameter. Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



# BOREHOLE LOG

CLIENT ST WILLIAM LLP

SBH02

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 7 July 2020 Easting 533216.7

Scale 1 : 50

End Date 8 July 2020 Northing 213144.7 Ground level 36.80mOD Depth 12.95 m



## **BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SBH03**

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 3 July 2020 Easting 533174.4

Scale 1 : 50

End Date 3 July 2020

Northing 213133.0 Ground level 37.70mOD Depth 7.00 m

progress date/time water depth	sample no & type	depth (m) from      to	casing depth (m)	test type & value	samp. /core range	instru- ment	description		depth (m)	reduced level (m)	legend
03/07/20 1000hrs	C	0.00 - 0.40			100	/	MADE GROUND comprising black TARMACADAM.		0.10	37.60	X
	1B	0.40 - 0.60					MADE GROUND comprising light grey CONCRETE.		0.40	37.30	X
	2B	0.60 - 0.80					0.12m: Copper pipe (30mm diam).				
	3B	0.80 - 0.90					0.30m: Transparent plastic membrane.				
	4B	1.00 - 1.20					Red and brown subangular brick COBBLES (up to 150mm) with much silty fine to coarse SAND matrix (pulverised brick). (MADE GROUND)		0.80	36.90	X
	1ES	1.00									
		1.20 - 1.65									
	5L	1.20 - 2.20									
	6D	2.20 - 2.30									
	7L	2.20 - 2.65									
		2.20 - 3.20									
	8L	3.20 - 3.65									
	9D	3.20 - 4.50									
		3.20 - 3.30									
	10L	4.50 - 4.95									
		4.50 - 5.50									
		4.20		C 15							
	11D	5.50 - 5.95									
	12L	5.50 - 7.00									
		5.50		S 7							
		7.00 - 7.45									
		7.00		S 3							
03/07/20 1350hrs 2.83m							Borehole completed at 7.00m.		7.00	30.70	
06/07/20 0940hrs 3.02m							{8.00}				

#### EQUIPMENT: Geotechnical Pioneer rig.

**METHOD:** Rotary core drilled (300mm) 0.00-0.40m. Hand dug inspection pit 0.40-1.20m. Dynamic sampled (113mm) 1.20-7.00m.

CASING: 140mm diam to 7.00m

BACKFILL: On 06/07/2020, a slotted standpipe (50mm) was installed to 7.00m, granular response zone 7.45-5.30m, bentonite seal 5.30-0.25m, concrete and helmet cover 0.25-0.00m

**REMARKS:** Environmental sampling undertaken by the Consultant

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush



CONTRACT  
**35880**

CHECKED



## **BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SBH04**

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 6 July 2020 Easting 533214.6

Scale 1 : 50

End Date 6 July 2020

Northing 213104.9 Ground level 36.90mOD Depth 7.65 m

#### EQUIPMENT: Geotechnical Pioneer rig

**METHOD:** Rotary drilled (300mm) 0.00-0.10m, Hand dug inspection pit 0.10-1.25m, Dynamic sampled (113mm) 1.25-7.20m

CASING: 140mm diam to 7.20m

**BACKFILL:** On 07/07/2020, a slotted standpipe (50mm) was installed to 7.20m, granular response zone 7.20-5.50m, bentonite seal 5.50-0.25m, concrete and helmet cover 0.25-0.00m.

**REMARKS:** Environmental sampling undertaken by the Consultant

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush



CONTRACT  
**35880**

CHECKED



# BOREHOLE LOG

CLIENT ST WILLIAM LLP

**SBH05**

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 3

Start Date 30 June 2020      Easting 533191.5

Scale 1 : 50

End Date 2 July 2020

Northing 213106.8 Ground level 37.20mOD Depth 25.55 m

#### EQUIPMENT: Geotechnical Pioneer rig

METHOD: Rotary core drilled (300mm) 0.00-0.09m. Hand dug inspection pit 0.09-1.20m. Dynamic sampled (128mm) 1.20-14.20m and 24.70-25.10m. Rotary core drilled (146mm) utilising a polymer flush 14.20-24.70m.

CASING: 168mm diam to 14.20m.

**BACKFILL:** On 02/07/2020, a bentonite seal was installed 25.55-17.50m, standpipe piezometer (19mm) with tip at 15.50m, granular response zone 17.50-13.50m, bentonite seal 13.50-9.20m. On 03/07/2020 a slotted standpipe (50mm) was installed to 9.00m, granular response zone 9.20-5.80m, bentonite seal 5.80-0.35m, gravel drain 0.35-0.25m, concrete and raised helmet cover 0.25-0.00m.

**REMARKS:** Falling head test undertaken. Results reported separately. Dynamic sampling carried out to recover dropped core. 23.20-24.70m recovered 0.20m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
------------------	------------	-------------	--------------------	---------

Groundwater not encountered prior to use of water flush



CONTRAC  
**35880**



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SBH05

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 3

Start Date 30 June 2020

Easting 533191.5

Scale 1 : 50

End Date 2 July 2020

Northing 213106.8

Ground level

37.20mOD

Depth 25.55 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	lf	instru-ment	description	depth (m)	reduced level (m)	legend
01/07/20 1725hrs 2.61m	14L	8.20 - 8.65 8.20 - 9.70	8.20	S 7						9.40	27.80
02/07/20 0800hrs 2.57m	15D 16L	9.70 - 10.15 9.70 - 11.20	8.20 9.70	S 16				Extremely weak to very weak low and medium density white with rare black specks CHALK. Fractures are subhorizontal to 30° and 80° to subvertical very closely and closely spaced planar smooth infilled (up to 3mm) with white silt. Medium and widely spaced bands of subangular and subrounded coarse rinded black nodular flint. (Probably CIRIA Grade C4 to C3). 10.45 - 10.55m: Locally stained orangish brown.			
	17D 18L	11.20 - 11.65 11.20 - 12.70	11.20	S 16							
	19D 20L	12.70 - 13.12 12.70 - 14.20	12.70	S 28						13.30	23.90
	21D 22C	14.20 - 14.65 14.20 - 15.70	14.20	S 16				Extremely weak to very weak low and medium density white with frequent black specks CHALK. Fractures are subhorizontal to 40° and 80° to subvertical extremely closely and very closely spaced planar smooth frequently infilled (up to 1mm) with clay. Medium spaced bands of cobble sized and subangular and subrounded medium and coarse rinded black nodular flint. (CIRIA Grade B5 to B3). 14.50 - 16.60m: Rarely with a veneer of white clay.			
	23D 24C	15.70 - 16.15 15.70 - 17.20	14.20	S 16						16.60	20.60
	25C	17.20 - 18.70	14.20					Very weak low density white with frequent black specks CHALK. Fractures are subhorizontal to 40° and 80° to subvertical closely spaced planar smooth. (CIRIA Grade A3).			
Continued Next Page											
water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks							
Groundwater not encountered prior to use of water flush.											
									CONTRACT <b>35880</b>	CHECKED	
								{18.00}			

**BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SBH05**

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 3 of 3

Start Date 30 June 2020 Easting 533191.5

Scale 1 : 50

End Date 2 July 2020 Northing 213106.8 Ground level 37.20mOD Depth 25.55 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	lf	instru-ment	description			depth (m)	reduced level (m)	legend
	26D	18.70 - 19.15	14.20	S 29			260	Very weak low density white with frequent black specks CHALK. Fractures are subhorizontal to 20° and 80° to subvertical closely to medium spaced planar and undulating smooth. Closely and medium spaced bands of cobble sized rinded black nodular flint. (CIRIA Grade A3 to A2).					
	27C	18.70 - 20.20			93 39 0								
	28C	20.20 - 21.70	14.20		95 83 47	70	110 290	Very weak low and medium density white with frequent black specks CHALK. Fractures are subhorizontal and subvertical very closely to medium spaced planar smooth. Medium to widely spaced bands of cobble sized rinded black nodular flint. (CIRIA Grade A3 to A2).			20.20	17.00	
	29D	21.70 - 22.12	14.20	S*56			100 71 42						
	30C	21.70 - 23.20											
	31C	23.20 - 24.70	14.20				87 73 41						
02/07/20 1540hrs 3.13m	32L	24.70 - 25.10	14.20					24.80 - 25.10m: Drilling disturbed.					
	33D	25.10 - 25.55	14.20	S 38				Borehole completed at 25.55m.			25.55	11.65	
								{28.00}					
		water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		Groundwater not encountered prior to use of water flush.					
								AGS	CONTRACT <b>35880</b>	CHECKED			



## **BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SBH06**

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 7 July 2020 Easting 533150.5

Scale 1 : 50

End Date 8 July 2020

Northing 213101.0 Ground level 37.45mOD Depth 12.85 m

#### EQUIPMENT: Geotechnical Pioneer rig

**METHOD:** Rotary core drilled (300mm) 0.00-0.12m. Hand dug inspection pit 0.12-1.20m. Dynamic sampled (128mm) 1.20-12.40m

CASING: 168mm diam to 11.20m

**BACKFILL:** On completion, borehole backfilled with bentonite 12.85-12.00m. A slotted standpipe (50mm) was installed to 12.00m, granular response zone 12.00-8.00m, bentonite seal 8.00-0.30m, concrete and helmet cover 0.30-0.00m.

**REMARKS:** Environmental sampling undertaken by the Consultant

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush



CONTRACT  
**35880**

**BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SBH06**

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 7 July 2020

Easting 533150.5

Scale 1 : 50

End Date 8 July 2020

Northing 213101.0

Ground level

37.45mOD

Depth 12.85 m

progress date/time water depth	sample no & type	depth (m) from      to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	16D 17L	8.20 - 8.65 8.20 - 9.70	8.20	S 14			Extremely weak low and medium density white with rare black specks CHALK. Fractures are subhorizontal to 40° and 70° to subvertical extremely closely and very closely spaced planar smooth frequently infilled (up to 4mm) with white silt and rarely stained orangish brown. Widely to medium spaced subangular coarse rinded black nodular flint. (Probably CIRIA Grade C5 to C4).			
	18L	9.70 - 10.15 9.70 - 11.20	9.70	S 17						
	19D 20L	11.20 - 11.65 11.20 - 12.40		S 18			Extremely weak to very weak medium density white with rare black specks CHALK. Fractures are subhorizontal to 30° and 80° to subvertical extremely closely to closely spaced planar smooth rarely with a veneer of clay. Medium and closely spaced bands of subrounded coarse rinded black nodular flint. (Probably CIRIA Grade A5 to A3).			
08/07/20 1410hrs 3.73m	21D	12.40 - 12.85 11.20	11.20	S 20			Borehole completed at 12.85m.			
water strike (m) casing (m) rose to (m) time to rise (m) remarks										
Groundwater not encountered prior to use of water flush.										
							AGS	CONTRACT <b>35880</b>	CHECKED	
{18.00}										



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SBH07

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 30 June 2020

Easting 533151.4

Scale 1 : 50

End Date 1 July 2020

Northing 213084.5

Ground level

37.55mOD

Depth 7.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
30/06/20 1420hrs	1B 2D	0.10 - 0.30 0.10 - 0.30				/	Grass over brown slightly gravelly sandy SILT. Gravel is angular to rounded fine to coarse brick, tarmacadam, concrete, flint and chalk. Frequent rootlets. (MADE GROUND)					
	3B 1ES	0.50 - 0.70 0.50				/	Stiff brown slightly sandy gravelly CLAY. Gravel is subangular and subrounded fine to coarse flint. (MADE GROUND)			1.00	36.55	
	4B 5D 6L	1.00 - 1.20 1.20 - 1.65 1.20 - 2.20	Nil 1.20	S 21		/	Stiff yellow and white slightly gravelly clayey SILT. Gravel is subangular and subrounded fine to coarse chalk. (MADE GROUND)			1.40	36.15	
30/06/20 1700hrs 1.45m	7D 8D	1.70 - 1.80 2.20 - 2.65	2.20	S 7		/	Firm brown slightly sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse flint and chalk. (MADE GROUND)			2.30	35.25	
01/07/20 0800hrs 0.70m	9L 10D	2.20 - 3.20 2.50 - 2.70				/	MADE GROUND comprising 100% yellow and black straw. (MADE GROUND) 3.05 - 3.20m: Roofing felt. 3.35 - 3.55m: 30% clay.			2.90	34.65	
	2ES 11D 12L	3.00 3.20 - 3.65 3.20 - 4.20	3.20	S 15		/	Brown sandy-locally clayey angular to subrounded fine to coarse flint GRAVEL. 3.55 - 3.70m: Stained black. 4.00 - 4.10m: Slightly gravelly sandy clay. 4.20m: Very dense.			3.55	34.00	
CT	13L	4.20 - 4.60 4.20 - 5.20	4.20	S*60		/	5.20m: Dense.					
	14L	5.20 - 5.65 5.20 - 6.20	5.20	C 36		/	Structureless CHALK composed of silty subangular to subrounded fine to coarse GRAVEL. Clasts are extremely weak low and medium density white with frequent black specks chalk. Matrix is cream. (Probably CIRIA Grade Dc).			5.90	31.65	
	15L	6.20 - 6.65 6.20 - 7.00	6.20	S 8		/	Borehole completed at 7.00m.			7.00	30.55	
01/07/20 1205hrs 5.80m		7.00 - 7.45	7.00	S 15						{8.00}		

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-7.00m.

CASING: 140mm diam to 7.00m.

BACKFILL: On completion, borehole backfilled with bentonite 7.45-5.50m. A slotted standpipe (50mm) was installed to 5.50m, granular response zone 5.50-4.00m, bentonite seal 4.00-0.30m, concrete and helmet cover 0.30-0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED

**BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SBH08**

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 2 July 2020 Easting 533160.0

Scale 1 : 50

End Date 2 July 2020 Northing 213063.0 Ground level 37.55mOD

Depth 1.10 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
02/07/20 1210hrs							Brown silty gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint, clinker, metal and chalk. (MADE GROUND)					
02/07/20 1330hrs Dry							1.00 - 1.10m: High subangular concrete cobble content. Borehole completed at 1.10m.			1.10	36.45	

EQUIPMENT: Geotechnical Pioneer rig.

EL  
35880 HERTFORD GW.GPJ TRIALJH.GPJ GEOTECH2.GLB 14/09/2020 10:59:54 IS

METHOD: Hand dug inspection pit 0.00-1.10m.

CASING: Not used.

BACKFILL: On completion, the borehole was backfilled with materials arising.

REMARKS: Unable to progress pit through cobbles. Relocated as SBH08A.

Approximate coordinates and level taken from topographical drawing.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

CONTRACT  
**35880**

CHECKED



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SBH08A

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 2 July 2020

Easting 533161.9

Scale 1 : 50

End Date 4 July 2020

Northing 213063.0

Ground level

37.65mOD

Depth 6.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
02/07/20 1315hrs	1B 2D	0.20 - 0.40 0.20 - 0.40					/	/	Brown gravelly silty fine to coarse SAND. Gravel is angular to rounded fine to coarse flint, clinker, metal and chalk. (MADE GROUND)			
	3B 4D 1ES 5D 6L	1.00 - 1.20 1.00 - 1.20 1.20 1.20 - 1.65 1.20 - 2.20	Nil 1.20	S 8					1.00 - 1.20m: Clayey.	1.20	36.45	
	7D 8L	2.20 - 2.65 2.20 - 3.20	2.20	S 12					Soft light brown and white slightly gravelly clayey SILT. Gravel is subangular to rounded fine to coarse flint and chalk. (MADE GROUND)	1.40	36.25	
	9D 10L	3.20 - 3.65 3.20 - 4.20	3.20	S 19					Firm brown sandy gravelly CLAY. Gravel is angular to rounded fine to coarse flint, brick, clinker, chalk and metal. (MADE GROUND)	2.90	34.75	
02/07/20 1705hrs 4.01m	11D 12L	4.00 - 4.10 4.20 - 4.65 4.20 - 5.20	4.20	C 24					Brown gravelly fine to coarse SAND. Gravel is subangular to rounded fine and medium flint.	3.20	34.45	
CT									Medium dense brown sandy subangular to rounded fine to coarse flint and rare quartzite GRAVEL.	3.75	33.90	
04/07/20 0805hrs 3.11m	13D 14L 15D 16D	5.20 - 5.65 5.20 - 6.20 5.60 - 5.60 6.20 - 6.65	5.20	S 4 S 5					Brown gravelly fine to coarse SAND. Gravel is subangular to rounded fine and medium flint.	3.90	33.75	
									Soft light brown very sandy silty CLAY.	4.25	33.40	
									Medium dense brown very sandy subangular to rounded fine to coarse flint and rare quartzite GRAVEL.	4.90	32.75	
									Structureless CHALK composed of light brown gravelly clayey SILT. Gravel is subangular and subrounded fine to coarse extremely weak low density white and light brown chalk, frequently flint. (Probably CIRIA Grade Dm).	5.20	32.45	
04/07/20 0910hrs 3.31m									Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low and medium density white with rare black specks chalk. Matrix is white. (Probably CIRIA Grade DC).	6.65	31.00	
									Borehole completed at 6.65m.	{8.00}		

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-6.20m.

CASING: 140mm diam to 5.20m.

BACKFILL: On completion, borehole backfilled with bentonite 6.65-4.50m. A slotted standpipe (50mm) was installed to 4.50m, granular response zone 4.50-3.50m, bentonite seal 3.50-0.30m, concrete and helmet cover 0.30-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SBH09

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 2

Start Date 4 July 2020

Easting 533187.8

Scale 1 : 50

End Date 6 July 2020

Northing 213064.6

Ground level

36.90mOD

Depth 13.15 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
04/07/20 1300hrs	1B 2D	0.20 - 0.40 0.20 - 0.40				/	/	/	Firm brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint, brick, tarmacadam, clinker and chalk. (MADE GROUND)			
04/07/20 1450hrs Dry	3B 4D 1ES 5D 6L	0.80 - 1.00 0.80 - 1.00 0.80 - 1.00 1.20 - 1.65 1.20 - 2.20	Nil	S 7					1.00 - 1.20m: Clayey.	1.20	35.70	
06/07/20 1010hrs Dry	7D 8L	2.20 - 2.63 2.20 - 3.20	2.20	S*54					Firm orangish brown and grey slightly gravelly sandy CLAY. Gravel is subangular to rounded fine to coarse flint.			
	9D 10L	3.20 - 3.65 3.20 - 4.20	3.20	S 17					1.90 - 2.20m: Very sandy.	2.50	34.40	
	11D 12L	4.20 - 0.65 4.20 - 5.20	4.20	S 17					Very dense brown sandy subangular to rounded fine to coarse flint and rare quartzite GRAVEL.			
	13D 14D 15L	5.10 5.20 - 5.65 5.20 - 6.70	5.20	S 6					3.20 - 4.00m: Medium dense.	4.00	32.90	
	16D 17D 18L	6.40 6.70 - 7.15 6.70 - 8.20	6.70	S 3					Structureless CHALK composed of light brown gravelly clayey SILT. Gravel is subangular to rounded fine to coarse extremely weak low density white chalk and flint. (Probably CIRIA Grade Dm). 4.20 - 5.20m: Limited recovery.			
									Structureless CHALK composed of silty subangular and subrounded fine to coarse GRAVEL. Clasts are extremely weak low and medium density white with rare black specks chalk. Matrix is white locally orangish brown. (Probably CIRIA Grade Dc).	5.35	31.55	
									Structureless CHALK composed of light brown gravelly clayey SILT. Gravel is subangular and subrounded fine to coarse extremely weak low density white and light brown chalk, frequently flint. (Probably CIRIA Grade Dm).	6.50	30.40	
									Continued Next Page	{8.00}		

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-12.70m.

CASING: 168mm diam to 12.70m.

BACKFILL: On 07/07/2020, borehole backfilled with bentonite 13.15-12.00m. A slotted standpipe (50mm) was installed to 12.00m, granular response zone 12.00-9.00m, bentonite seal 9.00-0.30m, concrete and helmet cover 0.30-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED



## **BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SBH09**

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 2 of 2

Start Date 4 July 2020

Scale 1 : 50

End Date 6 July 2020

Northing 213064.6 Ground level 36.90mOD Depth 13.15 m



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SBH10

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 1 July 2020

Easting 533145.2

Scale 1 : 50

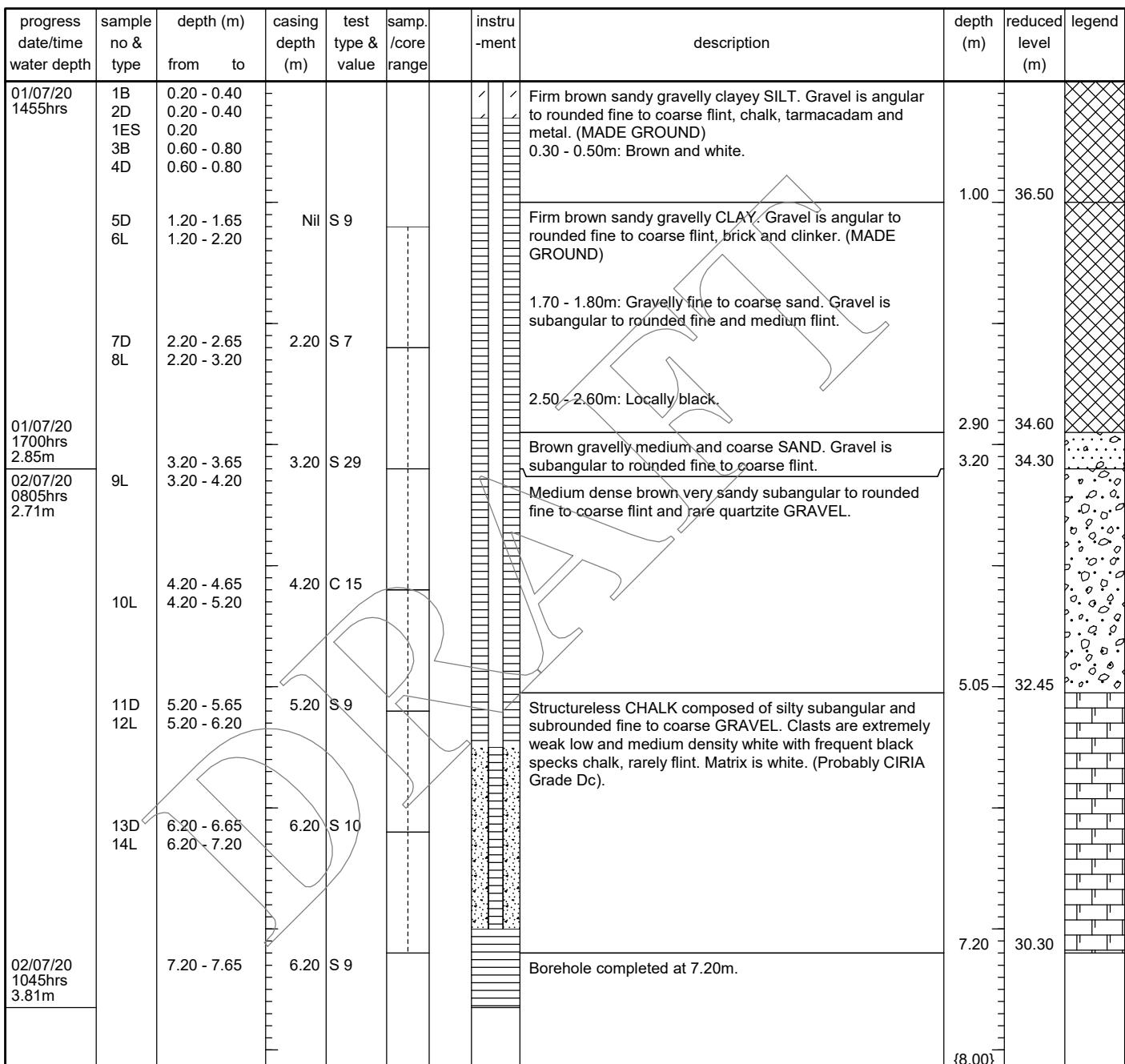
End Date 2 July 2020

Northing 213061.5

Ground level

37.50mOD

Depth 7.20 m



EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-7.20m.

CASING: 140mm diam to 6.20m.

BACKFILL: On completion, a bentonite seal was installed 7.65-7.00m, slotted standpipe (50mm) was installed to 7.00m, granular response zone 7.00-5.50m, bentonite seal 5.50-0.30m, concrete and helmet cover 0.30-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered prior to use of water flush.

CONTRACT  
35880

CHECKED

**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
BH01	1.20		1.65	Nil	Dry	1 3	75 75	4 3 4 3	75 75 75 75			S	14	78
BH01	2.20		2.65	2.20	1.80	3 6	75 75	5 5 5 5	75 75 75 75			S	20	78
BH01	4.20		4.65	4.20	2.75	1 2	75 75	3 4 3 2	75 75 75 75			C	12	78
BH01	5.20		5.65	5.20	2.50	3 6	75 75	2 3 4 8	75 75 75 75			C	17	78
BH01	6.70		7.15	6.70	2.65	1 2	75 75	1 2 4 3	75 75 75 75			S	10	78
BH02	1.20		1.65	Nil	Dry	2 5	75 75	6 8 11 11	75 75 75 75			C	36	76
BH02	2.20		2.65	Nil	Dry	5 7	75 75	6 6 4 5	75 75 75 75			C	21	76
BH02	3.20		3.65	Nil	Dry	2 4	75 75	5 5 4 5	75 75 75 75			C	19	76
BH02	4.20		4.65	4.20	2.73	3 6	75 75	7 7 7 8	75 75 75 75			C	29	76
BH02	5.20		5.65	5.20	2.36	3 11	75 75	10 10 8 6	75 75 75 75			C	34	76
BH02	6.70		7.15	6.70	3.12	6 8	75 75	10 10 14 13	75 75 75 75			C	47	76
BH02	8.20		8.65	8.20	1.41	2 1	75 75	1 6 8 6	75 75 75 75			S	21	76
BH02	9.70		10.15	9.70	2.10	4 2	75 75	3 3 5 4	75 75 75 75			S	15	76
BH02	11.20		11.65	9.70	4.32	3 4	75 75	4 2 2 3	75 75 75 75			S	11	76
BH02	12.20		12.65	9.70	5.40	2 2	75 75	5 10 7 6	75 75 75 75			S	28	76
BH03	1.25		1.70	Nil	Dry	2 6	75 75	6 4 5 5	75 75 75 75			C	20	76
BH03	2.20		2.53	Nil	Dry	4 9	75 75	12 21 17	75 75 30			C	83	76
BH03	3.20		3.48	3.20	1.65	7 18	75 55	23 27	75 75			C	100	76
BH03	4.20		4.65	4.20	2.30	7 12	75 75	12 13 12 12	75 75 75 75			C	49	76
BH03	5.20		5.65	5.20	4.04	6 10	75 75	10 8 9 11	75 75 75 75			C	38	76
BH03	6.70		7.15	6.70	1.98	5 7	75 75	8 6 3 2	75 75 75 75			S	19	76
BH03	8.20		8.65	7.00	2.83	1 2	75 75	1 2 2 2	75 75 75 75			S	7	76
BH03	9.70		10.15	8.30	4.87	2 7	75 75	7 7 6 8	75 75 75 75			S	28	76
BH03	11.20		11.65	8.30	4.83	2 3	75 75	4 3 4 5	75 75 75 75			S	16	76

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

CONTRACT <b>35880</b>	CHECKED
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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
BH03	12.70		13.15	12.70	1.60	4 3	75 75	4 4 4 3	75 75 75 75			S	15	76
BH03	14.20		14.65	14.20	3.60	3 3	75 75	1 2 4 4	75 75 75 75			S	11	76
BH03	15.70		16.15	15.70	4.04	4 5	75 75	6 5 5 6	75 75 75 75			S	22	76
BH03	17.20		17.65	17.00	4.74	13 11	75 75	8 6 7 8	75 75 75 75			S	29	76
BH03	18.70		19.15	17.00	4.67	3 4	75 75	5 6 8 9	75 75 75 75			S	28	76
BH03	20.00		20.45	17.00	4.65	6 6	75 75	7 7 9 11	75 75 75 75			S	34	76
BH03	23.00		23.45	17.00	3.47	3 8	75 75	6 8 13 15	75 75 75 75			S	42	76
BH03	25.30		25.75	17.00	3.98	3 6	75 75	8 9 9 11	75 75 75 75			S	37	76
BH04	1.20		1.65	Nil	Dry	4 5	75 75	7 4 5 4	75 75 75 75			S	20	78
BH04	2.20		2.65	Nil	Dry	4 8	75 75	8 7 6 12	75 75 75 75			S	33	78
BH04	3.20		3.64	Nil	Dry	3 2	75 75	3 9 13 25	75 75 75 65			S	52	78
BH04	4.20		4.49	4.20	1.75	2 7	75 75	18 32	75 60			C	111	78
BH04	5.20		5.65	5.20	3.80	3 2	75 75	2 3 1 8	75 75 75 75			C	14	78
BH04	6.70		7.15	6.70	0.25	3 5	75 75	9 5 4 5	75 75 75 75			C	23	78
BH04	8.20		8.65	6.70	4.20	3 2	75 75	2 2 3 32	75 75 75 75			C	39	78
BH05	1.20		1.65	Nil	Dry	2 3	75 75	3 3 3 4	75 75 75 75			S	13	78
BH05	2.20		2.65	2.20	2.00	2 4	75 75	6 5 5 7	75 75 75 75			S	23	78
BH05	3.20		3.65	3.20	2.85	2 3	75 75	5 16 15 12	75 75 75 75			C	48	78
BH05	4.20		4.65	4.20	1.70	1 8	75 75	12 9 9 8	75 75 75 75			C	38	78
BH05	5.20		5.65	5.20	3.05	5 8	75 75	4 4 3 9	75 75 75 75			C	20	78
BH05	6.70		7.15	6.70	3.45	5 8	75 75	9 7 9 6	75 75 75 75			C	31	78
BH05	8.20		8.65	8.20	2.50	1 1	75 75	1 1 2 2	75 75 75 75			S	6	78
BH07	1.20		1.65	Nil	Dry	1 3	75 75	5 6 6 5	75 75 75 75			S	22	78
BH07	2.20		2.65	2.20	2.20	2 4	75 75	6 12 13 10	75 75 75 75			C	41	78

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
BH07	3.20		3.55	3.20	2.95	2 12	75 75	18 14 18	75 75 45			C	77	78
BH07	4.20		4.64	4.20	1.05	6 8	75 75	19 12 11 8	75 75 75 60			C	53	78
BH07	5.20		5.65	5.20	2.95	2 1	75 75	2 3 2 2	75 75 75 75			S	9	78
BH07	6.70		7.15	6.70	3.30	1 2	75 75	3 3 2 1	75 75 75 75			S	9	78
BH08	1.20		1.65	1.20	Dry	1 1	75 75	1 1 1 1	75 75 75 75			C	4	76
BH08	2.20		2.65	2.20	0.33	1 1	75 75	2 7 7 7	75 75 75 75			C	23	76
BH08	3.20		3.65	3.20	1.52	1 3	75 75	2 2 1 0	75 75 75 75			C	5	76
BH08	4.20		4.65	4.20	2.12	2 2	75 75	1 2 1 0	75 75 75 75			C	4	76
BH08	5.20		5.65	5.20	2.60	3 3	75 75	2 1 1 2	75 75 75 75			C	6	76
BH08	6.70		7.15	6.70	2.56	1 3	75 75	2 1 2 2	75 75 75 75			S	7	76
BH08	8.50		8.95	8.50	2.23	2 1	75 75	1 2 1 2	75 75 75 75			S	6	76
BH08	10.00		10.45	10.00	3.24	2 2	75 75	1 3 2 1	75 75 75 75			S	7	76
BH08	11.00		11.45	11.00	2.77	3 2	75 75	3 4 3 2	75 75 75 75			S	12	76
BH08	12.00		12.45	12.00	3.20	2 1	75 75	2 2 4 5	75 75 75 75			S	13	76
BH09	1.20		1.65	Nil	Dry	2 3	75 75	5 5 5 5	75 75 75 75			S	20	78
BH09	2.20		2.65	2.20	1.10	3 3	75 75	3 6 8 7	75 75 75 75			C	24	78
BH09	3.20		3.65	3.20	1.80	2 3	75 75	3 1 1 2	75 75 75 75			C	7	78
BH09	4.20		4.65	4.20	1.80	3 1	75 75	3 3 3 2	75 75 75 75			C	11	78
BH09	5.20		5.65	5.20	2.95	1 2	75 75	1 3 2 2	75 75 75 75			C	8	78
BH09	6.70		7.15	6.70	2.25	1 1	75 75	2 1 1 2	75 75 75 75			S	6	78
BH09	8.20		8.65	8.20	5.15	1 3	75 75	32 2 3 3	75 75 75 75			S	40	78
BH09	9.70		10.15	9.70	5.90	7 5	75 75	2 4 2 3	75 75 75 75			S	11	78
BH09	11.20		11.65	11.20	6.40	2 2	75 75	2 3 2 4	75 75 75 75			S	11	78
BH09	12.70		13.15	12.70	4.45	3 5	75 75	4 6 4 4	75 75 75 75			S	18	78

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
BH09	14.20		14.65	14.20	8.40	3 4	75 75	3 3 3 4	75 75 75 75			S	13	78
BH09	15.70		16.15	15.70	2.41	3 3	75 75	6 5 5 7	75 75 75 75			S	23	78
BH09	17.20		17.65	17.20	2.85	4 13	75 75	8 11 9 10	75 75 75 75			S	38	78
BH09	18.70		19.15	17.20	2.90	2 2	75 75	3 4 45 7	75 75 75 75			S	59	78
BH09	20.20		20.65	17.20	3.45	2 5	75 75	6 7 6 10	75 75 75 75			S	29	78
BH09	21.40		21.85	17.20	3.75	5 9	75 75	8 13 14 12	75 75 75 75			S	47	78
BH09	22.90		23.35	17.20	4.25	4 5	75 75	8 7 9 8	75 75 75 75			S	32	78
BH09	24.40		24.85	17.20	3.85	2 5	75 75	12 13 10 8	75 75 75 75			S	43	78
BH09	25.60		26.05	17.20	3.75	2 6	75 75	8 10 16 13	75 75 75 75			S	47	78
BH10	1.20		1.65	Nil	Dry	3 3	75 75	5 7 9 8	75 75 75 75			S	29	78
BH10	2.20		2.65	2.20	1.05	3 10	75 75	13 11 13 9	75 75 75 75			S	46	78
BH10	3.20		3.65	3.20	2.50	5 7	75 75	6 7 7 8	75 75 75 75			C	28	78
BH10	4.20		4.65	4.20	3.10	6 10	75 75	5 8 5 6	75 75 75 75			C	24	78
BH10	5.20		5.65	5.20	3.25	5 3	75 75	4 2 3 3	75 75 75 75			S	12	78
BH10	6.20		6.65	6.20	3.33	1 1	75 75	1 2 2 2	75 75 75 75			S	7	78
BH10	7.70		8.15	7.70	4.21	1 0	75 75	1 2 1 1	75 75 75 75			S	5	78
BH10	9.20		9.65	9.20	3.35	3 4	75 75	4 5 5 3	75 75 75 75			S	17	78
BH10	10.70		11.15	10.70	3.61	3 3	75 75	4 4 6 6	75 75 75 75			S	20	78
BH10	12.20		12.65	12.20	2.84	3 4	75 75	3 8 5 6	75 75 75 75			S	22	78
BH10	13.70		14.15	13.70	2.82	5 6	75 75	5 8 6 6	75 75 75 75			S	25	78
BH10	15.20		15.65	15.20	6.62	3 5	75 75	7 8 9 8	75 75 75 75			S	32	78
BH10	16.70		17.15	15.20	3.45	2 2	75 75	4 6 6 5	75 75 75 75			S	21	78
BH10	18.20		18.65	15.20	3.45	3 6	75 75	7 9 10 18	75 75 75 75			S	44	78
BH10	19.70		20.15	15.20	3.65	2 6	75 75	8 10 10 8	75 75 75 75			S	36	78

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
BH10	21.20		21.65	15.20	3.31	1 2	75 75	7 8 8 12	75 75 75 75			S	35	78
BH10	22.70		23.15	15.20	4.63	4 6	75 75	7 7 11 7	75 75 75 75			S	32	78
BH10	24.20		24.65	15.20	3.63	4 8	75 75	9 10 12 16	75 75 75 75			S	47	78
BH10	25.70		26.15	15.20	3.72	2 3	75 75	6 7 8 6	75 75 75 75			S	27	78
BH11	1.20		1.29	1.20	Dry	10 15	75 5	50		10		C	1500	76
BH11	2.20		2.65	1.20	1.18	2 4	75 75	7 7 5 5	75 75 75 75			C	24	76
BH11	3.20		3.65	3.20	1.31	3 1	75 75	1 1 2 3	75 75 75 75			C	7	76
BH11	4.20		4.65	4.20	1.68	1 1	75 75	0 1 1 1	75 75 75 75			S	3	76
BH11	5.20		5.65	5.20	2.03	1 1	75 75	1 2 2 1	75 75 75 75			S	6	76
BH11	6.20		6.65	6.20	2.53	7 2	75 75	1 1 2 1	75 75 75 75			S	5	76
BH11	7.20		7.65	7.20	2.50	2 1	75 75	2 1 2 1	75 75 75 75			S	6	76
BH12	1.20		1.65	1.20	Dry	2 1	75 75	2 4 2 3	75 75 75 75			C	11	76
BH12	2.20		2.65	2.20	1.27	6 6	75 75	4 5 4 5	75 75 75 75			C	18	76
BH12	3.20		3.65	3.20	1.54	2 3	75 75	4 4 4 4	75 75 75 75			C	16	76
BH12	4.20		4.65	4.20	2.29	2 2	75 75	2 2 2 2	75 75 75 75			S	8	76
BH12	5.20		5.65	5.20	2.12	1 1	75 75	0 1 2 2	75 75 75 75			S	5	76
BH12	6.20		6.65	6.20	2.30	7 4	75 75	2 3 2 3	75 75 75 75			S	10	76
BH12	7.20		7.65	7.20	2.90	14 8	75 75	4 4 3 4	75 75 75 75			S	15	76
BH13	1.30	0.70	2.00	1.20	Dry	1						S	<1	76
BH13	2.20		2.65	2.20	1.15	3 5	75 75	5 3 4 4	75 75 75 75			S	16	76
BH13	3.20		3.65	3.20	1.67	3 9	75 75	10 10 8 6	75 75 75 75			C	34	76
BH13	4.20		4.65	4.20	1.34	1 0	75 75	0 1 1 1	75 75 75 75			S	3	76
BH13	5.20		5.65	5.20	1.37	1 0	75 75	1 1 1 1	75 75 75 75			S	4	76
BH13	6.50		6.95	6.50	2.56	1 2	75 75	1 2 3 4	75 75 75 75			S	10	76

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
BH13	8.00		8.45	8.00	2.34	5 5	75 75	3 2 2 2	75 75 75 75			S	9	76
BH13	9.50		9.95	9.50	3.56	1 2	75 75	2 1 1 2	75 75 75 75			S	6	76
BH13	11.00		11.45	11.00	3.93	1 3	75 75	3 3 3 6	75 75 75 75			S	15	76
BH13	12.50		12.95	12.50	4.05	2 2	75 75	4 4 4 4	75 75 75 75			S	16	76
BH13	14.00		14.45	14.00	4.63	3 7	75 75	5 5 5 6	75 75 75 75			S	21	76
BH13	15.50		15.95	15.50	2.62	4 4	75 75	5 8 8 8	75 75 75 75			S	29	76
BH13	18.50		18.95	15.50	2.29	4 7	75 75	8 10 12 14	75 75 75 75			S	44	76
BH13	22.10		22.55	15.50	2.94	3 6	75 75	6 8 12 12	75 75 75 75			S	38	76
BH13	25.10		25.43	15.50	3.18	5 8	75 75	16 24 10	75 75 25			S	86	76
BH14	1.20		1.65	1.20	0.88	1 1	75 75	1 0 1 2	75 75 75 75			C	4	76
BH14	2.20		2.65	2.20	1.84	2 1	75 75	2 1 2 3	75 75 75 75			C	8	76
BH14	3.20		3.65	3.20	1.58	1 2	75 75	1 1 2 2	75 75 75 75			S	6	76
BH14	4.20		4.65	4.20	1.44	1 2	75 75	2 2 2 2	75 75 75 75			S	8	76
BH14	5.20		5.65	5.20	1.27	2 2	75 75	3 4 3 4	75 75 75 75			S	14	76
BH14	6.20		6.65	6.00	1.22	2 2	75 75	3 3 4 6	75 75 75 75			S	16	76
BH14	7.20		7.65	6.00	2.55	6 4	75 75	4 4 3 4	75 75 75 75			S	15	76
BH15	1.30		1.75	1.30	1.10	1 0	75 75	1 0 0 1	75 75 75 75			C	2	76
BH15	2.20		2.65	2.20	1.10	1 1	75 75	2 2 2 1	75 75 75 75			S	7	76
BH15	3.20	0.45	3.65	3.20	1.41							S	<1	76
BH15	4.20		4.65	4.20	2.20	2 1	75 75	1 1 1 1	75 75 75 75			S	4	76
BH15	5.20		5.65	5.20	2.64	1 0	75 75	0 0 1 1	75 75 75 75			S	2	76
BH15	6.20		6.65	6.00	2.32	1 0	75 75	1 2 1 1	75 75 75 75			S	5	76
BH15	7.20		7.65	6.00	2.23	1 1	75 75	2 1 2 1	75 75 75 75			S	6	76
BH17	1.20		1.65	1.20	1.15	1 3	75 75	3 2 3 4	75 75 75 75			C	12	76

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)	
						blows	pen (mm)	blows	pen (mm)						
BH17	2.20		2.65	2.20	1.20	7 5	75 75	4	3	3	4	75 75 75 75	C	14	76
BH17	3.20		3.65	3.20	1.30	1 6	75 75	6	4	2	3	75 75 75 75	C	15	76
BH17	4.20		4.65	4.20	1.70	1	75 75	1	1	1	2	75 75 75 75	C	5	76
BH17	5.20		5.73	5.20	1.23	1 1	75 75	4	2	1		75 75 75 150	S	6	76
BH17	6.70		7.15	6.70	2.73	2 1	75 75	1	1	2	1	75 75 75 75	S	5	76
BH17	8.20		8.65	8.20	3.15	1 2	75 75	1	2	1	2	75 75 75 75	S	6	76
BH17	9.70		10.15	9.70	3.30	2 1	75 75	2	1	3	4	75 75 75 75	S	10	76
BH17	11.20		11.65	11.20	3.97	2 4	75 75	5	5	5	5	75 75 75 75	S	20	76
BH17	12.20		12.65	12.20	2.58	3 4	75 75	4	4	4	5	75 75 75 75	S	17	76
BH18	1.25		1.70	1.25	1.20	1 0	75 75	0	1	1	0	75 75 75 75	C	2	76
BH18	2.20		2.65	1.25	1.89	6 10	75 75	10	10	11	12	75 75 75 75	C	43	76
BH18	3.20		3.65	3.20	1.11	1 1	75 75	1	2	3	1	75 75 75 75	S	7	76
BH18	4.20		4.65	4.00	1.15	1 2	75 75	1	1	2	1	75 75 75 75	S	5	76
BH18	5.20		5.65	5.20	1.88	1 1	75 75	1	0	2	2	75 75 75 75	S	5	76
BH18	6.20		6.65	6.20	2.25	1 0	75 75	1	0	1	1	75 75 75 75	S	3	76
BH18	7.20		7.65	7.20	2.96	1 0	75 75	1	1	1	1	75 75 75 75	S	4	76
SBH02	1.20		1.65	1.20	Dry	2 1	75 75	1	2	1	1	75 75 75 75	C	5	76
SBH02	2.20		2.65	2.20	2.10	2 7	75 75	5	2	2	2	75 75 75 75	C	11	76
SBH02	3.20		3.65	3.20	2.20	1 0	75 75	0	0	1	1	75 75 75 75	C	2	76
SBH02	4.20		4.65	4.20	2.40	3 5	75 75	5	4	5	5	75 75 75 75	C	19	76
SBH02	5.20		5.65	5.20	2.70	1 3	75 75	2	2	2	2	75 75 75 75	S	8	76
SBH02	6.70		7.15	6.70	2.40	4 3	75 75	2	2	3	2	75 75 75 75	S	9	76
SBH02	8.20		8.65	8.20	2.60	3 3	75 75	3	3	3	3	75 75 75 75	S	12	76
SBH02	9.70		10.15	9.70	3.13	4 3	75 75	4	2	12	13	75 75 75 75	S	31	76

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
SBH02	11.20		11.65	11.20	2.80	2 4	75 75	3 3 4 5	75 75 75 75			S	15	76
SBH02	12.50		12.95	11.20	2.70	4 6	75 75	6 5 5 6	75 75 75 75			S	22	76
SBH03	1.20		1.65	1.20	Dry	2 2	75 75	2 2 1 2	75 75 75 75			C	7	76
SBH03	2.20		2.65	2.20	1.02	1 0	75 75	0 1 0 1	75 75 75 75			C	2	76
SBH03	3.20		3.65	3.20	2.00	1 1	75 75	1 2 1 1	75 75 75 75			C	5	76
SBH03	4.50		4.95	4.20	3.12	1 3	75 75	2 5 4 4	75 75 75 75			C	15	76
SBH03	5.50		5.95	5.50	2.56	2 2	75 75	3 2 1 1	75 75 75 75			S	7	76
SBH03	7.00		7.45	7.00	2.60	1 0	75 75	1 1 1 0	75 75 75 75			S	3	76
SBH04	1.25		1.70	Nil	Dry	3 7	75 75	7 5 5 4	75 75 75 75			C	21	76
SBH04	2.20		2.65	2.20	1.00	1 1	75 75	1 1 0 1	75 75 75 75			C	3	76
SBH04	3.20		3.65	3.20	2.50	1 0	75 75	0 0 0 2	75 75 75 75			C	2	76
SBH04	4.20		4.65	4.20	2.80	7 12	75 75	11 9 6 4	75 75 75 75			C	30	76
SBH04	5.20		5.65	5.20	2.60	2 1	75 75	2 2 2 3	75 75 75 75			S	9	76
SBH04	6.20		6.65	6.20	2.75	3 2	75 75	1 1 3 2	75 75 75 75			S	7	76
SBH04	7.20		7.65	7.20	2.92	1 0	75 75	3 1 1 2	75 75 75 75			S	7	76
SBH05	1.20		1.65	1.20	Dry	2 4	75 75	8 15 12 12	75 75 75 75			C	47	76
SBH05	2.20		2.65	2.20	0.71	2 1	75 75	2 2 2 1	75 75 75 75			C	7	76
SBH05	3.80		4.25	3.80	3.21	1 2	75 75	5 5 7 7	75 75 75 75			C	24	76
SBH05	5.20		5.65	5.20	2.30	2 2	75 75	1 2 2 1	75 75 75 75			S	6	76
SBH05	6.70		7.15	6.70	2.38	1 1	75 75	1 2 2 1	75 75 75 75			S	6	76
SBH05	8.20		8.65	8.20	2.74	2 5	75 75	2 2 2 1	75 75 75 75			S	7	76
SBH05	9.70		10.15	8.20	2.80	1 0	75 75	4 4 4 4	75 75 75 75			S	16	76
SBH05	11.20		11.65	11.20	2.88	2 2	75 75	3 4 4 5	75 75 75 75			S	16	76
SBH05	12.70		13.12	12.70	2.96	15 10	75 45	9 6 7 6	75 75 75 75			S	28	76

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
SBH05	14.20		14.65	14.20	2.34	8 6	75 75	3 4 5 4	75 75 75 75			S	16	76
SBH05	15.70		16.15	14.20	2.74	2 3	75 75	4 3 4 5	75 75 75 75			S	16	76
SBH05	18.70		19.15	14.20	3.28	2 4	75 75	5 8 8 8	75 75 75 75			S	29	76
SBH05	21.70		22.12	14.20	3.17	3 4	75 75	5 15 15 15	75 75 75 45			S	56	76
SBH05	25.10		25.55	14.20	3.40	3 5	75 75	8 9 9 12	75 75 75 75			S	38	76
SBH06	1.20		1.65	Nil	Dry	1 2	75 75	1 2 3 2	75 75 75 75			S	8	78
SBH06	2.20		2.65	2.20	0.90	6 10	75 75	9 10 11 11	75 75 75 75			S	41	78
SBH06	3.20		3.65	3.20	2.67	4 9	75 75	12 8 9 8	75 75 75 75			S	37	78
SBH06	4.20		4.65	4.20	2.81	1 0	75 75	1 3 10 12	75 75 75 75			C	26	78
SBH06	5.20		5.65	5.20	2.71	2 1	75 75	6 4 8 10	75 75 75 75			C	28	78
SBH06	6.70		7.15	6.70	2.72	7 2	75 75	4 2 2 4	75 75 75 75			S	12	78
SBH06	8.20		8.65	8.20	3.22	2 5	75 75	4 3 3 4	75 75 75 75			S	14	78
SBH06	9.70		10.15	9.70	3.41	3 4	75 75	4 3 4 6	75 75 75 75			S	17	78
SBH06	11.20		11.65	11.20	4.71	4 3	75 75	3 4 5 6	75 75 75 75			S	18	78
SBH06	12.40		12.85	11.20	3.68	1 4	75 75	4 4 6 6	75 75 75 75			S	20	78
SBH07	1.20	0.00	1.65	Nil	Dry	4 5	75 75	4 5 7 5	75 75 75 75			S	21	78
SBH07	2.20		2.65	2.20	1.45	1 1	75 75	2 2 1 2	75 75 75 75			S	7	78
SBH07	3.20		3.65	3.20	0.70	1 1	75 75	3 3 4 5	75 75 75 75			S	15	78
SBH07	4.20		4.60	4.20	3.75	5 15	75 75	9 18 10 13	75 75 75 25			S	60	78
SBH07	5.20		5.65	5.20	4.10	7 4	75 75	9 8 10 9	75 75 75 75			C	36	78
SBH07	6.20		6.65	6.20	5.31	2 4	75 75	2 2 2 2	75 75 75 75			S	8	78
SBH07	7.00		7.45	7.00	5.80	1 3	75 75	2 2 6 5	75 75 75 75			S	15	78
SBH08A	1.20		1.65	Nil	Dry	4 5	75 75	3 2 2 1	75 75 75 75			S	8	78
SBH08A	2.20		2.65	2.20	2.10	1 0	75 75	0 3 4 5	75 75 75 75			S	12	78

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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**STANDARD PENETRATION TEST**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows	pen (mm)					
SBH08A	3.20		3.65	3.20	3.00	4 6	75 75	6 4 6 3	75 75 75 75			S	19	78
SBH08A	4.20		4.65	4.20	4.01	2 5	75 75	6 6 5 7	75 75 75 75			C	24	78
SBH08A	5.20		5.65	5.20	3.11	1 1	75 75	0 1 1 2	75 75 75 75			S	4	78
SBH08A	6.20		6.65	5.20	3.31	1 0	75 75	1 1 1 2	75 75 75 75			S	5	78
SBH09	1.20		1.65	Nil	Dry	1 1	75 75	2 1 2 2	75 75 75 75			S	7	78
SBH09	2.20		2.63	2.20	1.44	7 12	75 75	13 14 15 8	75 75 75 55			S	54	78
SBH09	3.20		3.65	3.20	3.05	1 2	75 75	2 4 4 7	75 75 75 75			S	17	78
SBH09	4.20		4.65	4.20	3.08	2 5	75 75	3 4 5 5	75 75 75 75			S	17	78
SBH09	5.20		5.65	5.20	2.55	2 2	75 75	2 1 1 2	75 75 75 75			S	6	78
SBH09	6.70		7.15	6.70	3.63	1 1	75 75	0 0 1 2	75 75 75 75			S	3	78
SBH09	8.20		8.65	8.20	3.91	1 2	75 75	1 1 2 2	75 75 75 75			S	6	78
SBH09	9.70		10.15	9.70	2.84	1 2	75 75	1 2 1 1	75 75 75 75			S	5	78
SBH09	11.20		11.65	11.20	2.04	4 6	75 75	3 4 4 6	75 75 75 75			S	17	78
SBH09	12.70		13.15	12.70	2.72	3 3	75 75	5 5 4 4	75 75 75 75			S	18	78
SBH10	1.20		1.65	Nil	Dry	2 2	75 75	2 2 2 3	75 75 75 75			S	9	78
SBH10	2.20		2.65	2.20	0.40	2 4	75 75	2 2 1 2	75 75 75 75			S	7	78
SBH10	3.20		3.65	3.20	2.85	3 9	75 75	8 7 7 7	75 75 75 75			S	29	78
SBH10	4.20		4.65	4.20	2.71	6 7	75 75	6 4 2 3	75 75 75 75			C	15	78
SBH10	5.20		5.65	5.20	2.85	2 2	75 75	1 2 3 3	75 75 75 75			S	9	78
SBH10	6.20		6.65	6.20	2.74	1 2	75 75	2 3 3 2	75 75 75 75			S	10	78
SBH10	7.20		7.65	6.20	3.81	2 1	75 75	3 2 2 2	75 75 75 75			S	9	78

## notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

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## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SWS01

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 2 July 2020 Easting 533164.3

Scale 1 : 50

End Date 2 July 2020 Northing 213144.7 Ground level 38.05mOD Depth 0.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description	depth (m)	reduced level (m)	legend
02/07/20 0845hrs							MADE GROUND comprising red terracotta tile (20x20mm). MADE GROUND comprising light grey concrete. Borehole completed at 0.20m.	0.05 0.20	38.00 37.85	X

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-0.20m.

BACKFILL: On completion, the borehole was backfilled with materials arising.

REMARKS: Cancelled due to concrete/refusal from breaker.

Relocated approximately to the north as SWS01A.

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## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SWS01A

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 2 July 2020 Easting 533168.0

Scale 1 : 50

End Date 2 July 2020 Northing 213162.0 Ground level 38.20mOD

Depth 0.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description	depth (m)	reduced level (m)	legend
02/07/20 1415hrs							MADE GROUND comprising light grey concrete with rebar (5mm diam spaced 200mm). Borehole completed at 0.20m.	0.20	38.00	{X}

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-0.20m.

Cancelled due to hardened concrete and rebar.

BACKFILL: On completion, the borehole was backfilled with materials arising.

REMARKS: Relocated to the northeast as SWS01B.

Approximate coordinates and level taken from topographical drawing.

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**BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SWS01B**

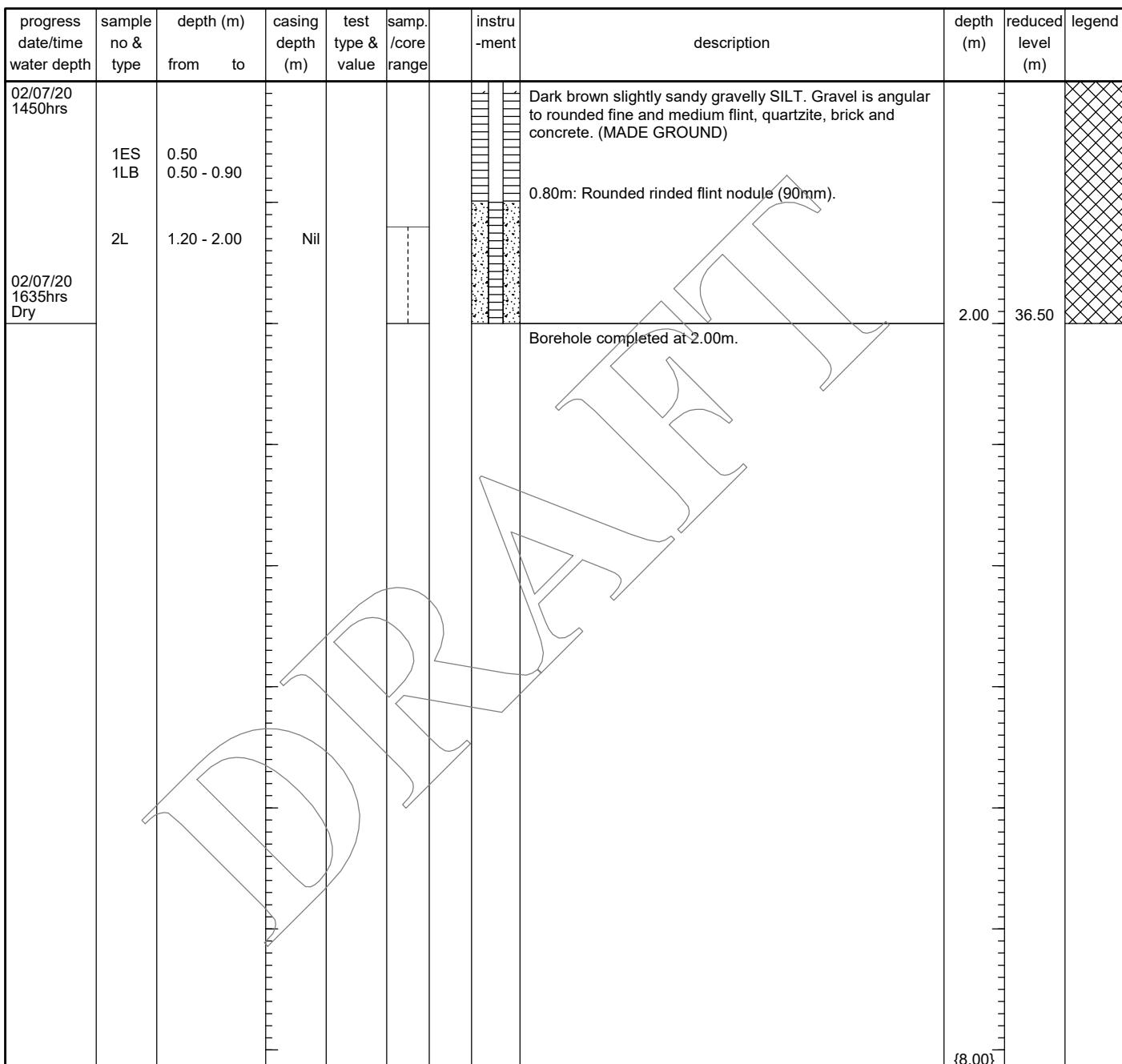
SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 2 July 2020 Easting 533171.8

Scale 1 : 50

End Date 2 July 2020 Northing 213162.5 Ground level 38.50mOD Depth 2.00 m



EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-2.00m

CASING: None used.

BACKFILL: On completion, a slotted standpipe (50mm) was installed to 2.00m, granular response zone 2.00-1.00m, bentonite seal 1.00-0.10m, concrete and helmet cover 0.10-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

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**BOREHOLE LOG**

CLIENT ST WILLIAM LLP

**SWS02**

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 2 July 2020 Easting 533207.2

Scale 1 : 50

End Date 2 July 2020 Northing 213134.6 Ground level 37.55mOD Depth 4.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
02/07/20 1140hrs							MADE GROUND comprising black TARMACADAM.			0.15	37.40	
	1D	0.60 - 0.70					Red and brown subangular brick and concrete COBBLES (up to 150mm) with much silty fine to coarse SAND matrix. (pulverised brick). (MADE GROUND)			0.45	37.10	
	2L	0.70 - 1.20		Nil			Black slightly silty TAR with frequent angular fine and medium coal fragments. (MADE GROUND)	0.80		0.80	36.75	
	3L	1.20 - 2.00	1.20				0.50m: Fragment of wood (80mm).			1.20	36.35	
	4L	2.00 - 3.00	2.00				Soft black and yellowish brown slightly gravelly sandy silty CLAY with rare grey pockets (up to 50mm). Gravel is angular to rounded fine to coarse flint, coal and brick. Faint hydrocarbon odour. (MADE GROUND)			2.40	35.15	
	1ES	2.40					Greyish brown slightly gravelly becoming very gravelly sandy SILT. Gravel is subangular to rounded fine to coarse chalk and flint. (MADE GROUND)	2.60		2.60	34.95	
	5L	3.00 - 4.00	3.00				1.21 - 1.70m: Gravel is predominantly rounded fine chalk. 2.00 - 3.00m: Limited recovery.			3.50	34.05	
							Yellow and red angular brick cobbles. Drilling disturbed. (MADE GROUND)			3.70	33.85	
							Dark brown slightly gravelly sandy SILT. Gravel is angular to rounded fine flint.			4.00	33.55	
							Soft greenish grey silty CLAY.					
							Black and dark grey sandy angular to subrounded fine flint GRAVEL.					
							Borehole completed at 4.00m.					
											{8.00}	

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-0.70m. Dynamic sampled (113mm) 0.70-4.00m

CASING: 128mm diam to 4.00m.

BACKFILL: On completion, borehole backfilled with bentonite 4.00-3.50m. A slotted standpipe (50mm) was installed to 3.50m, granular response zone 3.50-1.00m, bentonite seal 1.00-0.10m, concrete and helmet cover 0.10-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks	AGS	CONTRACT 35880	CHECKED
4.00	4.00	2.70	20				



# BOREHOLE LOG

CLIENT ST WILLIAM LLP

SWS03

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 2 July 2020 Easting 533157.8

Scale 1 : 50

End Date 2 July 2020

Northing 213124.7 Ground level 37.80mOD Depth 3.00 m

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-3.00m

CASING: 128mm diam to 3.00m.

**BACKFILL:** On completion, borehole backfilled with bentonite 3.00-2.50m. A slotted standpipe (50mm) was installed to 2.50m, granular response zone 2.50-1.00m bentonite seal 1.00-0.10m, concrete and helmet cover 0.10-0.00m.

**REMARKS:** Environmental sampling undertaken by the Consultant

~~EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS~~

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
3.00	3.00	2.90	20	



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## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SWS04

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 1 July 2020

Easting 533187.1

Scale 1 : 50

End Date 1 July 2020

Northing 213076.9

Ground level

37.40mOD

Depth 4.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
01/07/20 1410hrs	1B	0.10 - 0.20					Grass over brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint, brick, concrete and quartzite. (MADE GROUND)	0.01 - 0.10m: Frequent rootlets.				
	1ES	0.40					0.35 - 0.50m: Gravel is predominantly rounded chalk.			0.80	36.60	
	2D	1.10 - 1.20	1.20				Soft greyish brown slightly sandy silty CLAY. Gravel is angular to rounded fine to coarse flint and brick (MADE GROUND)			1.20	36.20	
	3L	1.20 - 2.00					Soft dark brown slightly sandy slightly gravelly clayey SILT. Gravel is angular to rounded fine to coarse flint, brick and clinker (MADE GROUND)					
	4L	2.00 - 3.00	2.00				2.30 - 3.80m: Black staining and slight hydrocarbon odour.			2.65	34.75	
	5L	3.00 - 4.00	3.00				Black sandy subangular to rounded fine and medium GRAVEL with slight hydrocarbon odour. (MADE GROUND)	2.65 - 2.75m: Wood.				
01/07/20 1635hrs Dry							Structureless CHALK composed of white and light grey gravelly SILT, Gravel is subangular to rounded fine white chalk. (Probably CIRIA Grade Dm).	Borehole completed at 4.00m.		3.80	33.60	
										4.00	33.40	
										{8.00}		

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-4.00m

CASING: 128mm diam to 4.00m.

BACKFILL: On completion, borehole backfilled with bentonite 4.00-2.50m. A slotted standpipe (50mm) was installed to 2.50m, granular response zone 2.50-1.00m, bentonite seal 1.00-0.10m, concrete and helmet cover 0.10-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

CONTRACT  
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## BOREHOLE LOG

CLIENT ST WILLIAM LLP

SWS05

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 1 July 2020

Easting 533148.8

Scale 1 : 50

End Date 1 July 2020

Northing 213053.4

Ground level

37.60mOD

Depth 4.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
01/07/20 1120hrs	1B	0.20 - 0.30					Grass over brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint, brick and quartzite. (MADE GROUND)			0.50	37.10	
	2B	1.10 - 1.20					Light grey slightly sandy gravelly SILT. Gravel is angular to rounded fine to coarse chalk, flint and brick. (MADE GROUND)			0.85	36.75	
	3L	1.20 - 2.00	1.20				Dark brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint, brick, concrete and quartzite. (MADE GROUND)			1.55	36.05	
	1ES	1.60					1.20 - 1.30m: Thin bed of Stiff grey and brown silty CLAY with rare roots (up to 3mm diam).					
	4L	2.00 - 3.00	2.00				Dark brown sandy gravelly clayey SILT. Gravel is subangular fine black stained roadstone (pulverised tarmac). (MADE GROUND)			2.55	35.05	
							2.00 - 2.55m: Limited recovery.					
							Light brown and black slightly silty gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse tarmacadam and concrete. (MADE GROUND)			2.80	34.80	
	5L	3.00 - 4.00	3.00				Brown sandy very silty subangular to rounded fine to coarse flint GRAVEL.					
							2.80 - 3.00m: Silt is dark brown.					
							3.01 - 4.00m: Limited recovery.					
01/07/20 1255hrs 3.30m							Borehole completed at 4.00m.			4.00	33.60	
							{8.00}					

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-4.00m

CASING: 128mm diam to 4.00m.

BACKFILL: On completion, borehole backfilled with bentonite 4.00-3.00m. A slotted standpipe (50mm) was installed to 3.00m, granular response zone 3.00-2.00m, bentonite seal 2.00-0.10m, concrete and raised helmet cover 0.10-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
4.00	4.00	3.30	20	

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# BOREHOLE LOG

WS01

CLIENT ST WILLIAM LLP

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 30 June 2020      Easting 533398.5

Scale 1 : 50

End Date 30 June 2020

Northing 213322.0 Ground level 35.40mOD Depth 3.00 m

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-3.00m.

CASING: 128mm diam to 3.00m

**BACKFILL:** On completion, borehole backfilled with bentonite 3.00-2.00m. A slotted standpipe (50mm) was installed to 2.00m, granular response zone 2.00-1.00m, bentonite seal 1.00-0.10m, concrete and helmet cover 0.10-0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered



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## BOREHOLE LOG

WS02

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 30 June 2020

Easting 533340.3

Scale 1 : 50

End Date 30 June 2020

Northing 213277.7

Ground level

35.75mOD

Depth 4.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
30/06/20 0840hrs	1D	0.15 0.20 - 0.30 0.25		H 76 H 86			Purplish brown slightly sandy silty subangular to subrounded fine and medium crystalline GRAVEL. (MADE GROUND)			0.05 0.30	35.70 35.45	
	1ES	1.00					Firm to stiff bluish grey and greenish grey CLAY. (MADE GROUND)			0.90	34.85	
	2B	1.10 - 1.20					Brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint, brick and chalk. (MADE GROUND)			1.40	34.35	
	3L	1.20 - 2.00	2.00				0.50m: Wooden fragment (20mm).			1.95	33.80	
	4L	2.00 - 3.00	3.00				Greyish brown slightly sandy slightly gravelly SILT frequently stained black (up to 20mm). Gravel is predominantly rounded fine chalk and angular to rounded fine and medium flint. (MADE GROUND)			2.75	33.00	
	2ES	2.20					Black and brown angular to subrounded medium and coarse flint GRAVEL. (MADE GROUND)			3.20	32.55	
	5L	3.00 - 4.00	4.00				1.40 - 1.95m: Limited recovery.			3.70	32.05	
							Black sandy organic SILT with abundant plant matter. Slight oily residue and faint organic odour. (MADE GROUND)			4.00	31.75	
							2.05m: Grey rag (60mm).					
							2.25m: Glass fragment (30mm).					
							Grey and black thinly laminated silty fine and medium SAND.					
							Black sandy angular to subangular fine to coarse flint GRAVEL.					
							Structureless CHALK composed of white and light grey slightly gravelly very sandy SILT. Gravel is subrounded fine and medium chalk. (Probably CIRIA Grade Dm).					
							Borehole completed at 4.00m.					
										{8.00}		

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-4.00m

CASING: 128mm diam to 4.00m.

BACKFILL: On completion, borehole backfilled with bentonite 4.00-2.50m. A slotted standpipe (50mm) was installed to 2.50m, granular response zone 2.50-1.00m, bentonite seal 1.00-0.10m, concrete and helmet cover 0.10-0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks  
2.00 2.00 2.00 20CONTRACT  
35880

CHECKED



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

WS03

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 1 July 2020

Easting 533334.2

Scale 1 : 50

End Date 1 July 2020

Northing 213338.2

Ground level

36.05mOD

Depth 4.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
01/07/20 0820hrs	1D	0.15 0.20 - 0.30 0.25		H 75 H 82			Purplish brown silty slightly sandy subangular to subrounded fine and medium granite GRAVEL. (MADE GROUND)			0.10 0.35	35.95 35.70	
	2B 3L	1.10 - 1.20 1.20 - 2.00	1.20				Firm to stiff bluish grey and greenish grey CLAY. (MADE GROUND)					
	4L	2.00 - 3.00	2.00				Brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint, brick, chalk and concrete. (MADE GROUND)			1.70 1.95	34.35 34.10	
	5L	3.00 - 4.00	3.00				Firm light brown sandy silty CLAY. (MADE GROUND)			2.00	34.05	
01/07/20 1020hrs 1.64m	1ES	3.50					Black angular to rounded fine and medium coal GRAVEL. (MADE GROUND)					
							Black and dark brown highly organic sandy SILT with abundant plant matter. (MADE GROUND)					
							Black sandy angular to rounded fine to coarse flint GRAVEL with faint hydrocarbon odour.					
							3.00 - 3.95m: Limited recovery					
							Structureless CHALK composed of white gravelly SILT. Gravel is subrounded to rounded fine to coarse flint. (Probably CIRIA grade Dm).					
							Borehole completed at 4.00m.					
										{8.00}		

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-4.00m.

CASING: 128mm diam to 4.00m.

BACKFILL: On completion, borehole backfilled with bentonite 4.00-3.00m. A slotted standpipe (50mm) was installed to 3.00m, granular response zone 3.00-2.00m, bentonite seal 2.00-0.10m, concrete and helmet cover 0.10-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
3.00	3.00	1.64	20	

CONTRACT  
35880

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## BOREHOLE LOG

WS04

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 30 June 2020

Easting 533289.8

Scale 1 : 50

End Date 30 June 2020

Northing 213258.7

Ground level

36.30mOD

Depth 2.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
30/06/20 1500hrs	1LB	0.40 - 0.80					Bark chippings over yellow slightly gravelly fine SAND. Gravel is subrounded and rounded fine and medium flint. (MADE GROUND) 0.00 - 0.20m: Frequent roots (up to 2mm diam).					
	2L	1.20 - 2.00	1.20				Firm yellowish brown sandy CLAY. (MADE GROUND)			1.30	35.00	
30/06/20 1550hrs 1.90m	1ES	1.60					Black slightly sandy organic SILT with abundant plant matter. Gravel is angular to rounded fine to coarse flint and rare brick. (MADE GROUND) 1.55 - 2.00m: Faint oily organic odour.			1.55	34.75	
							Borehole completed at 2.00m.			2.00	34.30	
							{8.00}					

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-2.00m

CASING: 128mm diam to 2.00m.

BACKFILL: On completion, a slotted standpipe (50mm) was installed to 2.00m, granular response zone 2.00-1.30m, bentonite seal 1.30-0.10m, concrete and helmet cover 0.10-0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
2.00	1.90	1.90	20	

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**35880**

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## BOREHOLE LOG

WS05

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 29 June 2020 Easting 533243.0

Scale 1 : 50

End Date 29 June 2020 Northing 213244.0 Ground level 38.15mOD

Depth 0.90 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
29/06/20 1350hrs							Vegetation over dark brown slightly gravelly sandy SILT. Gravel is angular to rounded fine and medium flint, brick and quartzite. (MADE GROUND)					
29/06/20 1420hrs Dry							Soft brown slightly gravelly sandy silty CLAY. gravel is subrounded and rounded fine to coarse flint and quartzite. (MADE GROUND)			0.70	37.45	
							50mm diam unidentified pipe. Borehole completed at 0.90m.			0.90	37.25	

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-0.90m

BACKFILL: Pit backfilled with materials arising.

REMARKS: Pit terminated due to encountering unknown service at base of pit. Relocated as WS05A.

Approximate coordinates and level taken from topographical drawing.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

CONTRACT  
35880

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## **BOREHOLE LOG**

CLIENT ST WILLIAM LLP

WS05A

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 29 June 2020      Easting 533243.3

Scale 1 : 50

End Date 29 June 2020

Northing 213244.4 Ground level 38.15mOD Depth 2.00 m

progress date/time water depth	sample no & type	depth (m)	casing depth (m)	test type & value	samp. /core range	instru -ment	description		depth (m)	reduced level (m)	legend
29/06/20 1425hrs							Vegetation over dark brown slightly gravelly sandy SILT. Gravel is angular to rounded fine and medium flint, brick and quartzite. (MADE GROUND) 0.20 - 0.25m: Frequent subangular concrete and brick cobbles.				
	1B	0.30 - 0.40					Soft brown slightly gravelly sandy silty CLAY. gravel is subrounded and rounded fine to coarse flint and quartzite.		0.70	37.45	X
	1ES	0.50					Brown and grey slightly silty sandy subrounded and rounded fine to coarse GRAVEL. 1.20m: Subrounded flint cobble.				
	2B	1.10 - 1.20							1.20	36.95	X
	3L	1.20 - 2.00	1.20				Borehole completed at 2.00m.				
29/06/20 1535hrs Dry									2.00	36.15	

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-2.00m

CASING: 128mm diam to 2.00m.

**BACKFILL:** On completion, borehole backfilled with bentonite 2.00-0.70m. A slotted standpipe (50mm) was installed to 0.70m, granular response zone 0.70-0.30m, bentonite seal 0.30-0.10m, concrete and helmet cover 0.10-0.00m.

**REMARKS:** Environmental sampling undertaken by the Consultant

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered



CONTRACT  
**35880**



## BOREHOLE LOG

CLIENT ST WILLIAM LLP

WS06

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 29 June 2020 Easting 533203.4

Scale 1 : 50

End Date 29 June 2020 Northing 213253.9 Ground level 38.75mOD Depth 4.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp./core range	instru-ment	description			depth (m)	reduced level (m)	legend
29/06/20 1000hrs	1B 1ES	0.30 - 0.40 0.40					MADE GROUND comprising black TARMACADAM.			0.10	38.65	
	2B 3L	1.00 - 1.10 1.20 - 2.00	1.20				Light brown very gravelly fine to coarse SAND. Gravel is subrounded and rounded fine to coarse flint and quartzite. (MADE GROUND)			0.20	38.55	
	4L	2.00 - 3.00	2.00				Greyish brown very gravelly sandy SILT with frequent coarse drainage pipe fragments. Gravel is angular to rounded fine to coarse flint and quartzite. (MADE GROUND)			0.50	38.25	
	5L	3.00 - 4.00	3.00				Brown slightly gravelly very sandy SILT. Gravel is subangular to rounded fine to coarse flint, quartzite and brick with frequent roots (up to 3mm diam). (MADE GROUND)			1.60	37.15	
							1.10 - 1.40m: Black staining with faint hydrocarbon odour.			2.00	36.75	
							Orangish brown silty fine and medium SAND. (MADE GROUND)					
							Yellowish brown very sandy subrounded to rounded fine to coarse flint GRAVEL.					
29/06/20 1225hrs Dry							Brown becoming grey sandy silty subangular to rounded fine and medium flint GRAVEL.			3.60	35.15	
							Borehole completed at 4.00m.			4.00	34.75	
							{8.00}					

EQUIPMENT: Geotechnical Terrier 2000 rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-4.00m

CASING: 128mm diam to 4.00m.

BACKFILL: On completion, borehole backfilled with bentonite 4.00-1.50m. A slotted standpipe (50mm) was installed to 1.50m, granular response zone 1.50-0.50m, bentonite seal 0.50-0.10m, concrete and helmet cover 0.10-0.00m.

REMARKS: Environmental sampling undertaken by the Consultant.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

CONTRACT  
35880

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**TRIAL PIT LOG****STP01**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 24 June 2020

Easting 533177

Scale 1 : 25

End Date 24 June 2020

Northing 213143

Ground level

38.15mOD

Depth 3.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
				MADE GROUND comprising light grey CONCRETE with rebar (3mm and 5mm diam spaced 100mm).			
				Reddish orange subangular brick COBBLES with some fine to coarse silty sand matrix (pulverised brick). (MADE GROUND) 0.35m: Translucent plastic membrane.	0.35	37.80	
	1B		0.75- 0.85				
	1ES		1.20	Black silty sandy GRAVEL. Gravel is angular to rounded fine to coarse flint and quartzite. Stained black with strong hydrocarbon odour and oily sheen. (MADE GROUND)	1.15	37.00	
	H 73		1.50	Firm to stiff greenish brown slightly sandy becoming sandy gravelly silty CLAY. Rare pockets (up to 150mm) of grey clay with rounded fine to coarse chalk gravel.	1.35	36.80	
	2D		1.70- 1.80	1.60m: Sandy.			
Dry.	3D		2.80- 2.90	Trial pit completed at 3.00m.	3.00	35.15	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 3.50x1.00x3.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



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**TRIAL PIT LOG****STP02**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 25 June 2020

Easting 533204

Scale 1 : 25

End Date 25 June 2020

Northing 213146

Ground level

37.35mOD

Depth 3.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
	1ES		0.30	MADE GROUND comprising black TARMACADAM. Orange slightly silty slightly gravelly fine to coarse SAND with rare roots (up to 3mm diam). Gravel is subangular and subrounded fine to coarse flint. (MADE GROUND)	0.10	37.25	
	1LB		0.40- 0.50	MADE GROUND comprising light grey and white CONCRETE. 0.20 - 3.00m: Slight hydrocarbon odour.	0.20	37.15	
				Black silty very sandy subangular to rounded fine to coarse flint, quartzite and clinker GRAVEL. Rare subrounded brick cobbles. (MADE GROUND) 0.60 - 0.90m: 1.00m long pocket of stiff greenish grey CLAY.	0.30	37.05	
				1.10m: 19mm black water hose surrounded by fine sand (redundant service).			
				1.30 - 1.90m: frequent exposed wires and cables. (redundant).			
				Black slightly gravelly sandy SILT. Gravel is subangular to rounded fine to coarse flint, quartzite and clinker. Rare subrounded brick cobbles. (MADE GROUND)	1.60	35.75	
	2LB		2.50- 2.60	2.50 - 2.70m: Abundant black vitreous subangular fine to coarse slag.			
3.00m.				Black oily water strike. Trial pit completed at 3.00m.	3.00	34.35	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater encountered at 3.00m. Contaminated with black oil.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 2.50x0.7x3.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



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**TRIAL PIT LOG****STP03**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 25 June 2020

Easting 533203

Scale 1 : 25

End Date 25 June 2020

Northing 213119 Ground level

37.10mOD

Depth 3.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
	1B		0.20- 0.30	MADE GROUND comprising black TARMACADAM. (MADE GROUND) Red and brown subangular brick COBBLES with much silty fine to coarse sand matrix. (pulverised brick) Frequent roots (up to 3mm diam). (MADE GROUND)	0.10	37.00	
				Brown very sandy SILT. (MADE GROUND)	0.50	36.60	
				Black, brown, green and purple slightly gravelly very sandy SILT. Gravel is angular to rounded predominantly fine to coarse flint, quartzite and brick. (MADE GROUND)	0.70	36.40	
	1ES		1.10				
	2LB		1.20- 1.30	1.30 - 1.90m: Frequent bricks and concrete block fragments.			
				Black and brown silty very sandy angular to rounded fine to coarse GRAVEL of ash and clinker with rare flint, quartzite and brick. (MADE GROUND)	1.90	35.20	
2.60m.	3LB		2.50- 2.60	2.60m: Black oily water strike.			
				Trial pit completed at 3.00m.	3.00	34.10	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater encountered at 2.60m. Contaminated with black oil.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 2.50x1.00x3.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



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**TRIAL PIT LOG****STP04**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 25 June 2020

Easting 533185

Scale 1 : 25

End Date 25 June 2020

Northing 213118

Ground level

37.45mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry.	1B		0.30- 0.40	MADE GROUND comprising black TARMACADAM.	0.10	37.35	
				Red and brown subangular brick COBBLES with much silty fine to coarse sand matrix. (pulverised brick) Frequent roots (up to 3mm diam). (MADE GROUND)			
				0.40m: 360mm diam concrete boulder.			
	2D		0.70- 0.80	Stiff dark brown and black mottled becoming greenish brown slightly sandy gravelly silty CLAY. Gravel is subangular to rounded fine to coarse flint, quartzite and concrete. (MADE GROUND)	0.50	36.95	
				0.50m: Rag in trench wall.			
	1ES		0.70	Stiff greenish brown very gravelly silty CLAY. Gravel is subangular to rounded fine to coarse flint, quartzite, chalk and concrete. (MADE GROUND)	1.20	36.25	
	3LB		2.20- 2.30	Broken concrete paving slab (390mm diam) Trial pit completed at 2.50m.	2.50	34.95	
	2ES		2.30				

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical until 2.50m at which point walls became unstable.  
 Trial pit dimensions 2.50x0.70x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****STP05**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 23 June 2020

Easting 533164

Scale 1 : 25

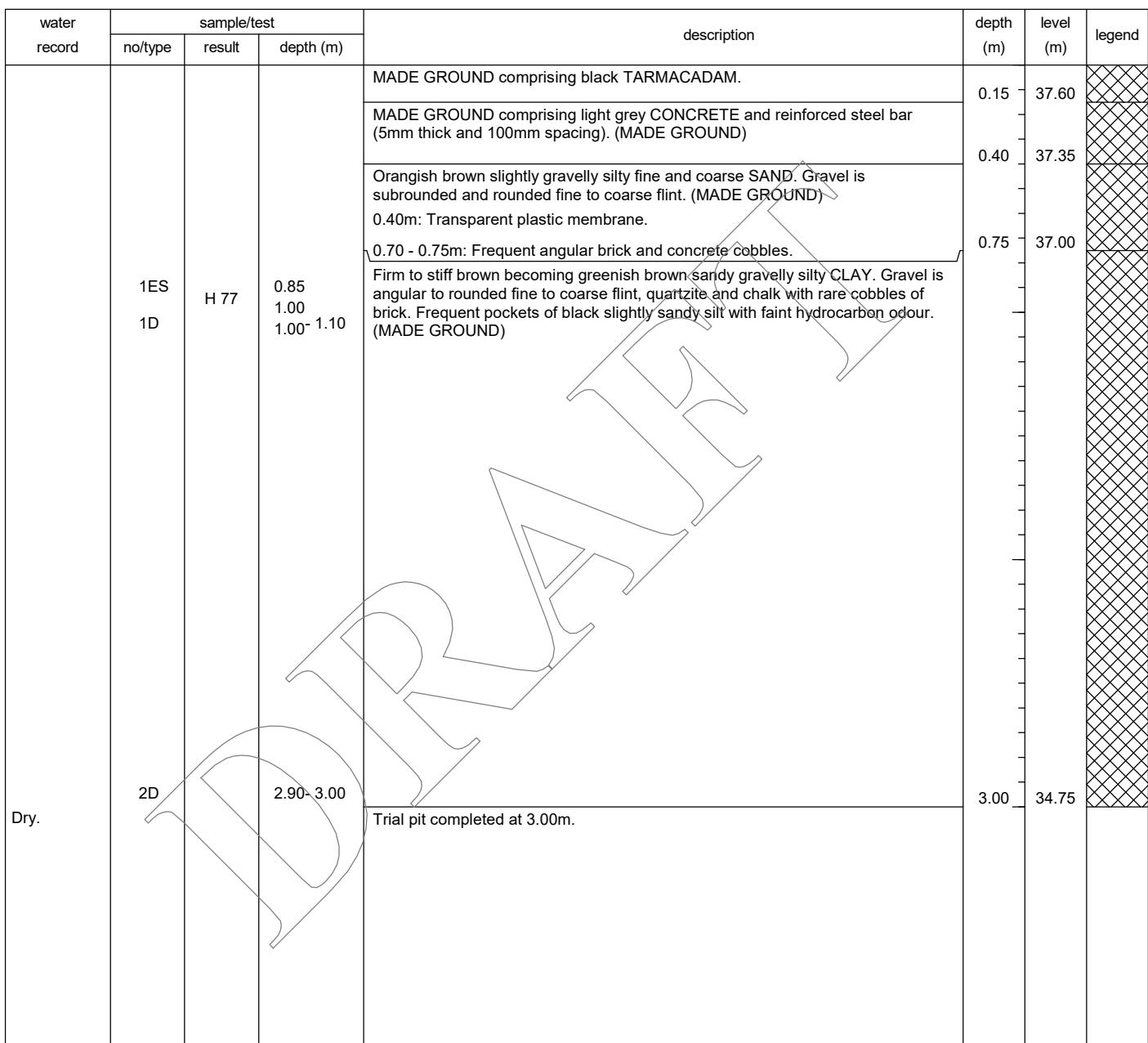
End Date 23 June 2020

Northing 213136

Ground level

37.75mOD

Depth 3.00 m



## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 2.50x1.00x3.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****STP06**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 24 June 2020

Easting 533163

Scale 1 : 25

End Date 24 June 2020

Northing 213097

Ground level

37.45mOD

Depth 3.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry.	1LB		0.20- 0.30	MADE GROUND comprising black TARMACADAM.	0.10	37.35	
				Orange and red silty fine to coarse SAND. (MADE GROUND)			
	2D		0.60- 0.70	0.30 - 0.40m: Frequent angular brick cobbles.	0.50	36.95	
				Yellowish white gravelly SILT. Gravel is subrounded and rounded fine and medium chalk and rare coarse subrounded flint. (MADE GROUND)			
	3D		1.40- 1.50	Firm dark brown gravelly slightly sandy slightly gravelly silty CLAY. Gravel is subangular to rounded fine and medium flint and chalk. (MADE GROUND)	0.75	36.70	
	H 41		2.20		2.00	35.45	
				Firm dark brown CLAY interbedded with black sandy silty CLAY with faint hydrocarbon odour and stained black. (MADE GROUND)			
	1ES		2.50	2.10m: Canvas sack.	2.50	34.45	
				2.30m: Cinder block.			
	4D		2.60- 2.70	2.80 - 3.00m: Strong hydrocarbon odour and oily sheen.	3.00	34.45	
				Trial pit completed at 3.00m.			

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 3.00x1.00x3.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.

CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG**

CLIENT ST WILLIAM LLP

**STP07**

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 24 June 2020

Easting 533195

Scale 1 : 25

End Date 24 June 2020

Northing 213101

Ground level

37.45mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
				MADE GROUND comprising black TARMACADAM. (MADE GROUND) Red and brown fine to coarse SAND with frequent subangular coarse brick fragments. Frequent rootlets (2mm diam). (MADE GROUND)	0.10 0.20	37.35 37.25	
	1LB		0.35- 0.45	Black slightly sandy slightly gravelly SILT. Gravel is subangular to rounded fine and coarse flint. Slight hydrocarbon odour. (MADE GROUND)			
		H 75	0.80 0.90- 1.00	Stiff dark brown gravelly CLAY. Gravel is subangular to rounded fine and medium flint and quartzite (MADE GROUND) 0.85m: Subrounded flint cobble (up to 450mm diam).		0.70 1.00	36.75 36.45
	2D						
	1ES		1.10	Black silty very sandy angular to rounded fine and medium flint, quartzite and clinker GRAVEL. (MADE GROUND)			
	3LB		1.20- 1.30				
Dry.	2ES		2.30- 2.50	2.30 - 2.50m: Possible ACM. Trial pit completed at 2.50m.		2.50	34.95

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical until 2.30m at which sides became unstable.  
 Trial pit dimensions 2.50x1.00x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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## **TRIAL PIT LOG**

CLIENT ST WILLIAM LLP

STP08

## SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 23 June 2020 Easting 533185

Scale 1 : 25

End Date 23 June 2020

Northing 213060

Ground level 37.10mOD

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
				Grass over dark brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint, quartzite, brick, clinker and chalk. Frequent rootlets. (MADE GROUND)			
	1LB		0.40- 0.50	0.70 - 0.90m: Frequent angular brick cobbles.			
	2LB		1.00- 1.10	Light brown becoming brown slightly gravelly sandy SILT. Gravel is angular to rounded fine to coarse flint and quartzite. (MADE GROUND) 1.10m: White porcelain fragment (140mm).			
2.6m: Heavy seepage.	2.5ES		1.00	Grey black and brown slightly sandy organic SILT with frequent angular cobbles of brick and concrete. Faint organic odour. (MADE GROUND)			
2.6m: Flow				2.60m: Dark brown and black water with oily sheen. No discernible odour.			
				Trial pit completed at 3.00m.			

## Notes

Sketch of Foundation - Not to scale. All dimensions in metres.

Trial pit excavated by JCB 3CX mechanical excavator.

Groundwater seepage encountered at 2.60m.

Trial pit sides remained stable and vertical.

Trial pit dimensions 3.80x0.70x3.00m.

On completion, the trial pit was backfilled with materials arising.

On completion, the trial pit was backfilled with material. Environmental sampling undertaken by the consultant.

**TRIAL PIT LOG****STP09**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 23 June 2020

Easting 533168

Scale 1 : 25

End Date 23 June 2020

Northing 213079

Ground level

37.35mOD

Depth 3.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry.	1LB	H 108	0.15- 0.25	Grass over dark brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint, quartzite and chalk. frequent roots and rootlets (up to 90mm diam). (MADE GROUND)	0.30	37.05	
	1ES		0.25	Firm light brown gravelly silty CLAY. Gravel is angular to rounded fine to coarse predominantly chalk with flint and quartzite. (MADE GROUND)	0.30	37.05	
	2D		0.50- 0.60		0.80	36.55	
	3D		0.90- 1.00	0.70 - 0.80m: Thin bed of chalky silt with several rounded flint cobbles. Stiff brown mottled white slightly gravelly CLAY. Gravel is subangular to rounded fine and medium predominantly chalk with flint and quartzite. (MADE GROUND)	0.90	36.55	
	4D		1.75- 1.85	Soft dark brown slightly gravelly sandy silty CLAY with pockets (up to 60mm) of black very sandy silt with faint hydrocarbon odour and black staining. Gravel is angular to rounded fine to coarse flint, quartzite and brick. (MADE GROUND) 1.75m: Broken glass jar.	1.60	35.75	
	2ES		1.80		2.80	34.55	
	5B		2.90- 3.00	Bluish black silty fine and medium organic SAND with rare pockets of green sand. Faint organic odour and oily sheen. Trial pit completed at 3.00m.	3.00	34.35	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 2.80x0.70x3.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****STP10**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 23 June 2020

Easting 533146

Scale 1 : 25

End Date 23 June 2020

Northing 213071

Ground level 37.55mOD

Depth 1.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry.	1LB		0.30- 0.40	Grass over dark brown sandy SILT with abundant rootlets (up to 5mm diam). (MADE GROUND)	0.20	37.35	
	1ES		0.70	Brown slightly sandy gravelly SILT. Gravel is angular to rounded fine to coarse flint, tarmacadam, concrete, clinker, tile and burnt coal. (MADE GROUND)  0.45m: Broken paving slab (510mm).  0.65m: Plastic engine oil bottle.  0.99m: Unidentified metal object. Trial pit completed at 1.00m.	1.00	36.55	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 3.00x0.70x1.00m.  
 Unidentified object unearthed at 1.00m. Pit terminated on instruction of the client.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP01**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 16 June 2020

Easting 533186

Scale 1 : 25

End Date 16 June 2020

Northing 213253

Ground level

38.80mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
	1ES		0.30	Vegetation over orangish brown gravelly silty fine and medium SAND. Gravel is subrounded and rounded flint. Rare rootlets (up to 60mm diam). (MADE GROUND) 0.20m: Rounded flint cobble (200mm diam).			
	1B		0.50- 0.60				
	2D		0.50- 0.60				
Dry.	3B		2.00- 2.10	Dark brown slightly silty very sandy sandy angular to rounded fine to coarse flint and quartzite GRAVEL.	1.80	37.00	
	4D		2.00- 2.10		2.50	36.30	
				Trial pit completed at 2.50m.			

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical to 1.80m with partial collapse of sidewalls 1.80-2.50m.  
 Trial pit dimensions 3.00x0.70x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.

CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP02**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 17 June 2020

Easting 533208

Scale 1 : 25

End Date 17 June 2020

Northing 213232

Ground level

38.75mOD

Depth 2.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry.	1D		0.00- 0.10	Wood chips over stiff dark grey dessicated slightly gravelly CLAY. Gravel is subangular to rounded fine and medium flint, quartzite and brick. Abundant rootlets (up to 10mm diam). (MADE GROUND)  Light brown becoming dark brown silty very sandy angular to rounded fine to coarse flint, quartzite, brick and concrete GRAVEL with low angular concrete cobbles. Rare rootlets. (MADE GROUND)  0.10m: rusted iron nail 100mm long.	0.10	38.65	
	2LB		0.70- 0.80				
	3LB		1.10- 1.20	Orangish brown slightly silty sandy subangular to rounded fine to coarse flint and quartzite GRAVEL.	0.90	37.85	
	1ES		1.20				

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 2.50x0.70x2.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP03**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 17 June 2020

Easting 533258

Scale 1 : 25

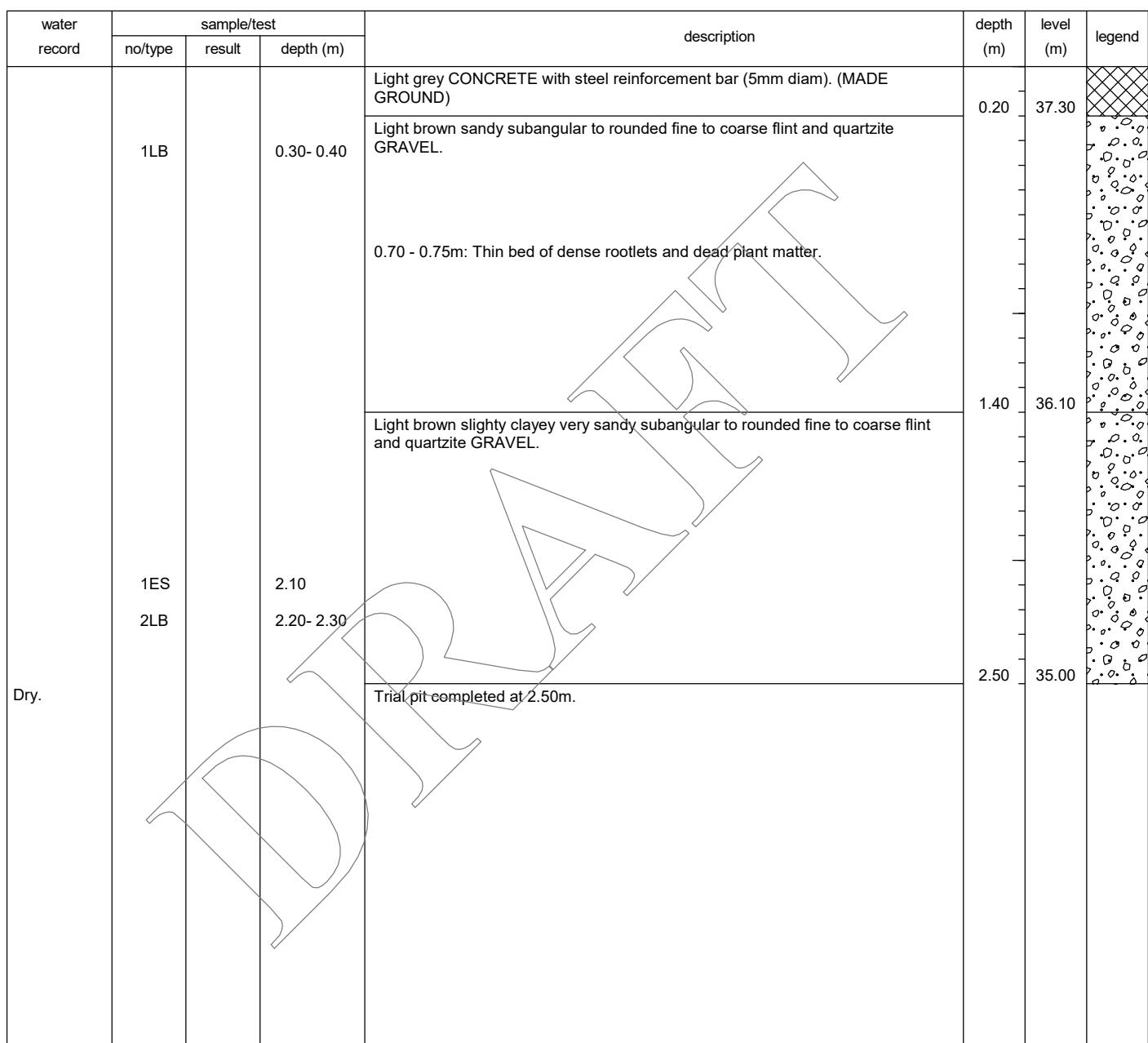
End Date 18 June 2020

Northing 213230

Ground level

37.50mOD

Depth 2.50 m



## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical until 2.30m with partial collapse of sidewalls 2.30-2.50m.  
 Trial pit dimensions 2.50x1.00x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP04**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 16 June 2020

Easting 533215

Scale 1 : 25

End Date 16 June 2020

Northing 213275

Ground level

39.10mOD

Depth 0.90 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry.	1LB		0.20- 0.30	Dark brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint, quartzite, brick, clinker, tile and concrete. Frequent whole or partial bricks. (MADE GROUND)			
	1ES		0.30	0.40m: rusted steel reinforcement bar (up to 300mm length)		0.45	38.65
	2LB		0.60- 0.70	Orangish brown silty gravelly fine and medium SAND. Gravel is angular to rounded fine to coarse flint and quartzite with frequent cobbles of brick and clinker (up to 150mm diam). (MADE GROUND)		0.90	38.20
Trial pit completed at 0.90m.							

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 3.00x0.70x0.90m.  
 On completion, the trial pit was backfilled with materials arising.  
 Practical refusal at 0.90m on concrete slab.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP05**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 16 June 2020

Easting 533239

Scale 1 : 25

End Date 16 June 2020

Northing 213278

Ground level

38.45mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry.				TARMACADAM. (MADE GROUND)	0.10	38.35	
	1D		0.20- 0.30	Dark brown and grey silty very sandy angular to rounded fine and medium flint, quartzite and clinker GRAVEL. Rare rootlets. (MADE GROUND)			
	2LB		0.20- 0.30	0.20m: concrete boulder (up to 500mm diam) 0.20 - 0.25m: Layer of cubic granite cobblestones; probably old road/path surface.	0.40	38.05	
	3D		0.50- 0.60	Soft brown slightly gravelly sandy silty CLAY. Gravel is angular to rounded fine and medium flint and quartzite.			
				Brown slightly silty sandy angular to rounded fine to coarse flint and quartzite GRAVEL.	0.70	37.75	
	1ES		1.30				
	4LB		1.30- 1.40				
	2ES		2.50	Trial pit completed at 2.50m.			
					2.50	35.95	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical until 1.80m with partial collapse of sidewalls 1.80-2.50m.  
 Trial pit dimensions 2.50x0.70x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP06**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 17 June 2020

Easting 533301

Scale 1 : 25

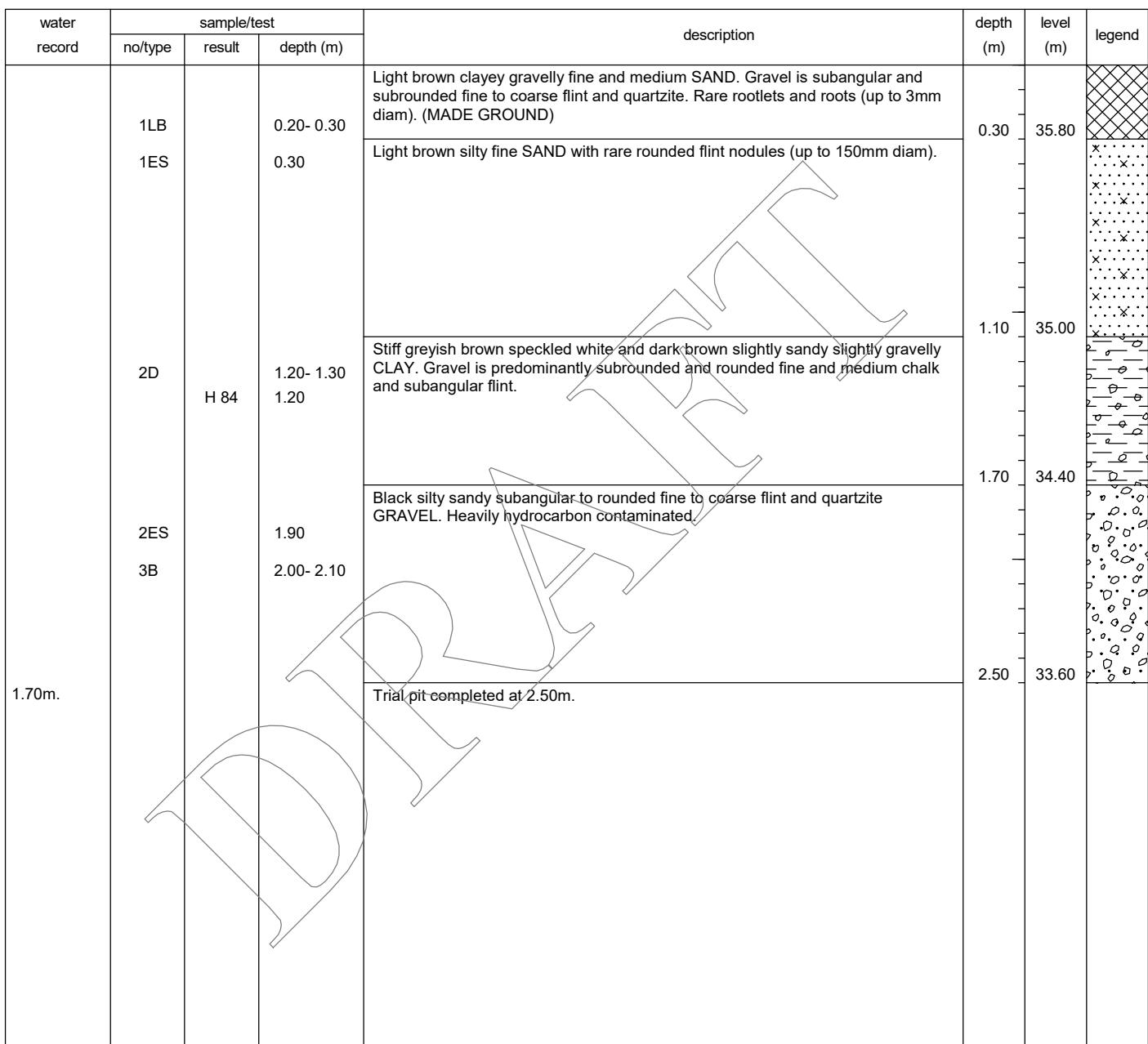
End Date 17 June 2020

Northing 213258

Ground level

36.10mOD

Depth 2.50 m



## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater encountered at 1.7m.  
 Trial pit sides remained stable and vertical until 2.00m with partial collapse of sidewalls 2.00-2.50m.  
 Trial pit dimensions 2.50x0.70x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



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**TRIAL PIT LOG****TP07**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 18 June 2020

Easting 533292

Scale 1 : 25

End Date 18 June 2020

Northing 213280

Ground level

35.95mOD

Depth 2.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
				Brown, black and light grey sandy gravelly SILT. Gravel is angular to rounded fine to coarse flint, quartzite, brick, clinker, ash and concrete. Frequent angular bricks. (MADE GROUND)			
	1LB		0.40- 0.50	0.30m: Rib bone 150mm length.			
	1ES		0.70	0.60m: Glass fragment 30mm diam.			
1.60m: Seepage	2B		1.80- 1.90	Brown and black silty very sandy angular to rounded fine and medium flint and quartzite GRAVEL. Rare rootlets.	1.70	34.25	
1.70m	2ES		1.80	1.70 - 1.95m: moderate hydrocarbon contamination.	2.00	33.95	
				Trial pit completed at 2.00m.			

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Seepage encountered at 1.60m  
 Trial pit sides remained stable and vertical until 1.80m with partial collapse of sidewalls 1.80-2.00m.  
 Trial pit dimensions 2.50x0.70x2.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP08**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 18 June 2020

Easting 533305

Scale 1 : 25

End Date 18 June 2020

Northing 213248

Ground level

35.95mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
1.40m: Seepage	1LB		0.50- 0.60	Yellowish brown slightly gravelly fine SAND with frequent pockets of silty sand (up to 160mm). Gravel is subangular and subrounded fine to coarse flint.		1.00	34.95
				Stiff greyish brown speckled white and dark brown slightly gravelly CLAY. Gravel is predominantly subrounded and rounded fine and medium chalk and subangular flint.			
	2D		1.30- 1.40			2.00	33.95
	3LB		2.10- 2.20	Black silty sandy subangular to rounded flint and quartzite GRAVEL. Heavy hydrocarbon contamination.		2.50	33.45
1.40m	2ES		2.40	Trial pit completed at 2.50m.			

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater encountered at 2.0m rising to 1.40m over course of excavation.  
 Trial pit sides remained stable and vertical until 2.00m with partial collapse of sidewalls 2.00-2.50m.  
 Trial pit dimensions 2.50x0.70x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP09**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 16 June 2020

Easting 533291

Scale 1 : 25

End Date 16 June 2020

Northing 213326

Ground level

36.30mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
	1D	H Re	0.10- 0.20	Purplish brown slightly sandy silty subangular to subrounded fine and medium granite GRAVEL. (MADE GROUND)	0.10	36.20	
	2LB		0.15	Very stiff dark greenish grey CLAY with frequent white powdery crystals (up to 1mm diam) and rare gastropod and belemnite fossils. (MADE GROUND)	0.25	36.05	
			0.30- 0.40	0.20m: bivalve fossil 40mm diam.			
				Light brown silty very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse flint with rare brick fragments. (MADE GROUND)			
				Light greenish brown silty very gravelly gravelly fine and medium SAND. Gravel is subangular to rounded fine to coarse flint, clinker and brick. (MADE GROUND)	0.70	35.60	
				0.70m: Tile fragment 150mm diam.			
	3LB		1.60- 1.70	1.40 - 1.70m: slight hydrocarbon contamination.			
	1ES		1.80	1.70m: Frequent wood splinters (up to 200mm length).			
	4B		1.90- 2.00	Black slightly clayey sandy subangular to rounded fine to coarse flint GRAVEL. Heavily contaminated with hydrocarbon.			
				Trial pit completed at 2.50m.			
					2.50	33.80	
2.50m: Seepage. 2.50m: 2.30							

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Seepage encountered at 2.50m rising to 2.30m. Heavily contaminated with hydrocarbon.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 3.00x0.70x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

## Sketch of Foundation - Not to scale. All dimensions in metres.

**CONTRACT  
35880**

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**TRIAL PIT LOG****TP10**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 18 June 2020

Easting 533306

Scale 1 : 25

End Date 18 June 2020

Northing 213291

Ground level

35.90mOD

Depth 1.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry.	1LB		0.50- 0.60	Grass over dark brown sandy SILT with abundant rootlets (up to 5mm diam). (MADE GROUND)	0.10	35.80	
				Firm light brown and yellowish brown sandy gravelly silty CLAY with high angular brick cobble content. Gravel is angular to rounded fine to coarse flint, quartzite, brick, clinker and coal. (MADE GROUND)	0.50	35.40	
	1ES		0.90	Firm brown, black and light grey sandy gravelly clayey SILT with high angular brick cobble content. Gravel is angular to rounded fine to coarse flint quartzite, brick, clinker, ash and concrete. (MADE GROUND)	1.00	34.90	
				Trial pit completed at 1.00m.			

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 2.50x0.70x1.00m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by Client.

Sketch of Foundation - Not to scale. All dimensions in metres.

CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP11**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 19 June 2020

Easting 533367

Scale 1 : 25

End Date 19 June 2020

Northing 213278

Ground level

35.40mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
0.90m: Seepage	1D	H 72	0.15	Purplish brown very silty fine and medium angular to subrounded granite GRAVEL. (MADE GROUND)	0.05	35.35	
			0.20- 0.30	Stiff grey slightly gravelly CLAY. Gravel is subangular and subrounded fine and medium flint. Frequent roots (up to 20mm diam). (MADE GROUND)	0.30	35.10	
	2LB		0.60- 0.70	Soft light brown slightly gravelly sandy silty CLAY. Gravel is subrounded to rounded fine and medium chalk and flint. Rare black staining of sands with slight contamination.			
	1ES		0.80				
1.3m	3LB		1.30- 1.40	Light brown silty sandy subangular to rounded fine to coarse flint GRAVEL with low subangular flint cobble content.	1.30	34.10	
				Trial pit completed at 2.50m.	2.50	32.90	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater encountered at 0.90m.  
 Trial pit sides remained stable and vertical until 1.30m with persistent collapse thereafter.  
 Trial pit dimensions 2.50mx0.70mx2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

## Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG**

TP12

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 18 June 2020

Easting 533320

Scale 1 : 25

End Date 18 June 2020

Northing 213351

Ground level

36.05mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Seepage.	1D	H 51	0.20	Purplish brown silty slightly sandy subangular to subrounded fine and medium granite GRAVEL. (MADE GROUND)	0.10	35.95	
			0.20- 0.30	Stiff frequently fissured dark greenish grey CLAY. Fissures are stained light brown up to 5mm either sided. Abundant rootlets (up to 70mm). (MADE GROUND)	0.30	35.75	
	2LB		0.55- 0.65	Soft to firm brown becoming greyish brown slightly sandy slightly gravelly silty CLAY. Gravel is angular to rounded fine and medium flint, quartzite, brick and clinker. (MADE GROUND)	0.60	35.45	
	1ES		0.60	Brown silty very gravelly fine to coarse SAND. Gravel is angular to rounded fine and medium flint, quartzite, brick and clinker. (MADE GROUND)			
Damp	3LB		1.00- 1.10	0.60 - 1.70m: slight hydrocarbon contamination.			
				1.70 - 2.30m: Heavy hydrocarbon contamination.			
	4D		2.40- 2.50	Structureless CHALK. composed of light grey gravelly SILT. Gravel is subrounded and rounded predominantly fine to coarse white chalk. (probably CIRIA Grade Dm).	2.30	33.75	
				Trial pit completed at 2.50m.	2.50	33.55	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Seepage encountered at 0.30-0.40m.  
 Trial pit sides remained stable and vertical until 2.30m with partial collapse of sidewalls 2.30-2.50m.  
 Trial pit dimensions 2.50x0.70x2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

## Sketch of Foundation - Not to scale. All dimensions in metres.



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**TRIAL PIT LOG****TP13**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 19 June 2020

Easting 533329

Scale 1 : 25

End Date 19 June 2020

Northing 213318

Ground level

36.00mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
		H 72	0.30 0.30- 0.40	Brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine to coarse flint and quartzite with frequent roots (up to 70mm diam). (MADE GROUND)  Stiff dark grey CLAY with frequent roots (up to 30mm diam). (MADE GROUND)	0.10	35.90	
	1D			Light brown very silty very gravelly SAND. Gravel is subangular to rounded fine to coarse flint, brick, chalk and clinker. (MADE GROUND)	0.40	35.60	
	2LB		0.60- 0.70				
				1.20m: frayed nylon rope			
				1.60 - 1.80m: Moderate hydrocarbon contamination.			
	1ES		1.70	Structureless CHALK composed of light grey gravelly SILT. Gravel is subrounded and rounded predominantly fine to coarse white chalk with rare rounded coarse flint. (CIRIA Grade Dm)	1.80	34.20	
	3D		2.00- 2.10	Trial pit completed at 2.50m.	2.50	33.50	
Dry.							

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater not encountered.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 2.00x0.70mx2.50m.  
 Pit terminated at 2.50m due to hardness of ground.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



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**TRIAL PIT LOG**

TP14

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 19 June 2020

Easting 533339

Scale 1 : 25

End Date 19 June 2020

Northing 213300

Ground level

35.80mOD

Depth 2.50 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
				Grass over MADE GROUND comprising black TARMACADAM.	0.10	35.70	
	1ES		0.30	Black silty gravelly fine to coarse SAND. Gravel is subangular to predominantly rounded fine to coarse flint, clinker, brick and concrete. (MADE GROUND) 0.30 - 0.35m: Frequent Brick cobbles (up to 200mm diam).	0.40	35.40	
	1LB		0.40- 0.50	Dark brown slightly sandy slightly gravelly SILT. Gravel is subrounded and rounded fine chalk and rare subangular flint. (MADE GROUND)			
	2LB		1.00- 1.10	0.70m: Bone fragment (70mm).			
	3LB		1.30- 1.50				
	4D		1.60- 1.70	Highly organic black sandy clayey SILT. Frequent waste including, pottery, glass, newspapers, leaves. (MADE GROUND)	1.50	34.30	
				2.40m: White enamel jug.			
				Sandy subrounded and rounded fine to coarse GRAVEL. Unable to recover gravel due to presence of groundwater. Trial pit completed at 2.50m.	2.50	33.30	
2.50m.							

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater encountered at 2.50m.  
 Trial pit sides remained stable and vertical.  
 Trial pit dimensions 2.50mx0.70mx2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP16**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 17 June 2020

Easting 533360

Scale 1 : 25

End Date 17 June 2020

Northing 213367

Ground level

35.60mOD

Depth 1.70 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Seepage. 1.70m: Dry.	1LB		0.40- 0.50	MADE GROUND comprising light grey CONCRETE with reinforced steel bar.	0.20	35.40	
				Dark brown slightly sandy slightly gravelly SILT. Gravel is angular to rounded fine and medium flint and quartzite.			
	1ES		0.50		1.30	34.30	
				1.20 - 1.70m: slight hydrocarbon contamination.			
	2ES		1.20	Dark brown silty sandy GRAVEL. Gravel is angular to rounded fine to predominantly coarse flints and quartzite.			
	2LB		1.60- 1.70	Trial pit completed at 1.70m.	1.70	33.90	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Groundwater encountered at 1.3m.  
 Trial pit sides remained stable and vertical until 1.50m with partial collapse of sidewalls to 1.50-1.70m.  
 Trial pit dimensions 2.5x0.70x1.70m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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**TRIAL PIT LOG****TP17**

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SITE HERTFORD GASWORKS GROUND INVESTIGATION

Sheet 1 of 1

Start Date 19 June 2020

Easting 533370

Scale 1 : 25

End Date 19 June 2020

Northing 213338 Ground level 35.55mOD

Depth 2.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
				MADE GROUND comprising black TARMACADAM.	0.10	35.45	
				Black silty subrounded and rounded medium and coarse flint GRAVEL. (MADE GROUND)	0.30	35.25	
				Red, orange and brown brick and concrete COBBLES with much black and dark brown Sandy silt matrix. (MADE GROUND)	0.80	34.75	
0.80m: Seepage	1ES		0.90	Soft to firm black sandy slightly gravelly silty CLAY with abundant organic matter. Gravel is angular to rounded fine to coarse flint, brick, clinker and rare chalk. Rare gravel sized fragments of glass and pottery. Moderate sweet organic odour. (MADE GROUND) 1.05m: rusted shovel head.			
1.40m.	2ES		1.75				
	1B		1.80- 1.90	1.90m: thin rusted metal sheeting (up to 500m m diam). light grey CLAY. Unable to recover clay on account of sidewall collapse. Trial pit completed at 2.00m.	2.00	33.55	

## Notes

Trial pit excavated by JCB 3CX mechanical excavator.  
 Seepage encountered at 0.80m.  
 groundwater encountered at 1.90m.  
 Trial pit sides remained stable and vertical until 1.90m with persistant collapse thereafter.  
 Trial pit dimensions 2.70mx0.70mx2.50m.  
 On completion, the trial pit was backfilled with materials arising.  
 Environmental sampling undertaken by the Consultant.

## Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT <b>35880</b>	CHECKED
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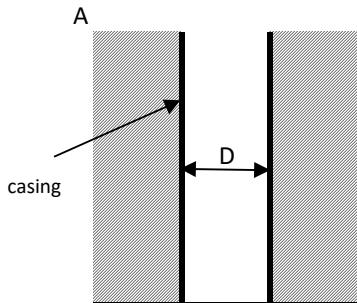
**IN-SITU VANE**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

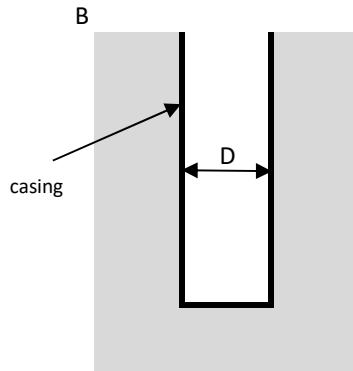
borehole /trial pit no.	depth (m)	vane peak (kPa)	average vane peak (kPa)	vane remoulded (kPa)	average vane remoulded (kPa)	remarks
STP01	1.50	78 57 84	73	29 26 34	30	
STP05	1.00	88 54 88	77	48 29 62	46	
STP06	2.20	35 47 41	41	19 33 26	26	
STP07	0.80	66 88 70	75	49 45 27	40	
STP09	0.90	105 118 101	108	43 68 52	54	
TP06	1.20	94 66 92	84	58 34 42	45	
TP09	0.15	150 >150 146		88 50 55	64	
TP11	0.15	68 68 80	72	40 32 34	35	
TP12	0.20	55 50 48	51	24 20 21	22	
TP13	0.30	80 63 72	72	22 28 39	30	
WS02	0.15	76	76	36	36	
WS02	0.25	86	86	46	46	
WS03	0.15	75	75	32	32	
WS03	0.25	82	82	33	33	
general remarks:						
Hand vane test results reported as undrained shear strength.						CONTRACT
*Average pocket penetrometer results reported as undrained shear strength.						<b>35880</b>
						CHECKED

# PERMEABILITY TEST - INTAKE FACTORS



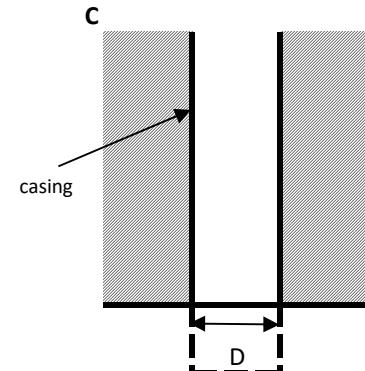
$$F=2D$$

Soil flush with bottom at impervious boundary



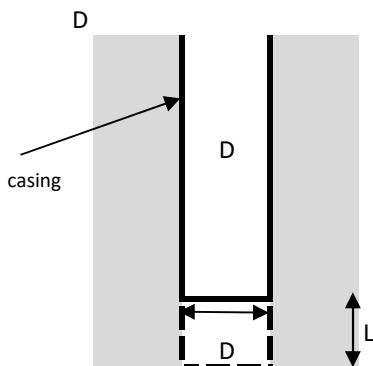
$$F=2.75D$$

Soil flush with bottom in uniform soil



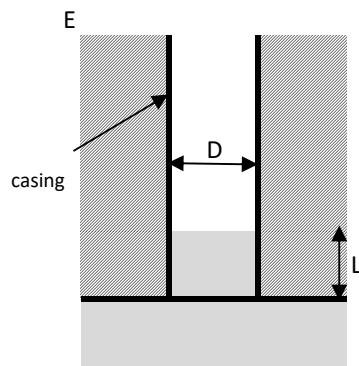
$$F = \frac{2\pi L}{\ln \left[ \frac{2L}{D} + \sqrt{1 + \left( \frac{(2L)^2}{D} \right)} \right]}$$

Well point or hole extended at impervious boundary



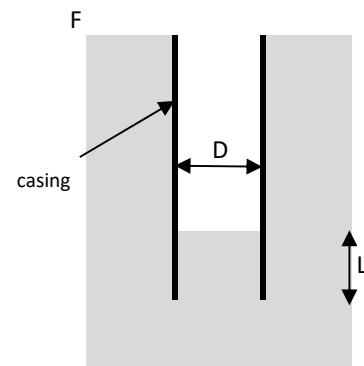
$$F = \frac{2\pi L}{\ln \left[ \frac{L}{D} + \sqrt{1 + (L/D)^2} \right]}$$

Well point or hole extended in uniform soil



$$F = \frac{2D}{1 + \left( \frac{8}{\pi} \left( \frac{L}{D} \right) \right)}$$

Soil in casing with bottom at impervious boundary



$$F = \frac{2.75D}{1 + \left( \frac{11}{\pi} \left( \frac{L}{D} \right) \right)}$$

Soil in casing with bottom in uniform soil

## REMARKS

Expressions come from Hvorlsev.

BS EN ISO 22282-2:2012 recommends the use of intake factors given above for the Hvorlsev method variable head test.

BS EN ISO 22282-2:2012 reports equation D as suitable for the Velocity method variable head test where  $1.2 < L/D < 10$ .

BS EN ISO 22282-2:2012 refers to a simpler version of Equation D for  $L/D > 10$ , however Equation D will still apply for  $L/D > 10$ .

Equation D may be used for tests using piezometer tips.

Cases A and B tend to measure the mean permeability of the soil; C and D the horizontal permeability; E and F the vertical permeability.

Where the horizontal permeability is much greater than the vertical, all tests tend to measure the former.

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION



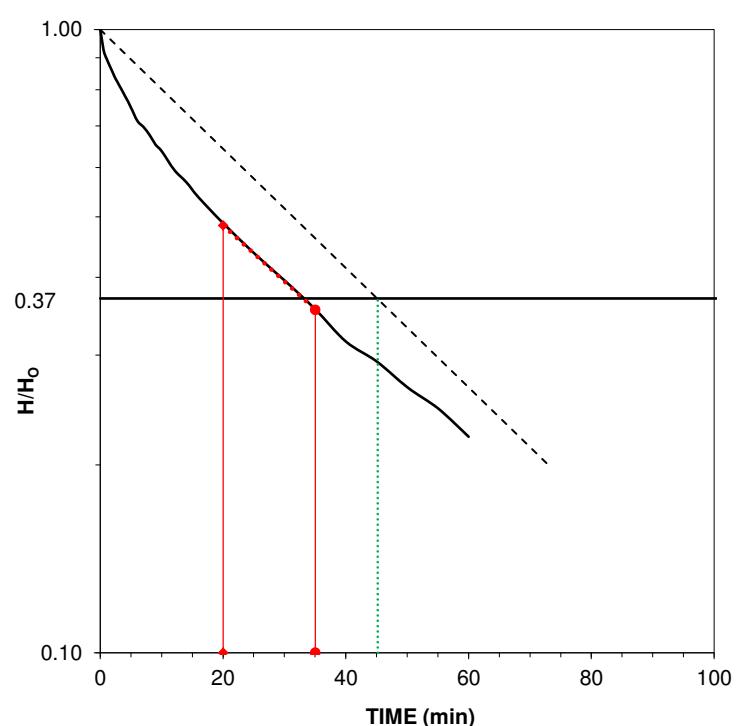
BOREHOLE

**BH03****DEPTH RECORD**

DEPTH OF BOREHOLE	12.70 m	BOREHOLE DIAMETER IN TEST SECTION	0.13 m
DEPTH TO BASE OF CASING	8.50 m	INTERNAL DIAMETER OF CASING	0.15 m
TEST INTERVAL	4.20 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	0.15 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	4.50 m	DATE	10/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.00	4.50	1.00
0.50	0.32	4.18	0.93
1.00	0.46	4.04	0.90
1.50	0.56	3.94	0.88
2.00	0.66	3.84	0.85
2.50	0.75	3.75	0.83
3.00	0.83	3.67	0.82
4.00	0.98	3.52	0.78
5.00	1.13	3.37	0.75
6.00	1.29	3.21	0.71
7.00	1.36	3.14	0.70
8.00	1.45	3.05	0.68
9.00	1.56	2.94	0.65
10.00	1.63	2.87	0.64
12.00	1.82	2.68	0.60
14.00	1.94	2.56	0.57
16.00	2.08	2.42	0.54
20.00	2.30	2.20	0.49
25.00	2.53	1.97	0.44
30.00	2.72	1.78	0.40
35.00	2.90	1.60	0.36
40.00	3.08	1.42	0.32
45.00	3.18	1.32	0.29
50.00	3.30	1.20	0.27
55.00	3.39	1.11	0.25
60.00	3.50	1.00	0.22



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\* D**RESULTS**

Hvorslev method	Velocity graph method
Cross sectional area of casing, A	<b>0.0177 m<sup>2</sup></b>
Intake factor*, D	<b>6.307 m</b>
Time lag, T	<b>2712 s</b>
Permeability, k	<b>1.0E-06 ms<sup>-1</sup></b>
Permeability, k	<b>9.7E-07 ms<sup>-1</sup></b>

**REMARKS**

Test Operator: IS

CONTRACT	CHECKED
<b>35880</b>	<b>CT</b>

**PERMEABILITY TEST - VARIABLE HEAD**

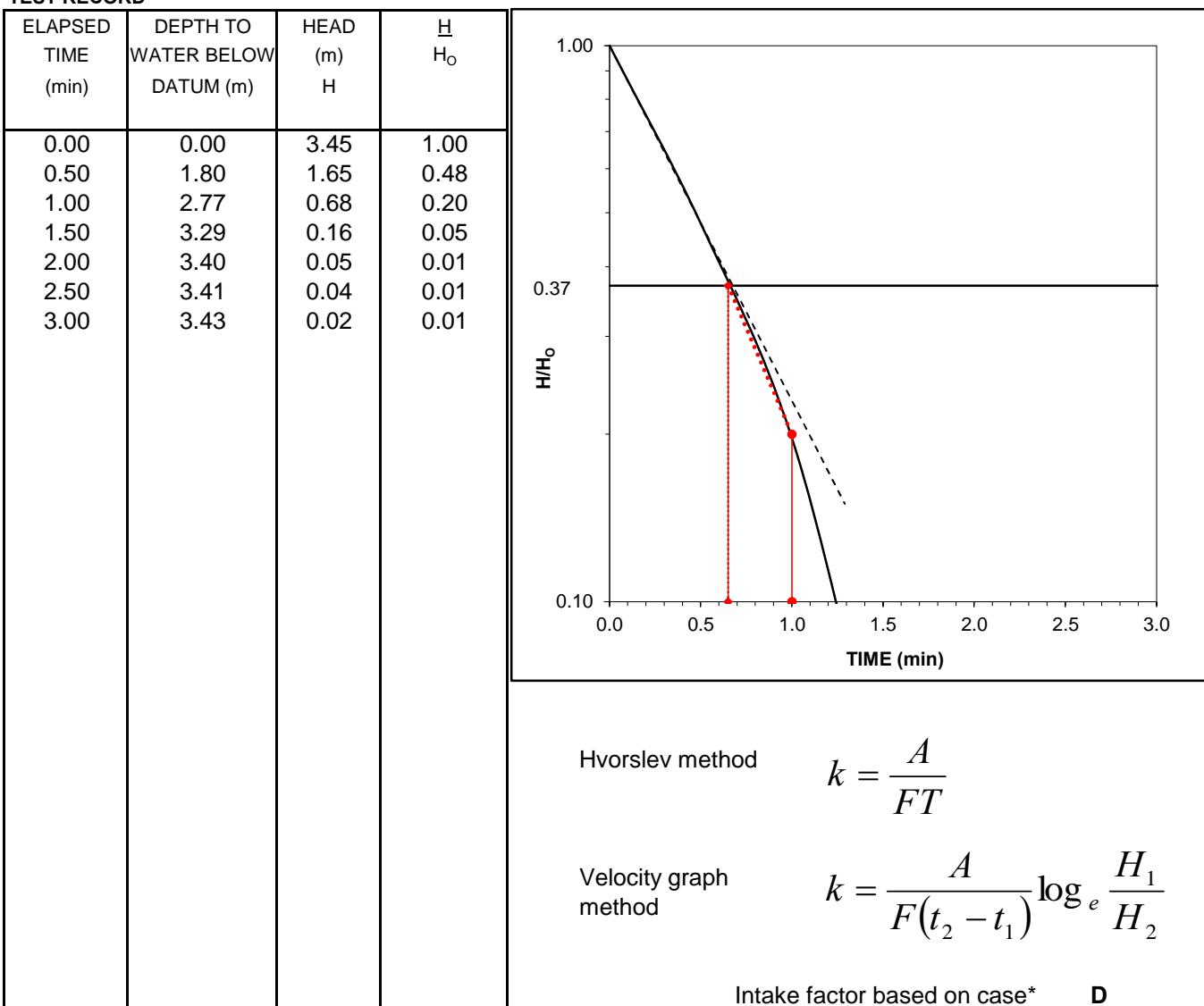
BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE SBH05  
TEST 1**DEPTH RECORD**

DEPTH OF BOREHOLE	5.20 m	BOREHOLE DIAMETER IN TEST SECTION	0.17 m
DEPTH TO BASE OF CASING	4.40 m	INTERNAL DIAMETER OF CASING	0.15 m
TEST INTERVAL	0.80 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	0.80 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	3.45 m	DATE	30/06/2020

**TEST RECORD****RESULTS**

Hvorslev method		Velocity graph method	
Cross sectional area of casing, A	<b>0.0181 m<sup>2</sup></b>	Cross sectional area of casing, A	<b>0.0181 m<sup>2</sup></b>
Intake factor*, D	<b>2.220 m</b>	Intake factor, F	<b>2.220 m</b>
Time lag, T	<b>39 s</b>	Variable head, H <sub>1</sub>	<b>1.28 m</b> at time, t <sub>1</sub>
Permeability, k	<b>2.1E-04 ms<sup>-1</sup></b>	Variable head, H <sub>2</sub>	<b>0.69 m</b> at time, t <sub>2</sub>
		Permeability, k	<b>2.4E-04 ms<sup>-1</sup></b>

**REMARKS**

Test Operator: IS

CONTRACT	CHECKED
<b>35880</b>	<b>CT</b>

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

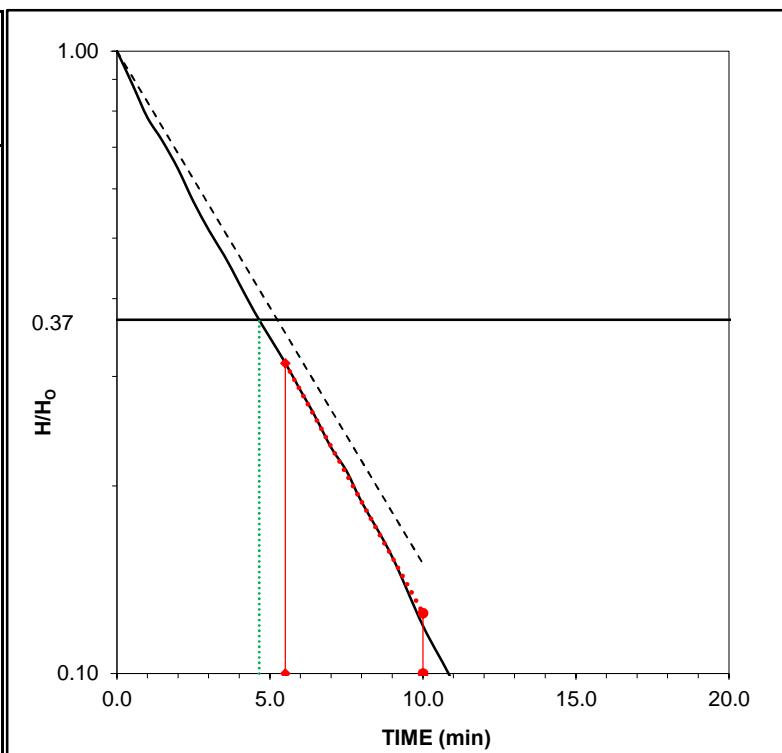
SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE SBH05  
TEST 2**DEPTH RECORD**

DEPTH OF BOREHOLE	9.70 m	BOREHOLE DIAMETER IN TEST SECTION	0.14 m
DEPTH TO BASE OF CASING	8.20 m	INTERNAL DIAMETER OF CASING	0.13 m
TEST INTERVAL	1.50 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	0.00 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	2.60 m**	DATE	30/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.00	2.60	1.00
0.50	0.30	2.30	0.88
1.00	0.57	2.03	0.78
1.50	0.74	1.86	0.72
2.00	0.92	1.68	0.65
2.50	1.11	1.49	0.57
3.00	1.26	1.34	0.52
3.50	1.38	1.22	0.47
4.00	1.50	1.10	0.42
4.50	1.61	0.99	0.38
5.00	1.70	0.90	0.35
5.50	1.78	0.82	0.32
6.00	1.86	0.74	0.28
6.50	1.93	0.67	0.26
7.00	2.00	0.60	0.23
7.50	2.05	0.55	0.21
8.00	2.11	0.49	0.19
9.00	2.20	0.40	0.15
10.00	2.29	0.31	0.12
11.00	2.35	0.25	0.10
12.00	2.41	0.19	0.07
14.00	2.48	0.12	0.05
16.00	2.56	0.04	0.02
18.00	2.60	0.00	0.00
20.00	2.64	0.04	0.02
23.00	2.68	0.08	0.03
26.00	2.70	0.10	0.04
30.00	2.72	0.12	0.05
35.00	2.75	0.15	0.06



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\* D**RESULTS**

Hvorslev method	Velocity graph method
Cross sectional area of casing, A	<b>0.0129 m<sup>2</sup></b>
Intake factor*, D	<b>3.094 m</b>
Time lag, T	<b>279 s</b>
Permeability, k	<b>1.5E-05 ms<sup>-1</sup></b>
Permeability, k	<b>1.4E-05 ms<sup>-1</sup></b>

**REMARKS**

Test Operator: IS

\*\*Standing water level of 2.60m determined from post installation monitoring.

CONTRACT	CHECKED
<b>35880</b>	<b>CT</b>

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

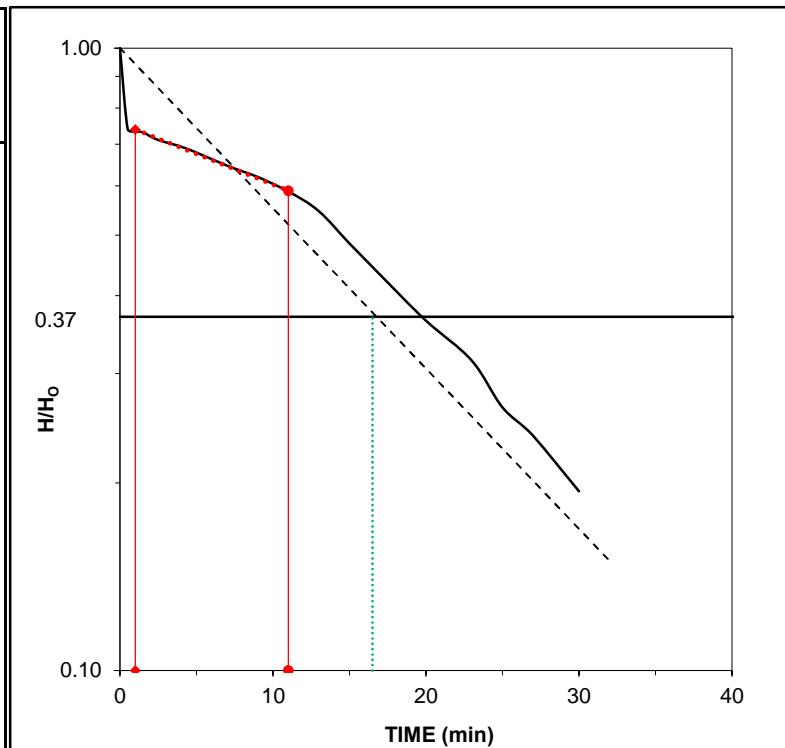
SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE **BH09**  
TEST 1**DEPTH RECORD**

DEPTH OF BOREHOLE	4.20 m	BOREHOLE DIAMETER IN TEST SECTION	0.13 m
DEPTH TO BASE OF CASING	2.50 m	INTERNAL DIAMETER OF CASING	0.17 m
TEST INTERVAL	1.70 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	0.90 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	3.40 m**	DATE	18/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.00	3.40	1.00
0.50	0.88	2.52	0.74
1.00	0.90	2.50	0.74
1.50	0.91	2.49	0.73
2.00	0.95	2.45	0.72
2.50	0.98	2.42	0.71
3.00	1.00	2.40	0.71
4.00	1.04	2.36	0.69
5.00	1.09	2.31	0.68
7.00	1.20	2.20	0.65
9.00	1.29	2.11	0.62
11.00	1.40	2.00	0.59
13.00	1.54	1.86	0.55
15.00	1.75	1.65	0.49
17.00	1.93	1.47	0.43
20.00	2.16	1.24	0.36
23.00	2.33	1.07	0.31
25.00	2.50	0.90	0.26
27.00	2.59	0.81	0.24
30.00	2.74	0.66	0.19



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\* D**RESULTS**

<b>Hvorslev method</b>		<b>Velocity graph method</b>	
Cross sectional area of casing, A	<b>0.0222 m<sup>2</sup></b>	Cross sectional area of casing, A	<b>0.0222 m<sup>2</sup></b>
Intake factor*, D	<b>3.256 m</b>	Intake factor*, F	<b>3.256 m</b>
Time lag, T	<b>990 s</b>	Variable head, H <sub>1</sub>	<b>2.52 m</b> at time, t <sub>1</sub>
Permeability, k	<b>6.9E-06 ms<sup>-1</sup></b>	Variable head, H <sub>2</sub>	<b>2.01 m</b> at time, t <sub>2</sub>
			<b>60 s</b>
			<b>660 s</b>
		Permeability, k	<b>2.6E-06 ms<sup>-1</sup></b>

**REMARKS**

\*\* Standing water level assumed to be at base of casing

Test Operator: IS

CONTRACT	CHECKED
<b>35880</b>	<b>JH</b>

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE

**BH09**

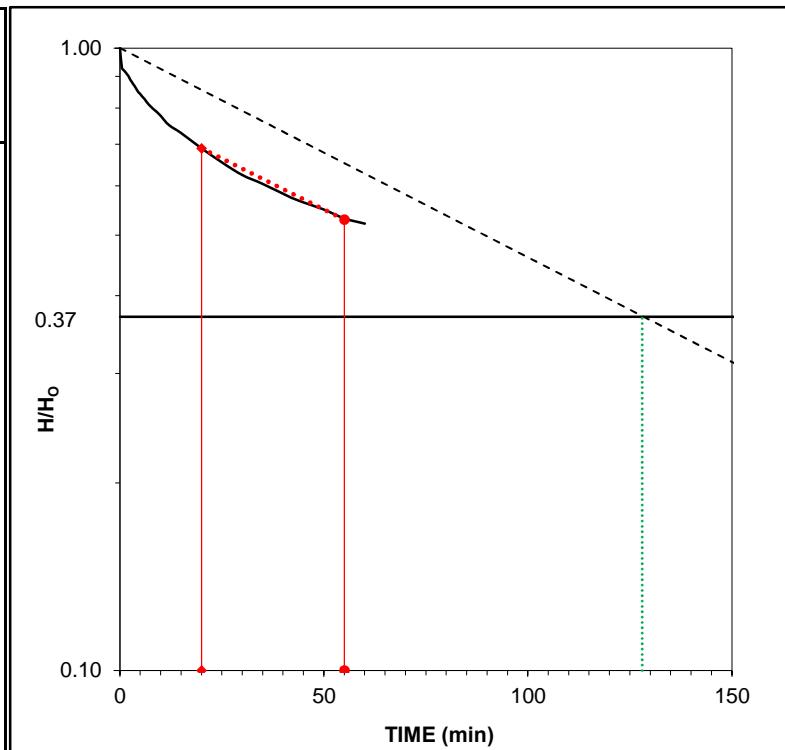
TEST 2

**DEPTH RECORD**

DEPTH OF BOREHOLE	9.70 m	BOREHOLE DIAMETER IN TEST SECTION	0.14 m
DEPTH TO BASE OF CASING	7.00 m	INTERNAL DIAMETER OF CASING	0.14 m
TEST INTERVAL	2.70 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	0.80 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	4.00 m**	DATE	18/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.00	4.00	1.00
0.50	0.28	3.72	0.93
1.00	0.32	3.68	0.92
1.50	0.35	3.65	0.91
2.00	0.39	3.61	0.90
2.50	0.44	3.56	0.89
3.00	0.48	3.52	0.88
3.50	0.52	3.48	0.87
4.00	0.56	3.44	0.86
4.50	0.60	3.40	0.85
5.00	0.63	3.37	0.84
6.00	0.69	3.31	0.83
7.00	0.75	3.25	0.81
8.00	0.80	3.20	0.80
9.00	0.84	3.16	0.79
10.00	0.89	3.11	0.78
12.00	0.99	3.01	0.75
15.00	1.08	2.92	0.73
20.00	1.24	2.76	0.69
25.00	1.38	2.62	0.66
30.00	1.50	2.50	0.63
35.00	1.58	2.42	0.61
42.00	1.70	2.30	0.58
45.00	1.74	2.26	0.57
50.00	1.80	2.20	0.55
55.00	1.87	2.13	0.53
60.00	1.91	2.09	0.52



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\*

D**RESULTS**

Hvorslev method	Velocity graph method
Cross sectional area of casing, A	<b>0.0154 m<sup>2</sup></b>
Intake factor*, D	<b>4.644 m</b>
Time lag, T	<b>7680 s</b>
Permeability, k	<b>4.3E-07 ms<sup>-1</sup></b>
Permeability, k	<b>4.2E-07 ms<sup>-1</sup></b>

**REMARKS**

Test Operator: IS

\*\*Standing water level of 3.20m bgl determined from post installation monitoring.

CONTRACT	CHECKED
<b>35880</b>	<b>JH</b>

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE

**BH10**

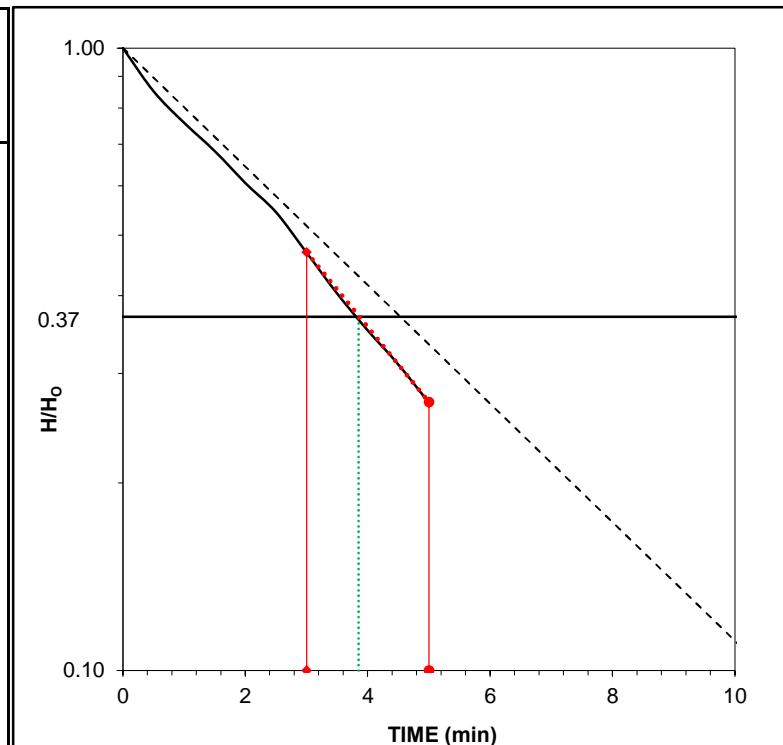
TEST 1

**DEPTH RECORD**

DEPTH OF BOREHOLE	3.20 m	BOREHOLE DIAMETER IN TEST SECTION	0.17 m
DEPTH TO BASE OF CASING	1.70 m	INTERNAL DIAMETER OF CASING	0.15 m
TEST INTERVAL	1.50 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	0.90 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	3.40 m	DATE	24/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.50	2.90	1.00
0.50	0.93	2.47	0.85
1.00	1.20	2.20	0.76
1.50	1.42	1.98	0.68
2.00	1.64	1.76	0.61
2.50	1.82	1.58	0.54
3.00	2.04	1.36	0.47
3.50	2.23	1.17	0.40
4.00	2.38	1.02	0.35
4.50	2.50	0.90	0.31
5.00	2.62	0.78	0.27



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\* D**RESULTS**

Hvorslev method	Velocity graph method
Cross sectional area of casing, A	<b>0.0181 m<sup>2</sup></b>
Intake factor*, D	<b>3.266 m</b>
Time lag, T	<b>231 s</b>
Permeability, k	<b>2.4E-05 ms<sup>-1</sup></b>
Permeability, k	<b>2.6E-05 ms<sup>-1</sup></b>

**REMARKS**

Test section not fully saturated. Treat permeability values with caution.

Test Operator: IS

CONTRACT	CHECKED
<b>35880</b>	<b>CT</b>

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

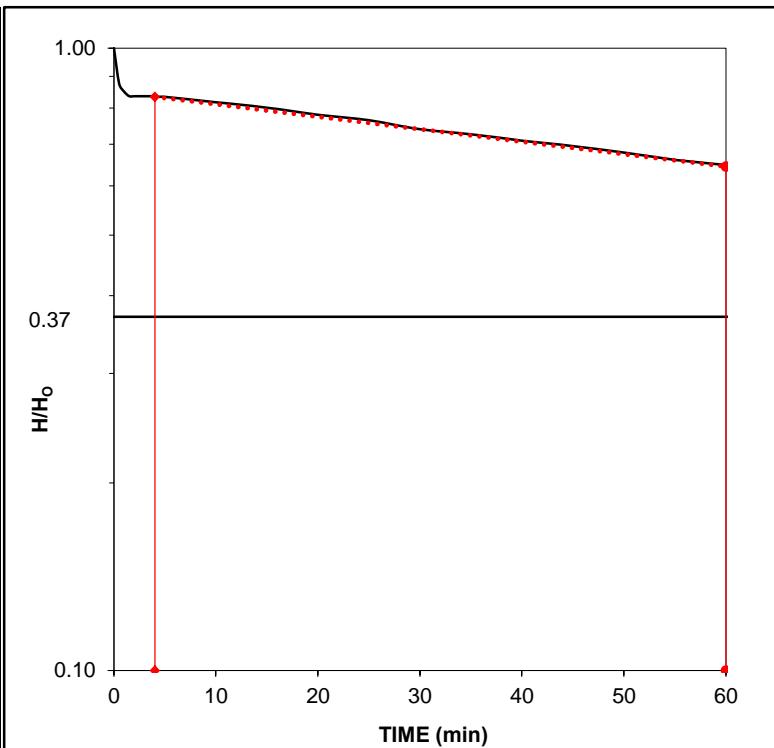
SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE **BH10**  
TEST 2**DEPTH RECORD**

DEPTH OF BOREHOLE	6.20 m	BOREHOLE DIAMETER IN TEST SECTION	0.14 m
DEPTH TO BASE OF CASING	5.20 m	INTERNAL DIAMETER OF CASING	0.13 m
TEST INTERVAL	1.00 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	0.90 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	4.90 m	DATE	25/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.00	4.90	1.00
0.50	0.60	4.30	0.88
1.00	0.73	4.17	0.85
1.50	0.80	4.10	0.84
2.00	0.80	4.10	0.84
2.50	0.80	4.10	0.84
3.00	0.80	4.10	0.84
3.50	0.80	4.10	0.84
4.00	0.80	4.10	0.84
4.50	0.81	4.09	0.83
5.00	0.81	4.09	0.83
10.00	0.89	4.01	0.82
15.00	0.97	3.93	0.80
20.00	1.07	3.83	0.78
25.00	1.15	3.75	0.77
30.00	1.27	3.63	0.74
35.00	1.34	3.56	0.73
40.00	1.42	3.48	0.71
45.00	1.49	3.41	0.70
50.00	1.57	3.33	0.68
55.00	1.66	3.24	0.66
60.00	1.72	3.18	0.65



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\* D**RESULTS**

Hvorslev method		Velocity graph method	
Cross sectional area of casing, A	<b>0.0127 m<sup>2</sup></b>	Cross sectional area of casing, A	<b>0.0127 m<sup>2</sup></b>
Intake factor*, D	<b>2.358 m</b>	Intake factor*, F	<b>2.358 m</b>
Time lag, T	s	Variable head, H <sub>1</sub>	<b>4.09 m</b> at time, t <sub>1</sub>
		Variable head, H <sub>2</sub>	<b>3.16 m</b> at time, t <sub>2</sub>
Permeability, k	<b>ms<sup>-1</sup></b>	Permeability, k	<b>4.1E-07 ms<sup>-1</sup></b>

**REMARKS**

Permeability calculated using velocity graph method only.

Test Operator: IS

CONTRACT	CHECKED
<b>35880</b>	<b>CT</b>

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE BH13

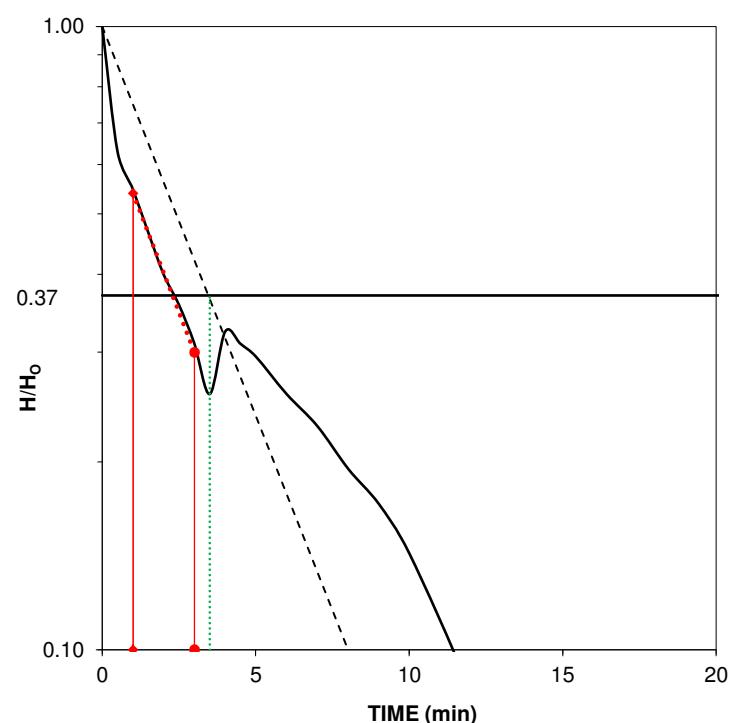
TEST 1 REAPPRAISED

**DEPTH RECORD**

DEPTH OF BOREHOLE	3.20 m	BOREHOLE DIAMETER IN TEST SECTION	0.13 m
DEPTH TO BASE OF CASING	2.20 m	INTERNAL DIAMETER OF CASING	0.15 m
TEST INTERVAL	1.00 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	1.00 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	2.10 m	DATE	18/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.00	2.10	1.00
0.50	0.78	1.32	0.63
1.00	0.95	1.15	0.55
1.50	1.12	0.98	0.47
2.00	1.26	0.84	0.40
2.50	1.35	0.75	0.36
3.00	1.45	0.65	0.31
3.50	1.56	0.54	0.26
4.00	1.42	0.68	0.32
4.50	1.45	0.65	0.31
5.00	1.48	0.62	0.30
6.00	1.56	0.54	0.26
7.00	1.62	0.48	0.23
8.00	1.69	0.41	0.20
9.00	1.74	0.36	0.17
10.00	1.80	0.30	0.14
12.00	1.92	0.18	0.09
14.00	2.00	0.10	0.05
15.00	2.04	0.06	0.03
16.00	2.06	0.04	0.02
17.00	2.08	0.02	0.01
18.00	2.09	0.01	0.00
19.00	2.09	0.01	0.00



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\* D**RESULTS****Hvorslev method**Cross sectional area of casing, A **0.0177 m<sup>2</sup>**Intake factor\*, D **2.282 m**Time lag, T **210 s**Permeability, k **3.7E-05 ms<sup>-1</sup>****Velocity graph method**Cross sectional area of casing, A **0.0177 m<sup>2</sup>**Intake factor\*, F **2.282 m**Variable head, H<sub>1</sub> **1.13 m** at time, t<sub>1</sub> **60 s**Variable head, H<sub>2</sub> **0.63 m** at time, t<sub>2</sub> **180 s**Permeability, k **3.8E-05 ms<sup>-1</sup>****REMARKS**

Due to anomalous rising in water level after 3.5 minutes the results have been analysed either side of the incident. Treat with caution.

Test Operator: IS

CONTRACT	CHECKED
<b>35880</b>	

\* See intake factors key sheet

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE

**BH13**

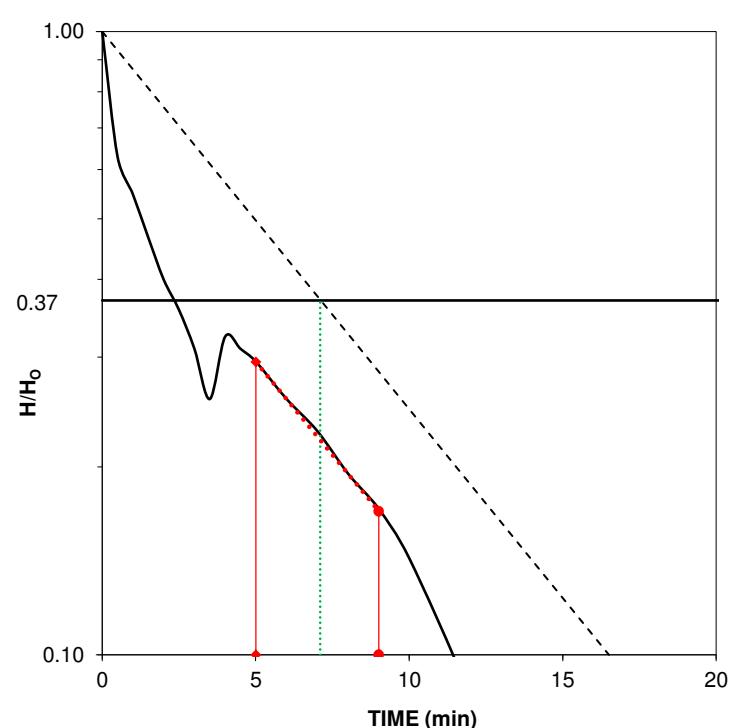
TEST 1

**DEPTH RECORD**

DEPTH OF BOREHOLE	3.20 m	BOREHOLE DIAMETER IN TEST SECTION	0.13 m
DEPTH TO BASE OF CASING	2.20 m	INTERNAL DIAMETER OF CASING	0.15 m
TEST INTERVAL	1.00 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	1.00 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	2.10 m	DATE	18/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.00	2.10	1.00
0.50	0.78	1.32	0.63
1.00	0.95	1.15	0.55
1.50	1.12	0.98	0.47
2.00	1.26	0.84	0.40
2.50	1.35	0.75	0.36
3.00	1.45	0.65	0.31
3.50	1.56	0.54	0.26
4.00	1.42	0.68	0.32
4.50	1.45	0.65	0.31
5.00	1.48	0.62	0.30
6.00	1.56	0.54	0.26
7.00	1.62	0.48	0.23
8.00	1.69	0.41	0.20
9.00	1.74	0.36	0.17
10.00	1.80	0.30	0.14
12.00	1.92	0.18	0.09
14.00	2.00	0.10	0.05
15.00	2.04	0.06	0.03
16.00	2.06	0.04	0.02
17.00	2.08	0.02	0.01
18.00	2.09	0.01	0.00
19.00	2.09	0.01	0.00



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\* D**RESULTS****Hvorslev method**Cross sectional area of casing, A **0.0177 m<sup>2</sup>**Intake factor\*, D **2.282 m**Time lag, T **426 s**Permeability, k **1.8E-05 ms<sup>-1</sup>****Velocity graph method**Cross sectional area of casing, A **0.0177 m<sup>2</sup>**Intake factor\*, F **2.282 m**Variable head, H<sub>1</sub> **0.62 m** at time, t<sub>1</sub> **300 s**Variable head, H<sub>2</sub> **0.36 m** at time, t<sub>2</sub> **540 s**Permeability, k **1.8E-05 ms<sup>-1</sup>****REMARKS**

Due to anomalous rising in water level after 3.5 minutes the results have been analysed either side of the incident. Treat with caution.

See BH13 Test 1 Reappraised.

\* See intake factors key sheet

Test Operator: IS

CONTRACT	CHECKED
<b>35880</b>	<b>CT</b>

**PERMEABILITY TEST - VARIABLE HEAD**

BS EN ISO 22282-2:2012



CLIENT ST WILLIAM LLP

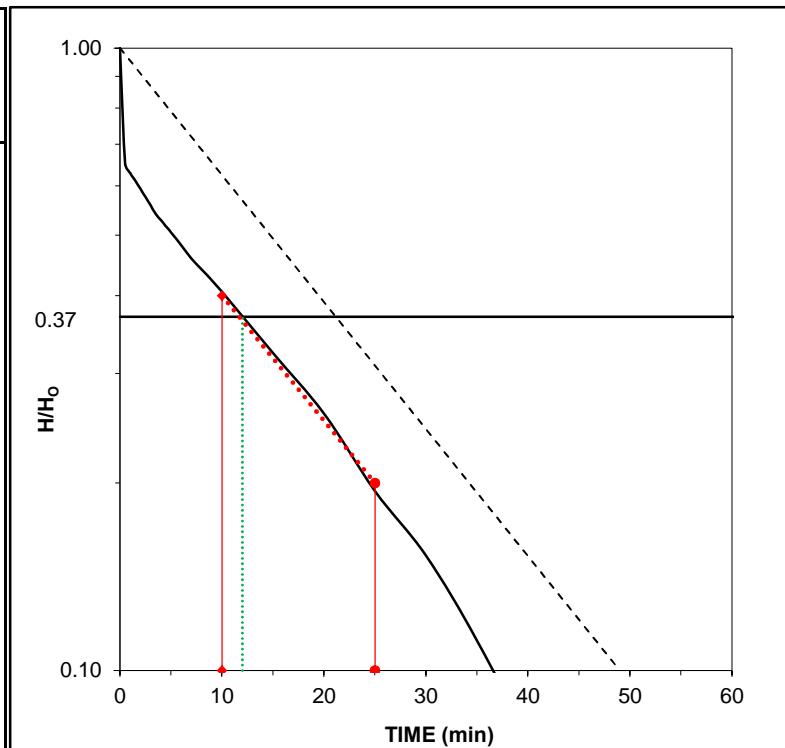
SITE HERTFORD GASWORKS GROUND INVESTIGATION

BOREHOLE TEST BH13  
2**DEPTH RECORD**

DEPTH OF BOREHOLE	8.00 m	BOREHOLE DIAMETER IN TEST SECTION	0.14 m
DEPTH TO BASE OF CASING	6.40 m	INTERNAL DIAMETER OF CASING	0.13 m
TEST INTERVAL	1.60 m		
HEIGHT OF DATUM ABOVE GROUND LEVEL	0.75 m	TYPE OF TEST	FALLING
DEPTH TO STANDING WATER BELOW DATUM	1.70 m	DATE	18/06/2020

**TEST RECORD**

ELAPSED TIME (min)	DEPTH TO WATER BELOW DATUM (m)	HEAD (m)	$\frac{H}{H_0}$
0.00	0.00	1.70	1.00
0.50	0.59	1.11	0.65
1.00	0.63	1.07	0.63
1.50	0.66	1.04	0.61
2.00	0.69	1.01	0.59
2.50	0.72	0.98	0.58
3.00	0.75	0.95	0.56
3.50	0.78	0.92	0.54
4.00	0.80	0.90	0.53
4.50	0.82	0.88	0.52
5.00	0.84	0.86	0.51
6.00	0.88	0.82	0.48
7.00	0.92	0.78	0.46
8.00	0.95	0.75	0.44
9.00	0.98	0.72	0.42
10.00	1.01	0.69	0.41
15.00	1.15	0.55	0.32
20.00	1.26	0.44	0.26
25.00	1.37	0.33	0.19
30.00	1.44	0.26	0.15
35.00	1.51	0.19	0.11
40.00	1.57	0.13	0.08
45.00	1.62	0.08	0.05
50.00	1.66	0.04	0.02
55.00	1.69	0.01	0.01
60.00	1.73	0.03	0.02



Hvorslev method

$$k = \frac{A}{FT}$$

Velocity graph method

$$k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

Intake factor based on case\* D**RESULTS**

Hvorslev method	Velocity graph method
Cross sectional area of casing, A	<b>0.0129 m<sup>2</sup></b>
Intake factor*, D	<b>3.211 m</b>
Time lag, T	<b>720 s</b>
Permeability, k	<b>5.6E-06 ms<sup>-1</sup></b>
Permeability, k	<b>3.1E-06 ms<sup>-1</sup></b>

**REMARKS**

Adjusted "rest water level" used as recorded standing water level too low.

75% recovery not achieved, treat with caution.

Test Operator: IS

CONTRACT	CHECKED
<b>35880</b>	<b>CT</b>



Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4180-1

Report Date: 15/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gassworks, off Marshgate Drive, Hertford, SG13 7JY

Test Details

Test Location: CBR01

Date of Test: 15/06/2020

Description: Sandy gravel with tarmac chippings

Reaction Load: 8 Tonne JCB

Material Class: Formation  
Layer: -500mm

Weather: Sunny

Plate Diameter (mm): 295

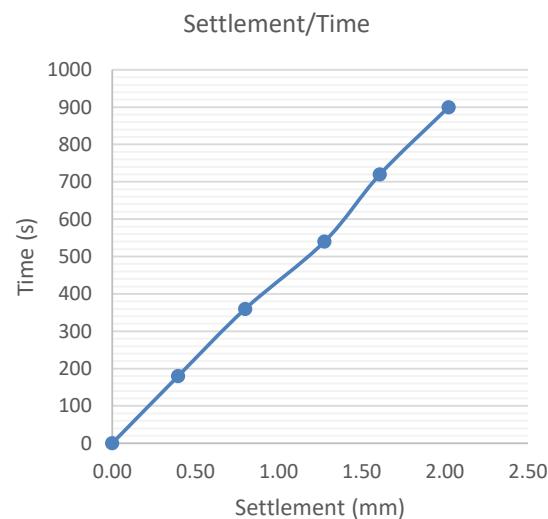
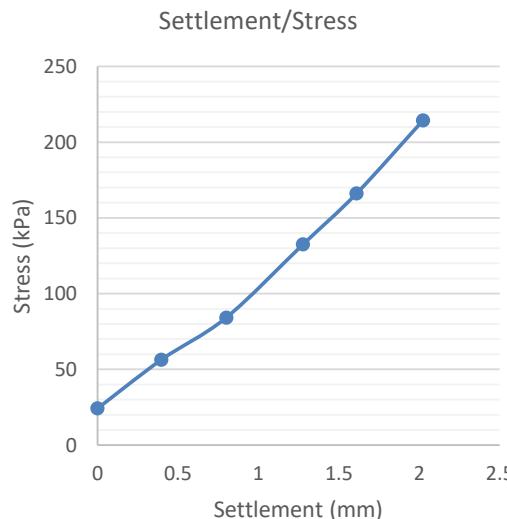
Condition: The results apply only to the location tested and the material was tested in an 'as found' condition

Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	24
180	0.40	56
360	0.80	84
540	1.28	132
720	1.61	166
900	2.02	214

Maximum Applied Stress (kPa):	214
Maximum Settlement (mm):	2.02
Equivalent CBR Value (%):	7
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	45

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)



For and on behalf of Hixtra Ltd



Kevin Shorthouse  
Authorised signatory





Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4180-2

Report Date: 15/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gassworks, off Marshgate Drive, Hertford, SG13 7JY

Test Details

Test Location: CBR02

Date of Test: 15/06/2020

Description: Sandy and gravel

Reaction Load: 8 Tonne JCB

Material Class: Formation  
Layer: -300mm

Weather: Sunny

Plate Diameter (mm): 295

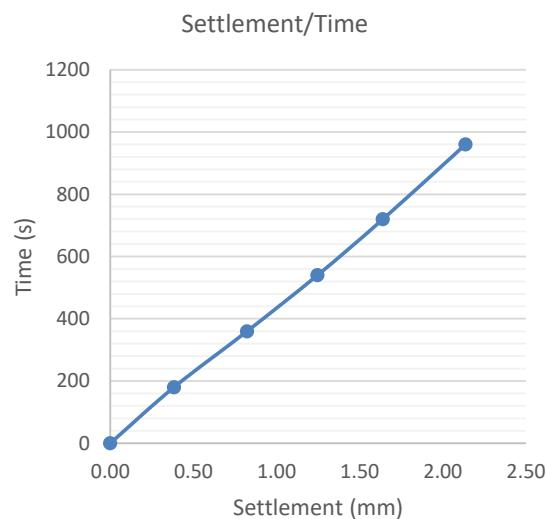
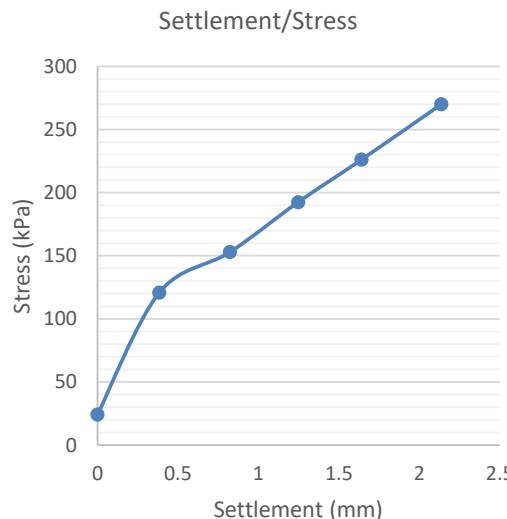
Condition: The results apply only to the location tested and the material was tested in an 'as found' condition

Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	24
180	0.38	121
360	0.82	153
540	1.25	192
720	1.64	226
960	2.14	270

Maximum Applied Stress (kPa):	270
Maximum Settlement (mm):	2.14
Equivalent CBR Value (%):	14
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	67

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)



For and on behalf of Hixtra Ltd

Kevin Shorthouse  
Authorised signatory





Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4180-3

Report Date: 15/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gassworks, off Marshgate Drive, Hertford, SG13 7JY

Test Details

Test Location: CBR03

Date of Test: 15/06/2020

Description: Sandy and gravel

Reaction Load: 8 Tonne JCB

Material Class: Formation

Weather: Sunny

Layer: -900mm

Plate Diameter (mm): 295

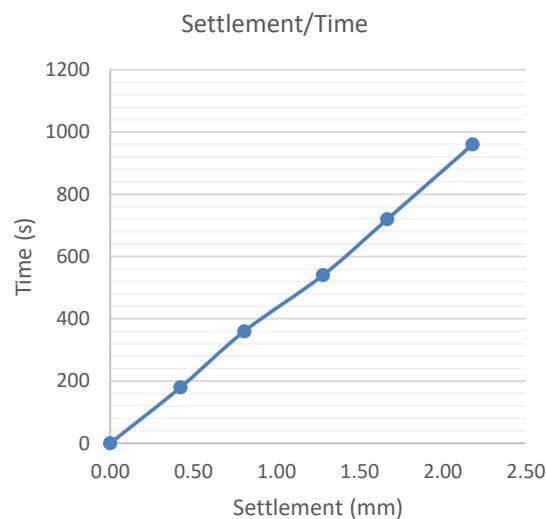
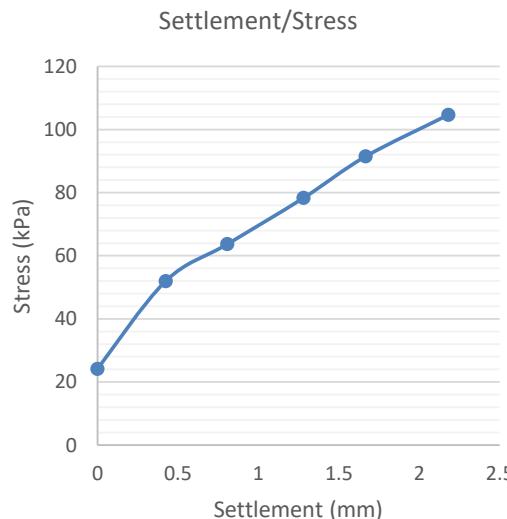
Condition: The results apply only to the location tested and the material was tested in an 'as found' condition

Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	24
180	0.42	52
360	0.81	64
540	1.28	78
720	1.67	91
960	2.18	105

Maximum Applied Stress (kPa):	105
Maximum Settlement (mm):	2.18
Equivalent CBR Value (%):	3
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	27

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)



For and on behalf of Hixtra Ltd

Kevin Shorthouse  
Authorised signatory





Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4180-4

Report Date: 15/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gassworks, off Marshgate Drive, Hertford, SG13 7JY

Test Details

Test Location: CBR04

Date of Test: 15/06/2020

Description: Sandy and gravel

Reaction Load: 8 Tonne JCB

Material Class: Formation  
Layer: -1M

Weather: Sunny

Plate Diameter (mm): 295

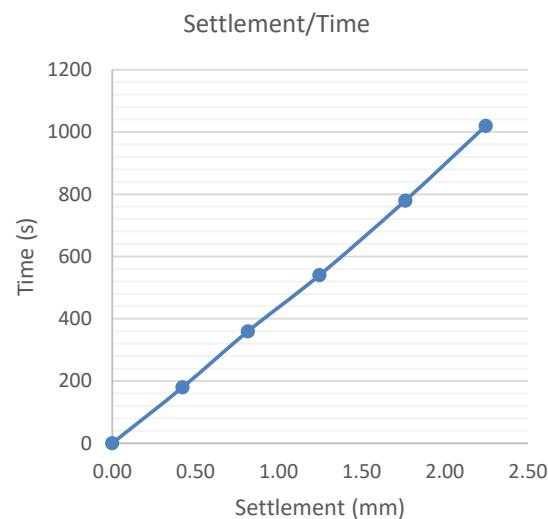
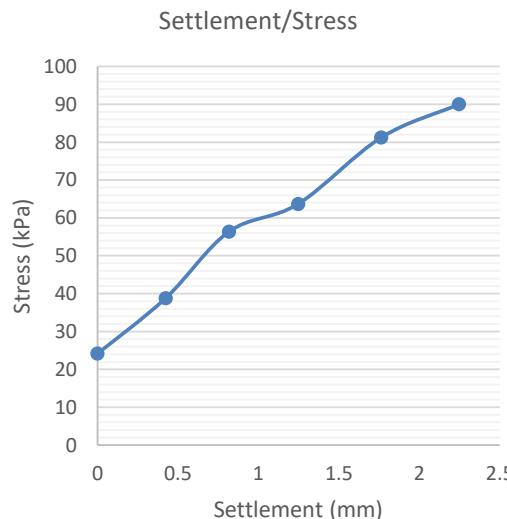
Condition: The results apply only to the location tested and the material was tested in an 'as found' condition

Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	24
180	0.42	39
360	0.82	56
540	1.25	64
780	1.76	81
1020	2.25	90

Maximum Applied Stress (kPa):	90
Maximum Settlement (mm):	2.25
Equivalent CBR Value (%):	2
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	22

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)



For and on behalf of Hixtra Ltd

Kevin Shorthouse  
Authorised signatory





Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4180-5

Report Date: 15/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gassworks, off Marshgate Drive, Hertford, SG13 7JY

Test Details

Test Location: CBR05

Date of Test: 15/06/2020

Description: Sandy and gravel

Reaction Load: 8 Tonne JCB

Material Class: Formation  
Layer: -200mm

Weather: Sunny

Plate Diameter (mm): 295

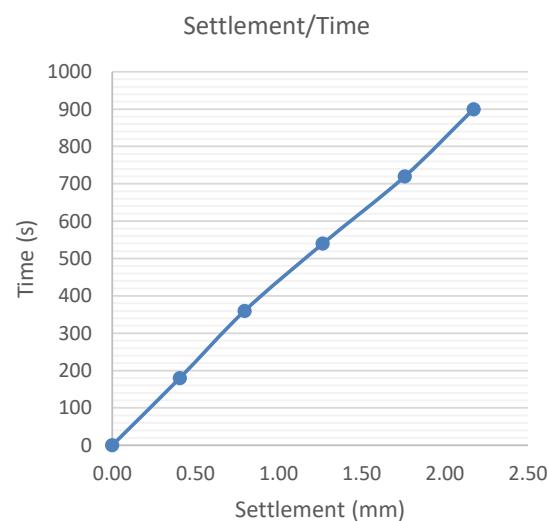
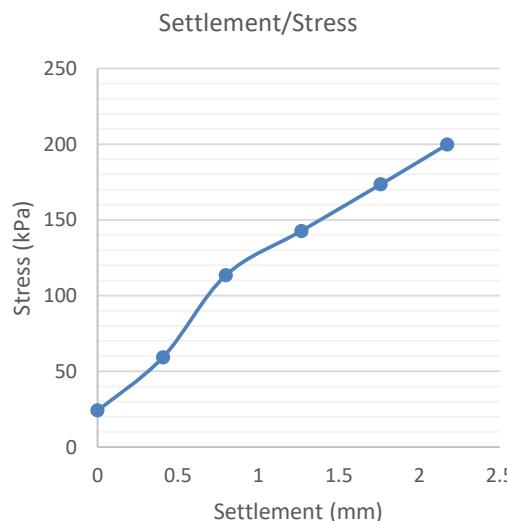
Condition: The results apply only to the location tested and the material was tested in an 'as found' condition

Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	24
180	0.41	59
360	0.80	113
540	1.27	143
720	1.76	173
900	2.17	200

Maximum Applied Stress (kPa):	200
Maximum Settlement (mm):	2.17
Equivalent CBR Value (%):	8
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	49

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)



For and on behalf of Hixtra Ltd

Kevin Shorthouse  
Authorised signatory





Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4180-6

Report Date: 15/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gassworks, off Marshgate Drive, Hertford, SG13 7JY

Test Details

Test Location: CBR06

Date of Test: 15/06/2020

Description: Type 1

Reaction Load: 8 Tonne JCB

Material Class: Formation

Weather: Sunny

Layer: -100mm

Plate Diameter (mm): 295

Condition: The results apply only to the location tested and the material was tested in an 'as found' condition

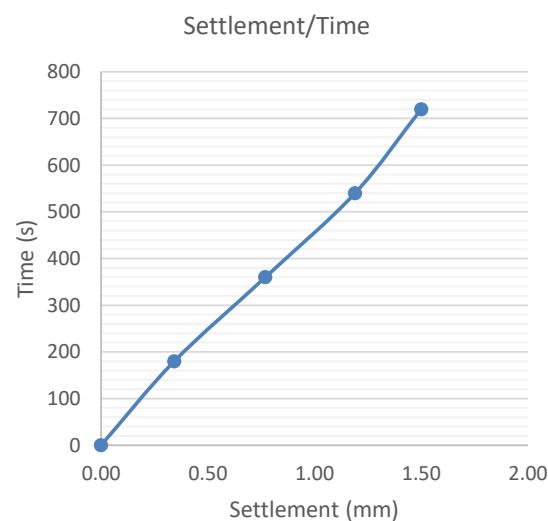
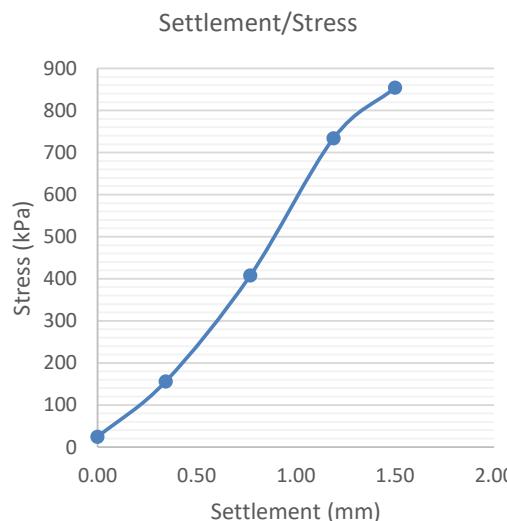
Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	24
180	0.34	156
360	0.77	407
540	1.19	734
720	1.50	854

Maximum Applied Stress (kPa):	854
Maximum Settlement (mm):	1.50
Equivalent CBR Value (%):	152
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	264

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009)  
Design Guidance for Road Pavement Foundations (Draft H25)

Note: Test stopped after the fourth load increment due to maximum load achieved using 8t for kentledge.



For and on behalf of Hixtra Ltd

Kevin Shorthouse  
Authorised signatory





Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4180-7

Report Date: 15/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gassworks, off Marshgate Drive, Hertford, SG13 7JY

Test Details

Test Location: CBR07

Date of Test: 15/06/2020

Description: Sand and gravel

Reaction Load: 8 Tonne JCB

Material Class: Formation  
Layer: -300mm

Weather: Sunny

Plate Diameter (mm): 295

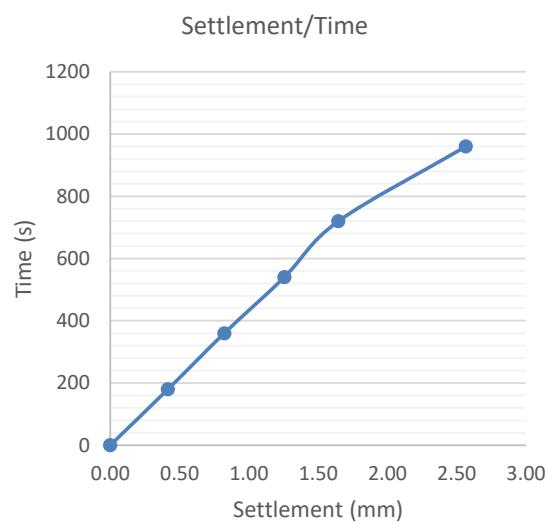
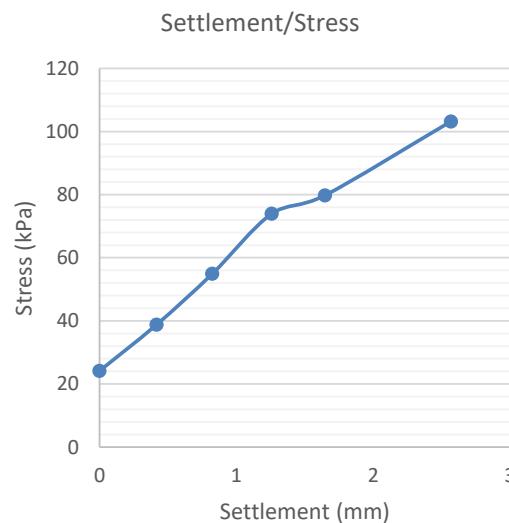
Condition: The results apply only to the location tested and the material was tested in an 'as found' condition

Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	24
180	0.42	39
360	0.82	55
540	1.26	74
720	1.65	80
960	2.57	103

Maximum Applied Stress (kPa):	103
Maximum Settlement (mm):	2.57
Equivalent CBR Value (%):	3
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	26

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)



For and on behalf of Hixtra Ltd

Kevin Shorthouse  
Authorised signatory





## Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4705-1

Report Date: 22/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gasworks, off Marshgate Drive, Hertford, SG13 7JY

### Test Details

Test Location: SCBR01

Date of Test: 22/06/2020

Description: Brown gravelly slightly sandy CLAY

Reaction Load: JCB 3CX

Material Class: Formation

Weather: Dry

Layer: 0.5 mbgl

Plate Diameter (mm): 300

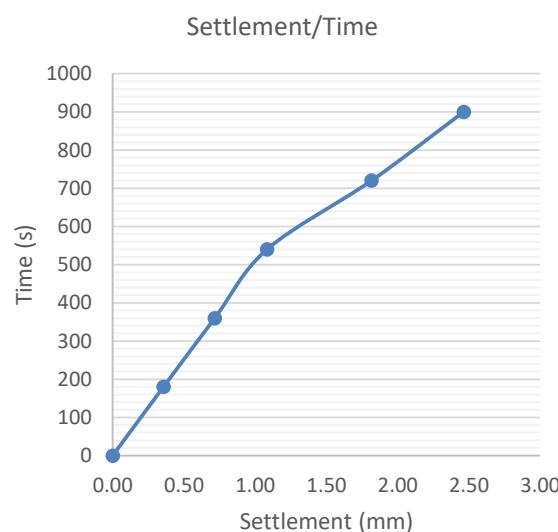
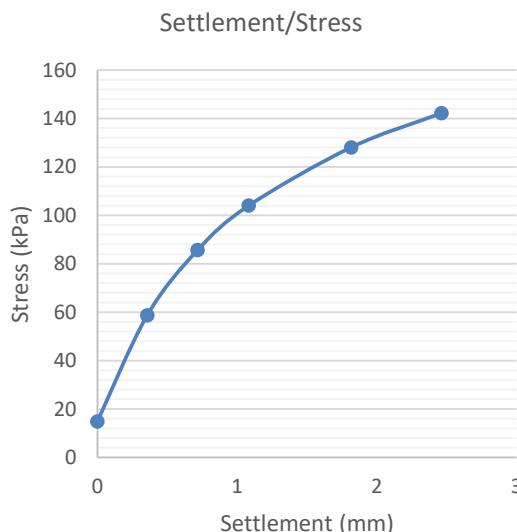
### Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	15
180	0.36	59
360	0.72	86
540	1.08	104
720	1.82	128
900	2.46	142

Maximum Applied Stress (kPa):	142
Maximum Settlement (mm):	2.46
Equivalent CBR Value (%):	5
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	39

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)

The results apply only to the location tested and the material was tested in an 'as found' condition



For and on behalf of Hixtra Ltd

Derek Griffin  
Authorised signatory



Issued subject to Hixtra Terms and Conditions available at [www.hixtra.com](http://www.hixtra.com)

HU-SOI-01B Issue 4



## Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4705-2

Report Date: 22/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gasworks, off Marshgate Drive, Hertford, SG13 7JY

### Test Details

Test Location: SCBR02

Date of Test: 22/06/2020

Description: Brown SAND / GRAVEL

Reaction Load: JCB 3CX

Material Class: Formation

Weather: Dry

Layer: 0.1 mbgl

Plate Diameter (mm): 300

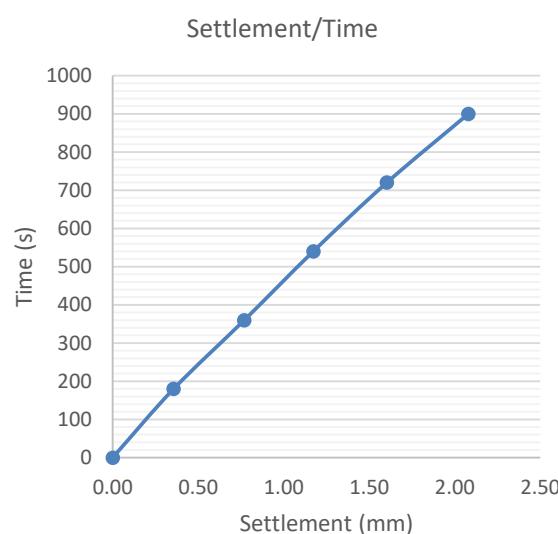
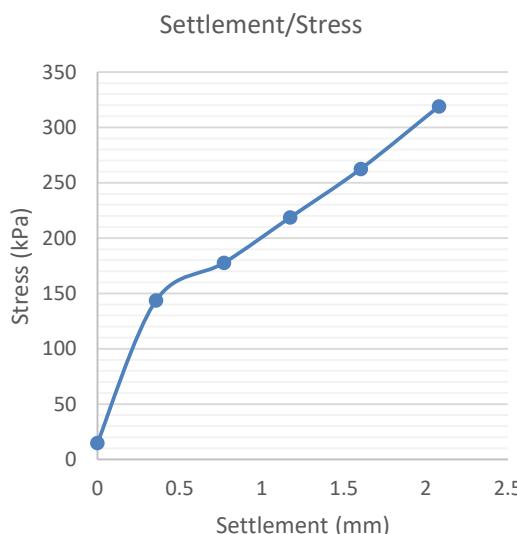
### Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	15
180	0.36	144
360	0.77	178
540	1.17	219
720	1.60	262
900	2.08	319

Maximum Applied Stress (kPa):	319
Maximum Settlement (mm):	2.08
Equivalent CBR Value (%):	19
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	80

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)

The results apply only to the location tested and the material was tested in an 'as found' condition



For and on behalf of Hixtra Ltd

Derek Griffin

Authorised signatory



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HU-SOI-01B Issue 4



## Certificate for the Determination of the Vertical Deformation and Strength Characteristics of Soil by the Incremental Plate Loading Test to BS 1377 Part 9: 1990

Report No: HS4705-3

Report Date: 22/06/2020

Client: Geotechnical Engineering Ltd,  
Address: Centurion House,  
Olympus Park, Quedgeley,  
Gloucester  
GL2 4NF

Site: Former Hertford Gasworks, off Marshgate Drive, Hertford, SG13 7JY

### Test Details

Test Location: SCBR03

Date of Test: 22/06/2020

Description: Brown slightly gravelly CLAY

Reaction Load: JCB 3CX

Material Class: Formation

Weather: Dry

Layer: 0.2 mbgl

Plate Diameter (mm): 300

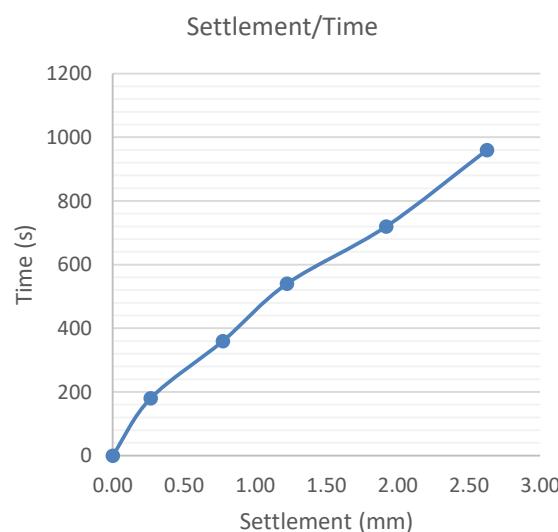
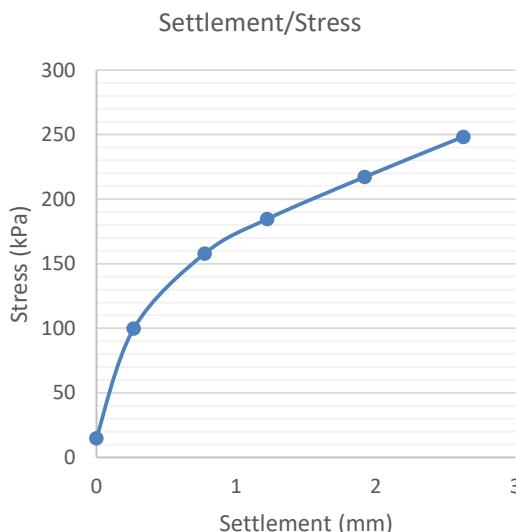
### Test Results

Time (s)	Settlement (mm)	Plate Stress (kPa)
0	0.00	15
180	0.27	100
360	0.77	158
540	1.22	185
720	1.92	217
960	2.63	248

Maximum Applied Stress (kPa):	248
Maximum Settlement (mm):	2.63
Equivalent CBR Value (%):	14
Modulus of Subgrade Reaction, $k_{762}$ (MN/m <sup>2</sup> /m):	66

Note: Supplemental test method and calculation of Equivalent CBR Value and Modulus of Subgrade Reaction: Interim Advice Note 73/06 (2009) Design Guidance for Road Pavement Foundations (Draft H25)

The results apply only to the location tested and the material was tested in an 'as found' condition



For and on behalf of Hixtra Ltd

Derek Griffin  
Authorised signatory



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HU-SOI-01B Issue 4



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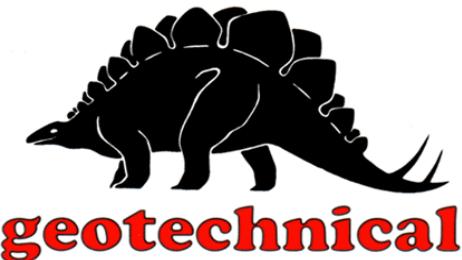
## **APPENDIX B**

### **LABORATORY TESTING**



2718

GEOTECHNICAL ENGINEERING LIMITED



For the attention of Jeremy Bowyer / Wayne Fitton

Version No. 2

Page No. 1 of 109

Date of Issue 11/09/2020

**TEST REPORT**

PROJECT/SITE	HERTFORD GASWORKS GROUND INVESTIGATION	Samples received	16/06/2020
GEL REPORT NUMBER	35880	Schedule received	16/06/2020
Your ref/PO:		Testing commenced	03/07/2020
Test report refers to	All schedules combined	Status	Incomplete

**SUMMARY OF RESULTS ATTACHED**

TEST METHOD & DESCRIPTION	QUANTITY	ACCREDITED TEST
BS EN ISO 17892-1: 2014:5. Water Content	53	YES
BS EN ISO 17892-1: 2014:5. Water Content (Subcontracted)	24	YES
BS1377: Part 2: 1990:4.2-4.4&5.2-5.4, Liquid & Plastic Limits	19	YES
BS1377: Part 2: 1990:4.5-4.6&5.2-5.4, Liquid (Casagrande Method) & Plastic Limits	3	NO
BS1377: Part 2: 1990:4.2-4.4&5.2-5.4, Liquid & Plastic Limits (Subcontracted)	9	YES
BS1377: Part 2: 1990:3.3, Saturation Moisture Content	6	YES
BS1377: Part 2: 1990:3.3, Saturation Moisture Content (Subcontracted)	9	YES
BS EN ISO 17892-2: 2014:5.2 Density - Immersion	1	YES
BS EN ISO 17892-2: 2014:5.2 Density - Immersion (Subcontracted)	6	YES
BS EN ISO 17892-4: 2016: 5.2, Particle Size Distribution - Wet Sieve	32	YES
BS EN ISO 17892-4: 2016: 5.2, Particle Size Distribution - Wet Sieve (Subcontracted)	8	YES
BS1377: Part 4: 1990:7, California Bearing Ratio (CBR)	5	YES
ISRM: 2007: Point Load Strength Test	5	YES
BRE SD1 Reduced Suite: pH, Sulphate - water and acid soluble, sulphur (Subcontracted)	17	YES
Loss On Ignition (Subcontracted)	4	YES

Remarks This report may not be partially reproduced without written permission from this laboratory.	Approved Signatories: <b>T Best (Deputy Laboratory Manager)</b> E Crimp (Senior Engineer) J Hanson (Director) N Parry (Director)
The results reported relate to samples received in the laboratory	

Doc TR01

Rev No. 22

Revision date 02/01/20

DC:JH

**Geotechnical Engineering Ltd**Centurion House  
Olympus Park, Quedgeley  
Gloucester GL2 4NFRegistered number: 00700739  
VAT Number: 682 5857 89[www.geoeng.co.uk](http://www.geoeng.co.uk)

geotech@geoeng.co.uk

TEL: 01452 527743

Fax: 01452 729314

Payments: Geotechnical Engineering Limited  
Sort code: 16-22-11 Bank account: 11125135

**LIQUID AND PLASTIC LIMITS**

BS.1377 : PART 2 : 1990 : 4 and 5



CLIENT ST WILLIAM LLP

**SITE HERTFORD GASWORKS GROUND INVESTIGATION**

borehole /trial pit no.	sample		specimen depth (m)	natural water content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
	no./type	depth (m)								
BH01	2B	0.50	0.50	8.6	BYE	79	51	NP		Dark brown silty very sandy GRAVEL with frequent rootlets
BH02	4B	1.00	1.00	12.1	E					Brown silty very gravelly SAND
BH02	7L	2.20	2.20	1	E					Brown slightly silty very sandy GRAVEL
BH02	13L	5.20	5.20	2.3	E					Brown sandy GRAVEL
BH02	19L	9.70	9.90	29	E					Off white slightly sandy slightly gravelly clayey SILT (chalk)
BH03	18D	6.70	6.70	13.3	BYE	55	24	17	7	Multicoloured slightly sandy gravelly clayey SILT (chalk)
BH03	20D	7.70	7.70	31.3	BYE	35	35	26	9	Off white slightly sandy slightly gravelly SILT (chalk)
BH05	4D	1.20	1.20	5	BZE	85	25	21	4	Brown silty sandy GRAVEL
BH07	2B	0.50	0.50	11	E					Dark brown silty very sandy GRAVEL with rare rootlets
BH10	3B	0.90	0.90	3.5	E					Orangish brown slightly clayey very gravelly SAND
BH10	9L	4.20	4.20	2.1	E					Yellowish brown silty sandy GRAVEL
BH10	13L	7.70	8.80	22.3	E					Off white slightly sandy GRAVEL (chalk)
BH12	4B	1.20	1.20	17.1	BYE	59	34	19	15	Dark brown mottled orangish brown slightly gravelly slightly sandy silty CLAY
BH15	5B	1.00	1.00	48.7	E					Dark brown silty very sandy GRAVEL with rare rootlets and rare wood fragments
BH17	7L	2.20	2.20	0.4	E					Light brown slightly clayey sandy GRAVEL
BH17	10L	4.20		2.4	E					
SBH02	8D	3.20	3.20	8.1	E					Brown very sandy GRAVEL
SBH03	8L	3.20	3.20	4.6	E					Brown slightly clayey very sandy GRAVEL
SBH05	9L	3.80	3.80	4.4	E					Orangish brown slightly clayey very sandy GRAVEL
general remarks										
natural water content determined in accordance with BS EN ISO 17892 - 1 : 2014 (unless specified)										
NP denotes non plastic										
# denotes sample tested is smaller than that which is recommended in accordance with BS1377 or BS EN ISO 17892										
specimen preparation				test method				CONTRACT		CHECKED
A - as received				X - cone penetrometer (test 4.3)				<b>35880</b>		<b>TB</b>
B - washed on 0.425mm sieve				Y - cone penetrometer (test 4.4)						
C - air dried				Z - casagrande apparatus (test 4.5)						

**LIQUID AND PLASTIC LIMITS**

BS.1377 : PART 2 : 1990 : 4 and 5



CLIENT ST WILLIAM LLP

**SITE HERTFORD GASWORKS GROUND INVESTIGATION**

borehole /trial pit no.	sample		specimen depth (m)	natural water content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
	no./type	depth (m)								
SBH06	7D	1.70	1.70	17.5	BXE	30	49	19	30	Brown slightly sandy slightly gravelly CLAY
SBH06	11L	3.20	3.20	1.5	E					Brown slightly clayey sandy GRAVEL
SBH06	14D	6.20	6.20	27	BYE	42	30	23	7	Off white slightly sandy gravelly SILT (chalk)
SBH07	5D	1.20	1.20	13.2	BXE	28	27	14	13	Off white mottled brown slightly sandy slightly gravelly clayey SILT (chalk)
SBH07	13L	4.20	4.20	0.7	E#					Brown slightly silty sandy GRAVEL
SBH08A	7D	2.20	2.20	17.5	BXE	52	31	16	15	Brown mottled dark brown slightly gravelly slightly sandy CLAY
SBH09	10L	3.20	3.20	6.6	E					Off white mottled brown silty sandy GRAVEL (chalk)
SBH10	5D	1.20	1.20	9	ZE	76	30	18	12	Dark brown clayey very sandy GRAVEL
SBH10	9L	3.20	3.20	1.7	E					Brown silty very sandy GRAVEL
STP01	2D	1.70	1.70	15.4	BXE	22	45	17	28	Orangish brown mottled grey slightly gravelly slightly sandy silty CLAY
STP04	2D	0.70	0.70	16.4	BXE	29	58	21	37	Light brown mottled dark brown slightly sandy slightly gravelly silty CLAY
STP05	1D	1.00	1.00	17.8	BXE	22	49	16	33	Brown slightly sandy slightly slightly gravelly silty CLAY
STP06	3D	1.40	1.40	14.6	BXE	35	45	19	26	Brown mottled grey slightly sandy slightly gravelly silty CLAY with rare rootlets and rare wood framments
STP07	3LB	1.20	1.20	12.9	E					Dark brown silty very sandy GRAVEL
STP09	2D	0.50	0.50	10.2	BXE	34	36	16	20	Brown slightly sandy slightly gravelly silty CLAY with rare rootlets
TP01	1B	0.50	0.50	8.6	E					Brown silty gravelly SAND
TP01	3B	2.00	2.00	3.1	E					Brown clayey very sandy GRAVEL
TP02	2LB	0.70	0.70	7.2	E					Dark brown silty very sandy GRAVEL with rare rootlets
TP02	3LB	1.10	1.10	6.1	E					Dark brown slightly silty sandy GRAVEL
general remarks										
natural water content determined in accordance with BS EN ISO 17892 - 1 : 2014 (unless specified)										
NP denotes non plastic										
# denotes sample tested is smaller than that which is recommended in accordance with BS1377 or BS EN ISO 17892										
specimen preparation				test method			CONTRACT		CHECKED	
A - as received				X - cone penetrometer (test 4.3)			<b>35880</b>		<b>TB</b>	
B - washed on 0.425mm sieve				Y - cone penetrometer (test 4.4)						
C - air dried				Z - casagrande apparatus (test 4.5)						

**LIQUID AND PLASTIC LIMITS**

BS.1377 : PART 2 : 1990 : 4 and 5



CLIENT ST WILLIAM LLP

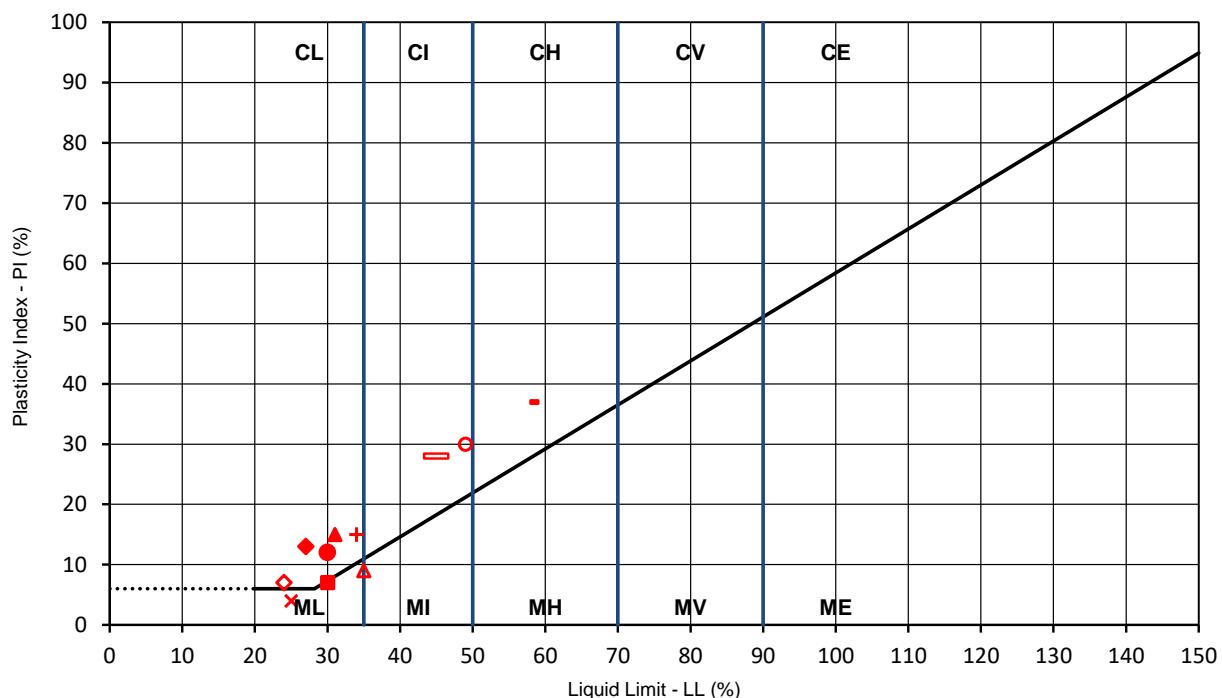
**SITE HERTFORD GASWORKS GROUND INVESTIGATION**

borehole /trial pit no.	sample		specimen depth (m)	natural water content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
	no./type	depth (m)								
TP03	2LB	2.20	2.20	5.7	E					Orangish brown slightly clayey very sandy GRAVEL
TP05	4LB	1.30	1.30	6.6	E					Dark orangish brown silty sandy GRAVEL
TP06	2D	1.20	1.20	23.3	BXE	10	55	19	36	Orangish brown slightly gravelly slightly sandy CLAY
TP07	2B	1.80	1.80	14.4	E					Black silty very sandy GRAVEL with rare rootlets
TP08	2D	1.30	1.30	20.1	BXE	9	50	17	33	Brown slightly gravelly slightly sandy CLAY
TP09	3LB	1.60	1.60	11.5	E					Orangish brown silty very gravelly SAND
TP11	2LB	0.60	0.60	11.6	BXE	33	29	14	15	Dark brown slightly gravelly sandy silty CLAY
TP11	3LB	1.30	1.30	7.2	E					Dark brown mottled black clayey sandy GRAVEL with medium cobble content and rare rootlets
TP12	3LB	1.00	1.00	10.3	BYE	42	27	NP		Brown silty very gravelly SAND
TP12	4D	2.40	2.40	16.4	BXE	34	22	16	6	Off whitish brown slightly gravelly slightly sandy clayey SILT (chalk)
TP13	2LB	0.60	0.60	10.8	E					Orangish brown very silty very gravelly SAND
TP14	2LB	1.00	1.00	23.9	E					Dark brown slightly sandy slightly gravelly clayey SILT
TP16	2LB	1.60	1.60	7.9	E					Dark brown slightly clayey sandy GRAVEL
WS01	2B	1.10	1.10	30.6	BXE	45	41	NP		Dark brown slightly sandy slightly gravelly SILT
WS04	2L	1.20	1.20	8	ZE	79	36	24	12	Dark brown clayey sandy GRAVEL
general remarks										
natural water content determined in accordance with BS EN ISO 17892 - 1 : 2014 (unless specified)										
NP denotes non plastic										
# denotes sample tested is smaller than that which is recommended in accordance with BS1377 or BS EN ISO 17892										
specimen preparation				test method			CONTRACT		CHECKED	
A - as received				X - cone penetrometer (test 4.3)			<b>35880</b>		<b>TB</b>	
B - washed on 0.425mm sieve				Y - cone penetrometer (test 4.4)						
C - air dried				Z - casagrande apparatus (test 4.5)						

**ATTERBERG LINE PLOT**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION



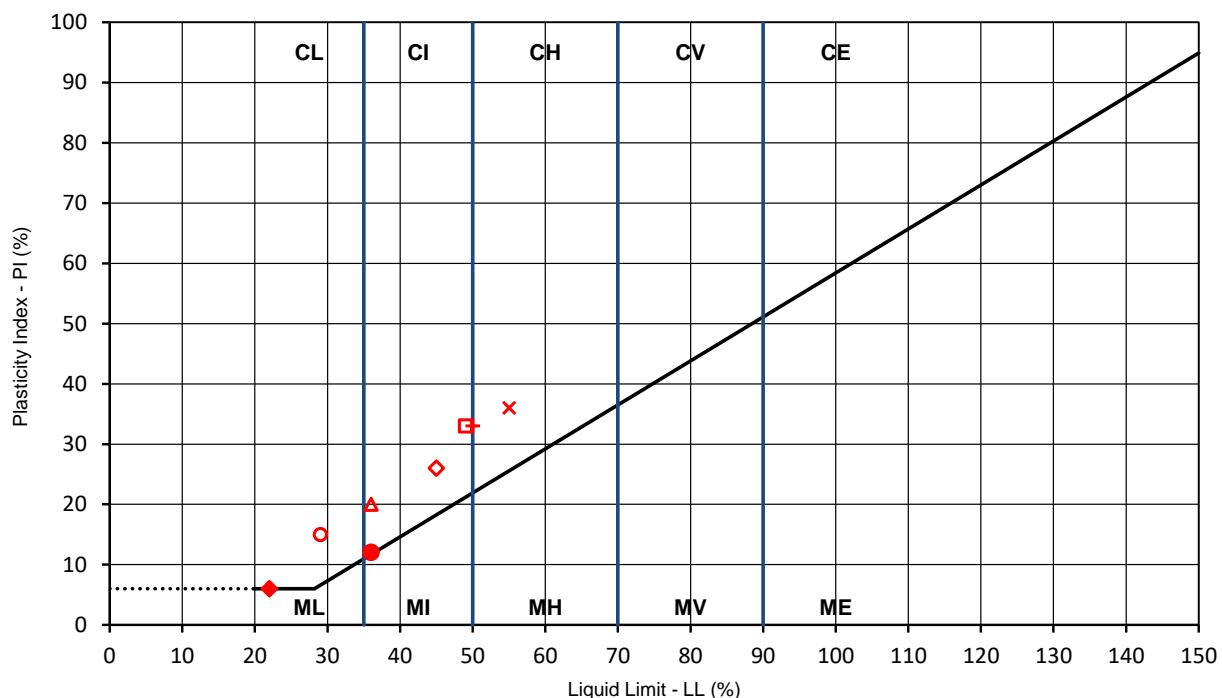
	BH/TP No.	depth (m)	LL	PL	PI	remarks
	BH01	0.50	51	NP		
◇	BH03	6.70	24	17	7	
△	BH03	7.70	35	26	9	
×	BH05	1.20	25	21	4	
+	BH12	1.20	34	19	15	
○	SBH06	1.70	49	19	30	
■	SBH06	6.20	30	23	7	
◆	SBH07	1.20	27	14	13	
▲	SBH08A	2.20	31	16	15	
●	SBH10	1.20	30	18	12	
□	STP01	1.70	45	17	28	
-	STP04	0.70	58	21	37	

CONTRACT 35880	CHECKED TB
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**ATTERBERG LINE PLOT**

CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION



BH/TP No.		depth (m)	LL	PL	PI	remarks
□	STP05	1.00	49	16	33	
◊	STP06	1.40	45	19	26	
△	STP09	0.50	36	16	20	
×	TP06	1.20	55	19	36	
+	TP08	1.30	50	17	33	
○	TP11	0.60	29	14	15	
	TP12	1.00	27	NP		
◆	TP12	2.40	22	16	6	
	WS01	1.10	41	NP		
●	WS04	1.20	36	24	12	

CONTRACT 35880	CHECKED TB
-------------------	---------------



4041

Client: Geotechnical Engineering Ltd

Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor

Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

# SUMMARY REPORT

## Summary of Classification Test Results

Tested in Accordance with:

Moisture Content by BS 1377-2: 1990: Clause 3.2; Water Content by BS EN  
17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test),  
Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB

Client Reference: 35880-WF

Job Number: 20-26183

Date Sampled: Not Given

Date Received: 21/08/2020

Date Tested: 29/08/2020

Sampled By: Not Given

### Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Moisture Content [W]	Water Content [W]	Atterberg				Density			Total Porosity/ #
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um	WL	Wp	Ip	bulk Mg/m³	dry Mg/m³	PD Mg/m³	
1600445	BH01	9	3.20	4.20	B	Brown slightly clayey sandy GRAVEL			14.4								
1600446	BH02	17	8.20	9.70	B	White CHALK			25.6								
1600447	BH03	13	3.20	3.50	B	Brown slightly clayey sandy GRAVEL			5.0								
1600448	BH03	26	11.20	12.70	B	White CHALK			27.2								
1600449	BH03	34	17.20	18.70	B	White CHALK			23.1								
1600450	BH03	41	23.00	23.50	B	White gravelly CHALK			25.7								
1600452	BH04	7	1.20	1.65	B	Brown gravelly sandy CLAY	Atterberg 1 Point	10.2	41	38	20	18					
1600453	BH04	17	6.70	8.20	B	White clayey CHALK	Atterberg 1 Point	27.2	96	42	24	18					
1600454	BH05	15	8.20	8.65	B	White slightly gravelly clayey CHALK with fragments of flintstone	Atterberg 1 Point	24.2	89	37	24	13					
1600455	BH08	5	2.00	2.20	B	Black gravelly SILT	Atterberg 1 Point	17.1	47	80	51	29					

Note: # Non accredited; NP - Non plastic

Comments:

Sample tested under Red Lab condition

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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4041

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# SUMMARY REPORT

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Tested in Accordance with:

Moisture Content by BS 1377-2: 1990: Clause 3.2; Water Content by BS EN  
17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test),  
Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB

Client Reference: 35880-WF

Job Number: 20-26183

Date Sampled: Not Given

Date Received: 21/08/2020

Date Tested: 29/08/2020

Sampled By: Not Given

### Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Moisture Content [W]	Water Content [W]	Atterberg				Density			Total Porosity/ #	
		Reference	Depth Top	Depth Base	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD		
m	m							%	%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3	%	
1600456	BH08	14	7.20	8.50	B	White CHALK			25.0									
1600458	BH09	9	3.60	3.70	B	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point		23.7	94	34	20	14					
1600459	BH09	10	4.20	5.20	B	White CHALK			24.3									
1600466	BH11	8	3.20	3.30	B	White slightly gravelly clayey CHALK	Atterberg 1 Point		29.3	92	34	24	10					
1600468	BH13	8	2.20	3.20	B	Brown sandy GRAVEL			4.3									
1600469	BH13	13	4.20	5.20	B	White CHALK			24.4									
1600471	BH14	10	4.20	5.20	B	White CHALK			27.7									
1600472	BH18	7	1.50	1.60	B	Black gravelly organic CLAY	Atterberg 1 Point		59.5	58	69	41	28					
1600473	SBH03	6	2.00	2.30	B	Brownish grey very sandy SILT			13.0									
1600474	STP02	1	0.40	0.50	B	Dark brown clayey very sandy GRAVEL			12.0									

Note: # Non accredited; NP - Non plastic

Comments:

Sample tested under Red Lab condition

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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4041

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GL2 4NF

Contact: James Taylor

Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

## **SUMMARY REPORT**

## Summary of Classification Test Results

Tested in Accordance with:

Moisture Content by BS 1377-2: 1990: Clause 3.2; Water Content by BS EN 17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client Reference: 35880-WF

Job Number: 20-26183

Date Sampled: Not Given

Date Received: 21/08/2020

Date Tested: 29/08/2020

Sampled By: Not Given

## Test results

Note: # Non accredited: NP - Non plastic

### Comments:

Sample tested under Red Lab condition

Signed -

Marko  
- 2004

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



## Liquid and Plastic Limits

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

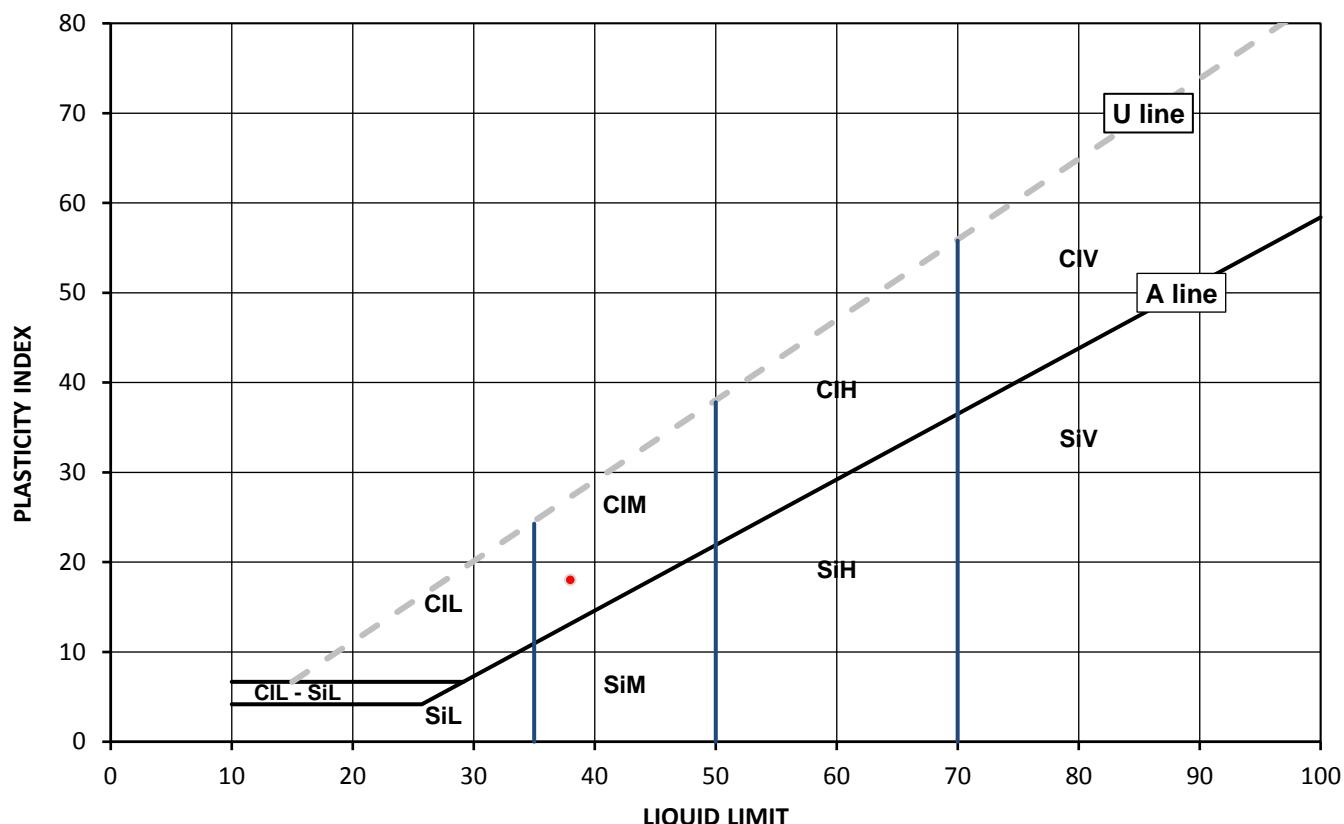
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

**Test Results:**

Laboratory Reference: 1600452  
Hole No.: BH04  
Sample Reference: 7  
Soil Description: Brown gravelly sandy CLAY

Sample Preparation: Tested after washing to remove &gt;425μm

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425μm BS Test Sieve
10	38	20	18	41



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg CIHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek

PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



## Liquid and Plastic Limits

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

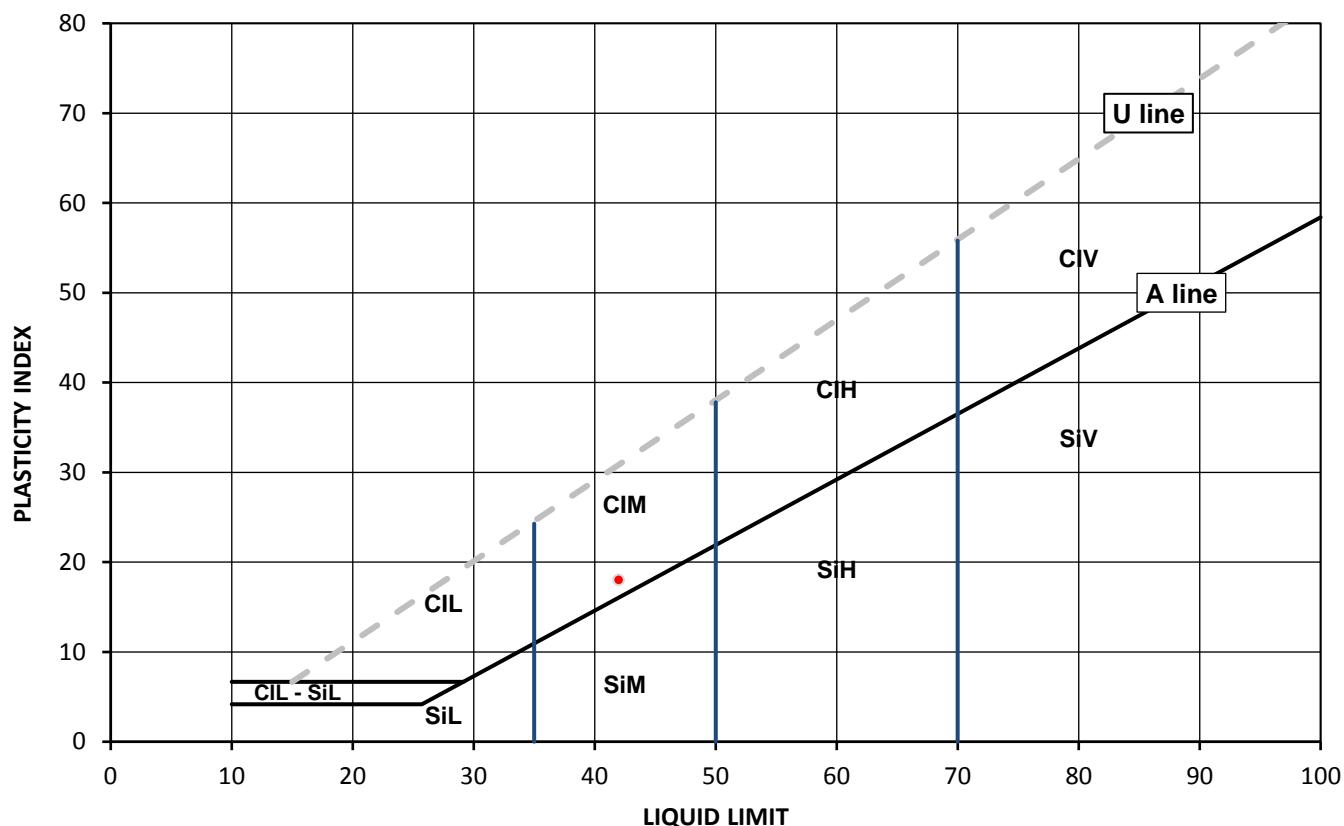
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600453  
Hole No.: BH04  
Sample Reference: 17  
Soil Description: White clayey CHALK  
  
Sample Preparation: Tested after washing to remove >425um

Depth Top [m]: 6.70  
Depth Base [m]: 8.20  
Sample Type: B

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425μm BS Test Sieve
27	42	24	18	96



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg CIHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Liquid and Plastic Limits

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

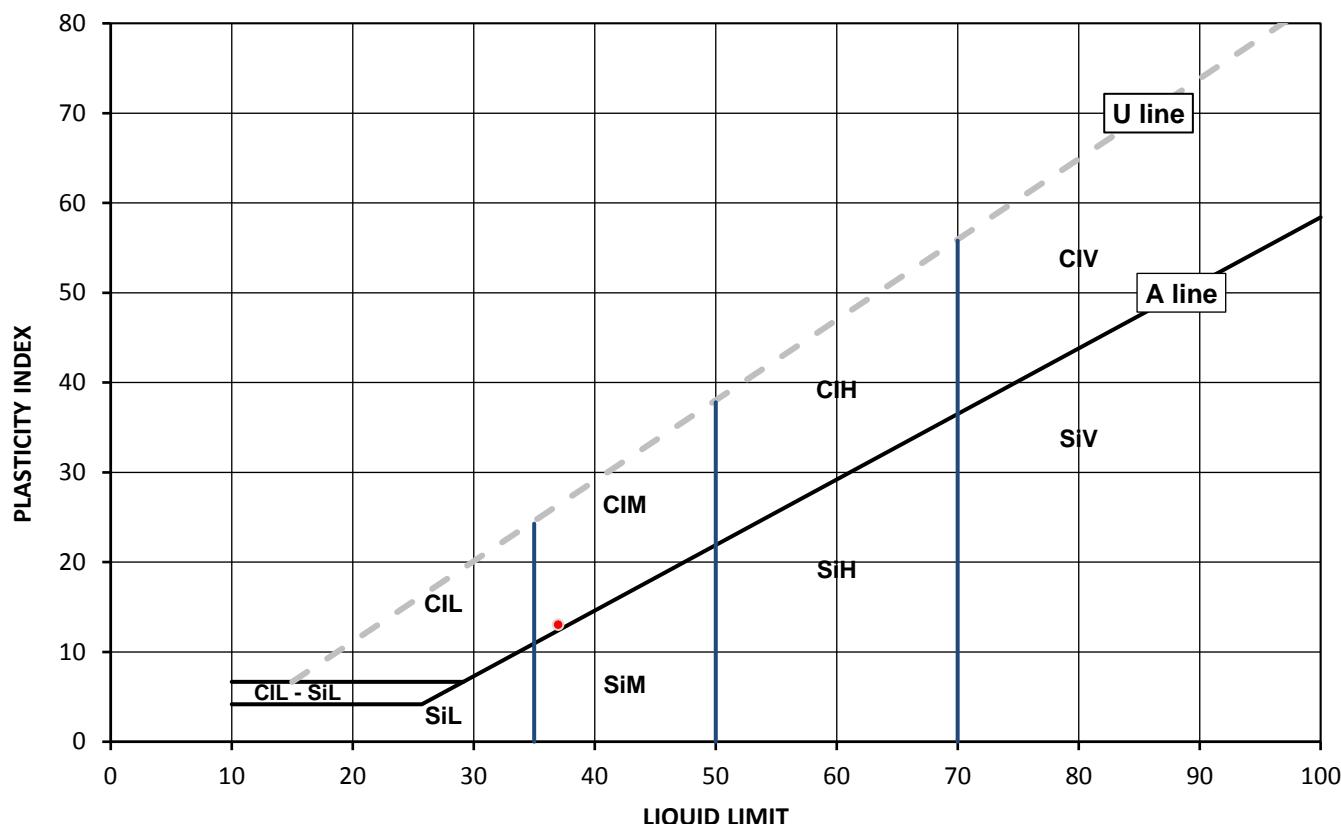
**Test Results:**

Laboratory Reference: 1600454  
Hole No.: BH05  
Sample Reference: 15  
Soil Description: White slightly gravelly clayey CHALK with fragments of flintstone

Depth Top [m]: 8.20  
Depth Base [m]: 8.65  
Sample Type: B

Sample Preparation: Tested after washing to remove &gt;425μm

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425μm BS Test Sieve
24	37	24	13	89



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg CIHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek

PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Liquid and Plastic Limits

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

**Test Results:**

Laboratory Reference: 1600455

Depth Top [m]: 2.00

Hole No.: BH08

Depth Base [m]: 2.20

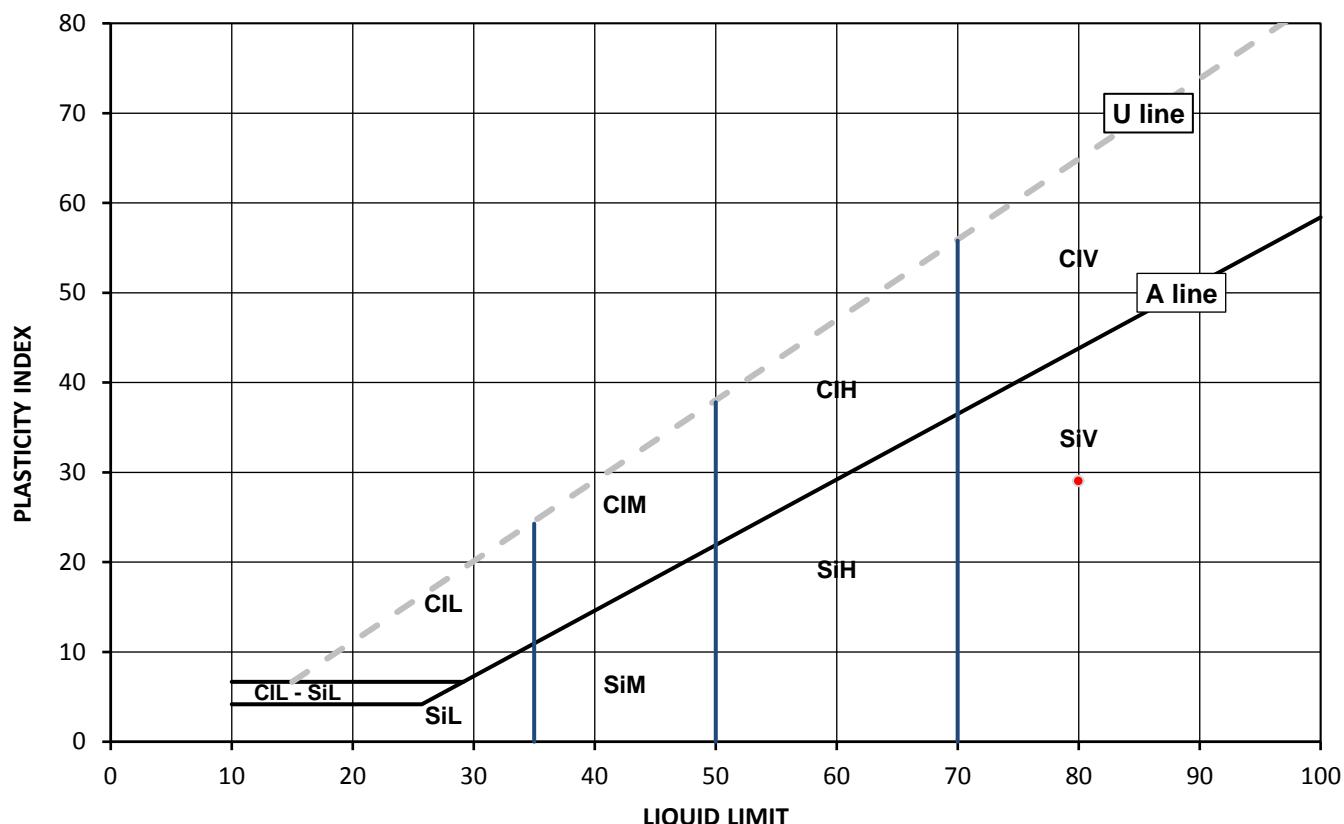
Sample Reference: 5

Sample Type: B

Soil Description: Black gravelly SILT

Sample Preparation: Tested after washing to remove &gt;425μm

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425μm BS Test Sieve
17	80	51	29	47



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg ClHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek

PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



## Liquid and Plastic Limits

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

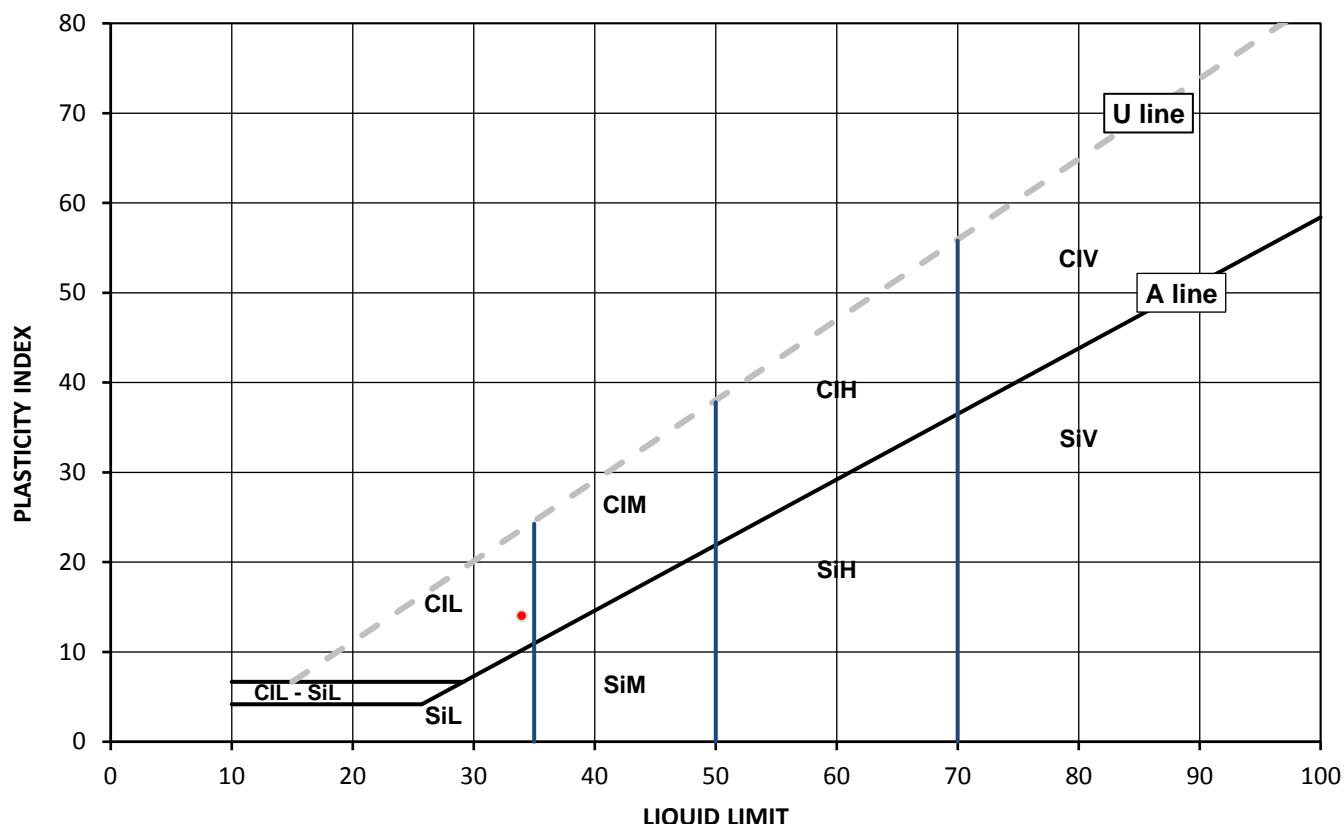
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

**Test Results:**

Laboratory Reference: 1600458  
Hole No.: BH09  
Sample Reference: 9  
Soil Description: Brown slightly gravelly very sandy CLAY

Sample Preparation: Tested after &gt;425um removed by hand

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425µm BS Test Sieve
24	34	20	14	94



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg CIHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Liquid and Plastic Limits

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

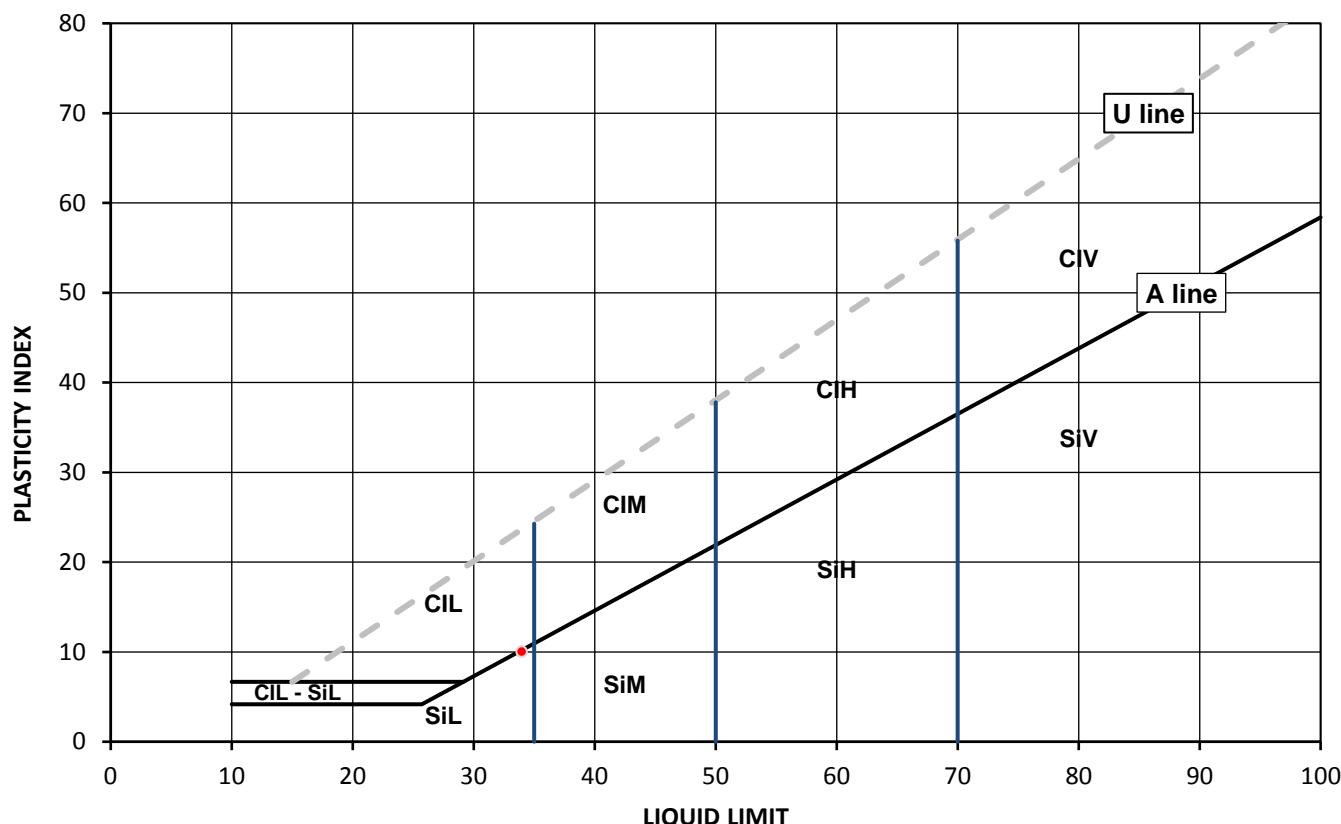
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

**Test Results:**

Laboratory Reference: 1600466  
Hole No.: BH11  
Sample Reference: 8  
Soil Description: White slightly gravelly clayey CHALK

Sample Preparation: Tested after washing to remove &gt;425μm

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425μm BS Test Sieve
29	34	24	10	92



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg ClHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek

PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



## Liquid and Plastic Limits

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

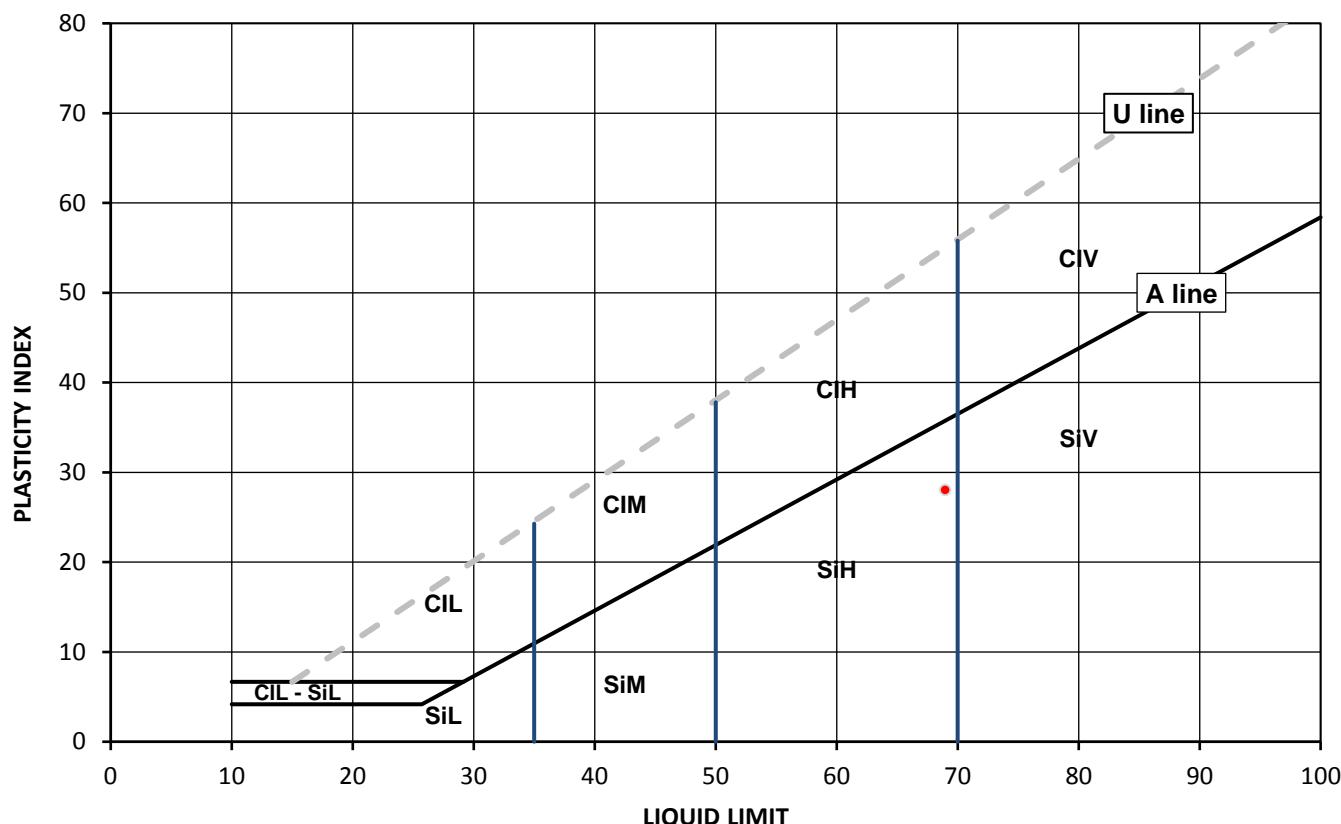
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

**Test Results:**

Laboratory Reference: 1600472  
Hole No.: BH18  
Sample Reference: 7  
Soil Description: Black gravelly organic CLAY

Sample Preparation: Tested after washing to remove &gt;425μm

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425μm BS Test Sieve
59	69	41	28	58



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg CIHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Liquid and Plastic Limits

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

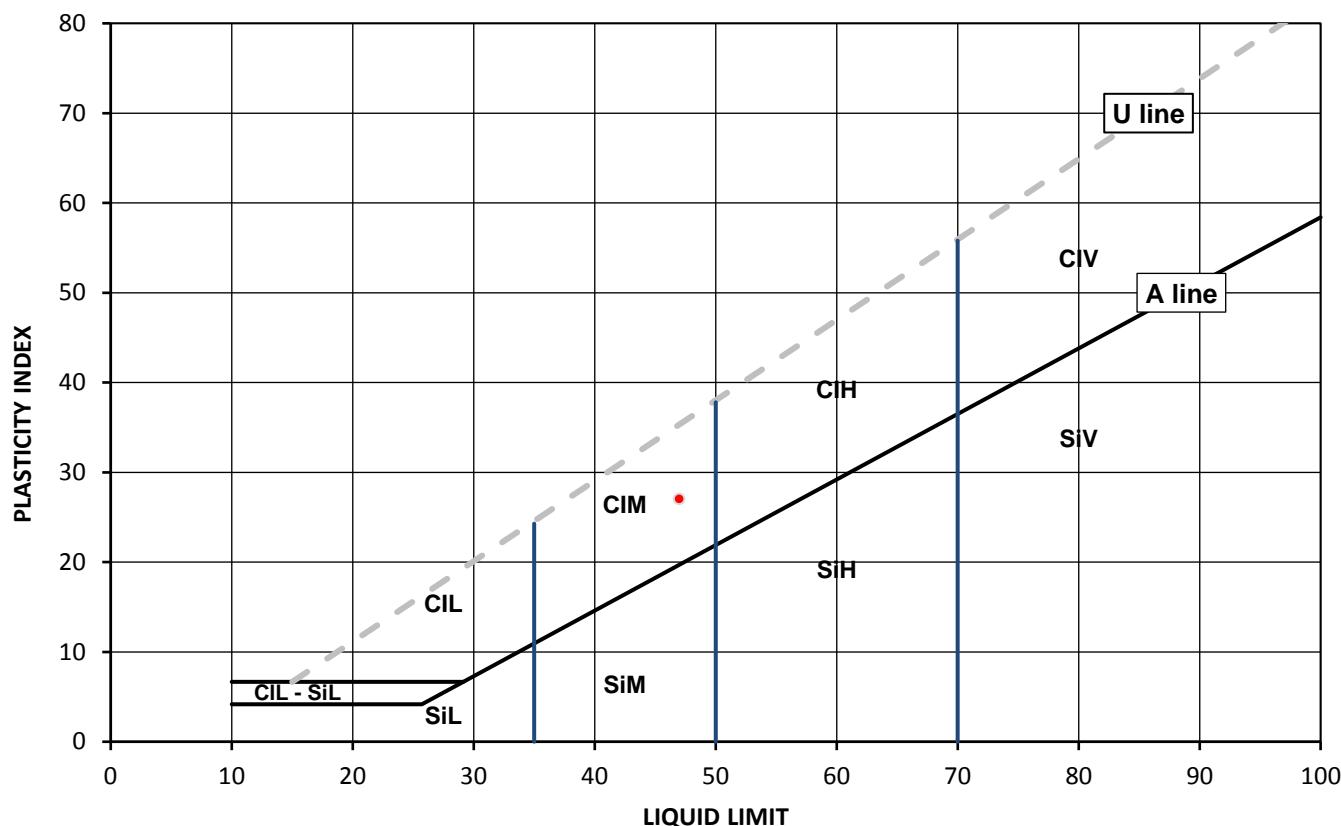
**Test Results:**

Laboratory Reference: 1600476  
Hole No.: STP06  
Sample Reference: 4  
Soil Description: Brown slightly gravelly slightly sandy CLAY

Depth Top [m]: 2.60  
Depth Base [m]: 2.70  
Sample Type: B

Sample Preparation: Tested after washing to remove &gt;425μm

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425μm BS Test Sieve
20	47	20	27	68



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg CIHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek

PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

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Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



## Liquid and Plastic Limits

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

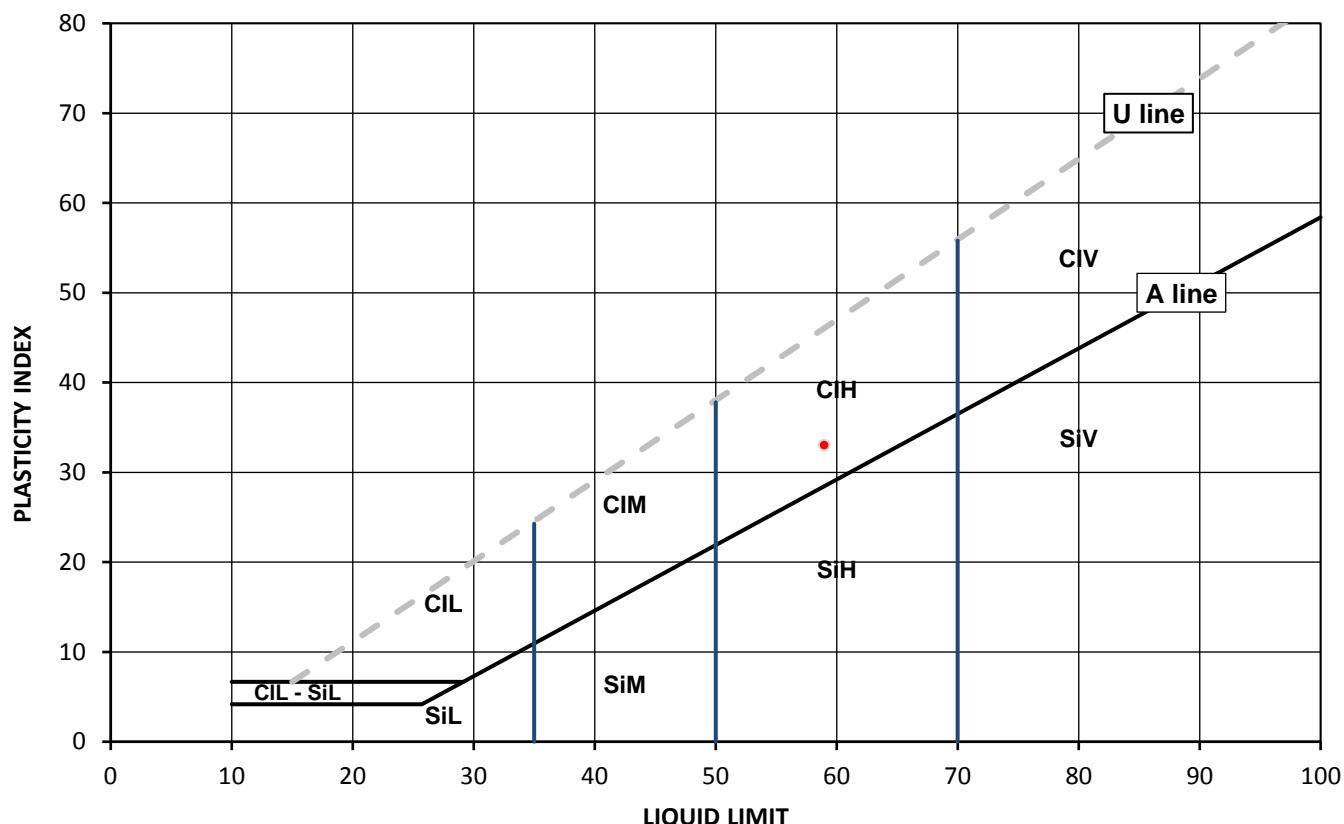
**Test Results:**

Laboratory Reference: 1600477  
Hole No.: STP09  
Sample Reference: 4  
Soil Description: Brown gravelly slightly sandy CLAY

Sample Preparation: Tested after washing to remove >425um

Depth Top [m]: 1.75  
Depth Base [m]: 1.85  
Sample Type: B

As Received Moisture Content [ W ] %	Liquid Limit [ WL ] %	Plastic Limit [ Wp ] %	Plasticity Index [ Ip ] %	% Passing 425µm BS Test Sieve
22	59	26	33	62



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material ( eg ClHO )

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Sample tested under Red Lab condition

Signed:

Monika Janoszek

PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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Geotechnical Engineering Limited

# SATURATION MOISTURE CONTENT OF CHALK

BS.1377 : PART 2 : 1990 : 3.3



CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole /trial pit no.	sample		specimen depth (m)	natural moisture content (%)	bulk density (Mg/m3)	dry density (Mg/m3)	saturation moisture content (%)	porosity (%)	description and remarks
	no./type	depth (m)							
BH09	21L	12.70	14.10	26.60	1.91	1.51	29	44	Off white CHALK
BH10	23C	15.20	15.80	31.20	1.92	1.47	31	46	Off white CHALK #
BH13	35C	20.80	21.90	26.20	1.90	1.51	29	44	Off white CHALK
SBH05	24C	15.70	17.00	30.80	1.93	1.48	31	45	Off white CHALK
SBH05	28C	20.20	21.60	25.10	1.85	1.48	31	45	Off white CHALK
SBH05	31C	23.20	23.70	30.30	1.93	1.48	31	45	Off white CHALK
general remarks									
natural moisture content determined in accordance with BS1377 : Part 2 : 1990 : 3.2 (unless specified)									
# denotes sample tested is smaller than that which is recommended in accordance with BS1377									
test method immersion in water (test 3.3)								CONTRACT <b>35880</b>	CHECKED <b>TB</b>



4041

Client: Geotechnical Engineering Ltd

Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor

Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

# SUMMARY REPORT

## Summary of Saturation Moisture Content Test Results

Tested in Accordance with: BS 1377-2: 1990: Clause 3.3

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB

Client Reference: 35880-WF

Job Number: 20-26183

Date Sampled: Not Given

Date Received: 21/08/2020

Date Tested: 30/08/2020

Sampled By: Not Given

### Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	SMC	Bulk density	Dry density	MC	%	Mg/m³	Mg/m³	%
		Reference	Depth Top m	Depth Base m	Type				%	Mg/m³					
1600457	BH08	18	10.00	11.00	B	White CHALK	Supplied lump of chalk fails to comply with volume requirements as per BS1377:2 Clause 3.3.5.1	34	1.79	1.40	28				
1600460	BH09	15	8.20	9.70	B	White CHALK	Supplied lump of chalk fails to comply with volume requirements as per BS1377:2 Clause 3.3.5.1	34	1.89	1.41	34				
1600461	BH09	17	9.70	11.20	B	White CHALK	Supplied lump of chalk fails to comply with volume requirements as per BS1377:2 Clause 3.3.5.1	27	1.91	1.56	22				
1600462	BH09	27	17.20	18.70	B	White CHALK	Supplied lump of chalk fails to comply with volume requirements as per BS1377:2 Clause 3.3.5.1	34	1.82	1.41	29				
1600463	BH09	29	18.70	20.20	B	White CHALK		31	1.85	1.47	26				
1600464	BH10	17	10.70	12.20	B	White CHALK	Supplied lump of chalk fails to comply with volume requirements as per BS1377:2 Clause 3.3.5.1	34	1.71	1.40	22				
1600465	BH10	34	24.20	24.70	B	White CHALK	Supplied lump of chalk fails to comply with volume requirements as per BS1377:2 Clause 3.3.5.1	28	1.98	1.53	30				
1600467	BH11	15	6.20	7.20	B	White CHALK	Supplied lump of chalk fails to comply with volume requirements as per BS1377:2 Clause 3.3.5.1	33	1.84	1.43	28				
1600470	BH13	23	11.00	12.50	B	White CHALK	Supplied lump of chalk fails to comply with volume requirements as per BS1377:2 Clause 3.3.5.1	30	1.89	1.49	26				

Note: SMC - Saturation Moisture Content; MC - Moisture Content

Comments: Sample tested under Red Lab condition

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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Geotechnical Engineering Limited

# DENSITY (IMMERSION IN FLUID METHOD)

BS EN ISO 17892 - 2 : 2014 Clause 5.2



CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole /trial pit no.	sample		specimen depth (m)	test method	natural water content (%)	bulk density (Mg/m <sup>3</sup> )	dry density (Mg/m <sup>3</sup> )	description and remarks
	no./type	depth (m)						
BH18	11L	3.20	4.10	B	27.4	1.94	1.52	Off white CHALK
general remarks								
# denotes sample tested is smaller than that which is recommended in accordance with BS EN ISO 17892 - 2 : 2014								
test method								CONTRACT <b>35880</b>
A - linear measurement (5.1) B - immersion in fluid (5.2) C - fluid displacement (5.3)								CHECKED <b>TB</b>



4041

Client: Geotechnical Engineering Ltd

Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF

Contact: James Taylor

Site Address: Hertford Gasworks Ground Investigation

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Ślaska, Poland

# SUMMARY REPORT

## Summary of Density by Immersion in Water Test Results

Tested in Accordance with: BS EN ISO 17892-2: 2014: Clause 5.2

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB

Client Reference: 35880-WF

Job Number: 20-26183

Date Sampled: Not Given

Date Received: 21/08/2020

Date Tested: 30/08/2020

Sampled By: Not Given

### Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Bulk density Mg/m³	Dry density Mg/m³	WC %									
		Reference	Depth Top m	Depth Base m	Type														
1600446	BH02	17	8.20	9.70	B	White CHALK		1.88	1.50	25.6									
1600448	BH03	26	11.20	12.70	B	White CHALK		1.85	1.46	27.2									
1600449	BH03	34	17.20	18.70	B	White CHALK		1.71	1.39	23.1									
1600450	BH03	41	23.00	23.50	B	White gravelly CHALK		1.79	1.42	25.7									
1600456	BH08	14	7.20	8.50	B	White CHALK		1.71	1.36	25.0									
1600471	BH14	10	4.20	5.20	B	White CHALK		1.94	1.52	27.7									

Note: WC - Water Content

### Comments:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd



4041

# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

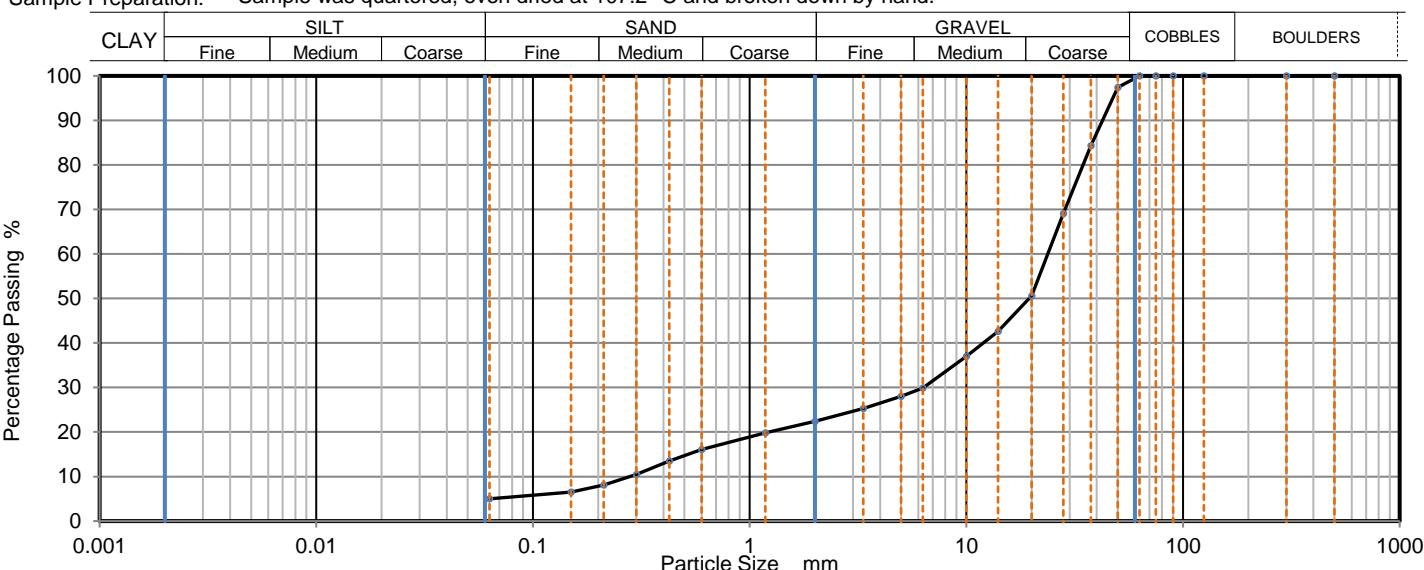
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600445  
Hole No.: BH01  
Sample Reference: 9  
Sample Description: Brown slightly clayey sandy GRAVEL  
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 3.20  
Depth Base [m]: 4.20  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	97		
37.5	84		
28	69		
20	51		
14	43		
10	37		
6.3	30		
5	28		
3.35	25		
2	22		
1.18	20		
0.6	16		
0.425	14		
0.3	11		
0.212	8		
0.15	7		
0.063	5		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	77.60
Sand	17.40
Fines <0.063mm	5.00

Grading Analysis		
D100	mm	63
D60	mm	23.7
D30	mm	6.36
D10	mm	0.28
Uniformity Coefficient		85
Curvature Coefficient		6.1

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

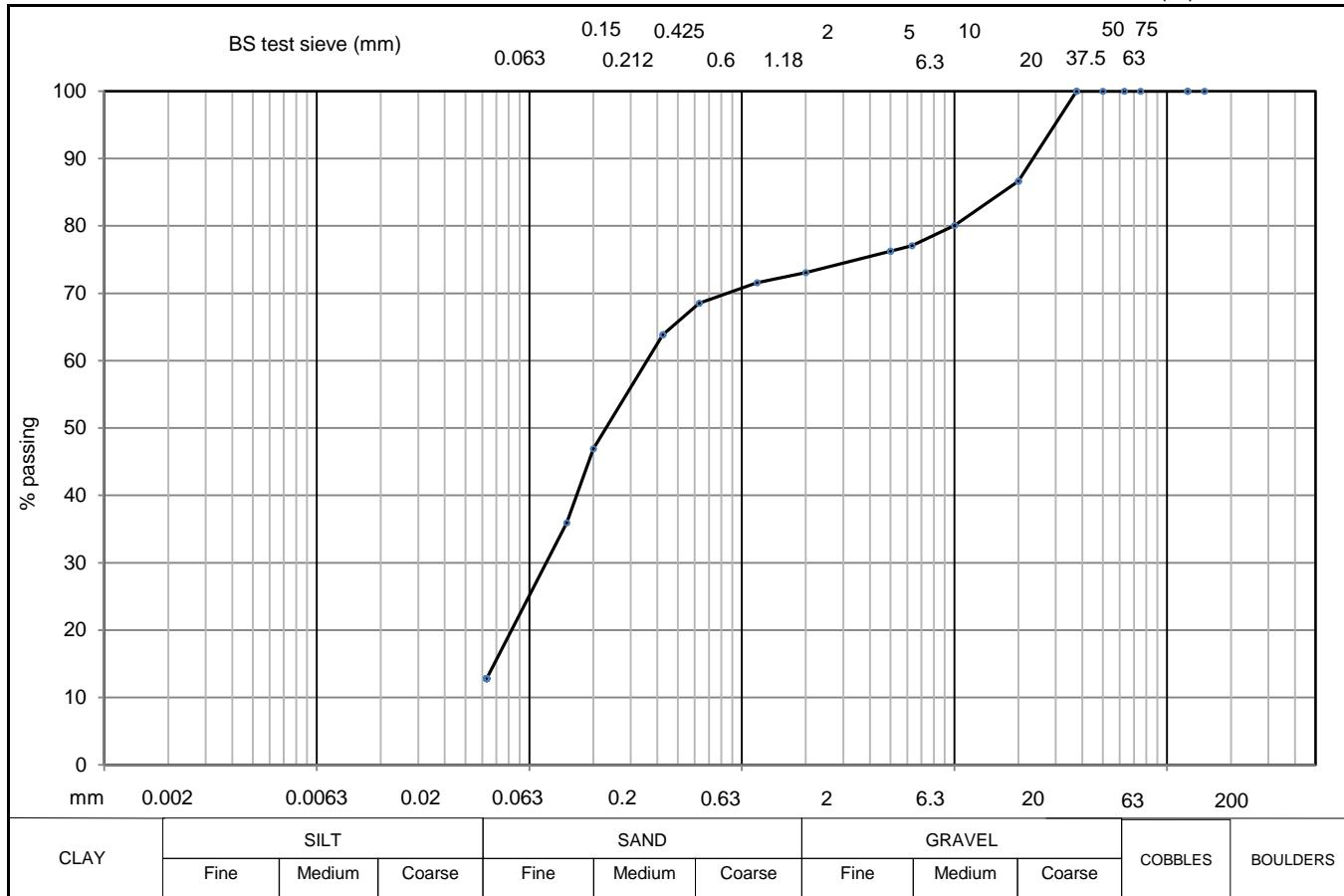
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**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH02
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	4B
DESCRIPTION	Brown silty very gravelly SAND	SAMPLE DEPTH (m)	1.00
		SPECIMEN TOP (m)	1.00
		SPECIMEN BASE (m)	1.20



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

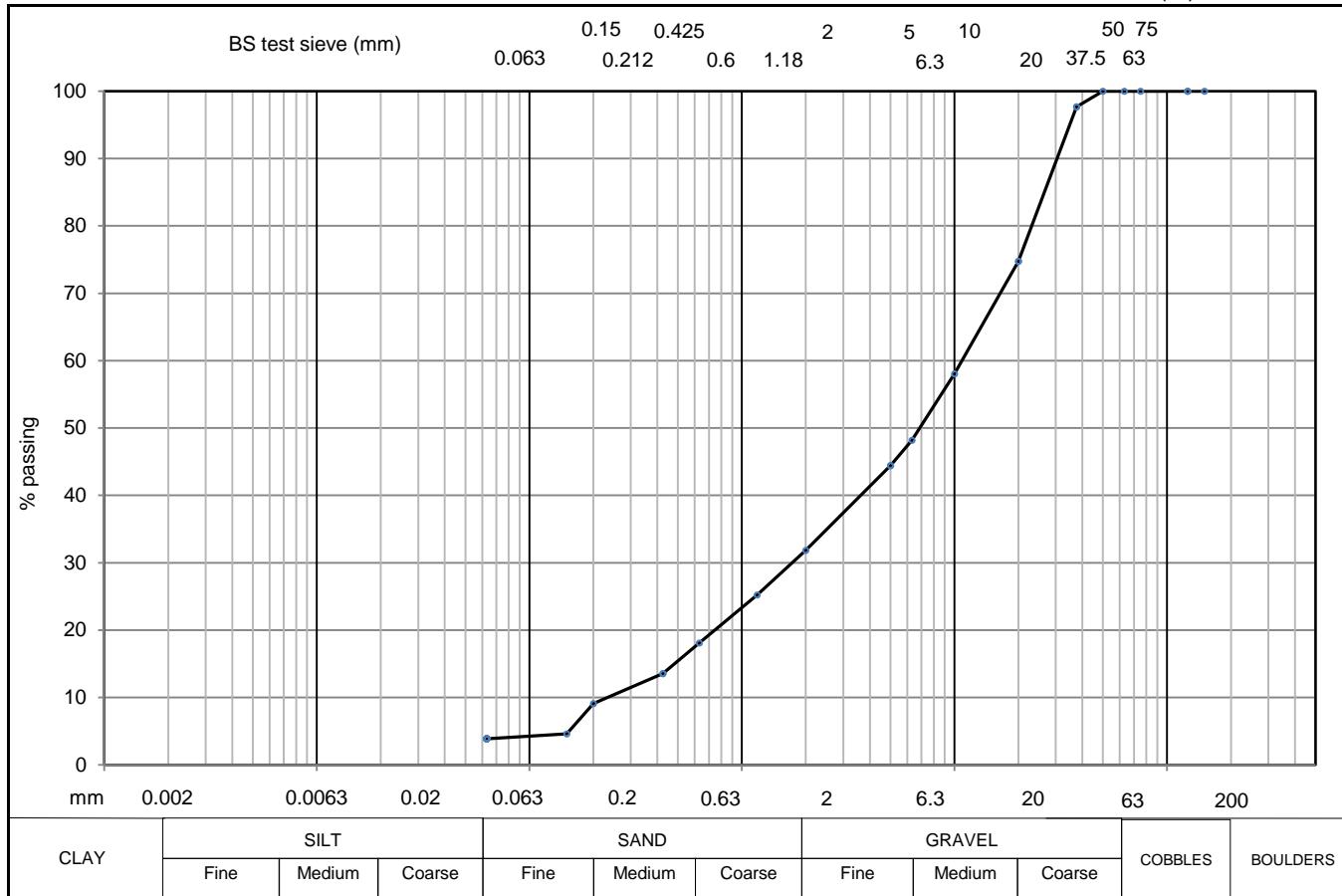
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	76	20	
SILT		75		2	73	6	
SILT & CLAY	13	63		1.18	72	2	
SAND	60	50		0.63	69		
GRAVEL	27	37.5	100	0.425	64		
COBBLE & BOULDER	0	20	87	0.2	47		
test method(s)	5.2	10	80	0.15	36		
test method		6.3	77	0.063	13		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m³							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH02
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	7L
DESCRIPTION	Brown slightly silty very sandy GRAVEL	SAMPLE DEPTH (m)	2.20
		SPECIMEN TOP (m)	2.20
		SPECIMEN BASE (m)	3.20



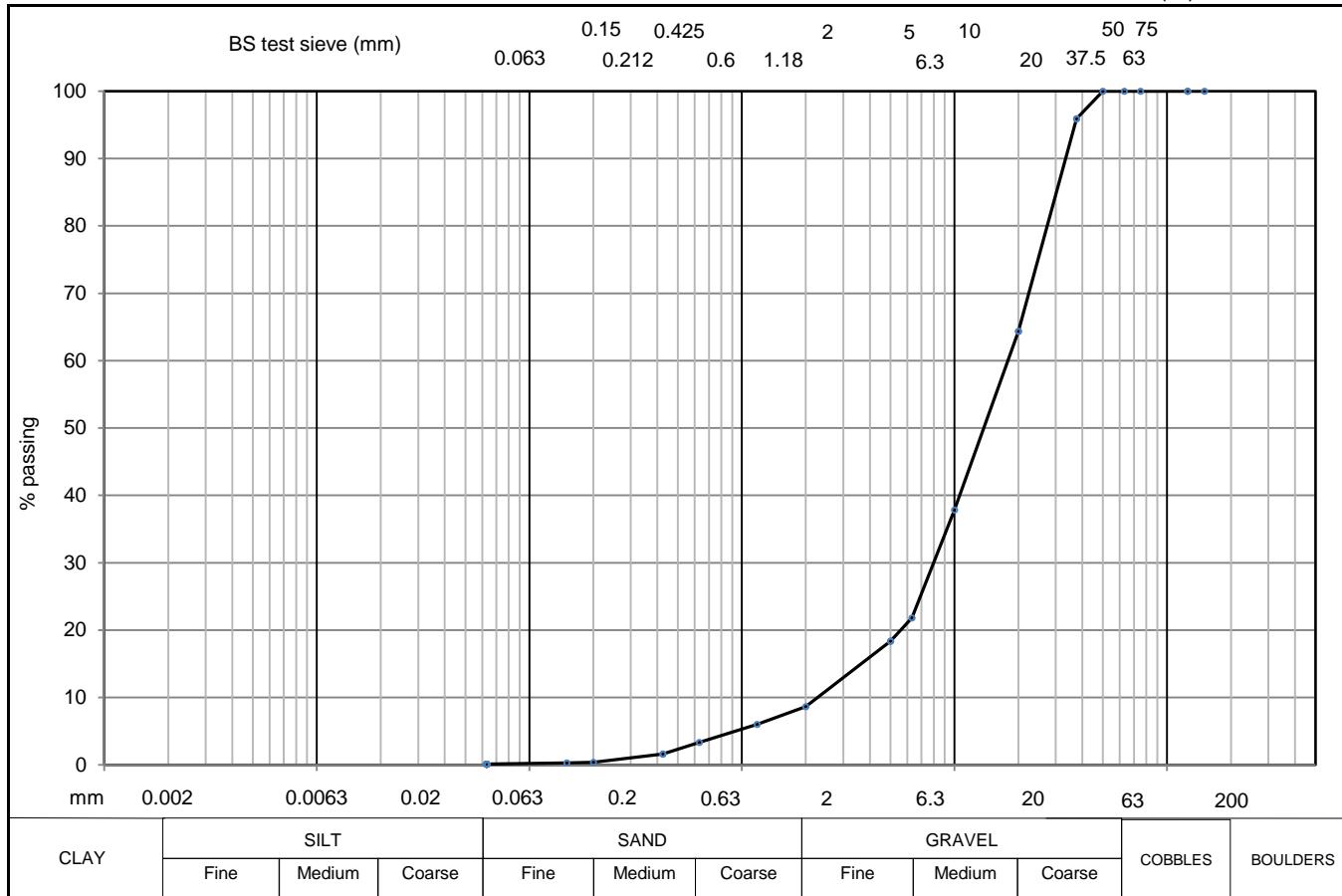
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve ( $\mu\text{m}$ )	% finer
CLAY							
SILT							
SILT & CLAY	4	150		5	44	20	
SAND	28	75		2	32	6	
GRAVEL	68	63		1.18	25	2	
COBBLE & BOULDER	0						
test method(s)	5.2	50	100	0.63	18		
test method		37.5	98	0.425	14		
5.2 - sieving		20	75	0.2	9		
5.3 - sedimentation by hydrometer		10	58	0.15	5		
5.4 - sedimentation by pipette		6.3	48	0.063	4		
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>					CONTRACT	CHECKED
						35880	TB

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH02
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	13L
DESCRIPTION	Brown sandy GRAVEL	SAMPLE DEPTH (m)	5.20
		SPECIMEN TOP (m)	5.20
		SPECIMEN BASE (m)	6.70



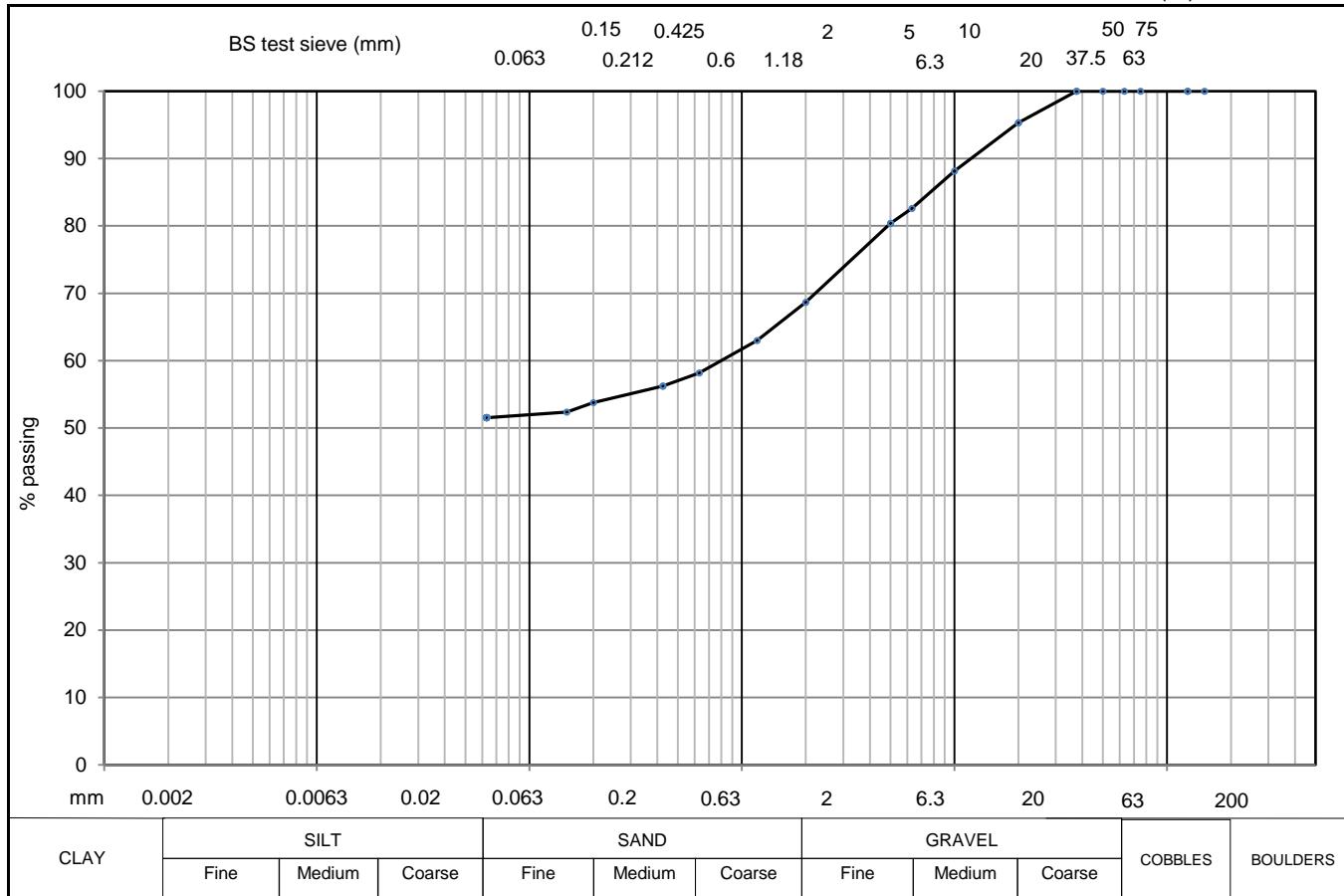
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	0										
SAND	9										
GRAVEL	91										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							CONTRACT	CHECKED		
								35880	TB		

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH02
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	19L
DESCRIPTION	Off white slightly sandy slightly gravelly clayey SILT (chalk)	SAMPLE DEPTH (m)	9.70
		SPECIMEN TOP (m)	9.90
		SPECIMEN BASE (m)	10.15



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY							
SILT							
SILT & CLAY	52	150		5	80	20	
SAND	17	75		2	69	6	
GRAVEL	31	63		1.18	63	2	
COBBLE & BOULDER	0						
test method(s)	5.2						
test method							
5.2 - sieving		50		0.63	58		
5.3 - sedimentation by hydrometer		37.5	100	0.425	56		
5.4 - sedimentation by pipette		20	95	0.2	54		
		10	88	0.15	52		
		6.3	83	0.063	52		
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m³							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						



4041

# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

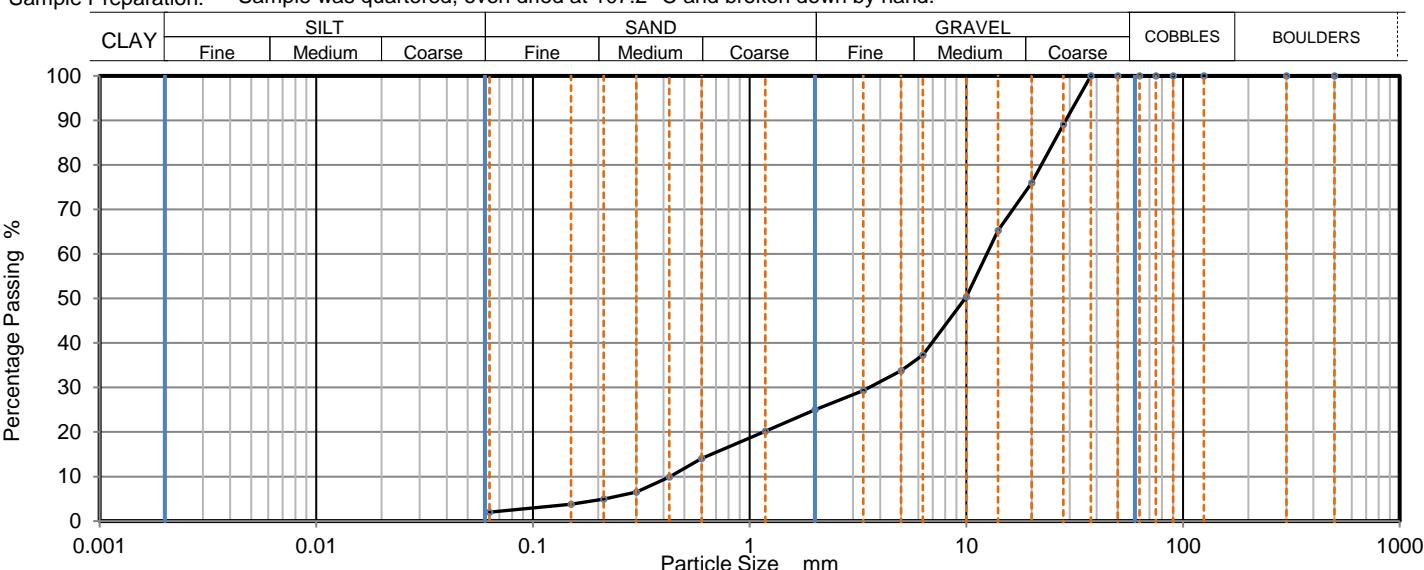
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600447  
Hole No.: BH03  
Sample Reference: 13  
Sample Description: Brown slightly clayey sandy GRAVEL  
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 3.20  
Depth Base [m]: 3.50  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	89		
20	76		
14	65		
10	50		
6.3	37		
5	34		
3.35	29		
2	25		
1.18	20		
0.6	14		
0.425	10		
0.3	7		
0.212	5		
0.15	4		
0.063	3		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	75.00
Sand	22.40
Fines <0.063mm	2.60

Grading Analysis		
D100	mm	37.5
D60	mm	12.4
D30	mm	3.57
D10	mm	0.429
Uniformity Coefficient		29
Curvature Coefficient		2.4

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

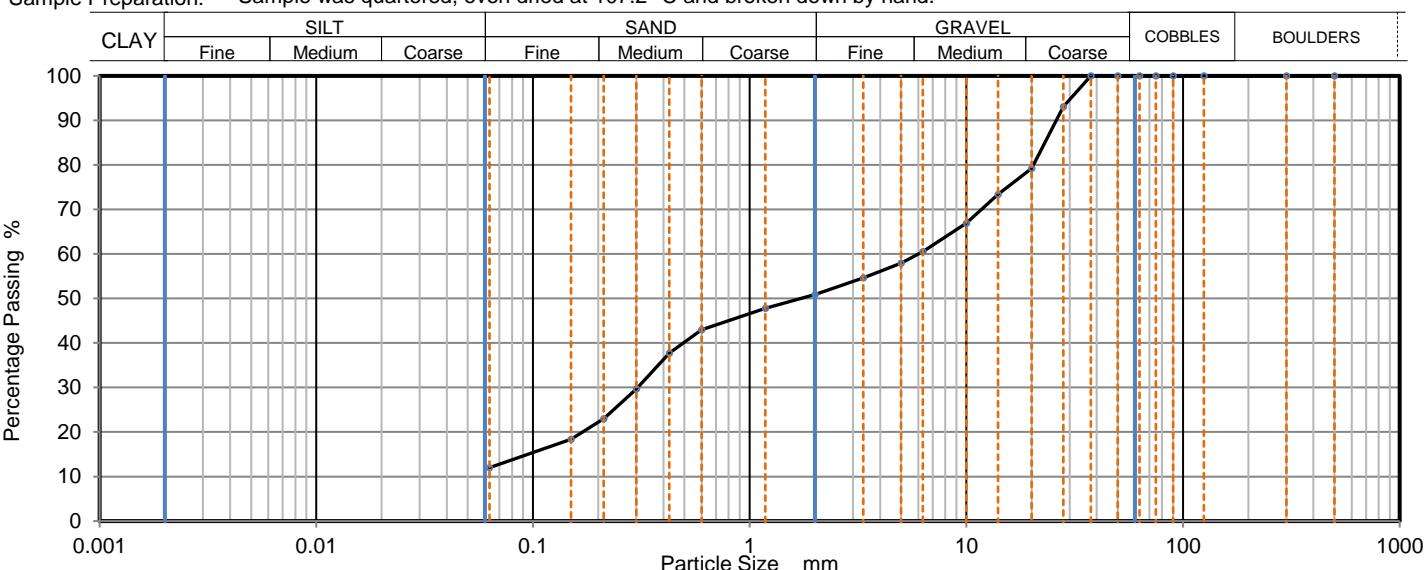
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600451  
Hole No.: BH04  
Sample Reference: 6  
Sample Description: Brown clayey very sandy GRAVEL  
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 1.00  
Depth Base [m]: 1.20  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	79		
14	73		
10	67		
6.3	61		
5	58		
3.35	55		
2	51		
1.18	48		
0.6	43		
0.425	38		
0.3	30		
0.212	23		
0.15	18		
0.063	12		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	49.10
Sand	38.50
Fines <0.063mm	12.40

Grading Analysis		
D100	mm	37.5
D60	mm	6.03
D30	mm	0.303
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

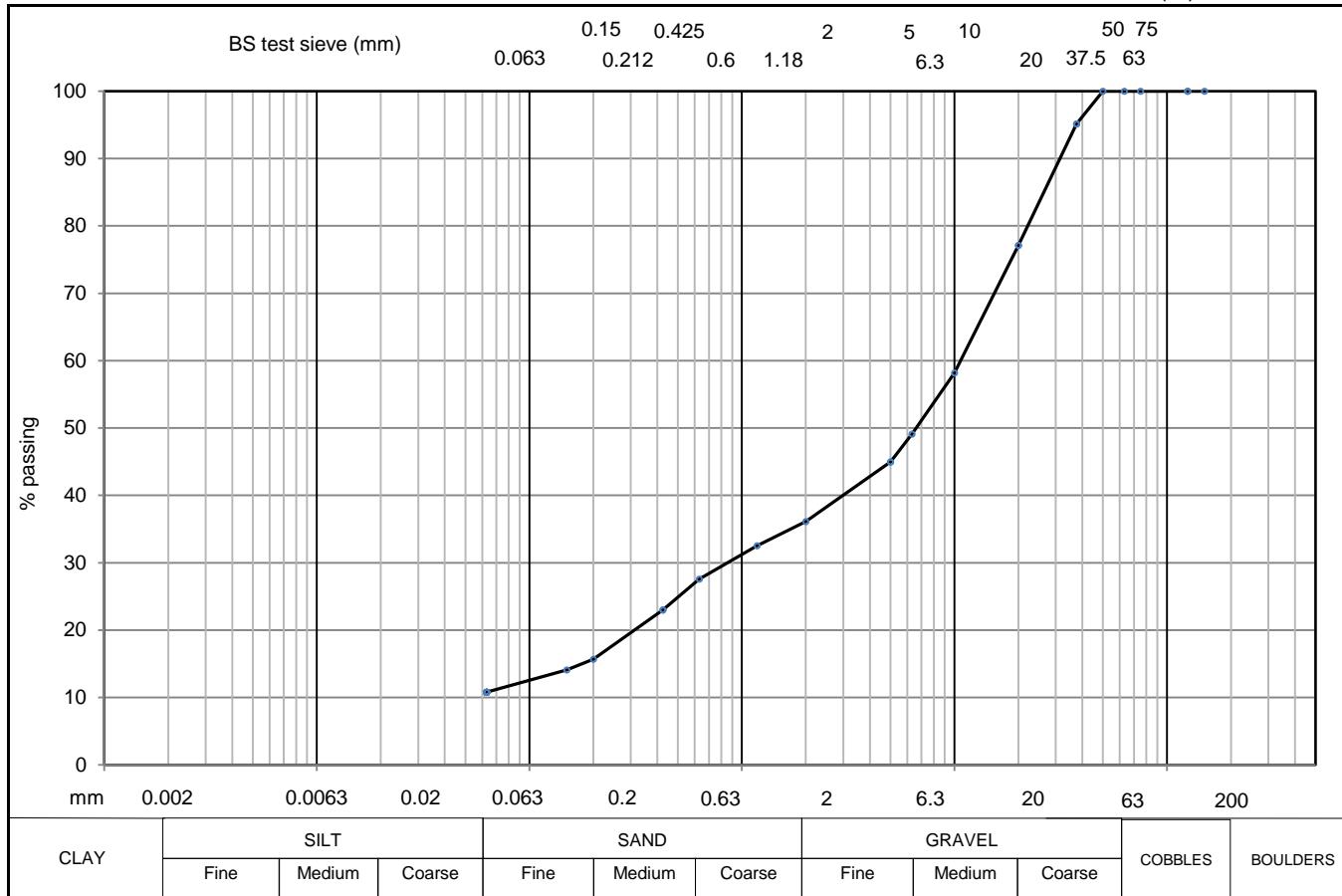
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**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH07
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2B
DESCRIPTION	Dark brown silty very sandy GRAVEL with rare rootlets	SAMPLE DEPTH (m)	0.50
		SPECIMEN TOP (m)	0.50
		SPECIMEN BASE (m)	0.70



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	11										
SAND	25										
GRAVEL	64										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>								CONTRACT	CHECKED	
									35880	TB	



4041

# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

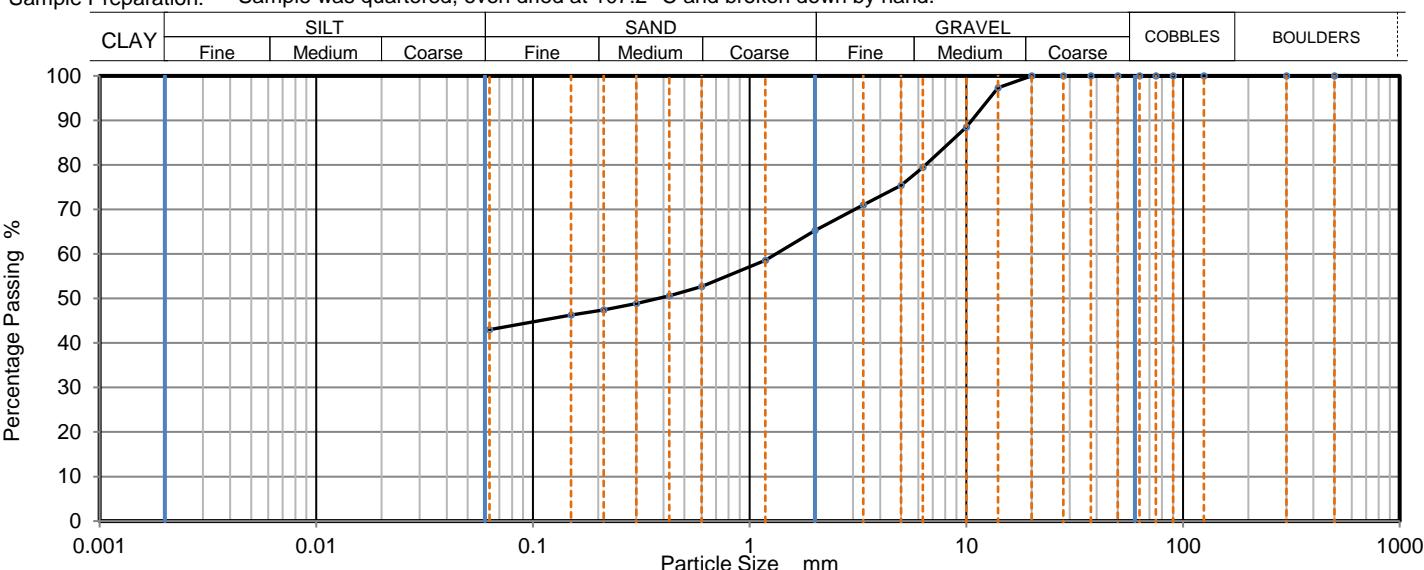
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600459  
Hole No.: BH09  
Sample Reference: 10  
Sample Description: White CHALK  
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 4.20  
Depth Base [m]: 5.20  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	97		
10	89		
6.3	79		
5	75		
3.35	71		
2	65		
1.18	59		
0.6	53		
0.425	51		
0.3	49		
0.212	47		
0.15	46		
0.063	43		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	34.70
Sand	22.00
Fines <0.063mm	43.30

Grading Analysis		
D100	mm	20
D60	mm	1.32
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

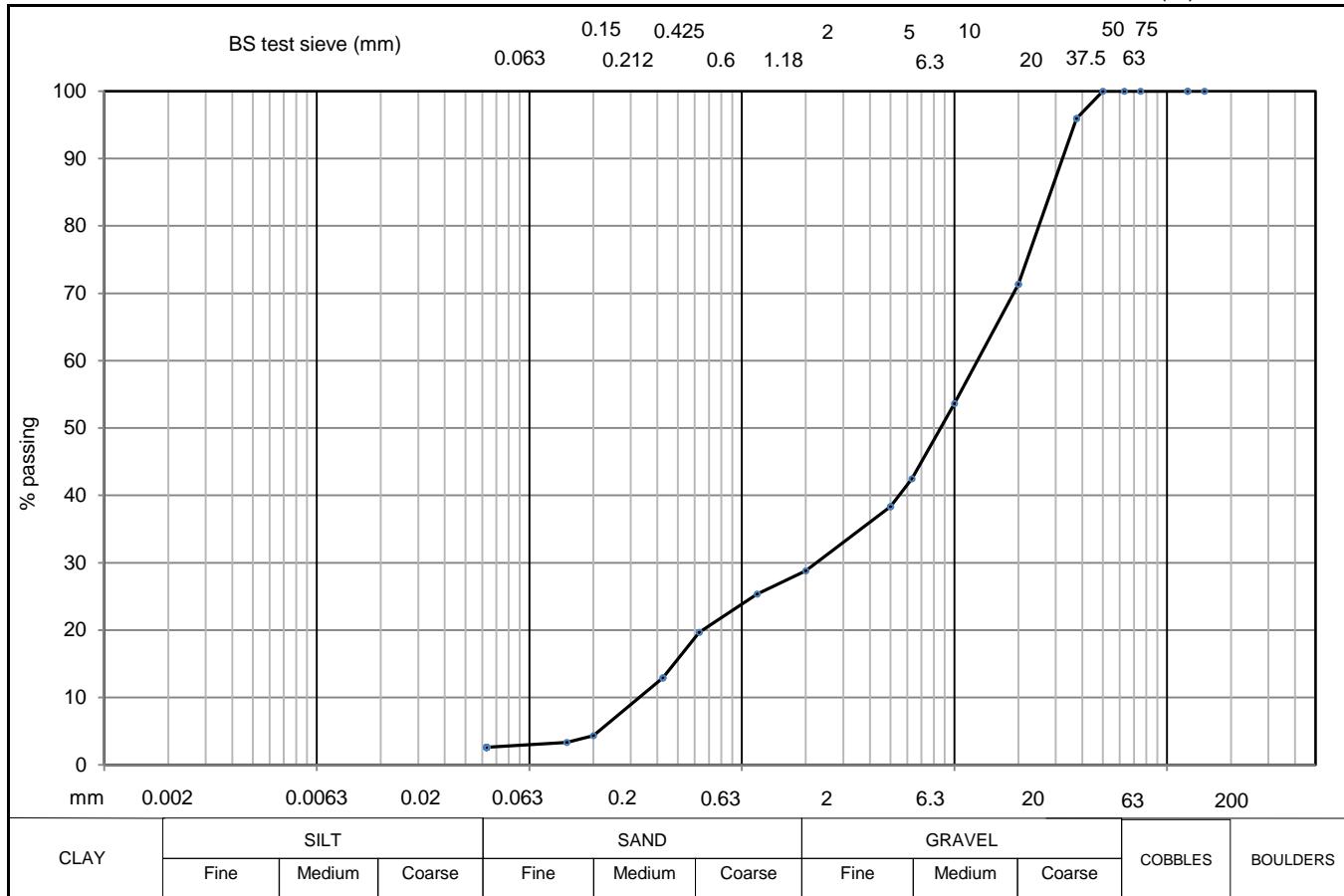
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**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH10
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	3B
DESCRIPTION	Orangish brown slightly clayey very gravelly SAND	SAMPLE DEPTH (m)	0.90
		SPECIMEN TOP (m)	0.90
		SPECIMEN BASE (m)	1.00



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	3										
SAND	26										
GRAVEL	71										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							CONTRACT	CHECKED		
								35880	TB		

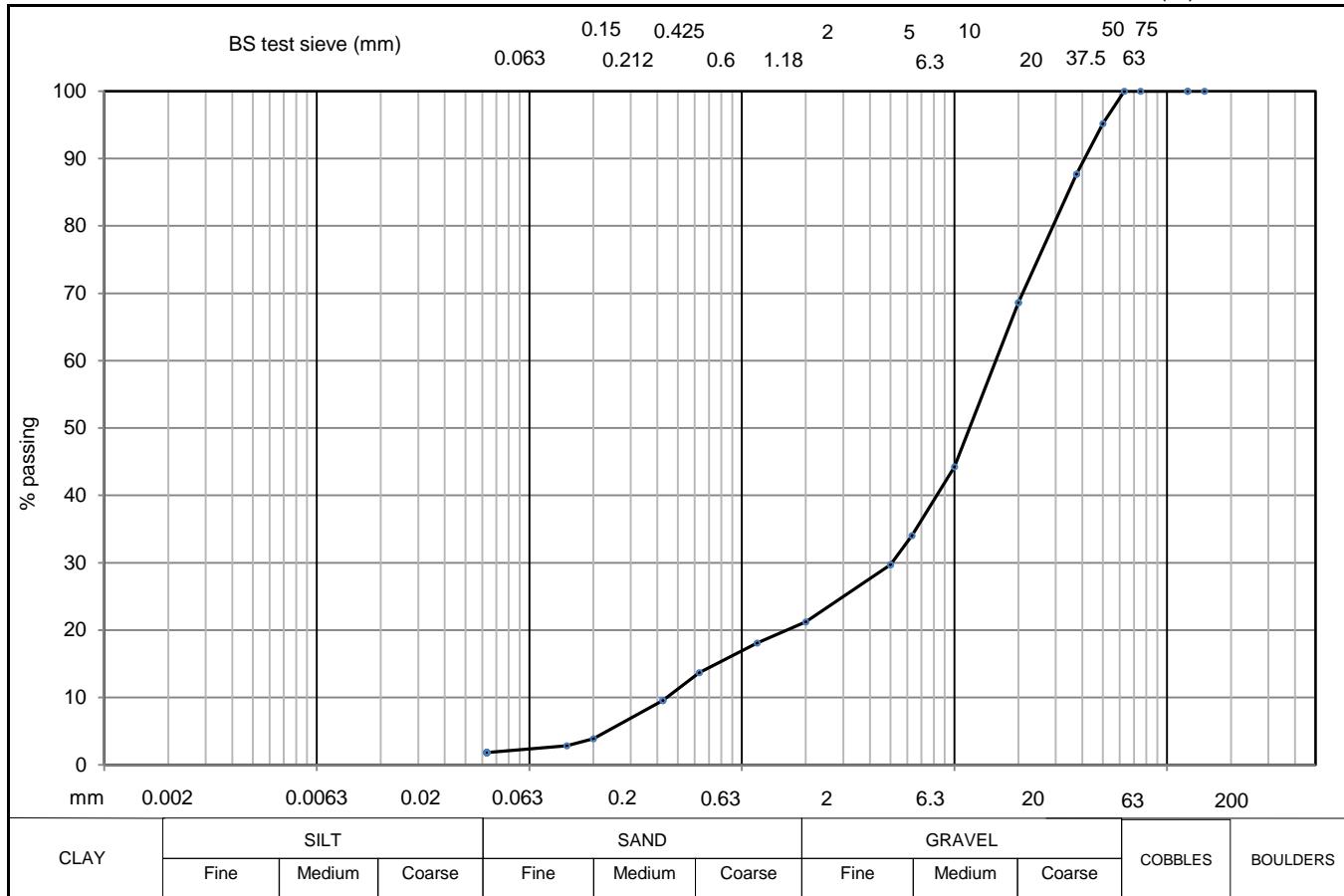
Geotechnical Engineering Limited

# PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH10
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	9L
DESCRIPTION	Yellowish brown slightly silty sandy GRAVEL	SAMPLE DEPTH (m)	4.20
		SPECIMEN TOP (m)	4.20
		SPECIMEN BASE (m)	5.20



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	2										
SAND	19										
GRAVEL	79										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							CONTRACT	CHECKED		
								35880	TB		



4041

# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

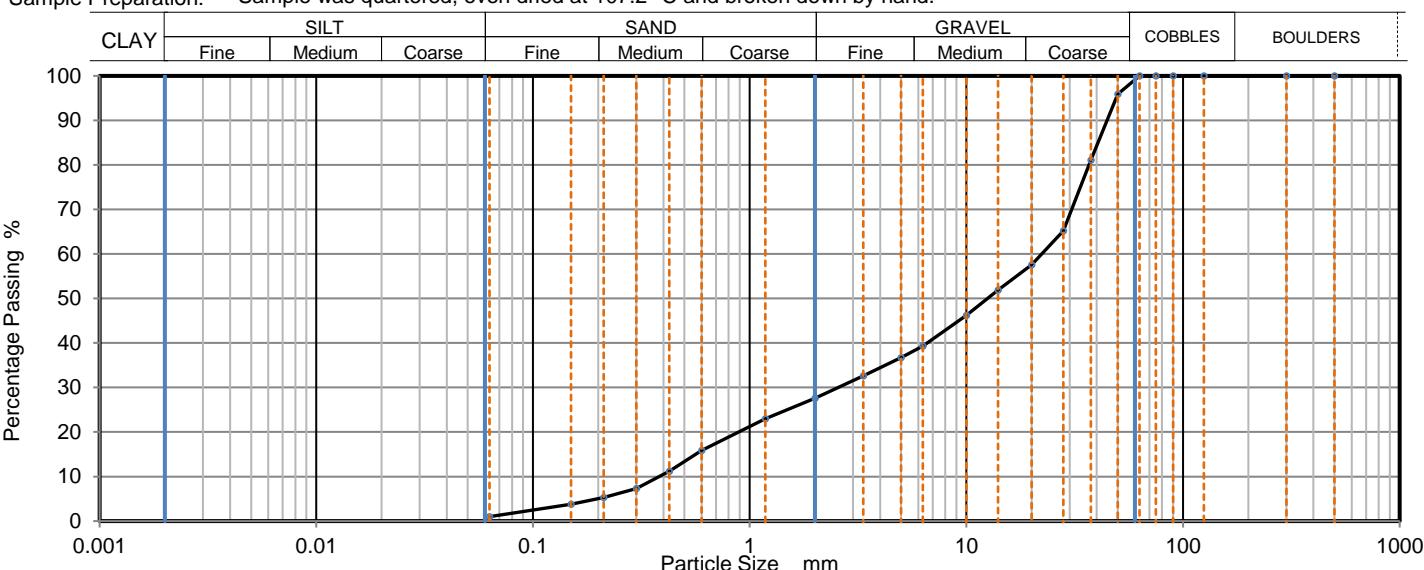
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600468  
Hole No.: BH13  
Sample Reference: 8  
Sample Description: Brown sandy GRAVEL  
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 2.20  
Depth Base [m]: 3.20  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	81		
28	65		
20	58		
14	52		
10	46		
6.3	39		
5	37		
3.35	33		
2	28		
1.18	23		
0.6	16		
0.425	11		
0.3	7		
0.212	5		
0.15	4		
0.063	2		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	72.40
Sand	25.80
Fines <0.063mm	1.80

Grading Analysis		
D100	mm	63
D60	mm	22.2
D30	mm	2.56
D10	mm	0.383
Uniformity Coefficient		58
Curvature Coefficient		0.77

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

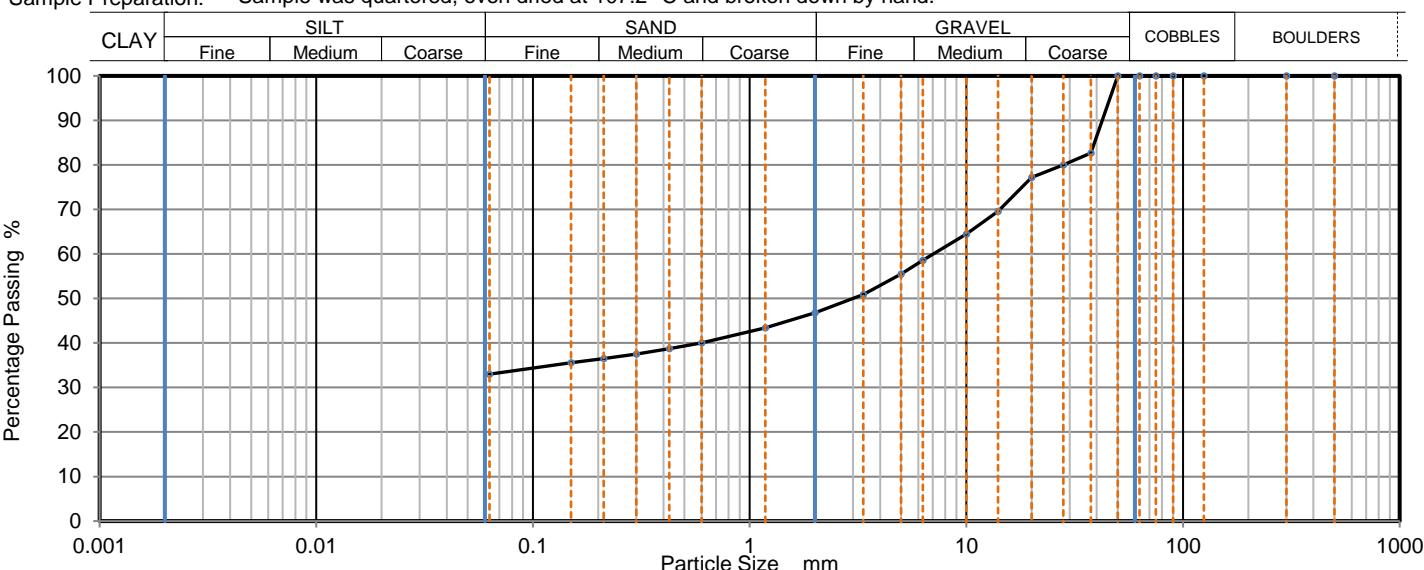
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600469  
Hole No.: BH13  
Sample Reference: 13  
Sample Description: White CHALK  
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 4.20  
Depth Base [m]: 5.20  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	83		
28	80		
20	77		
14	70		
10	65		
6.3	59		
5	56		
3.35	51		
2	47		
1.18	43		
0.6	40		
0.425	39		
0.3	38		
0.212	37		
0.15	36		
0.063	33		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	53.20
Sand	13.60
Fines <0.063mm	33.20

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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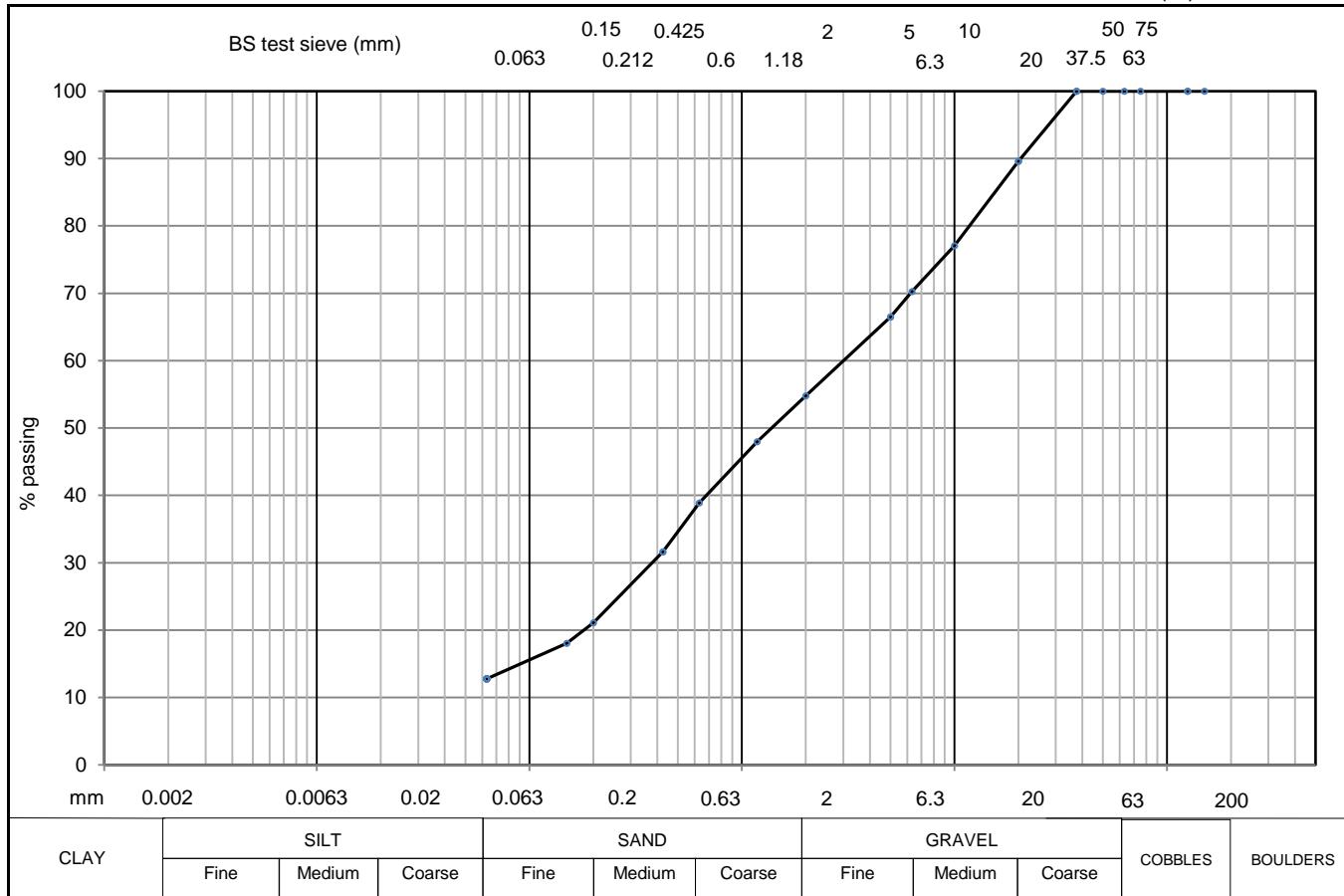
Geotechnical Engineering Limited

# PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH15
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	5B
DESCRIPTION	Dark brown silty very sandy GRAVEL with rare rootlets and rare wood fragments	SAMPLE DEPTH (m)	1.00
		SPECIMEN TOP (m)	1.00
		SPECIMEN BASE (m)	1.30



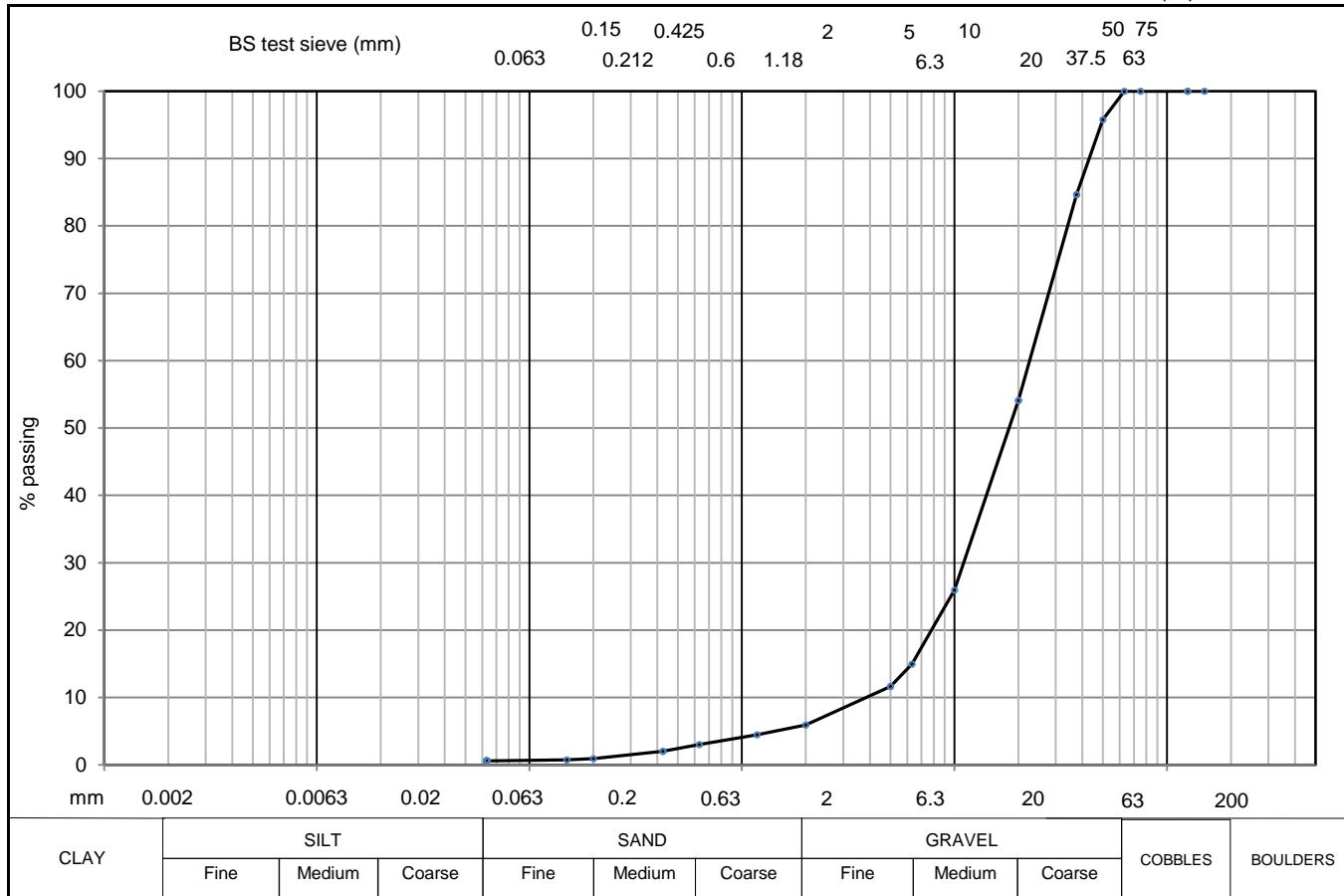
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	13										
SAND		42									
GRAVEL		45									
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>								CONTRACT	CHECKED	
									35880	TB	

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH17
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	7L
DESCRIPTION	Light brown slightly clayey sandy GRAVEL	SAMPLE DEPTH (m)	2.20
		SPECIMEN TOP (m)	2.20
		SPECIMEN BASE (m)	3.20



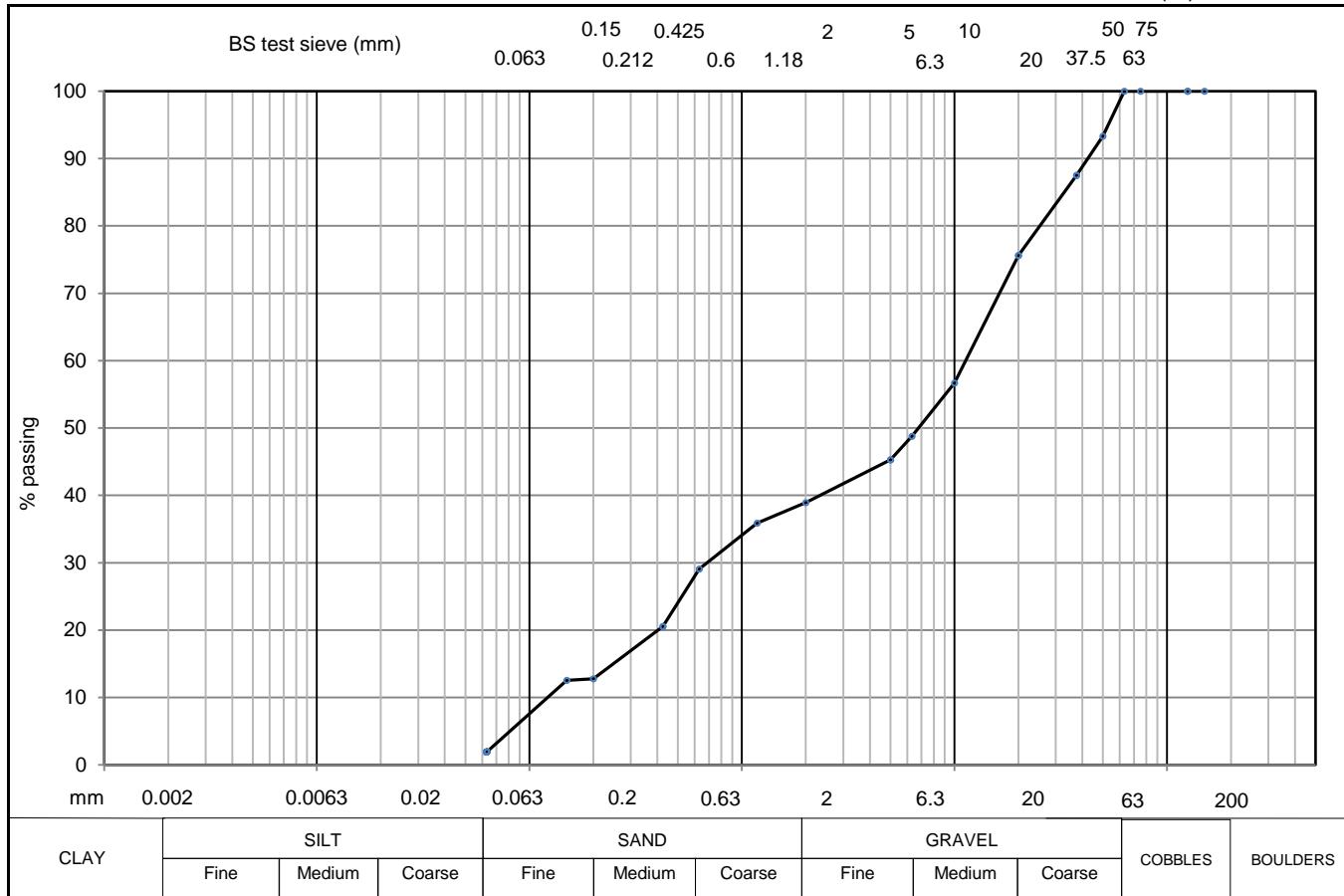
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	1										
SAND	5										
GRAVEL	94										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>								CONTRACT	CHECKED	
									35880	TB	

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	BH17
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	10L
DESCRIPTION	Light brown slightly silty very sandy GRAVEL	SAMPLE DEPTH (m)	4.20
		SPECIMEN TOP (m)	4.20
		SPECIMEN BASE (m)	5.20



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

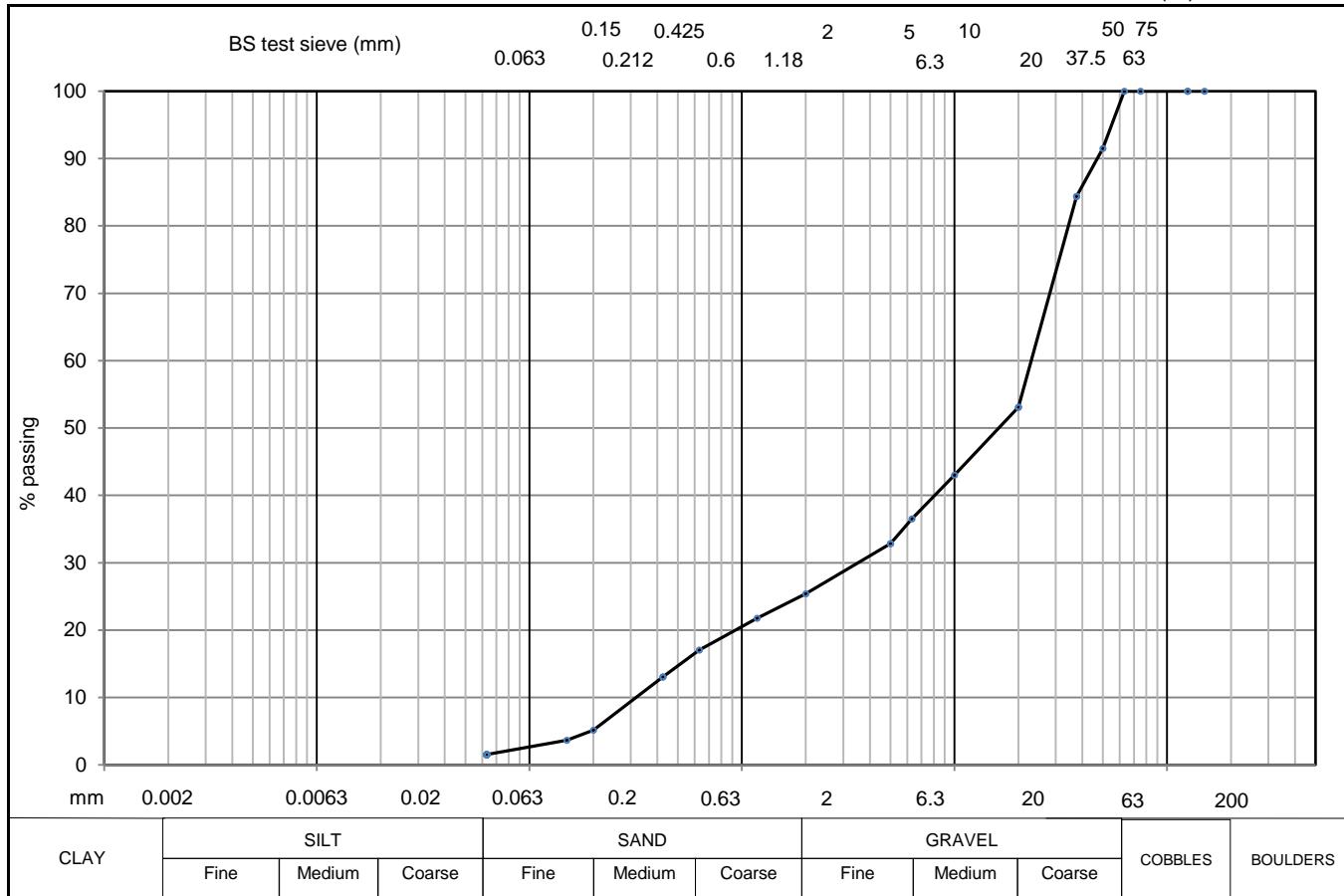
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve ( $\mu\text{m}$ )	% finer
CLAY		150		5	45	20	
SILT		75		2	39	6	
SILT & CLAY	2	63	100	1.18	36	2	
SAND	37	50	93	0.63	29		
GRAVEL	61	37.5	88	0.425	21		
COBBLE & BOULDER	0	20	76	0.2	13		
test method(s)	5.2	10	57	0.15	13		
test method		6.3	49	0.063	2		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	SBH03
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	8L
DESCRIPTION	Brown slightly clayey very sandy GRAVEL	SAMPLE DEPTH (m)	3.20
		SPECIMEN TOP (m)	3.20
		SPECIMEN BASE (m)	4.50



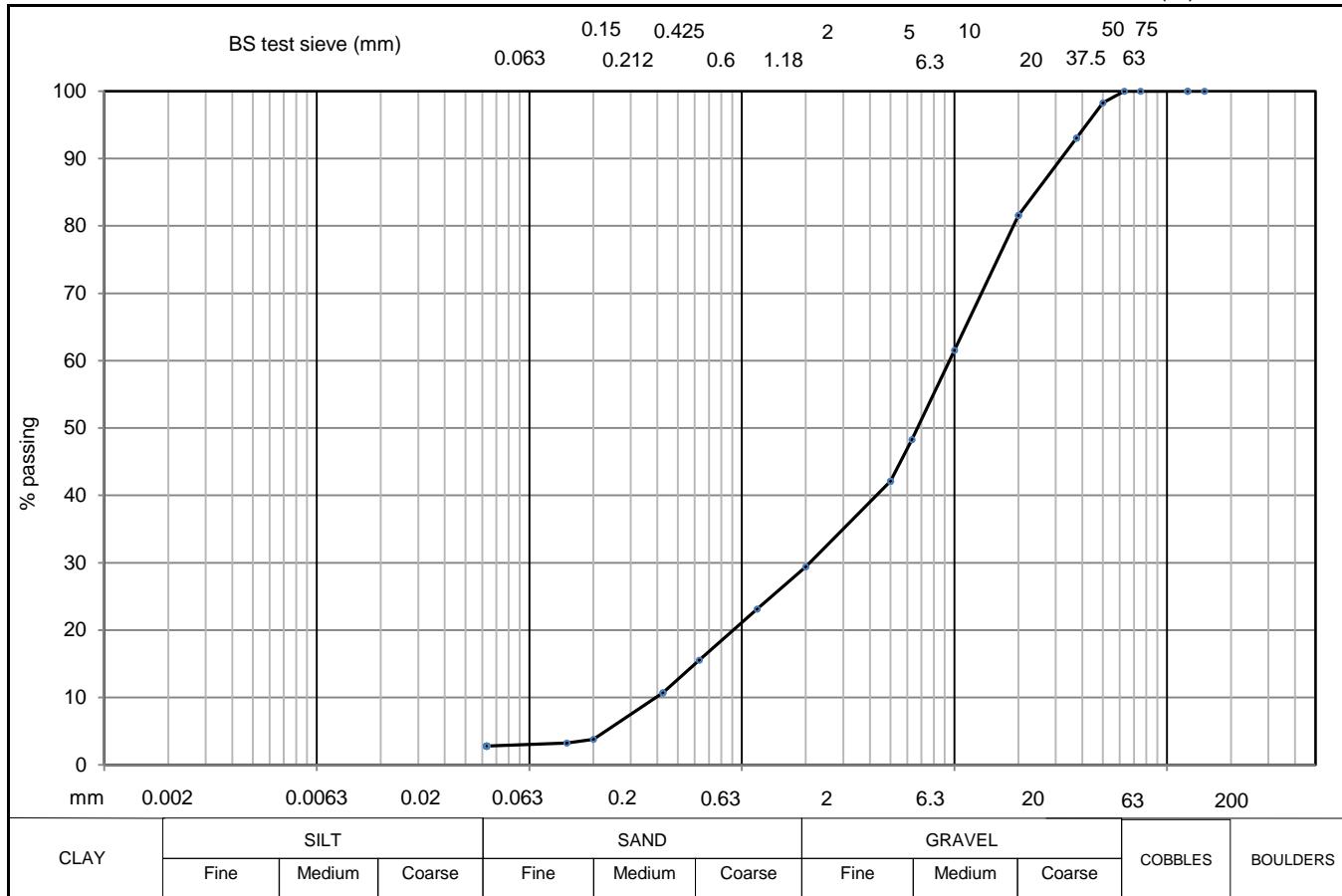
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	2										
SAND	24										
GRAVEL	75										
COBBLE & BOULDER	0										
test method(s)	5.2#										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>								CONTRACT	CHECKED	
									35880	TB	

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	SBH05
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	9L
DESCRIPTION	Orangish brown slightly clayey very sandy GRAVEL	SAMPLE DEPTH (m)	3.80
		SPECIMEN TOP (m)	3.80
		SPECIMEN BASE (m)	5.20



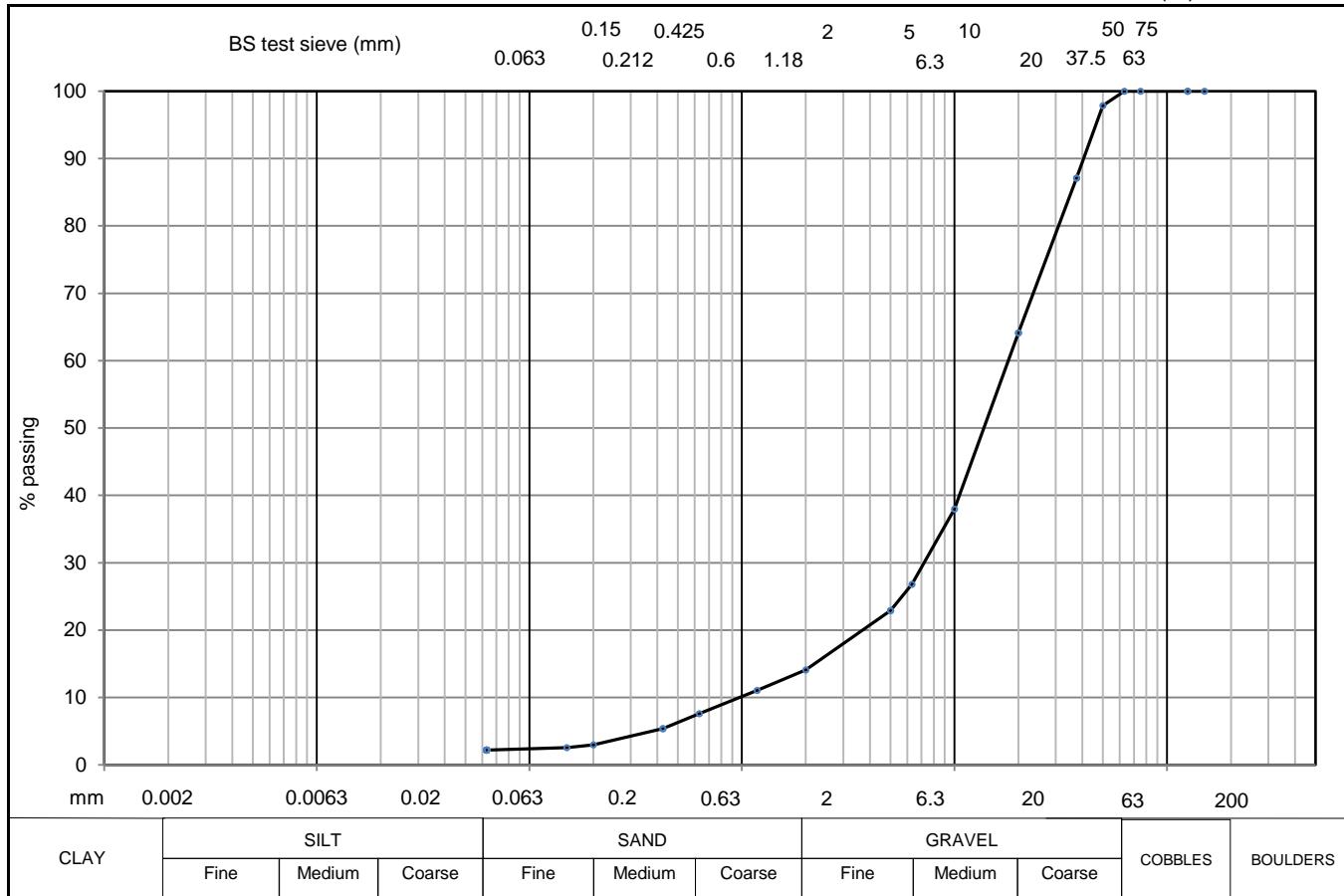
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY							
SILT							
SILT & CLAY	3	150		5	42	20	
SAND	27	75		2	29	6	
GRAVEL	71	63	100	1.18	23	2	
COBBLE & BOULDER	0	50	98	0.63	16		
test method(s)	5.2	37.5	93	0.425	11		
test method		20	82	0.2	4		
5.2 - sieving		10	62	0.15	3		
5.3 - sedimentation by hydrometer		6.3	48	0.063	3		
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m³							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	SBH06
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	11L
DESCRIPTION	Brown slightly clayey sandy GRAVEL	SAMPLE DEPTH (m)	3.20
		SPECIMEN TOP (m)	3.20
		SPECIMEN BASE (m)	4.20



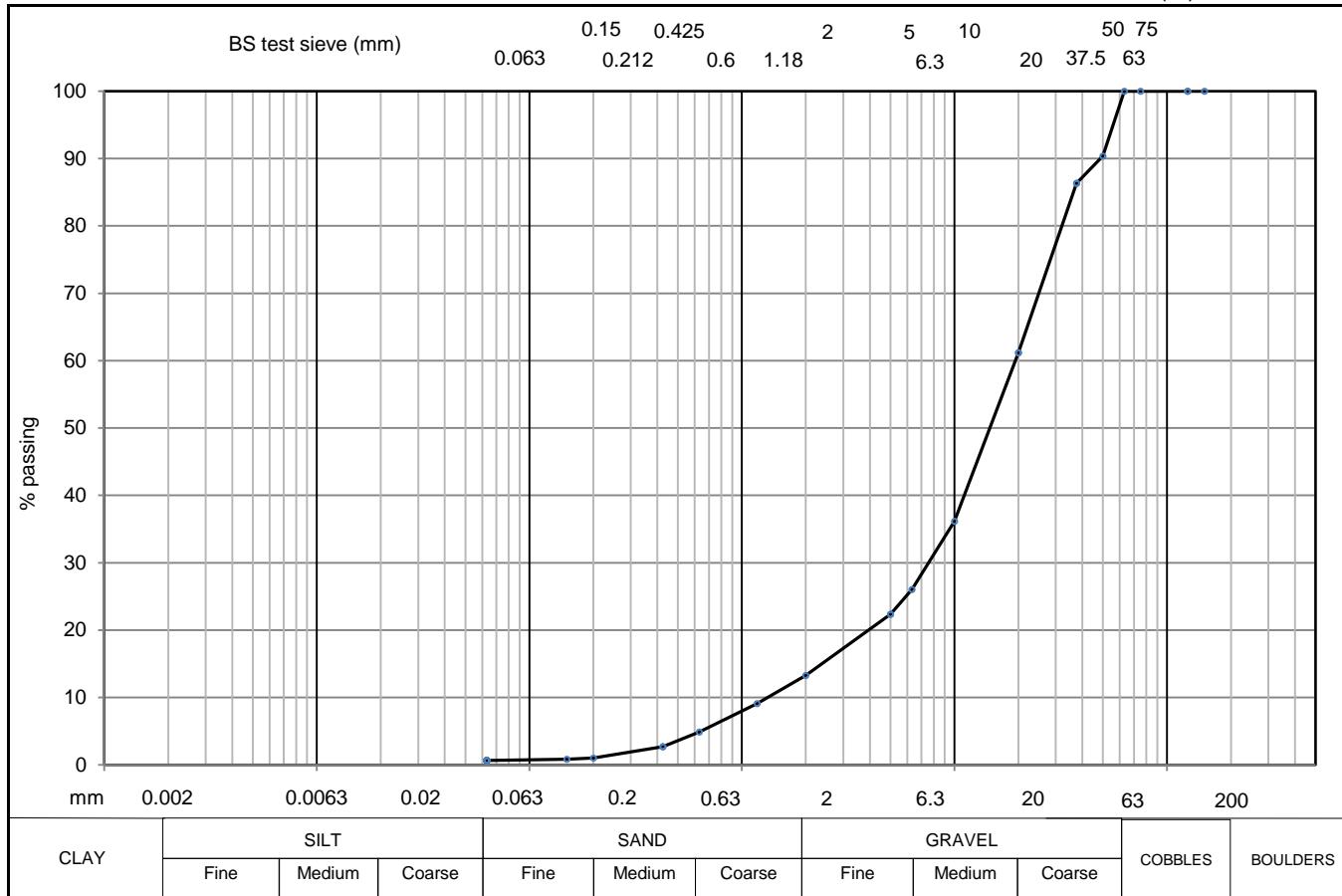
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	2										
SAND		12									
GRAVEL		86									
COBBLE & BOULDER	0										
test method(s)	5.2#										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m3								CONTRACT	CHECKED	
									35880	TB	

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	SBH07
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	13L
DESCRIPTION	Brown slightly silty sandy GRAVEL	SAMPLE DEPTH (m)	4.20
		SPECIMEN TOP (m)	4.20
		SPECIMEN BASE (m)	5.20



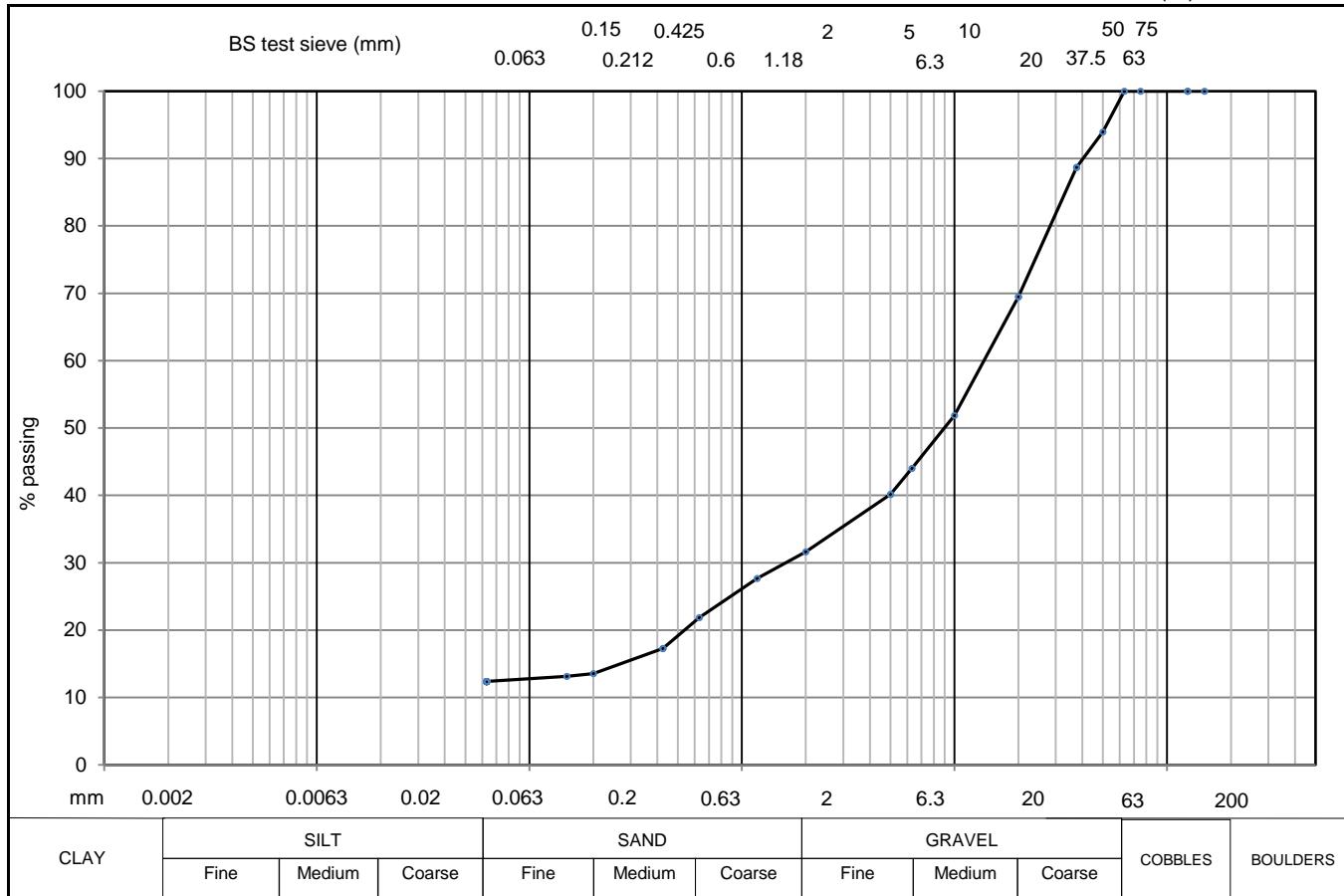
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	1										
SAND	13										
GRAVEL	87										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							CONTRACT	CHECKED		
								35880	TB		

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	SBH09
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	10L
DESCRIPTION	Off white mottled brown silty sandy GRAVEL (chalk)	SAMPLE DEPTH (m)	3.20
		SPECIMEN TOP (m)	3.20
		SPECIMEN BASE (m)	4.20



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

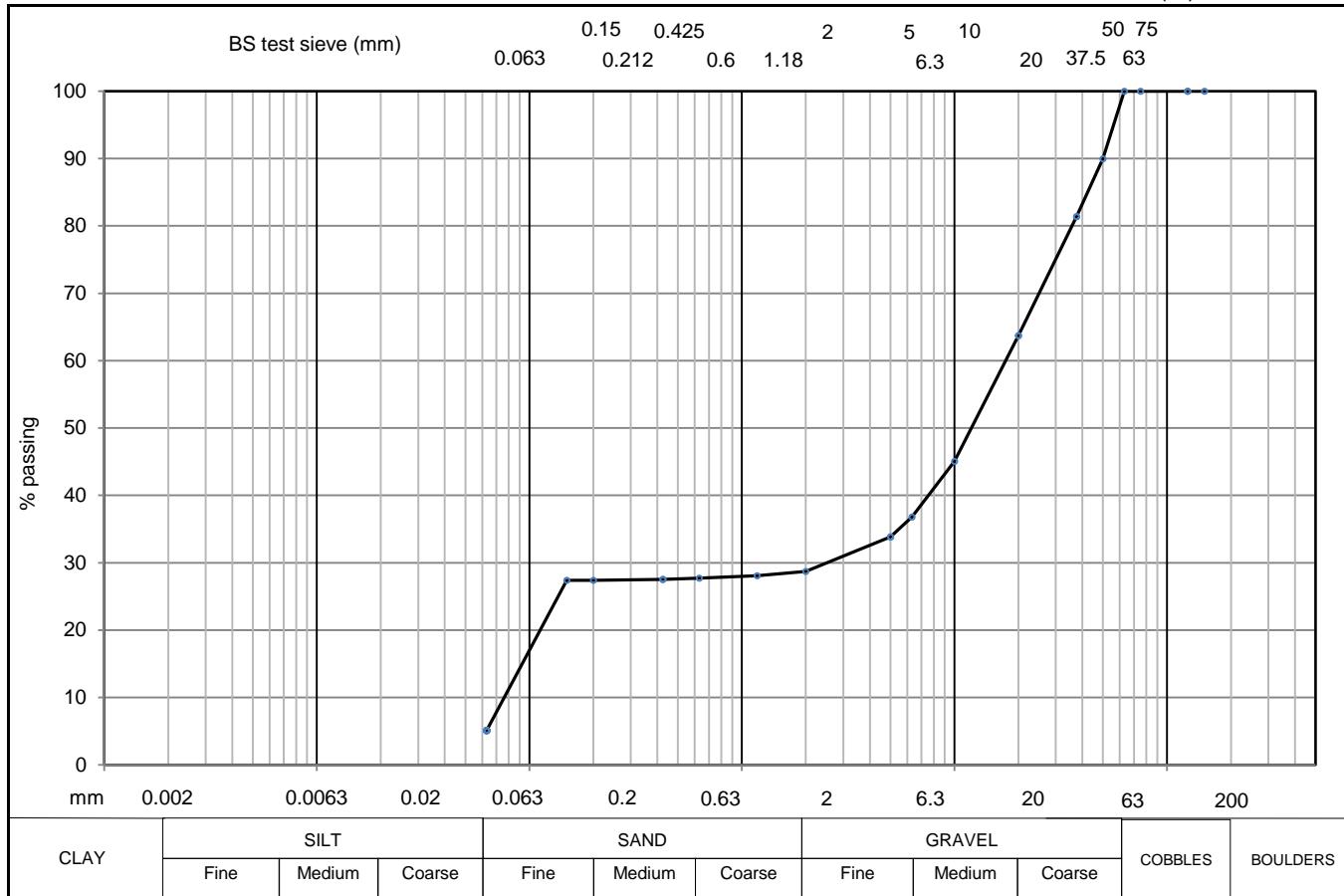
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	40	20	
SILT		75		2	32	6	
SILT & CLAY	12	63	100	1.18	28	2	
SAND	19	50	94	0.63	22		
GRAVEL	68	37.5	89	0.425	17		
COBBLE & BOULDER	0	20	69	0.2	14		
test method(s)	5.2	10	52	0.15	13		
test method		6.3	44	0.063	12		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>					CONTRACT	CHECKED
						35880	TB

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	SBH10
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	9L
DESCRIPTION	Brown silty very sandy GRAVEL	SAMPLE DEPTH (m)	3.20
		SPECIMEN TOP (m)	3.20
		SPECIMEN BASE (m)	4.20



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve ( $\mu\text{m}$ )	% finer
CLAY		150		5	34	20	
SILT		75		2	29	6	
SILT & CLAY	5	63	100	1.18	28	2	
SAND	24	50	90	0.63	28		
GRAVEL	71	37.5	81	0.425	28		
COBBLE & BOULDER	0	20	64	0.2	27		
test method(s)	5.2	10	45	0.15	27		
test method		6.3	37	0.063	5		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>					CONTRACT	CHECKED
						35880	TB



4041

# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

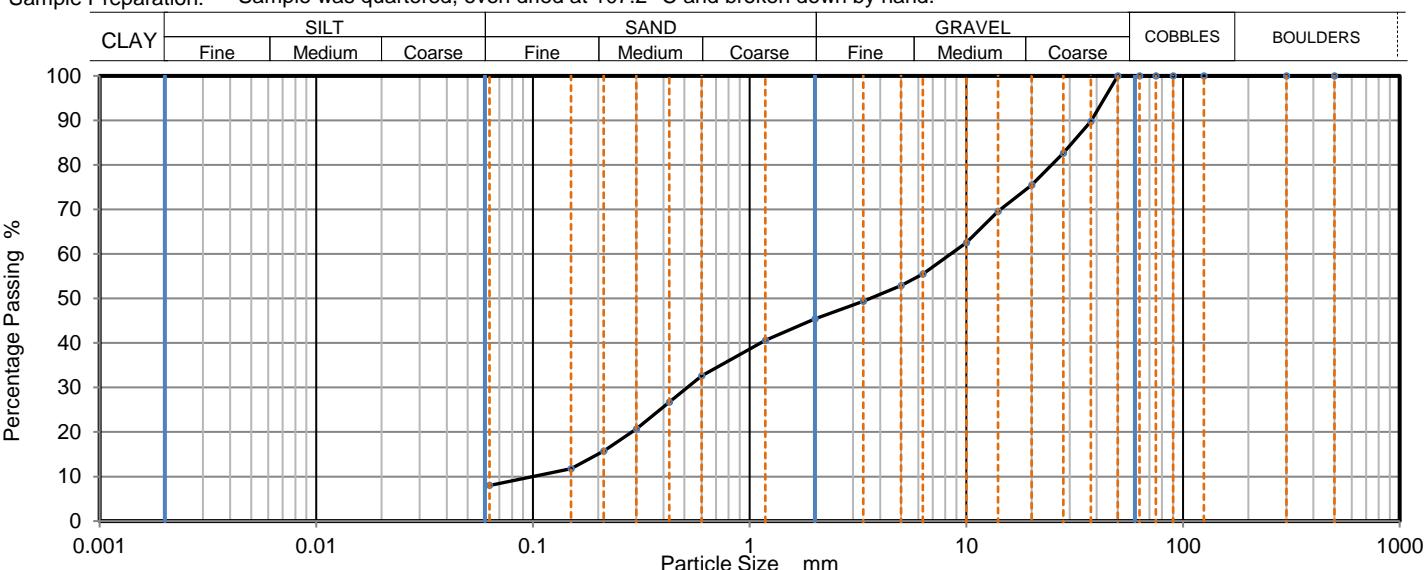
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600474  
Hole No.: STP02  
Sample Reference: 1  
Sample Description: Dark brown clayey very sandy GRAVEL  
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 0.40  
Depth Base [m]: 0.50  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	90		
28	83		
20	76		
14	70		
10	63		
6.3	56		
5	53		
3.35	49		
2	45		
1.18	41		
0.6	33		
0.425	27		
0.3	21		
0.212	16		
0.15	12		
0.063	8		

Sample Proportions		% dry mass
Very coarse		0.00
Gravel		54.60
Sand		37.00
Fines <0.063mm		8.40

Grading Analysis		
D100	mm	50
D60	mm	8.49
D30	mm	0.515
D10	mm	0.0956
Uniformity Coefficient		89
Curvature Coefficient		0.33

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

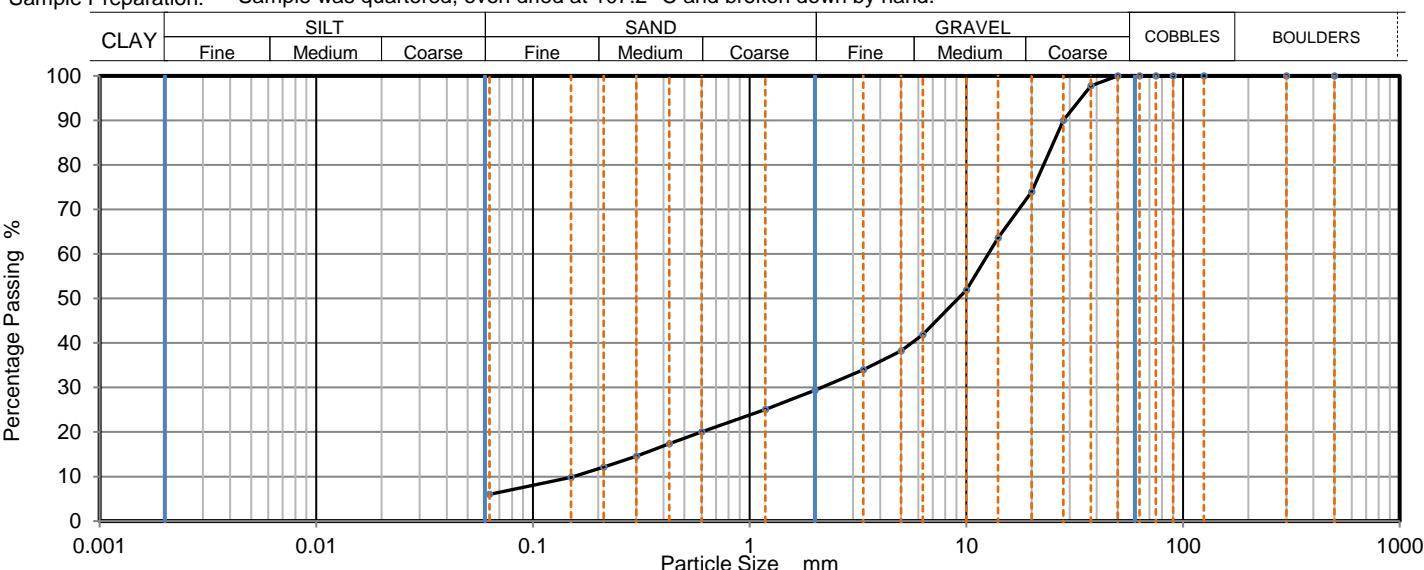
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600475  
Hole No.: STP03  
Sample Reference: 3  
Sample Description: Black clayey sandy GRAVEL  
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 2.50  
Depth Base [m]: 2.60  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	90		
20	74		
14	64		
10	52		
6.3	42		
5	38		
3.35	34		
2	29		
1.18	25		
0.6	20		
0.425	17		
0.3	15		
0.212	12		
0.15	10		
0.063	7		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	70.60
Sand	22.50
Fines <0.063mm	6.90

Grading Analysis		
D100	mm	50
D60	mm	12.6
D30	mm	2.15
D10	mm	0.155
Uniformity Coefficient		81
Curvature Coefficient		2.3

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

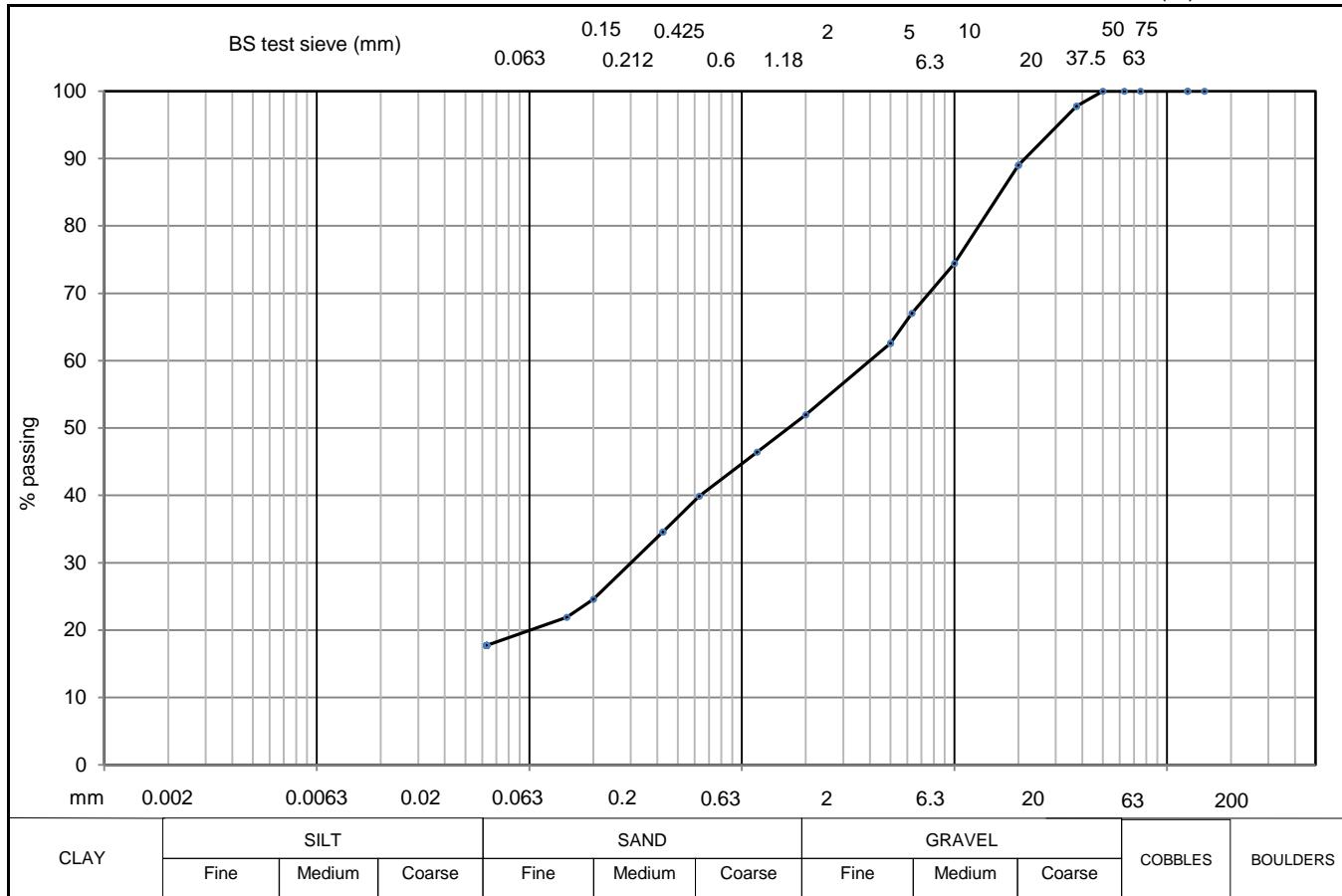
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**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	STP07
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	3LB
DESCRIPTION	Dark brown silty very sandy GRAVEL	SAMPLE DEPTH (m)	1.20
		SPECIMEN TOP (m)	1.20
		SPECIMEN BASE (m)	1.30



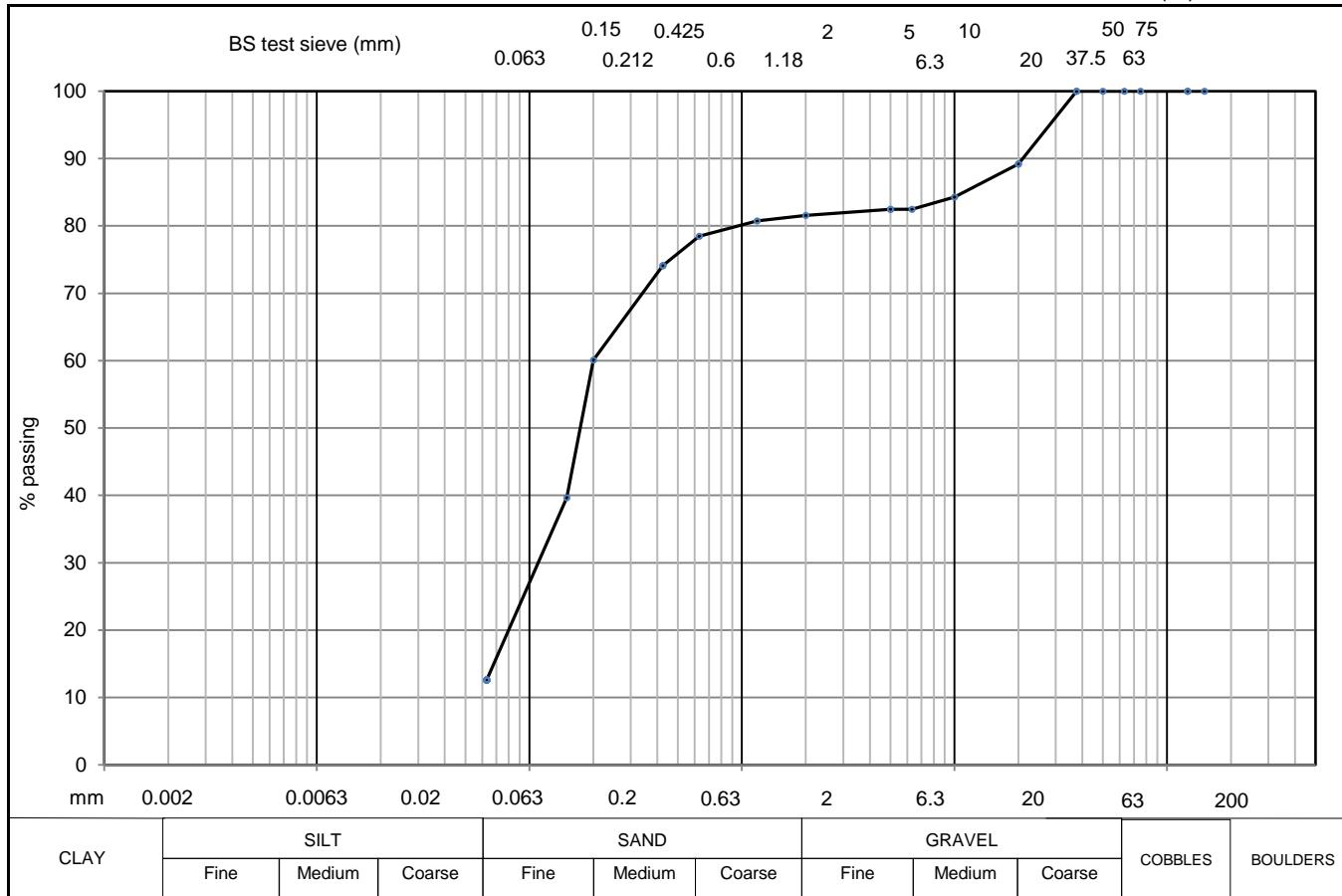
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve ( $\mu\text{m}$ )	% finer
CLAY							
SILT							
SILT & CLAY	18	150		5	63	20	
SAND	34	75		2	52	6	
GRAVEL	48	63		1.18	46	2	
COBBLE & BOULDER	0	50	100	0.63	40		
test method(s)	5.2	37.5	98	0.425	35		
test method		20	89	0.2	25		
5.2 - sieving		10	74	0.15	22		
5.3 - sedimentation by hydrometer		6.3	67	0.063	18		
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP01
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	1B
DESCRIPTION	Brown silty gravelly SAND	SAMPLE DEPTH (m)	0.50
		SPECIMEN TOP (m)	0.50
		SPECIMEN BASE (m)	0.60



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

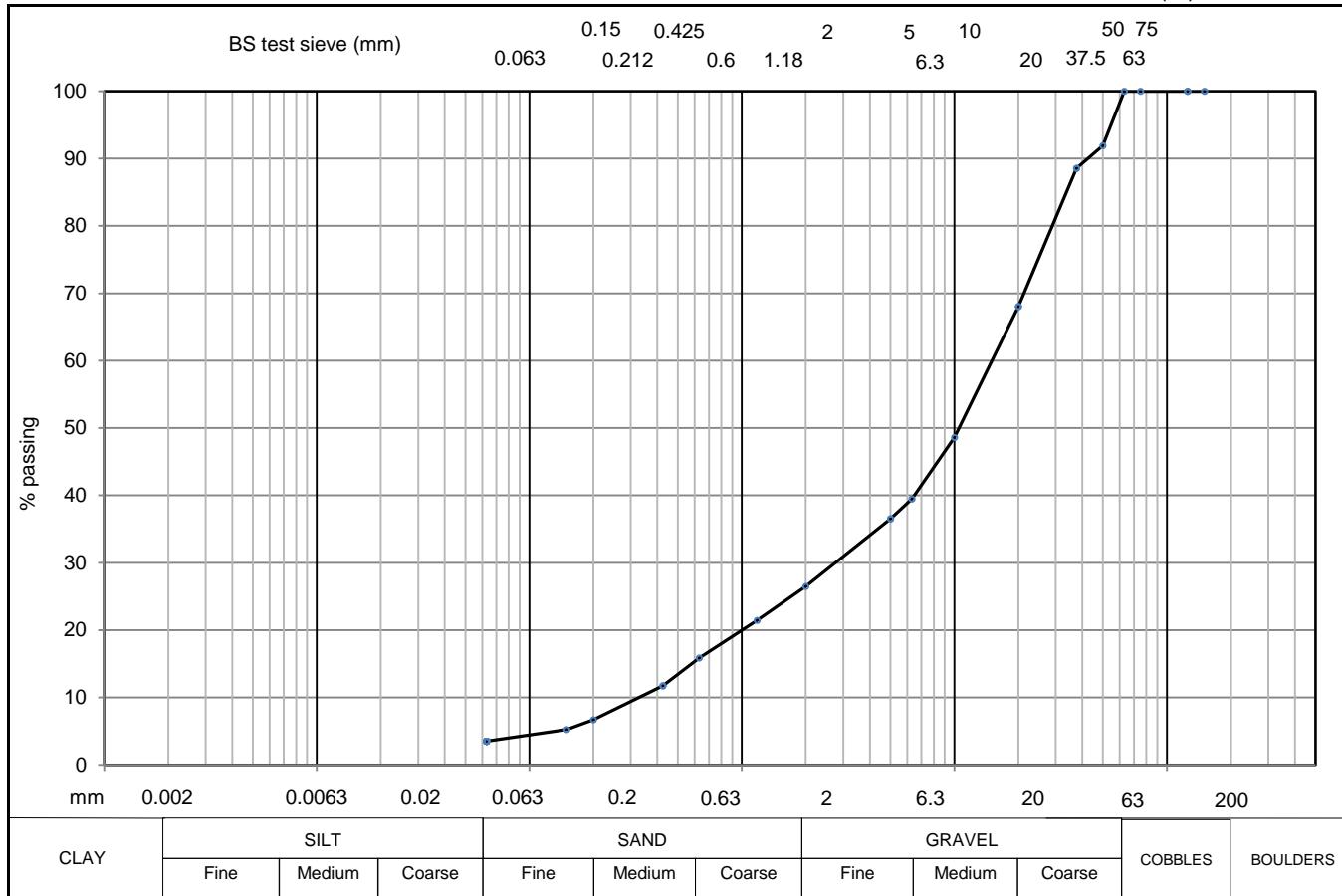
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	82	20	
SILT		75		2	82	6	
SILT & CLAY	13	63		1.18	81	2	
SAND	69	50		0.63	78		
GRAVEL	18	37.5	100	0.425	74		
COBBLE & BOULDER	0	20	89	0.2	60		
test method(s)	5.2	10	84	0.15	40		
test method		6.3	82	0.063	13		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m³							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP01
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	3B
DESCRIPTION	Brown clayey very sandy GRAVEL	SAMPLE DEPTH (m)	2.00
		SPECIMEN TOP (m)	2.00
		SPECIMEN BASE (m)	2.10



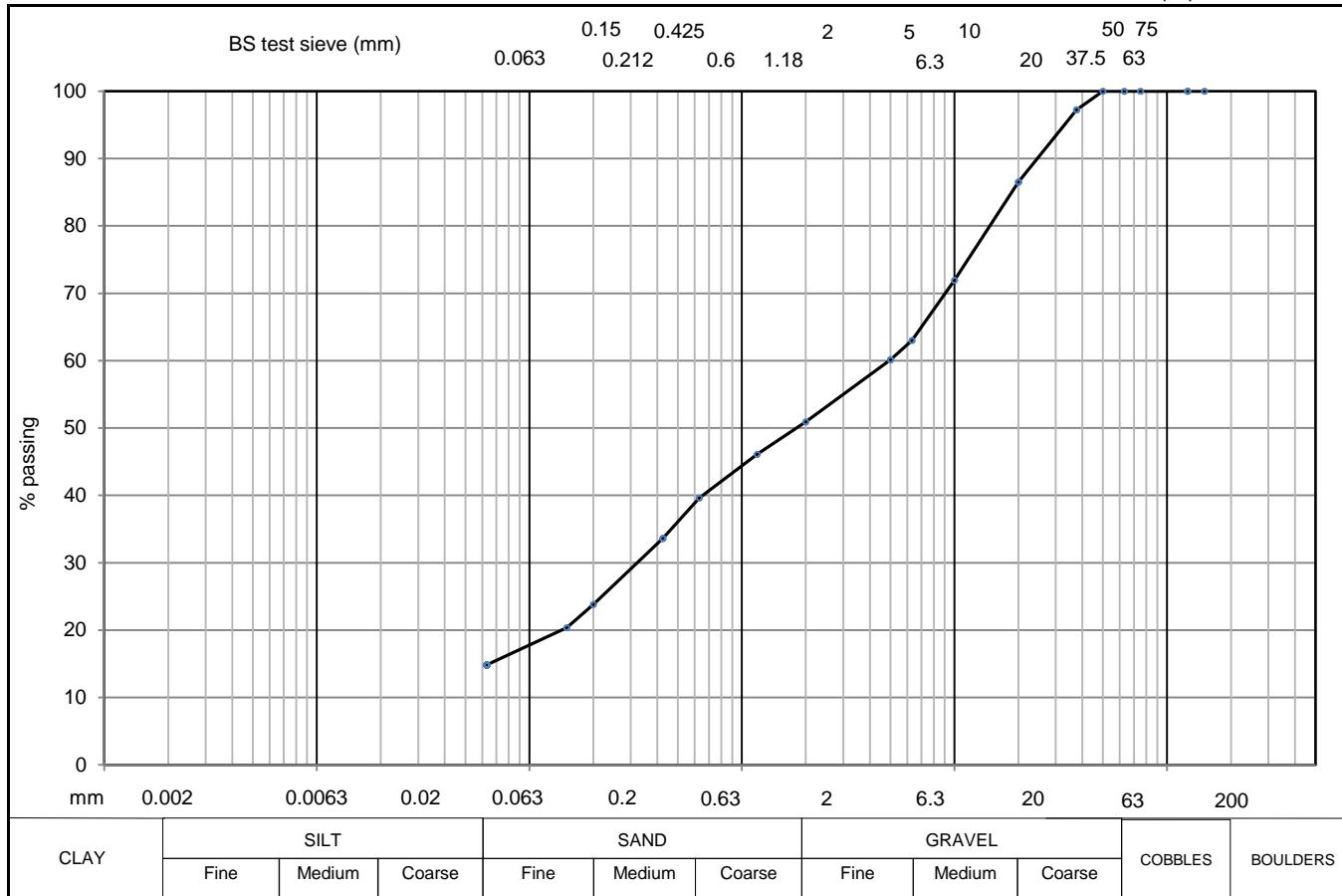
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	4										
SAND		23									
GRAVEL		73									
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>								CONTRACT	CHECKED	
									35880	TB	

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP02
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Dark brown silty very sandy GRAVEL with rare rootlets	SAMPLE DEPTH (m)	0.70
		SPECIMEN TOP (m)	0.70
		SPECIMEN BASE (m)	0.80



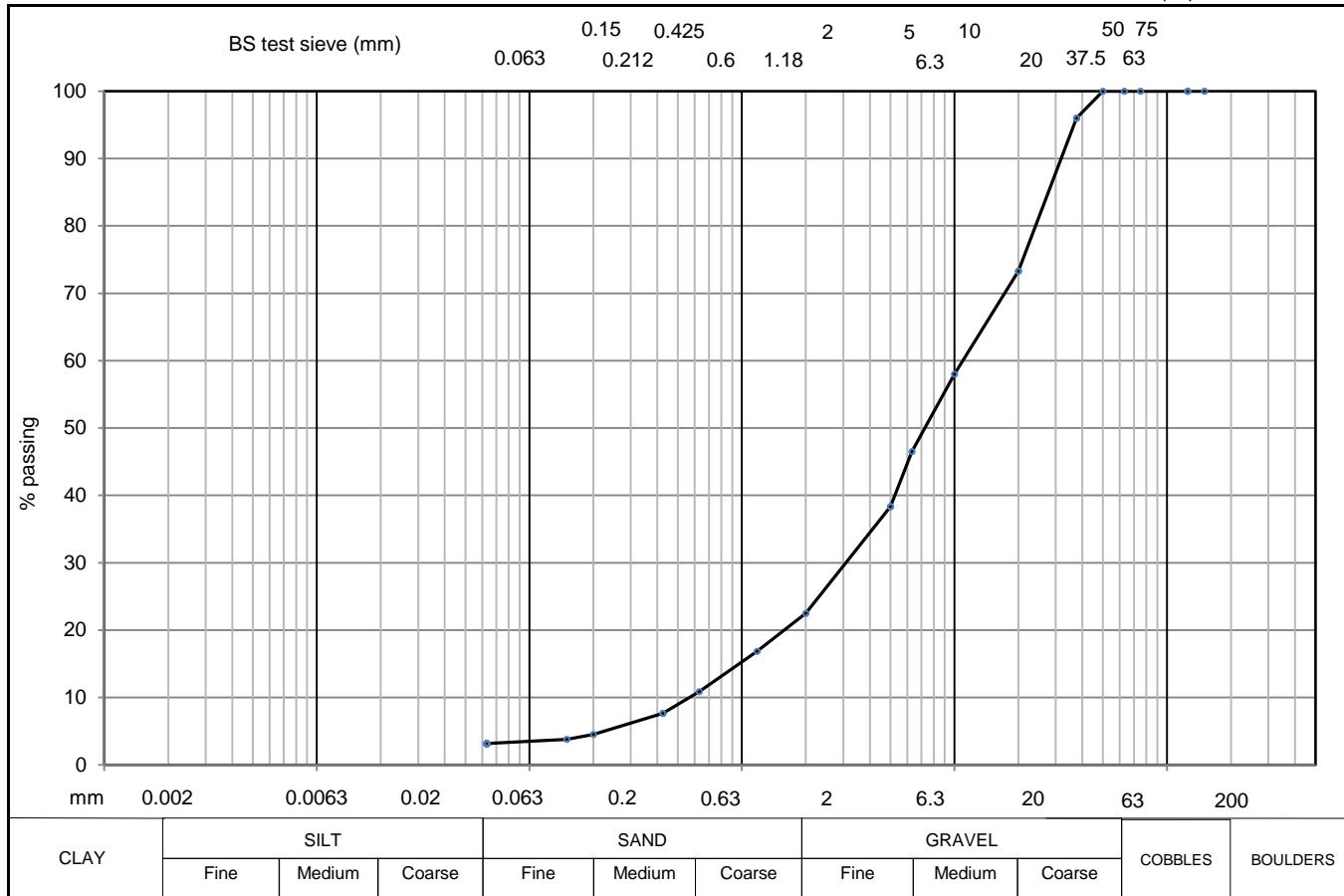
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	15										
SAND	36										
GRAVEL	49										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>								CONTRACT	CHECKED	
									35880	TB	

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP02
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	3LB
DESCRIPTION	Dark brown slightly silty sandy GRAVEL	SAMPLE DEPTH (m)	1.10
		SPECIMEN TOP (m)	1.10
		SPECIMEN BASE (m)	1.20



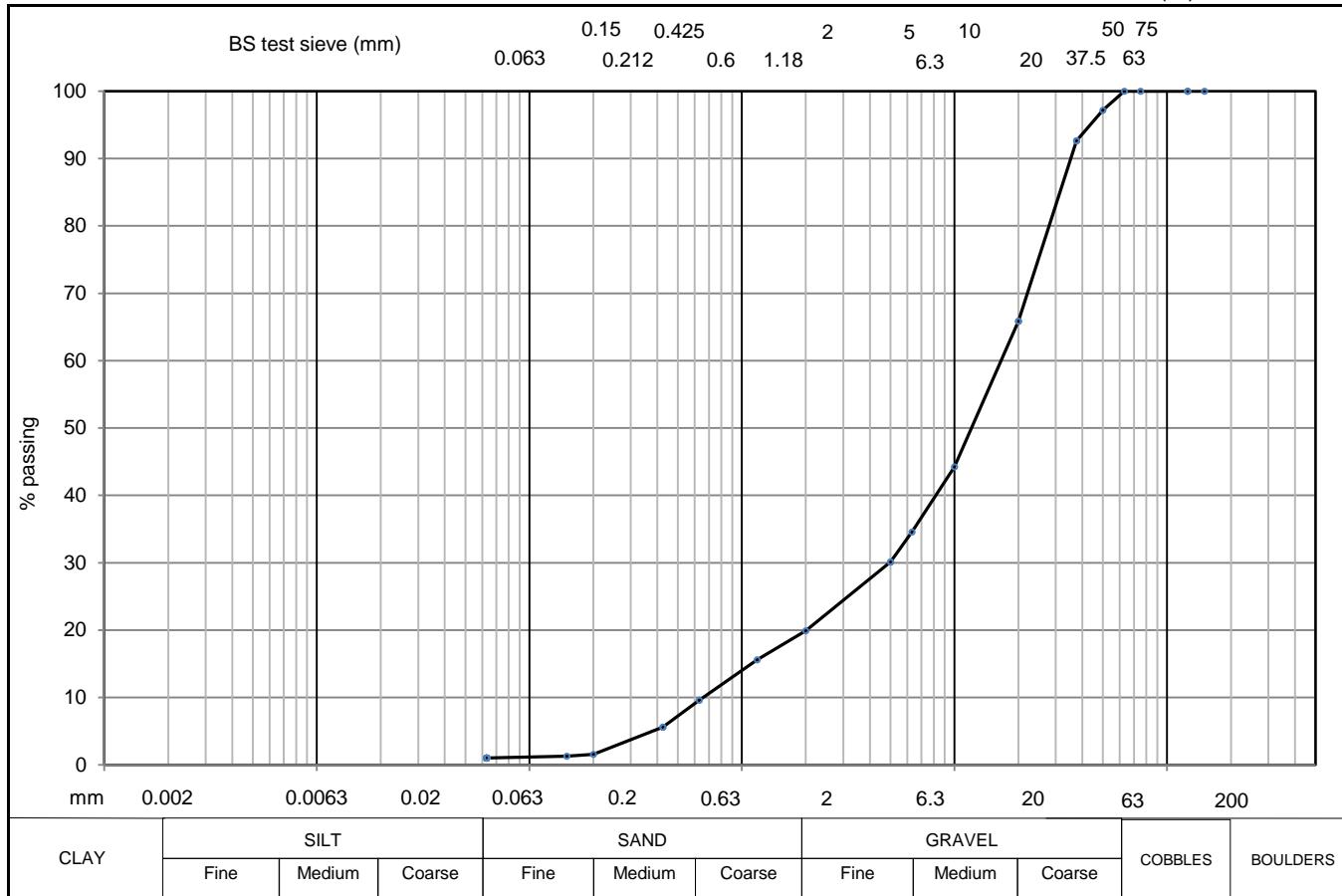
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve ( $\mu\text{m}$ )	% finer
CLAY							
SILT							
SILT & CLAY	3	150		5	38	20	
SAND	19	75		2	22	6	
GRAVEL	78	63		1.18	17	2	
COBBLE & BOULDER	0						
test method(s)	5.2						
test method							
5.2 - sieving		50	100	0.63	11		
5.3 - sedimentation by hydrometer		37.5	96	0.425	8		
5.4 - sedimentation by pipette		20	73	0.2	5		
		10	58	0.15	4		
		6.3	46	0.063	3		
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP03
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	1LB
DESCRIPTION	Brown slightly clayey sandy GRAVEL	SAMPLE DEPTH (m)	0.30
		SPECIMEN TOP (m)	0.30
		SPECIMEN BASE (m)	0.40



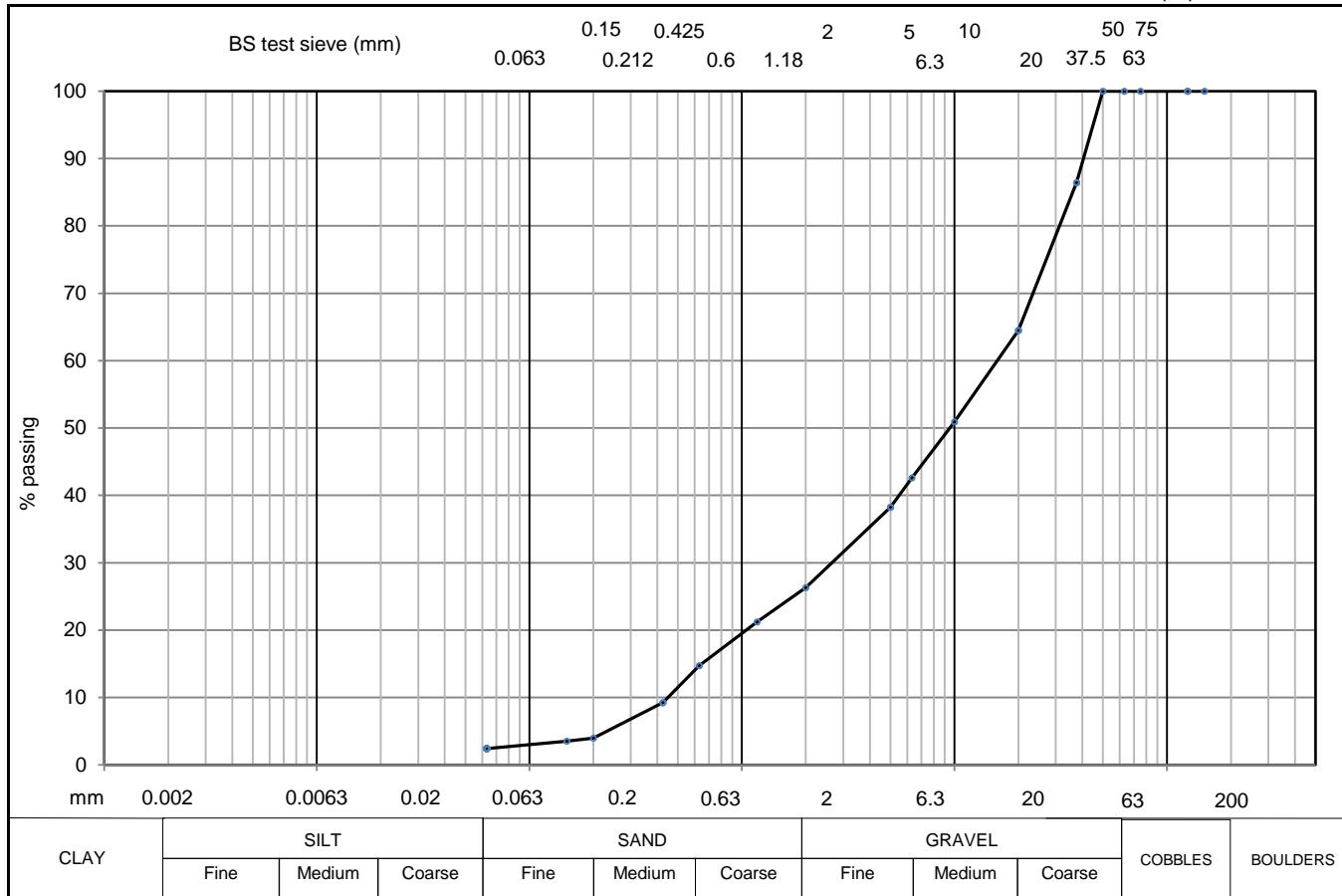
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve ( $\mu\text{m}$ )	% finer
CLAY							
SILT							
SILT & CLAY	1	150		5	30	20	
SAND	19	75		2	20	6	
GRAVEL	80	63	100	1.18	16	2	
COBBLE & BOULDER	0	50	97	0.63	10		
test method(s)	5.2	37.5	93	0.425	6		
test method		20	66	0.2	2		
5.2 - sieving		10	44	0.15	1		
5.3 - sedimentation by hydrometer		6.3	35	0.063	1		
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP03
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Orangish brown slightly clayey very sandy GRAVEL	SAMPLE DEPTH (m)	2.20
		SPECIMEN TOP (m)	2.20
		SPECIMEN BASE (m)	2.30



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

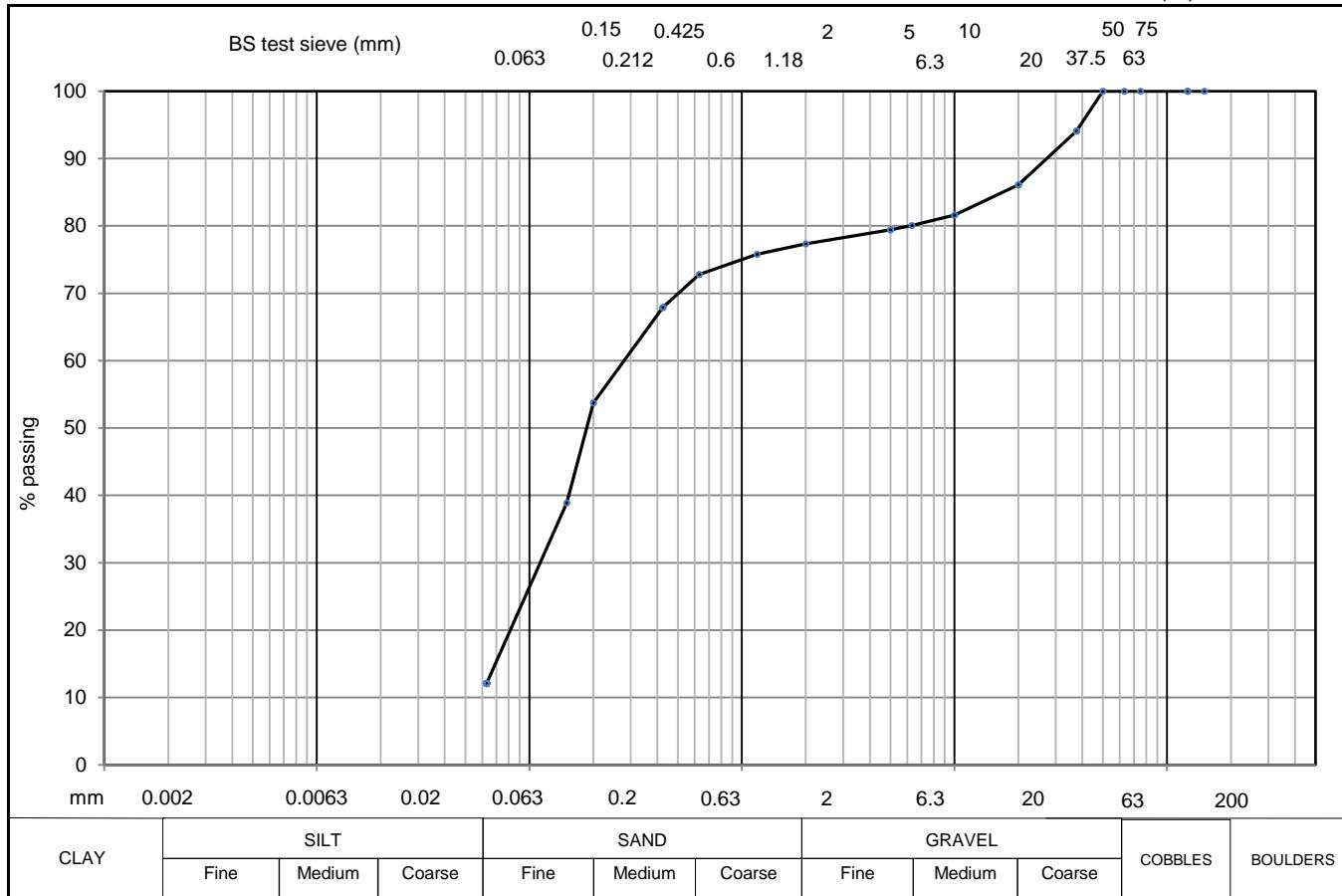
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve ( $\mu\text{m}$ )	% finer
CLAY		150		5	38	20	
SILT		75		2	26	6	
SILT & CLAY	2	63		1.18	21	2	
SAND	24	50	100	0.63	15		
GRAVEL	74	37.5	86	0.425	9		
COBBLE & BOULDER	0	20	64	0.2	4		
test method(s)	5.2	10	51	0.15	4		
test method		6.3	43	0.063	2		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP04
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Orangish brown clayey very gravelly SAND	SAMPLE DEPTH (m)	0.60
		SPECIMEN TOP (m)	0.60
		SPECIMEN BASE (m)	0.70



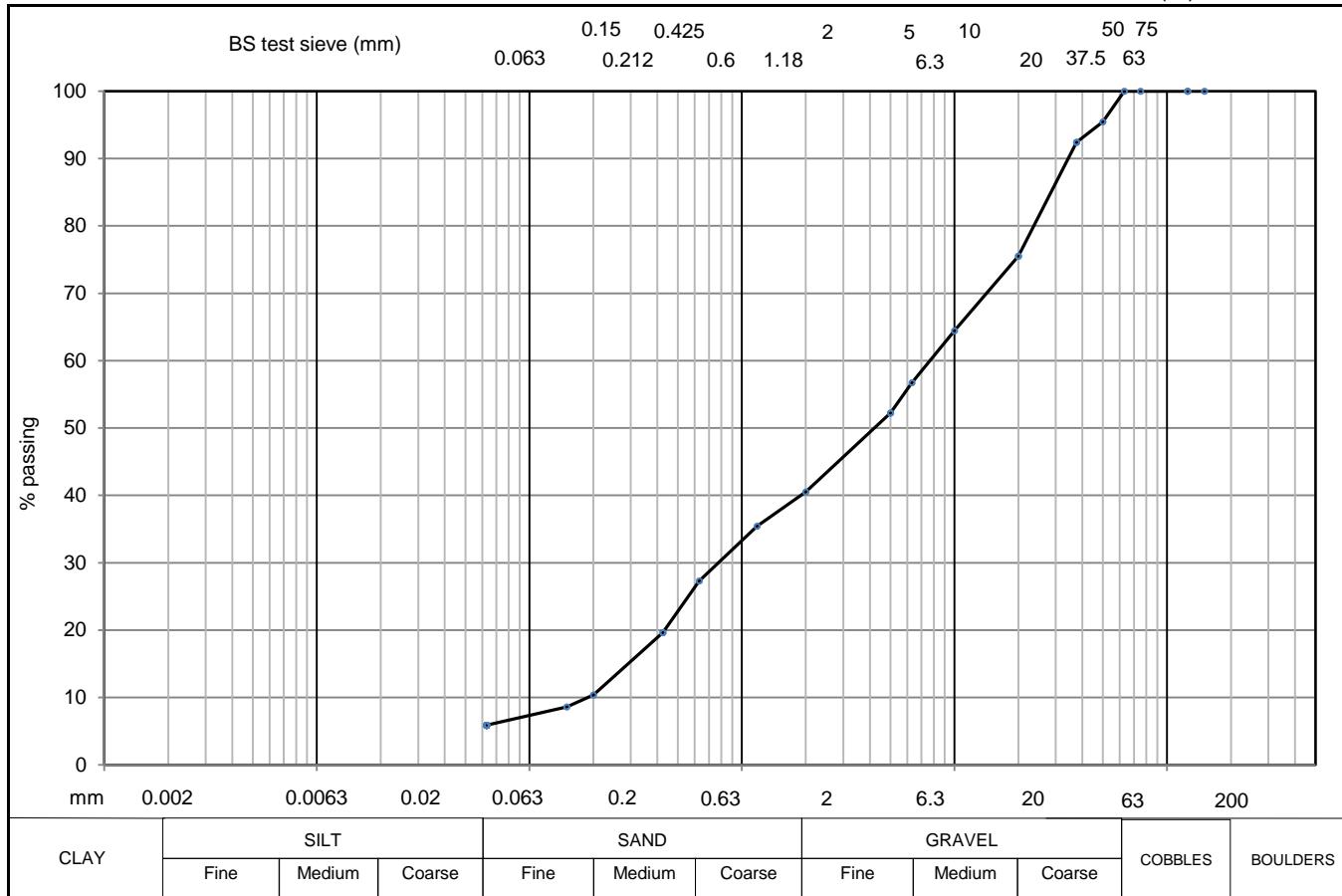
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	12										
SAND	65										
GRAVEL	23										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>								CONTRACT	CHECKED	
									35880	TB	

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP05
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Dark brown silty very sandy GRAVEL with rare rootlets	SAMPLE DEPTH (m)	0.20
		SPECIMEN TOP (m)	0.20
		SPECIMEN BASE (m)	0.30



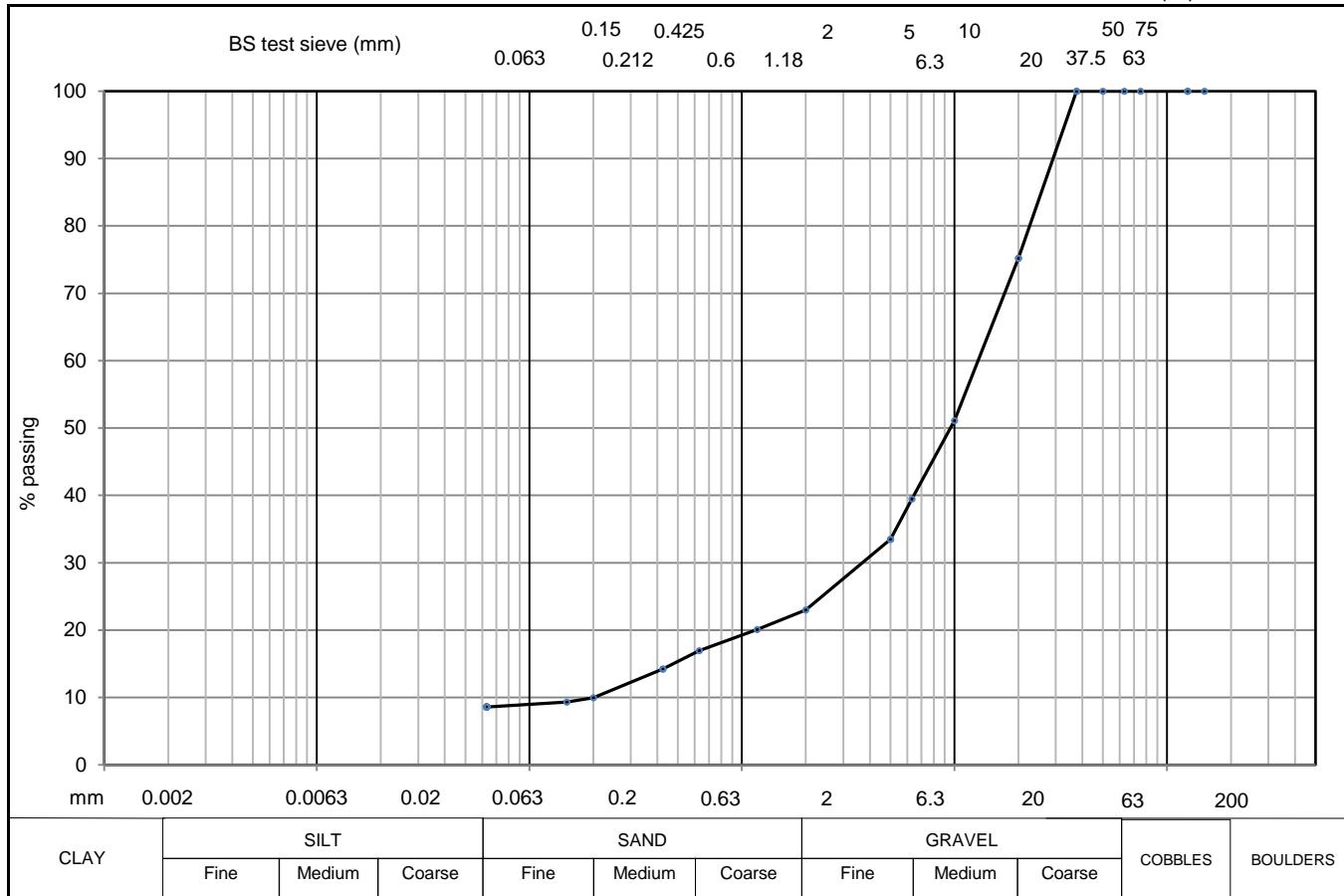
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve ( $\mu\text{m}$ )	% finer
CLAY							
SILT							
SILT & CLAY	6	150		5	52	20	
SAND	35	75		2	40	6	
GRAVEL	60	63	100	1.18	35	2	
COBBLE & BOULDER	0						
test method(s)	5.2						
test method							
5.2 - sieving		50	95	0.63	27		
5.3 - sedimentation by hydrometer		37.5	92	0.425	20		
5.4 - sedimentation by pipette		20	76	0.2	10		
		10	64	0.15	9		
		6.3	57	0.063	6		
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP05
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	4LB
DESCRIPTION	Dark orangish brown silty sandy GRAVEL	SAMPLE DEPTH (m)	1.30
		SPECIMEN TOP (m)	1.30
		SPECIMEN BASE (m)	1.40



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

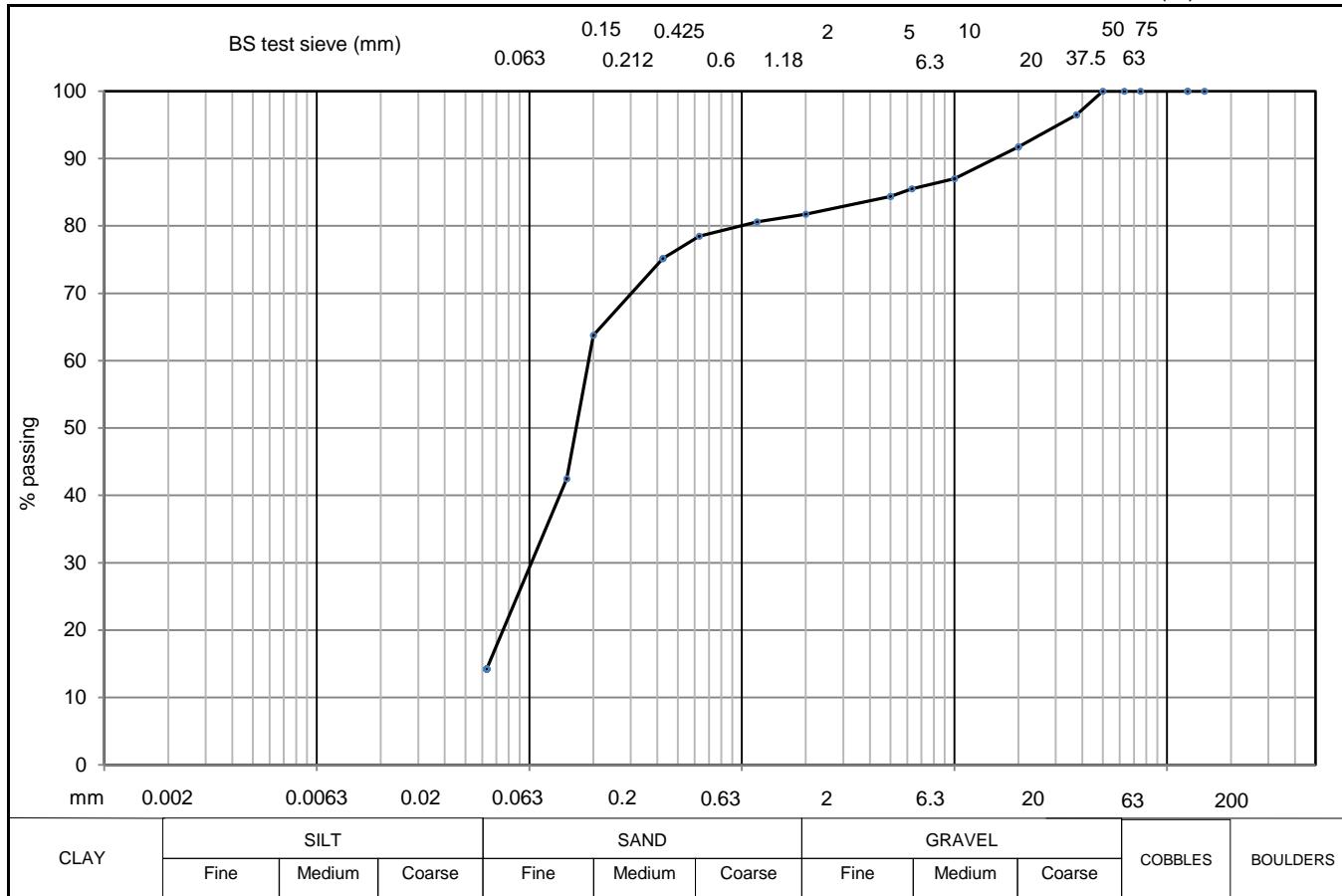
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	33	20	
SILT		75		2	23	6	
SILT & CLAY	9	63		1.18	20	2	
SAND	14	50		0.63	17		
GRAVEL	77	37.5	100	0.425	14		
COBBLE & BOULDER	0	20	75	0.2	10		
test method(s)	5.2	10	51	0.15	9		
test method		6.3	39	0.063	9		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m³					CONTRACT	CHECKED
						35880	TB

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP06
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	1LB
DESCRIPTION	Light brown clayey gravelly SAND with rare rootlets	SAMPLE DEPTH (m)	0.20
		SPECIMEN TOP (m)	0.20
		SPECIMEN BASE (m)	0.30



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

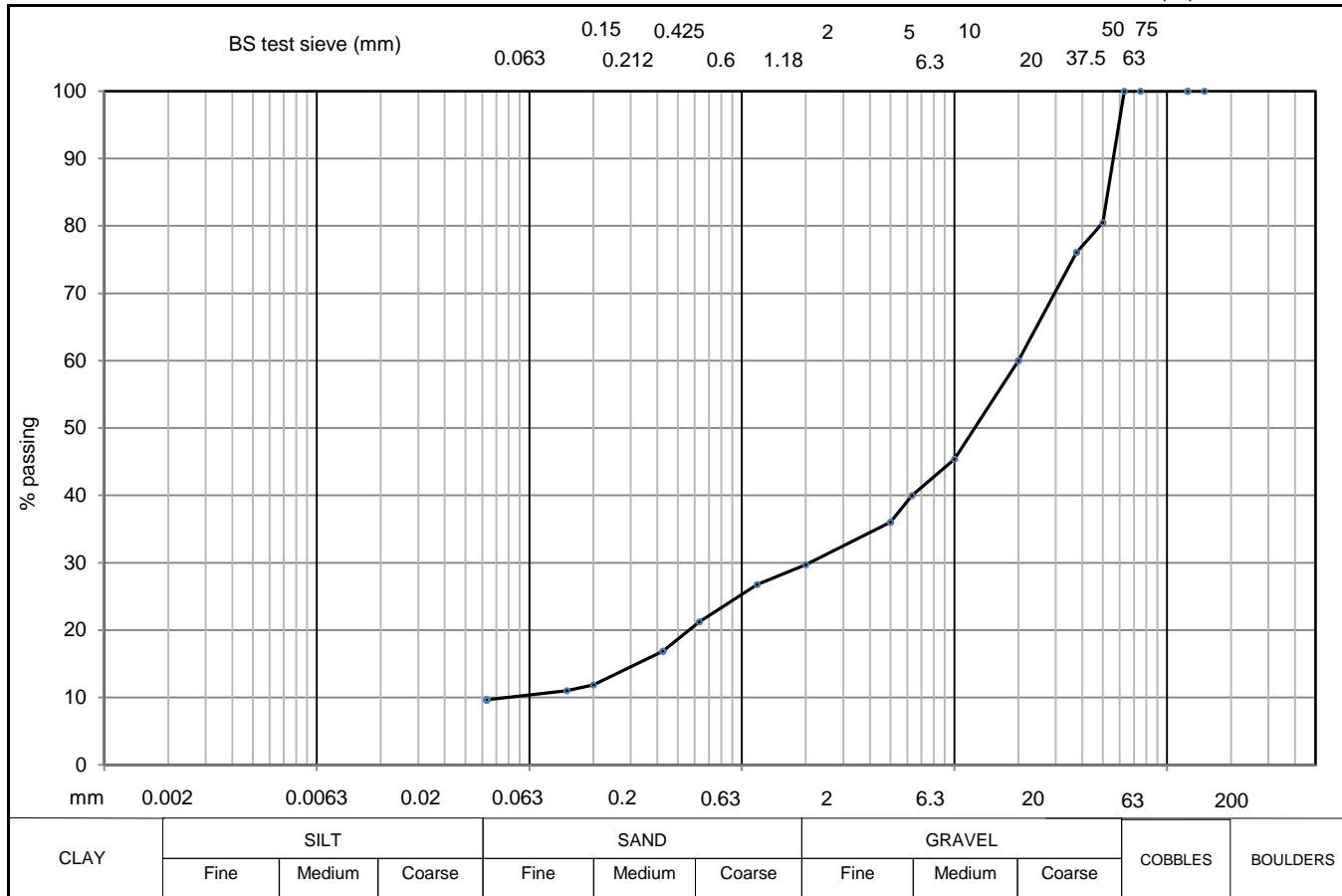
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	84	20	
SILT		75		2	82	6	
SILT & CLAY	14	63		1.18	81	2	
SAND	68	50	100	0.63	78		
GRAVEL	18	37.5	97	0.425	75		
COBBLE & BOULDER	0	20	92	0.2	64		
test method(s)	5.2	10	87	0.15	42		
test method		6.3	86	0.063	14		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m³					CONTRACT	CHECKED
						35880	TB

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP07
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2B
DESCRIPTION	Black silty very sandy GRAVEL with rare rootlets	SAMPLE DEPTH (m)	1.80
		SPECIMEN TOP (m)	1.80
		SPECIMEN BASE (m)	1.90



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	36	20	
SILT		75		2	30	6	
SILT & CLAY	10	63	100	1.18	27	2	
SAND	20	50	80	0.63	21		
GRAVEL	70	37.5	76	0.425	17		
COBBLE & BOULDER	0	20	60	0.2	12		
test method(s)	5.2	10	45	0.15	11		
test method		6.3	40	0.063	10		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m³							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

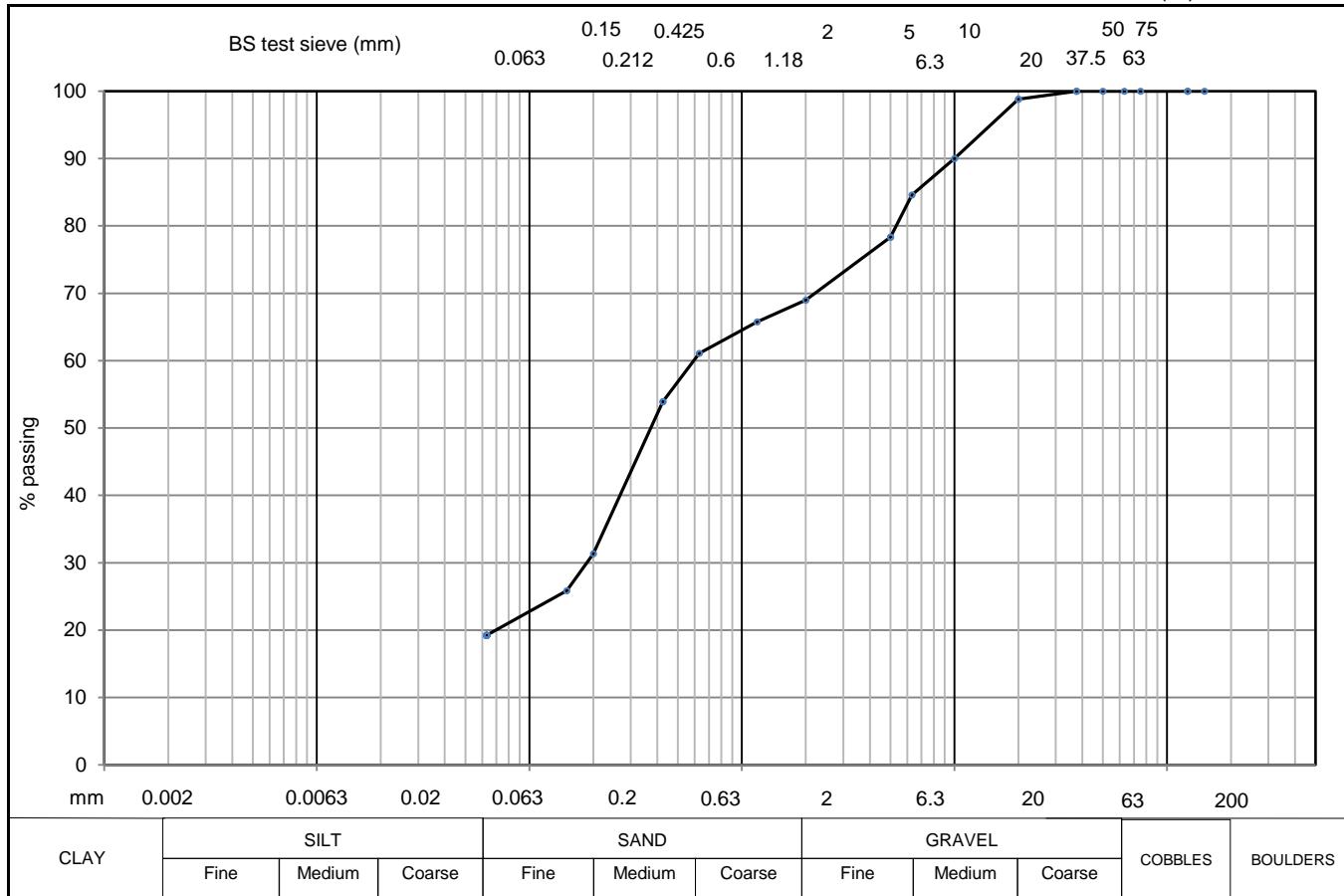
Geotechnical Engineering Limited

# PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP09
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Dark orangish brown silty very gravelly SAND	SAMPLE DEPTH (m)	0.30
		SPECIMEN TOP (m)	0.30
		SPECIMEN BASE (m)	0.40



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

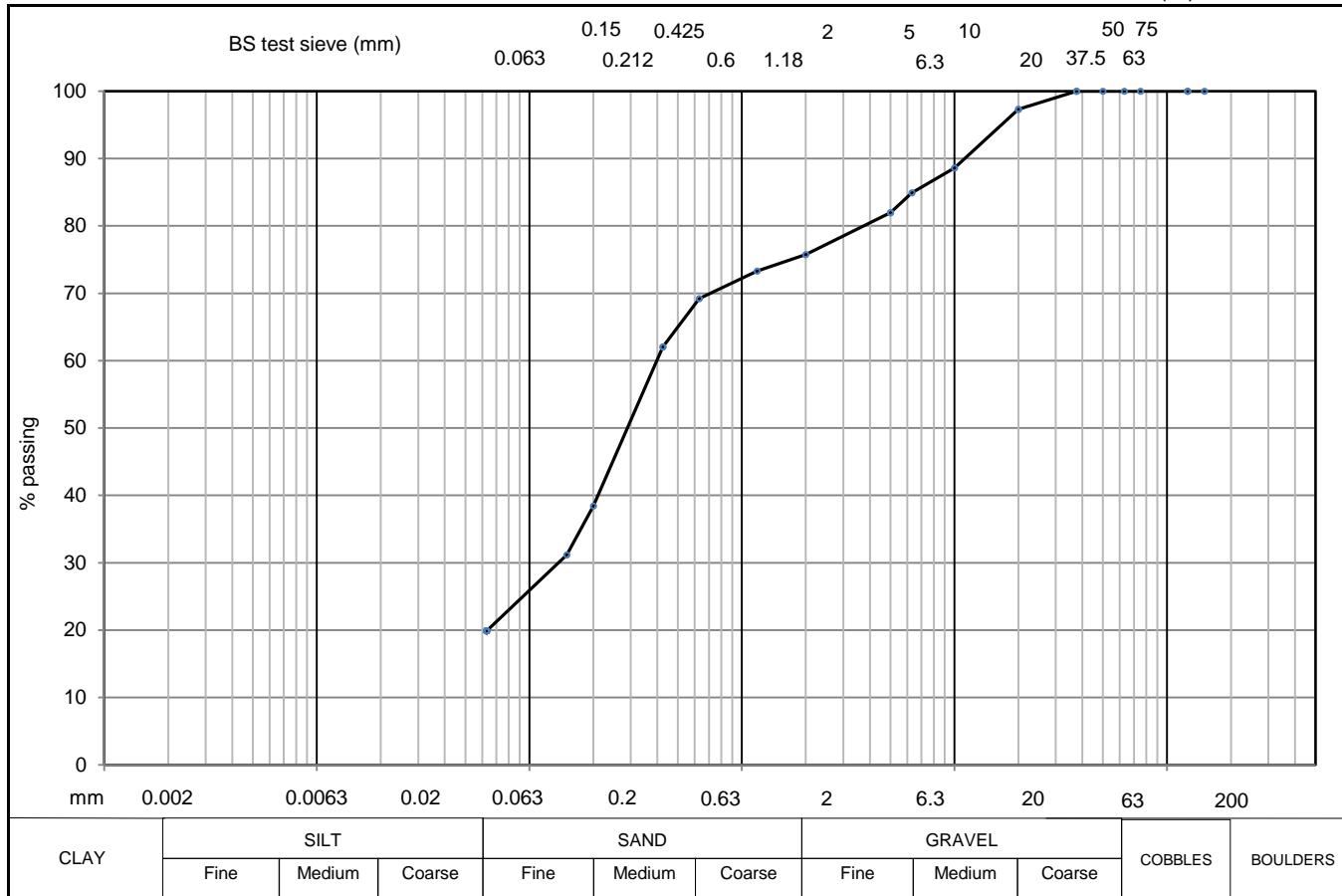
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	78	20	
SILT		75		2	69	6	
SILT & CLAY	19	63		1.18	66	2	
SAND	50	50		0.63	61		
GRAVEL	31	37.5	100	0.425	54		
COBBLE & BOULDER	0	20	99	0.2	31		
test method(s)	5.2	10	90	0.15	26		
test method		6.3	85	0.063	19		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m³							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP09
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	3LB
DESCRIPTION	Orangish brown silty very gravelly SAND	SAMPLE DEPTH (m)	1.60
		SPECIMEN TOP (m)	1.60
		SPECIMEN BASE (m)	1.70



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	82	20	
SILT		75		2	76	6	
SILT & CLAY	20	63		1.18	73	2	
SAND	56	50		0.63	69		
GRAVEL	24	37.5	100	0.425	62		
COBBLE & BOULDER	0	20	97	0.2	38		
test method(s)	5.2	10	89	0.15	31		
test method		6.3	85	0.063	20		
5.2 - sieving							
5.3 - sedimentation by hydrometer							
5.4 - sedimentation by pipette							
remarks							
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892							
Particle density assigned an assumed value of 2.70 Mg/m³							
CONTRACT	CHECKED						
<b>35880</b>	<b>TB</b>						



4041

# TEST CERTIFICATE

## Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd  
Unit 8 Harrowden Road  
Brackmills Industrial Estate  
Northampton NN4 7EB



Client: Geotechnical Engineering Ltd  
Client Address: Centurion House, Olympus Park,  
Quedgeley, Gloucester,  
GL2 4NF  
Contact: James Taylor  
Site Address: Hertford Gasworks Ground Investigation

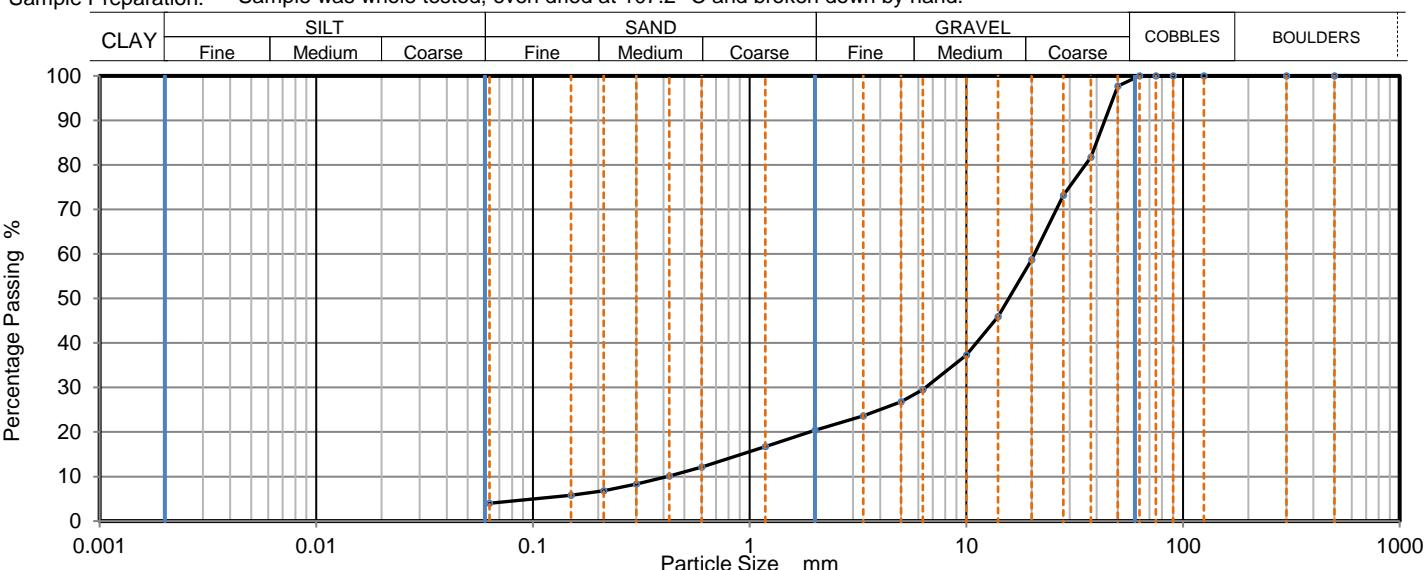
Client Reference: 35880-WF  
Job Number: 20-26183  
Date Sampled: Not Given  
Date Received: 21/08/2020  
Date Tested: 29/08/2020  
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Śląska, Poland

**Test Results:**

Laboratory Reference: 1600478  
Hole No.: TP09  
Sample Reference: 4  
Sample Description: Brownish grey slightly clayey sandy GRAVEL  
Sample Preparation: Sample was whole tested, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 1.90  
Depth Base [m]: 2.00  
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	98		
37.5	82		
28	73		
20	59		
14	46		
10	37		
6.3	30		
5	27		
3.35	24		
2	20		
1.18	17		
0.6	12		
0.425	10		
0.3	8		
0.212	7		
0.15	6		
0.063	5		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	79.60
Sand	15.90
Fines <0.063mm	4.50

Grading Analysis		
D100	mm	63
D60	mm	20.6
D30	mm	6.48
D10	mm	0.419
Uniformity Coefficient		49
Curvature Coefficient		4.9

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Monika Janoszek  
PL Deputy Head of Geotechnical Section  
for and on behalf of i2 Analytical Ltd

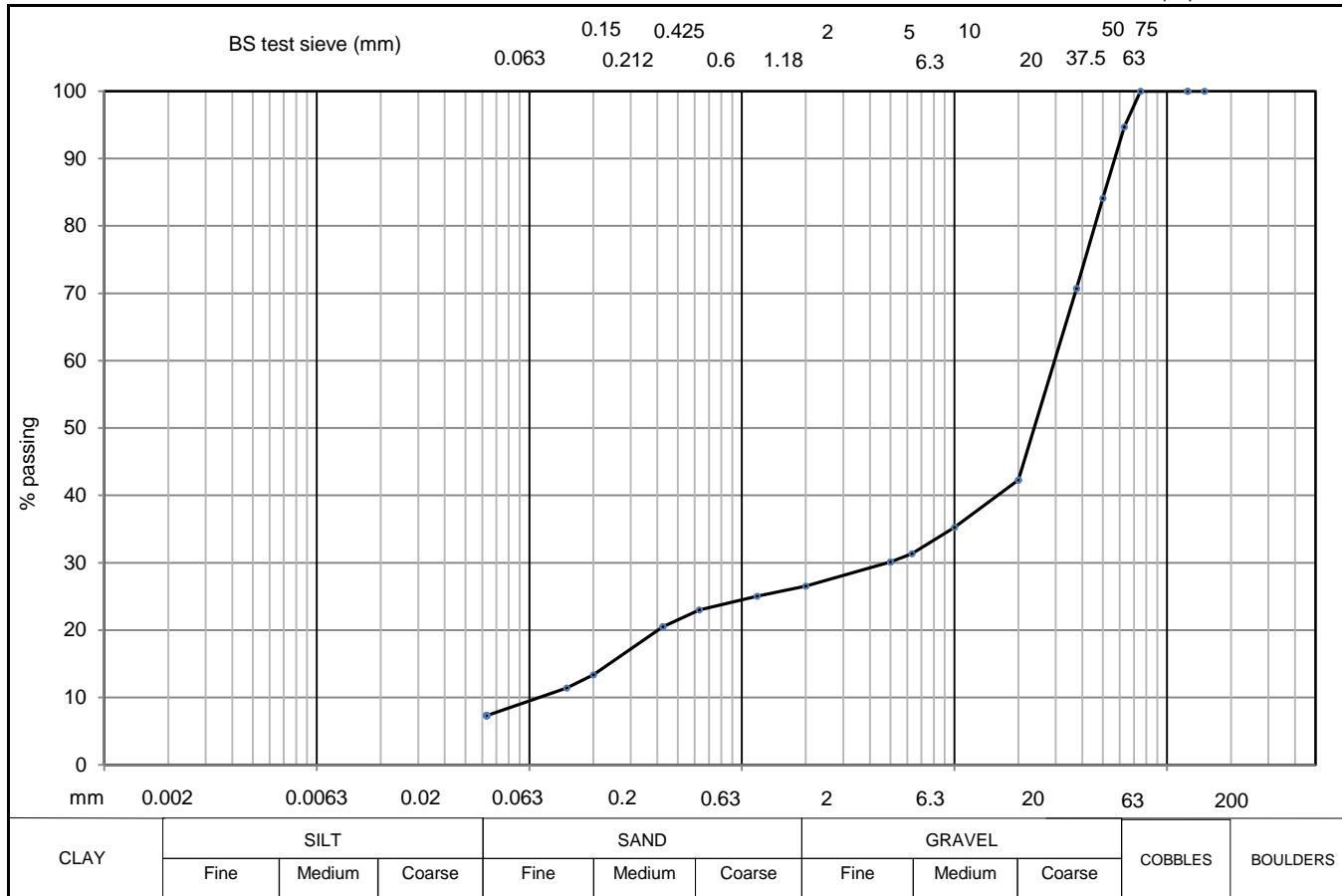
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**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP11
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	3LB
DESCRIPTION	Dark brown mottled black clayey sandy GRAVEL with medium cobble content and rare rootlets	SAMPLE DEPTH (m)	1.30
		SPECIMEN TOP (m)	1.30
		SPECIMEN BASE (m)	1.50



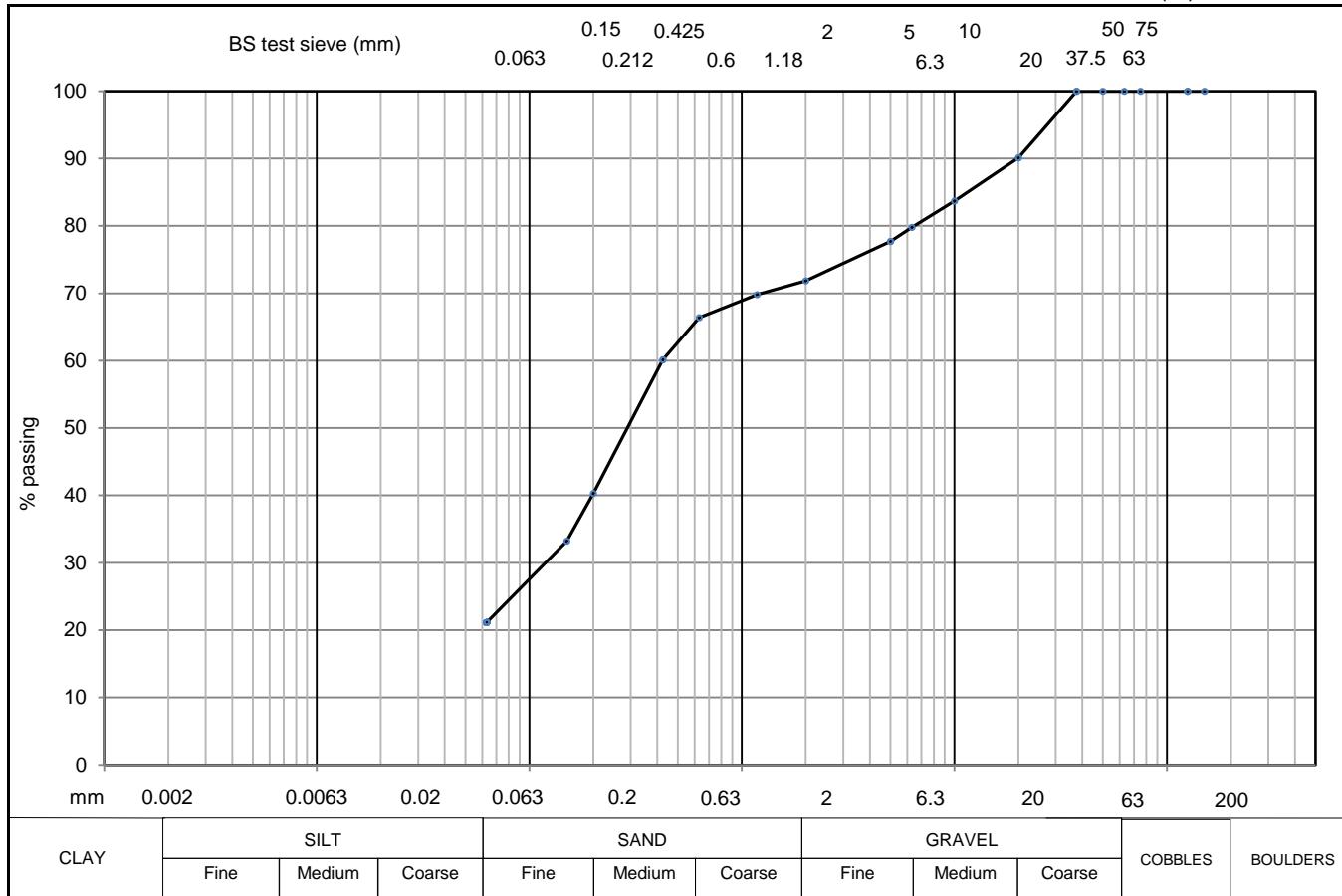
CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	7										
SAND	19										
GRAVEL	68										
COBBLE & BOULDER	5										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>							CONTRACT	CHECKED		
								35880	TB		

**PARTICLE SIZE DISTRIBUTION**

BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	ST WILLIAM LLP	BH/TP No.	TP13
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Orangish brown very silty very gravelly SAND	SAMPLE DEPTH (m)	0.60
		SPECIMEN TOP (m)	0.60
		SPECIMEN BASE (m)	0.70



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
CLAY											
SILT											
SILT & CLAY	21										
SAND	51										
GRAVEL	28										
COBBLE & BOULDER	0										
test method(s)	5.2										
test method											
5.2 - sieving											
5.3 - sedimentation by hydrometer											
5.4 - sedimentation by pipette											
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m <sup>3</sup>								CONTRACT	CHECKED	
									35880	TB	

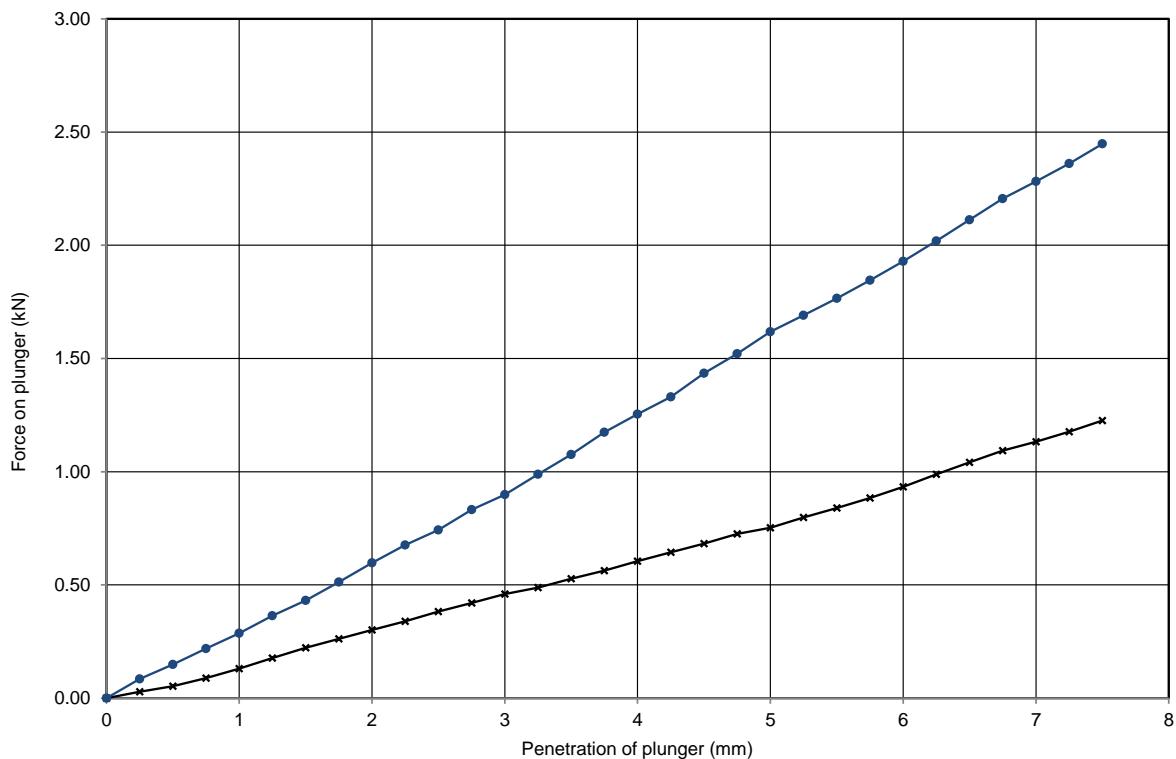
Geotechnical Engineering Limited

# CALIFORNIA BEARING RATIO

BS. 1377 : Part 4 : 1990 : 7



CLIENT	ST WILLIAM LLP	BH/TP No.	STP07
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	1LB
DESCRIPTION	Dark grey slightly clayey gravelly SAND	SAMPLE DEPTH (m)	0.35
		SPECIMEN DEPTH (m)	0.30



sample preparation:		Dynamic compaction - 2.5kg rammer with specified effort	
proportion > 20mm removed (%)	13.6	sample condition	Unsoaked
surcharge mass (kg)	10	amount of swell (mm)	
INITIAL CONDITIONS		FINAL CONDITIONS	
moisture content (%)	13	moisture content top (%)	13
bulk density (Mg/m <sup>3</sup> )	2.16	moisture content base (%)	14
dry density (Mg/m <sup>3</sup> )	1.91		
remarks	results		
	CBR value top (%)	3.8	
	CBR value base (%)	8.1	
	average CBR value (%)		
---x---x--- Top -----●----- Base		CONTRACT	CHECKED
		35880	TB

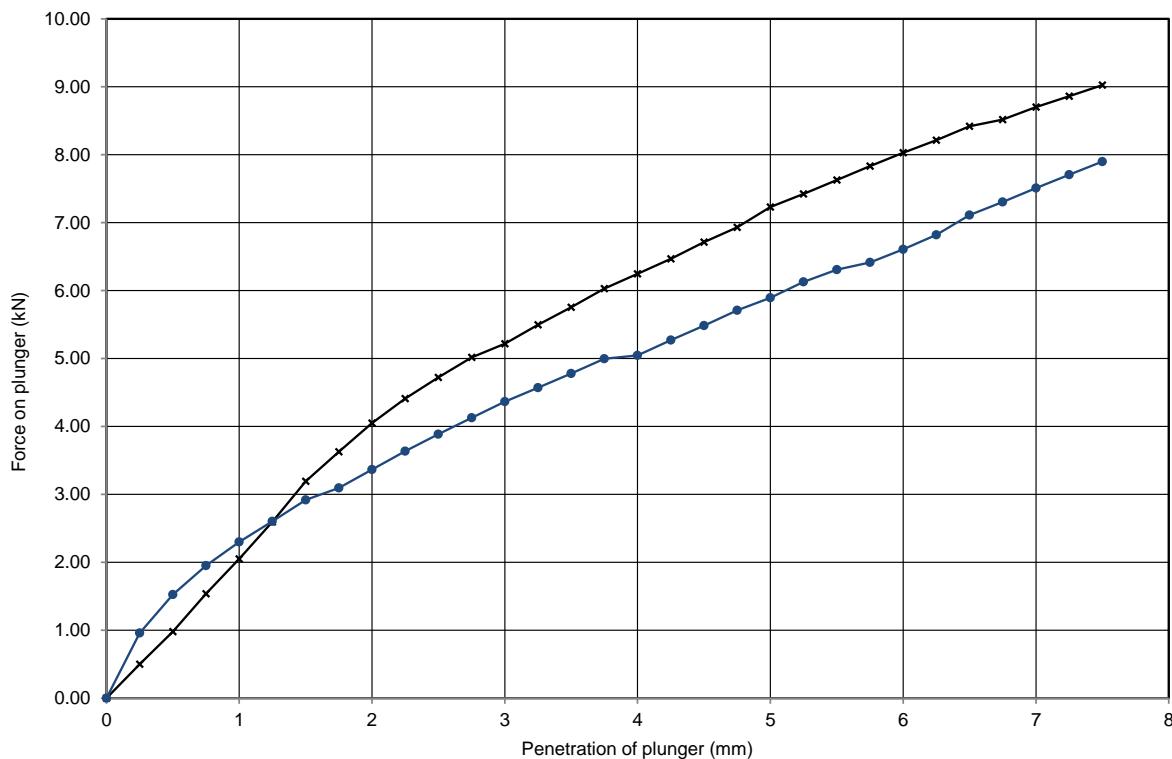
Geotechnical Engineering Limited

# CALIFORNIA BEARING RATIO

BS. 1377 : Part 4 : 1990 : 7



CLIENT	ST WILLIAM LLP	BH/TP No.	STP08
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Brown slightly gravelly sandy SILT	SAMPLE DEPTH (m)	1.00
		SPECIMEN DEPTH (m)	1.00



sample preparation:		Dynamic compaction - 2.5kg rammer with specified effort				
proportion > 20mm removed (%)	11.3	sample condition	Unsoaked			
surcharge mass (kg)	10	amount of swell (mm)				
INITIAL CONDITIONS		FINAL CONDITIONS				
moisture content (%)	10	moisture content top (%)	10			
bulk density (Mg/m <sup>3</sup> )	2.11	moisture content base (%)	9			
dry density (Mg/m <sup>3</sup> )	1.92					
remarks		results				
		CBR value top (%)	36			
		CBR value base (%)	29			
		average CBR value (%)				
—————— * —————— Top —————— ● —————— Base		CONTRACT <b>35880</b> CHECKED <b>TB</b>				

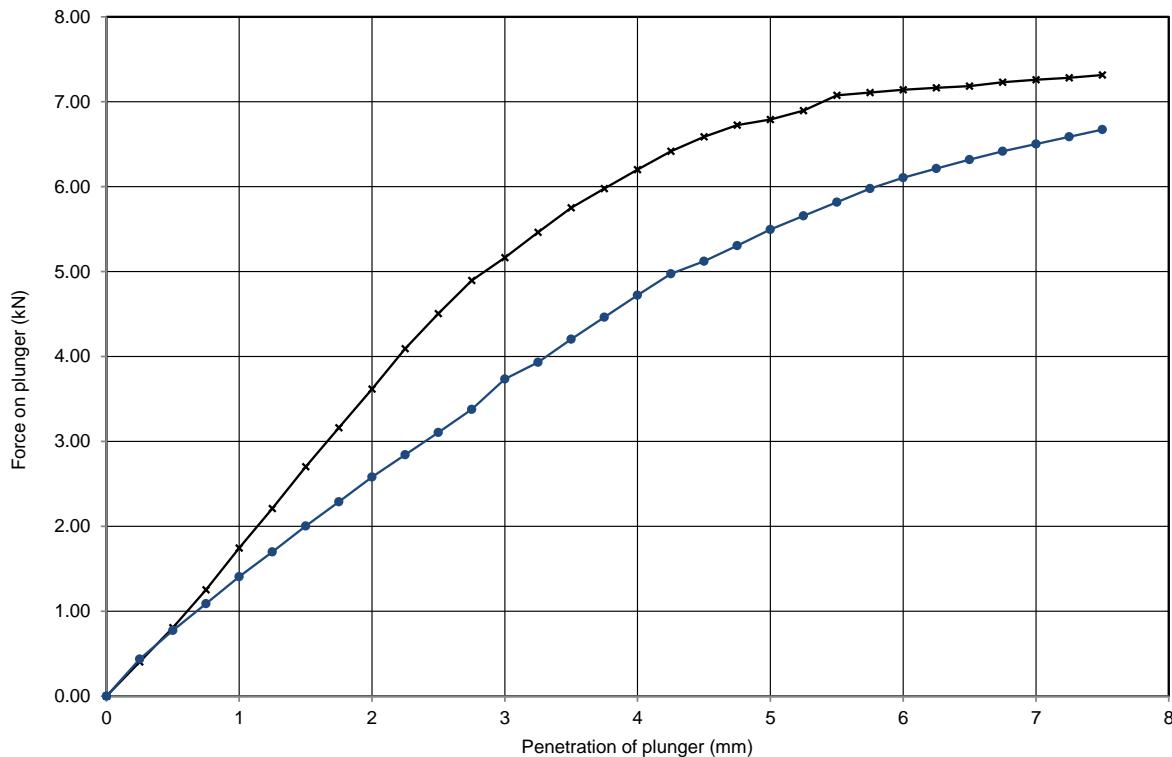
Geotechnical Engineering Limited

# CALIFORNIA BEARING RATIO

BS. 1377 : Part 4 : 1990 : 7



CLIENT	ST WILLIAM LLP	BH/TP No.	TP04
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Orangish brown clayey very gravelly SAND	SAMPLE DEPTH (m)	0.60
		SPECIMEN DEPTH (m)	0.60



sample preparation:		Dynamic compaction - 2.5kg rammer with specified effort				
proportion > 20mm removed (%)	7.6	sample condition	Unsoaked			
surcharge mass (kg)	10	amount of swell (mm)				
INITIAL CONDITIONS		FINAL CONDITIONS				
moisture content (%)	8	moisture content top (%)	7			
bulk density (Mg/m <sup>3</sup> )	1.88	moisture content base (%)	7			
dry density (Mg/m <sup>3</sup> )	1.74					
remarks		results				
		CBR value top (%)	34			
		CBR value base (%)	27			
		average CBR value (%)				
* --- * Top ● --- ● Base		CONTRACT		CHECKED		
		<b>35880</b>		<b>TB</b>		

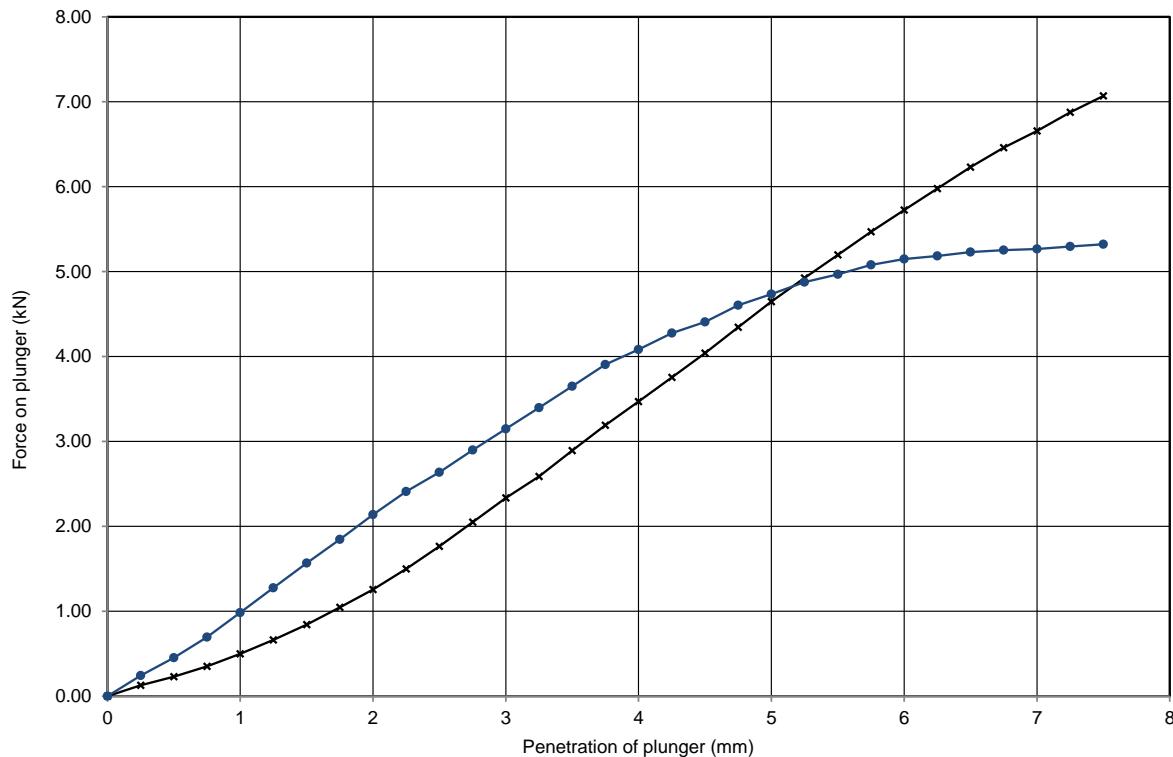
Geotechnical Engineering Limited

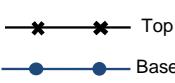
# CALIFORNIA BEARING RATIO

BS. 1377 : Part 4 : 1990 : 7



CLIENT	ST WILLIAM LLP	BH/TP No.	TP06
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	1LB
DESCRIPTION	Light brown clayey gravelly SAND with rare rootlets	SAMPLE DEPTH (m)	0.20
		SPECIMEN DEPTH (m)	0.20



sample preparation:		Dynamic compaction - 2.5kg rammer with specified effort				
proportion > 20mm removed (%)	2.4	sample condition	Unsoaked			
surcharge mass (kg)	10	amount of swell (mm)				
INITIAL CONDITIONS		FINAL CONDITIONS				
moisture content (%)	14	moisture content top (%)	14			
bulk density (Mg/m <sup>3</sup> )	2.04	moisture content base (%)	14			
dry density (Mg/m <sup>3</sup> )	1.79					
remarks		results				
		CBR value top (%)	23			
		CBR value base (%)	24			
		average CBR value (%)	23			
		CONTRACT		CHECKED		
		<b>35880</b>		<b>TB</b>		

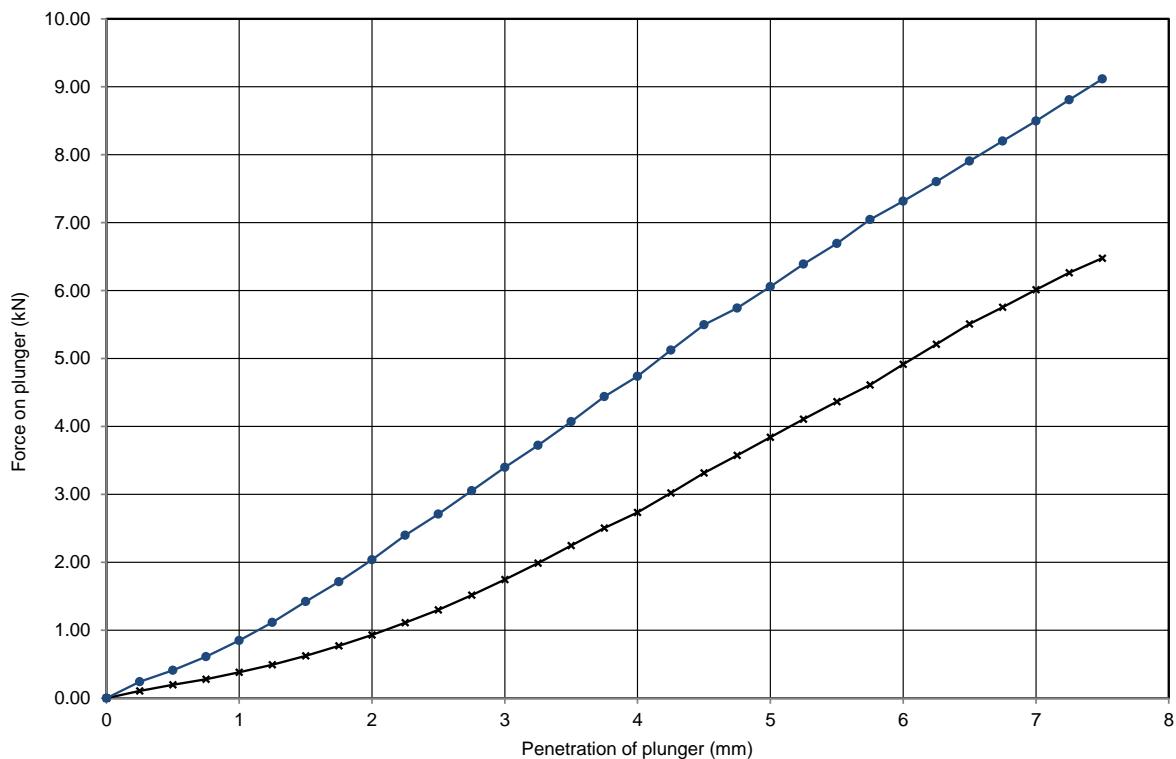
Geotechnical Engineering Limited

# CALIFORNIA BEARING RATIO

BS. 1377 : Part 4 : 1990 : 7



CLIENT	ST WILLIAM LLP	BH/TP No.	TP09
SITE	HERTFORD GASWORKS GROUND INVESTIGATION	SAMPLE No./TYPE	2LB
DESCRIPTION	Dark orangish brown silty very gravelly SAND	SAMPLE DEPTH (m)	0.30
		SPECIMEN DEPTH (m)	0.30



sample preparation:		Dynamic compaction - 2.5kg rammer with specified effort				
proportion > 20mm removed (%)	4.7	sample condition	Unsoaked			
surcharge mass (kg)	10	amount of swell (mm)				
INITIAL CONDITIONS		FINAL CONDITIONS				
moisture content (%)	10	moisture content top (%)	10			
bulk density (Mg/m <sup>3</sup> )	2.20	moisture content base (%)	10			
dry density (Mg/m <sup>3</sup> )	1.99					
remarks		results				
		CBR value top (%)	19			
		CBR value base (%)	30			
		average CBR value (%)				
Top Base			CONTRACT	CHECKED		
			35880	TB		

Geotechnical Engineering Limited

# POINT LOAD STRENGTH TEST

I.S.R.M. Suggested Methods : 2007 Edition



CLIENT ST WILLIAM LLP

SITE HERTFORD GASWORKS GROUND INVESTIGATION

borehole /trial pit no.	sample depth (m)	test type	test orientation	moisture condition	width W (mm)	length L (mm)	platen sep. D (mm)	failure load P (kN)	equiv. diam. De (mm)	Is (MPa)	size factor	Is(50) (MPa)	description and remarks
BH03	21.50	A	X	P	90		50	0.27	75.69	0.05	1.21	0.06	Off White CHALK
BH03	21.50	D	Y	P		55	90	0.05	90.00	0.01	1.30	0.01	Off White CHALK
BH09	25.30	A	X	P	85	4	40	0.53	65.80	0.12	1.13	0.14	Off white CHALK
BH09	25.30	D	Y	P		50	85	0.53	85.00	0.07	1.27	0.09	Off white CHALK
BH10	20.20	I	X	P	70	60	40	0.27	59.71	0.08	1.08	0.08	Off white CHALK
BH13	16.80	I	X	P	60	100	55	0.24	64.82	0.06	1.12	0.06	Off white CHALK
BH13	19.80	I	U	P	40	40	30	0.22	39.09	0.14	0.90	0.13	Off white CHALK

general remarks

tests carried out in accordance with I.S.R.M.(2007): Suggested Methods for Determining Point Load Strength  
test machine PLM02

test type	test orientation relative to discontinuities			moisture condition	CONTRACT	CHECKED
A - axial	X - perpendicular	U - unknown		N - natural moisture content		
D - diametral	Y - parallel			P - partially air dried		
I - irregular lump	Z - oblique			S - soaked	35880	TB



## Final Report

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**Report No.:** 20-17221-1  
**Initial Date of Issue:** 13-Jul-2020  
**Client** Geotechnical Engineering Ltd  
**Client Address:** Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
Gloucestershire  
GL2 4NF  
**Contact(s):** GEL  
Tom Best  
**Project** 35880 Hertford Gasworks Ground  
Investigation  
**Quotation No.:** **Date Received:** 07-Jul-2020  
**Order No.:** 35880/LAB **Date Instructed:** 07-Jul-2020  
**No. of Samples:** 2  
**Turnaround (Wkdays):** 5 **Results Due:** 13-Jul-2020  
**Date Approved:** 13-Jul-2020  
**Approved By:**  
  
**Details:** Glynn Harvey, Technical Manager

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## Results - Soil

**Project: 35880 Hertford Gasworks Ground Investigation**

<b>Client:</b> Geotechnical Engineering Ltd	<b>Chemtest Job No.:</b>		20-17221	20-17221
Quotation No.:	<b>Chemtest Sample ID.:</b>		1027624	1027625
	Client Sample ID.:		15D	27D
	Sample Location:		BH03	BH03
	Sample Type:		SOIL	SOIL
	Top Depth (m):		4.20	12.70
	Bottom Depth (m):			13.20
	Date Sampled:		03-Jul-2020	03-Jul-2020
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010
Total Sulphur	U	2175	%	0.010
Sulphate (Acid Soluble)	U	2430	%	0.010
				0.014
				0.036

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## Report Information

### **Key**

---

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
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SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

### **Sample Deviation Codes**

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- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### **Sample Retention and Disposal**

---

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## Final Report

---

**Report No.:** 20-17222-1  
**Initial Date of Issue:** 13-Jul-2020  
**Client** Geotechnical Engineering Ltd  
**Client Address:** Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
Gloucestershire  
GL2 4NF  
**Contact(s):** GEL  
Tom Best  
**Project** 35880 B Hertford Gasworks Ground  
Investigation  
**Quotation No.:** **Date Received:** 07-Jul-2020  
**Order No.:** 35880/TB **Date Instructed:** 07-Jul-2020  
**No. of Samples:** 3  
**Turnaround (Wkdays):** 5 **Results Due:** 13-Jul-2020  
**Date Approved:** 13-Jul-2020  
**Approved By:**  
  
**Details:** Glynn Harvey, Technical Manager

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## Results - Soil

**Project: 35880 B Hertford Gasworks Ground Investigation**

<b>Client:</b> Geotechnical Engineering Ltd	<b>Chemtest Job No.:</b> 20-17222			
Quotation No.:	<b>Chemtest Sample ID.:</b> 1027626			
Order No.: 35880/TB	Client Sample Ref.: B			
	Client Sample ID.: 3			
	Sample Location: TP06			
	Sample Type: SOIL			
	Top Depth (m): 2.00			
	Bottom Depth (m): 2.10			
	Date Sampled: 03-Jul-2020			
Determinand	Accred.	SOP	Units	LOD
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010
Total Sulphur	U	2175	%	0.010
Sulphate (Acid Soluble)	U	2430	%	0.010
				0.054
				0.067
				0.024

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## Report Information

### **Key**

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U	UKAS accredited
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Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

### **Sample Deviation Codes**

---

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### **Sample Retention and Disposal**

---

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## Final Report

---

**Report No.:** 20-17217-1  
**Initial Date of Issue:** 13-Jul-2020  
**Client** Geotechnical Engineering Ltd  
**Client Address:** Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
Gloucestershire  
GL2 4NF  
**Contact(s):** GEL  
Tom Best  
**Project** 35880/D Hertford Gasworks Ground  
Investigation  
**Quotation No.:** **Date Received:** 07-Jul-2020  
**Order No.:** 35880-D/TB **Date Instructed:** 07-Jul-2020  
**No. of Samples:** 1  
**Turnaround (Wkdays):** 5 **Results Due:** 13-Jul-2020  
**Date Approved:** 13-Jul-2020  
**Approved By:**  
  
**Details:** Glynn Harvey, Technical Manager

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## Results - Soil

### **Project: 35880/D Hertford Gasworks Ground Investigation**

<b>Client:</b> Geotechnical Engineering Ltd	<b>Chemtest Job No.:</b> 20-17217			
Quotation No.:	<b>Chemtest Sample ID.:</b> 1027603			
Order No.: 35880-D/TB	<b>Client Sample Ref.:</b> 3			
	<b>Client Sample ID.:</b>	B		
	<b>Sample Location:</b>	BH05		
	<b>Sample Type:</b>	SOIL		
	<b>Top Depth (m):</b>	1.00		
	<b>Bottom Depth (m):</b>	1.20		
	<b>Date Sampled:</b>	03-Jul-2020		
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010
Total Sulphur	U	2175	%	0.010
Sulphate (Acid Soluble)	U	2430	%	0.010
				0.14

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## Report Information

### **Key**

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For all other tests the samples were dried at < 37°C prior to analysis

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Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

### **Sample Deviation Codes**

---

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### **Sample Retention and Disposal**

---

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## Final Report

---

**Report No.:** 20-17218-1  
**Initial Date of Issue:** 13-Jul-2020  
**Client** Geotechnical Engineering Ltd  
**Client Address:** Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
Gloucestershire  
GL2 4NF  
**Contact(s):** GEL  
Tom Best  
**Project** 35880/C Hertford Gasworks Ground  
Investigation  
**Quotation No.:** **Date Received:** 07-Jul-2020  
**Order No.:** 35880-C/TB **Date Instructed:** 07-Jul-2020  
**No. of Samples:** 4  
**Turnaround (Wkdays):** 5 **Results Due:** 13-Jul-2020  
**Date Approved:** 13-Jul-2020  
**Approved By:**  
  
**Details:** Glynn Harvey, Technical Manager

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## Results - Soil

**Project: 35880/C Hertford Gasworks Ground Investigation**

<b>Client: Geotechnical Engineering Ltd</b>	<b>Chemtest Job No.:</b>				20-17218	20-17218	20-17218	20-17218
Quotation No.:	<b>Chemtest Sample ID.:</b>				1027604	1027605	1027606	1027607
Order No.: 35880-C/TB	Client Sample Ref.:				2	3	4	1
	Client Sample ID.:	LB	D	D	B			
	Sample Location:	TP11	TP13	TP14	TP17			
	Sample Type:	SOIL	SOIL	SOIL	SOIL			
	Top Depth (m):	0.60	2.00	1.60	1.80			
	Bottom Depth (m):	0.70	2.10	1.70	1.90			
	Date Sampled:	03-Jul-2020	03-Jul-2020	03-Jul-2020	03-Jul-2020			
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>				
Moisture	N	2030	%	0.020	11	17	24	35
pH	U	2010		4.0		8.3		
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010		0.093		
Total Sulphur	U	2175	%	0.010		0.019		
Sulphate (Acid Soluble)	U	2430	%	0.010		0.059		
LOI	U	2610	%	0.10	2.7		7.0	15

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.

## Report Information

### **Key**

---

U	UKAS accredited
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---

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### **Sample Retention and Disposal**

---

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## Final Report

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<b>Report No.:</b>	20-18038-1				
<b>Initial Date of Issue:</b>	20-Jul-2020				
<b>Client</b>	Geotechnical Engineering Ltd				
<b>Client Address:</b>	Centurion House Olympus Park Quedgeley Gloucester Gloucestershire GL2 4NF				
<b>Contact(s):</b>	GEL Tom Best				
<b>Project</b>	35880/F Hertford Gasworks Ground Investigation				
<b>Quotation No.:</b>		<b>Date Received:</b>	15-Jul-2020		
<b>Order No.:</b>	35880/TB	<b>Date Instructed:</b>	15-Jul-2020		
<b>No. of Samples:</b>	2				
<b>Turnaround (Wkdays):</b>	5	<b>Results Due:</b>	21-Jul-2020		
<b>Date Approved:</b>	20-Jul-2020				
<b>Approved By:</b>					
<b>Details:</b>	Glynn Harvey, Technical Manager				

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## Results - Soil

**Project: 35880/F Hertford Gasworks Ground Investigation**

<b>Client:</b> Geotechnical Engineering Ltd	<b>Chemtest Job No.:</b>		20-18038	20-18038
Quotation No.:	<b>Chemtest Sample ID.:</b>		1031610	1031611
Order No.: 35880/TB	<b>Client Sample Ref.:</b>		7	7
	<b>Client Sample ID.:</b>		D	D
	<b>Sample Location:</b>		BH14	BH18
	<b>Sample Type:</b>		SOIL	SOIL
	<b>Top Depth (m):</b>		3.20	1.50
	<b>Bottom Depth (m):</b>		3.60	1.60
	<b>Date Sampled:</b>		14-Jul-2020	14-Jul-2020
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010
Total Sulphur	U	2175	%	0.010
Sulphate (Acid Soluble)	U	2430	%	0.010
Organic Matter	U	2625	%	0.40
				12

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

## Report Information

### **Key**

---

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

### **Sample Deviation Codes**

---

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### **Sample Retention and Disposal**

---

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## Final Report

---

<b>Report No.:</b>	20-18041-1				
<b>Initial Date of Issue:</b>	20-Jul-2020				
<b>Client</b>	Geotechnical Engineering Ltd				
<b>Client Address:</b>	Centurion House Olympus Park Quedgeley Gloucester Gloucestershire GL2 4NF				
<b>Contact(s):</b>	GEL Tom Best				
<b>Project</b>	35880/G Hertford Gasworks Ground Investigation				
<b>Quotation No.:</b>		<b>Date Received:</b>	15-Jul-2020		
<b>Order No.:</b>	35880/TB	<b>Date Instructed:</b>	15-Jul-2020		
<b>No. of Samples:</b>	1				
<b>Turnaround (Wkdays):</b>	5	<b>Results Due:</b>	21-Jul-2020		
<b>Date Approved:</b>	20-Jul-2020				
<b>Approved By:</b>					
<b>Details:</b>	Glynn Harvey, Technical Manager				

---

## Results - Soil

Project: 35880/G Hertford Gasworks Ground Investigation

Client: Geotechnical Engineering Ltd	Chemtest Job No.: 20-18041			
Quotation No.:	Chemtest Sample ID.: 1031618			
Order No.: 35880/TB	Client Sample Ref.: 2			
	Client Sample ID.:	LB		
	Sample Location:	ST04		
	Sample Type:	SOIL		
	Top Depth (m):	2.20		
	Bottom Depth (m):	2.30		
	Date Sampled:	14-Jul-2020		
Determinand	Accred.	SOP	Units	LOD
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010
Total Sulphur	U	2175	%	0.010
Sulphate (Acid Soluble)	U	2430	%	0.010
				0.21

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## Report Information

### **Key**

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U	UKAS accredited
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N/E	not evaluated
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None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

### **Sample Deviation Codes**

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- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### **Sample Retention and Disposal**

---

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## Final Report

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<b>Report No.:</b>	20-18035-1				
<b>Initial Date of Issue:</b>	21-Jul-2020				
<b>Client</b>	Geotechnical Engineering Ltd				
<b>Client Address:</b>	Centurion House Olympus Park Quedgeley Gloucester Gloucestershire GL2 4NF				
<b>Contact(s):</b>	GEL Tom Best				
<b>Project</b>	35880/H Hertford Gasworks Ground Investigation				
<b>Quotation No.:</b>		<b>Date Received:</b>	15-Jul-2020		
<b>Order No.:</b>	35880/TB	<b>Date Instructed:</b>	15-Jul-2020		
<b>No. of Samples:</b>	3				
<b>Turnaround (Wkdays):</b>	5	<b>Results Due:</b>	21-Jul-2020		
<b>Date Approved:</b>	21-Jul-2020				
<b>Approved By:</b>					
<b>Details:</b>	Glynn Harvey, Technical Manager				

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## Results - Soil

**Project: 35880/H Hertford Gasworks Ground Investigation**

<b>Client:</b> Geotechnical Engineering Ltd	<b>Chemtest Job No.:</b> 20-18035 20-18035 20-18035			
Quotation No.:	<b>Chemtest Sample ID.:</b> 1031565 1031566 1031567			
Order No.: 35880/TB	Client Sample Ref.:	6	9	6
	Client Sample ID.:	D	L	D
	Sample Location:	BH08	BH08	BH11
	Sample Type:	SOIL	SOIL	SOIL
	Top Depth (m):	2.20	3.20	2.20
	Bottom Depth (m):	2.30	4.20	2.30
	Date Sampled:	14-Jul-2020	14-Jul-2020	14-Jul-2020
Determinand	Accred.	SOP	Units	LOD
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010
Total Sulphur	U	2175	%	0.010
Sulphate (Acid Soluble)	U	2430	%	0.010

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## Report Information

### **Key**

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### **Sample Deviation Codes**

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- A - Date of sampling not supplied
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### **Sample Retention and Disposal**

---

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## Final Report

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<b>Report No.:</b>	20-18039-1				
<b>Initial Date of Issue:</b>	20-Jul-2020				
<b>Client</b>	Geotechnical Engineering Ltd				
<b>Client Address:</b>	Centurion House Olympus Park Quedgeley Gloucester Gloucestershire GL2 4NF				
<b>Contact(s):</b>	GEL Tom Best				
<b>Project</b>	35880/I Hertford Gasworks Ground Investigation				
<b>Quotation No.:</b>		<b>Date Received:</b>	15-Jul-2020		
<b>Order No.:</b>	35880/TB	<b>Date Instructed:</b>	15-Jul-2020		
<b>No. of Samples:</b>	2				
<b>Turnaround (Wkdays):</b>	5	<b>Results Due:</b>	21-Jul-2020		
<b>Date Approved:</b>	20-Jul-2020				
<b>Approved By:</b>					
<b>Details:</b>	Glynn Harvey, Technical Manager				

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## Results - Soil

**Project: 35880/I Hertford Gasworks Ground Investigation**

<b>Client:</b> Geotechnical Engineering Ltd	<b>Chemtest Job No.:</b>		20-18039	20-18039
Quotation No.:	<b>Chemtest Sample ID.:</b>		1031612	1031613
Order No.: 35880/TB	Client Sample Ref.:		3	13
	Client Sample ID.:		B	L
	Sample Location:		BH12	BH12
	Sample Type:		SOIL	SOIL
	Top Depth (m):		1.00	5.20
	Bottom Depth (m):		1.20	6.20
	Date Sampled:		14-Jul-2020	14-Jul-2020
Determinand	Accred.	SOP	Units	LOD
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010
Total Sulphur	U	2175	%	0.010
Sulphate (Acid Soluble)	U	2430	%	0.010
				0.056
				0.046

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## Report Information

### **Key**

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Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

### **Sample Deviation Codes**

---

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### **Sample Retention and Disposal**

---

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## Final Report

---

**Report No.:** 20-20730-1  
**Initial Date of Issue:** 12-Aug-2020  
**Client** Geotechnical Engineering Ltd  
**Client Address:** Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
Gloucestershire  
GL2 4NF  
**Contact(s):** Tom Best  
GEL  
**Project** 35880/J Hertford Gasworks Ground  
Investigation  
**Quotation No.:** **Date Received:** 07-Aug-2020  
**Order No.:** 35880/J/TB **Date Instructed:** 07-Aug-2020  
**No. of Samples:** 4  
**Turnaround (Wkdays):** 5 **Results Due:** 13-Aug-2020  
**Date Approved:** 12-Aug-2020  
**Approved By:**  
  
**Details:** Glynn Harvey, Technical Manager

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## Results - Soil

**Project: 35880/J Hertford Gasworks Ground Investigation**

<b>Client:</b> Geotechnical Engineering Ltd	<b>Chemtest Job No.:</b>		20-20730	20-20730	20-20730	20-20730
Quotation No.:	<b>Chemtest Sample ID.:</b>		1044637	1044638	1044639	1044640
Order No.: 35880/J/TB	Client Sample Ref.:		11	12	12	3
	Sample Location:	SBH02	SBH04	SBH06	WS01	
	Sample Type:	SOIL	SOIL	SOIL	SOIL	
	Top Depth (m):	5.20	3.20	4.20	1.20	
	Bottom Depth (m):	6.70	3.30	5.20	2.00	
	Date Sampled:	04-Aug-2020	04-Aug-2020	04-Aug-2020	04-Aug-2020	
Determinand	Accred.	SOP	Units	LOD		
Moisture	N	2030	%	0.020	21	38
pH	U	2010		4.0	8.9	8.4
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.14	0.68
Total Sulphur	U	2175	%	0.010	0.034	1.3
Sulphate (Acid Soluble)	U	2430	%	0.010	0.061	0.21
					0.011	0.13

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## Report Information

### **Key**

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U	UKAS accredited
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Uncertainty of measurement for the determinands tested are available upon request

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---

### **Sample Deviation Codes**

- A - Date of sampling not supplied
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- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

---

### **Sample Retention and Disposal**

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## Final Report

---

**Report No.:** 20-20716-1  
**Initial Date of Issue:** 12-Aug-2020  
**Client** Geotechnical Engineering Ltd  
**Client Address:** Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
Gloucestershire  
GL2 4NF  
**Contact(s):** Tom Best  
GEL  
**Project** 35880/K Hertford Gasworks Ground  
Investigation  
**Quotation No.:** **Date Received:** 07-Aug-2020  
**Order No.:** 35880/TB **Date Instructed:** 07-Aug-2020  
**No. of Samples:** 1  
**Turnaround (Wkdays):** 5 **Results Due:** 13-Aug-2020  
**Date Approved:** 12-Aug-2020  
**Approved By:**  
  
**Details:** Glynn Harvey, Technical Manager

---

## Results - Soil

Project: 35880/K Hertford Gasworks Ground Investigation

Client: Geotechnical Engineering Ltd	Chemtest Job No.: 20-20716			
Quotation No.:	Chemtest Sample ID.: 1044603			
Order No.: 35880/TB	Client Sample Ref.: 9			
	Sample Location:	SBH05		
	Sample Type:	SOIL		
	Top Depth (m):	8.20		
	Bottom Depth (m):	9.70		
	Date Sampled:	04-Aug-2020		
Determinand	Accred.	SOP	Units	LOD
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010
Total Sulphur	U	2175	%	0.010
Sulphate (Acid Soluble)	U	2430	%	0.010
				0.022

## **Test Methods**

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

## Report Information

### **Key**

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For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

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### **Sample Deviation Codes**

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

---

### **Sample Retention and Disposal**

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

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## APPENDIX C MATERIAL DATA PLOTS

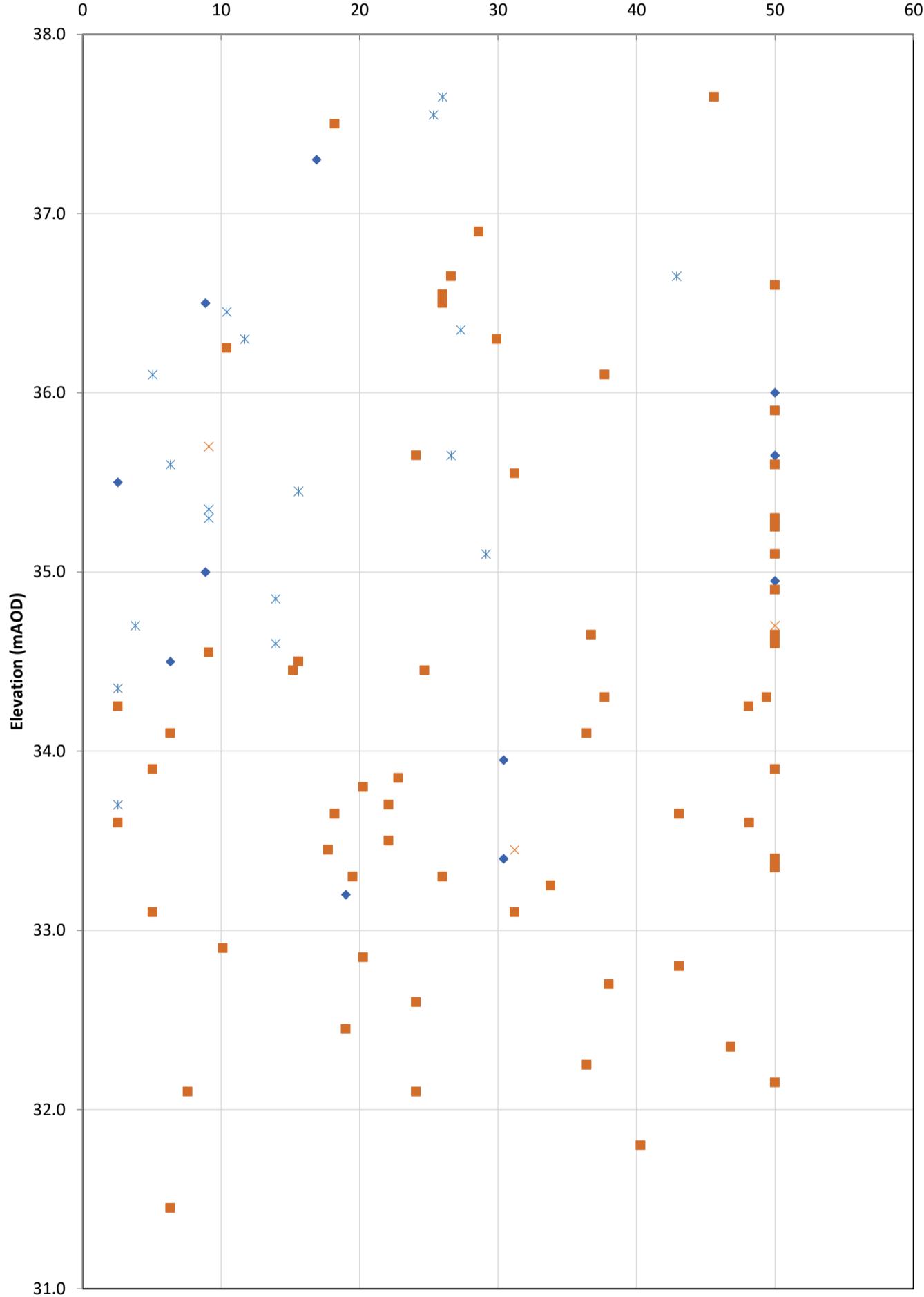
◆ MADE GROUND (GRANULAR)

■ KEMPTON PARK GRAVEL MEMBER (GRANULAR)

✖ MADE GROUND (COHESIVE)

✖ KEMPTON PARK GRAVEL MEMBER (COHESIVE)

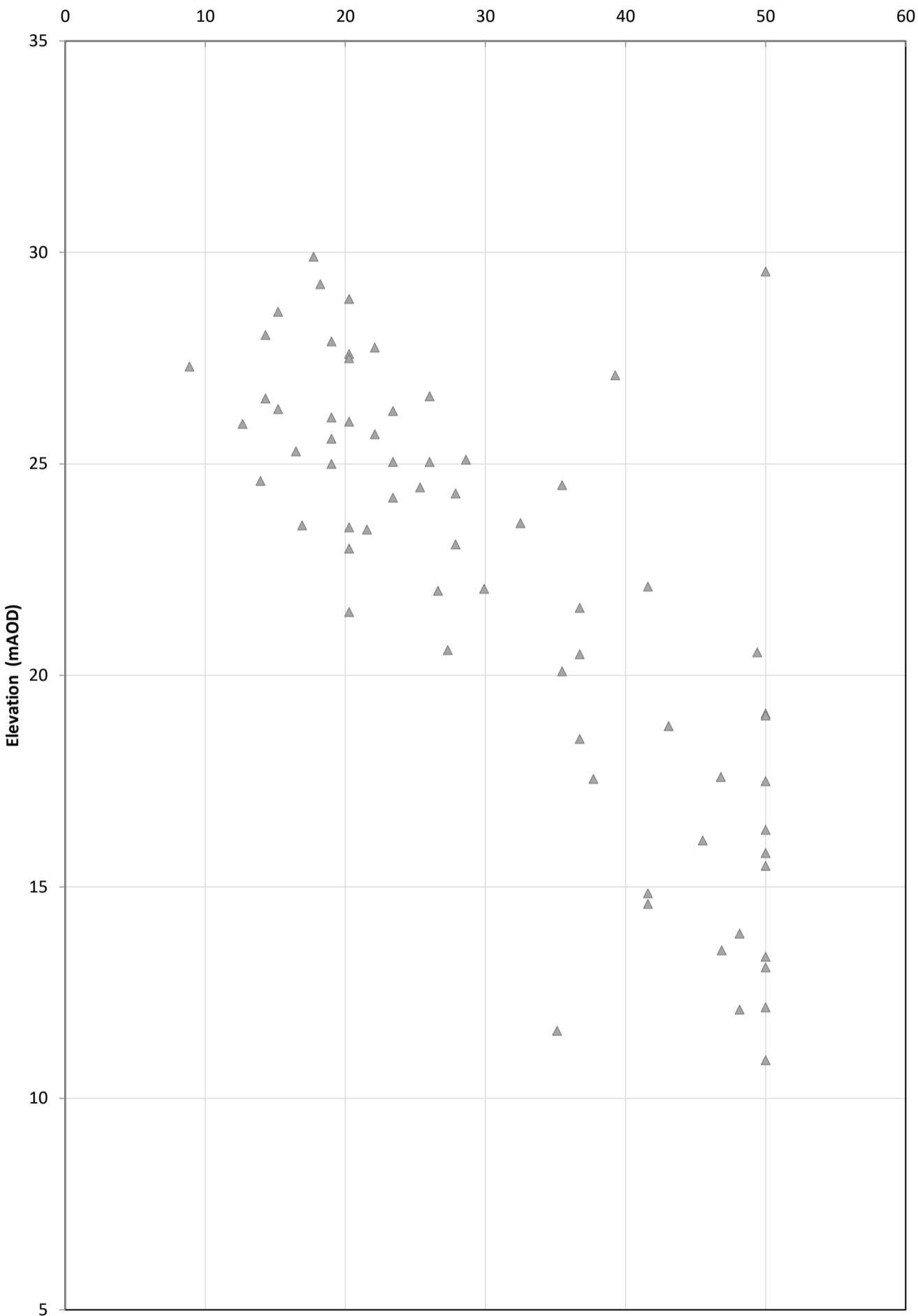
Corrected SPT N60 value



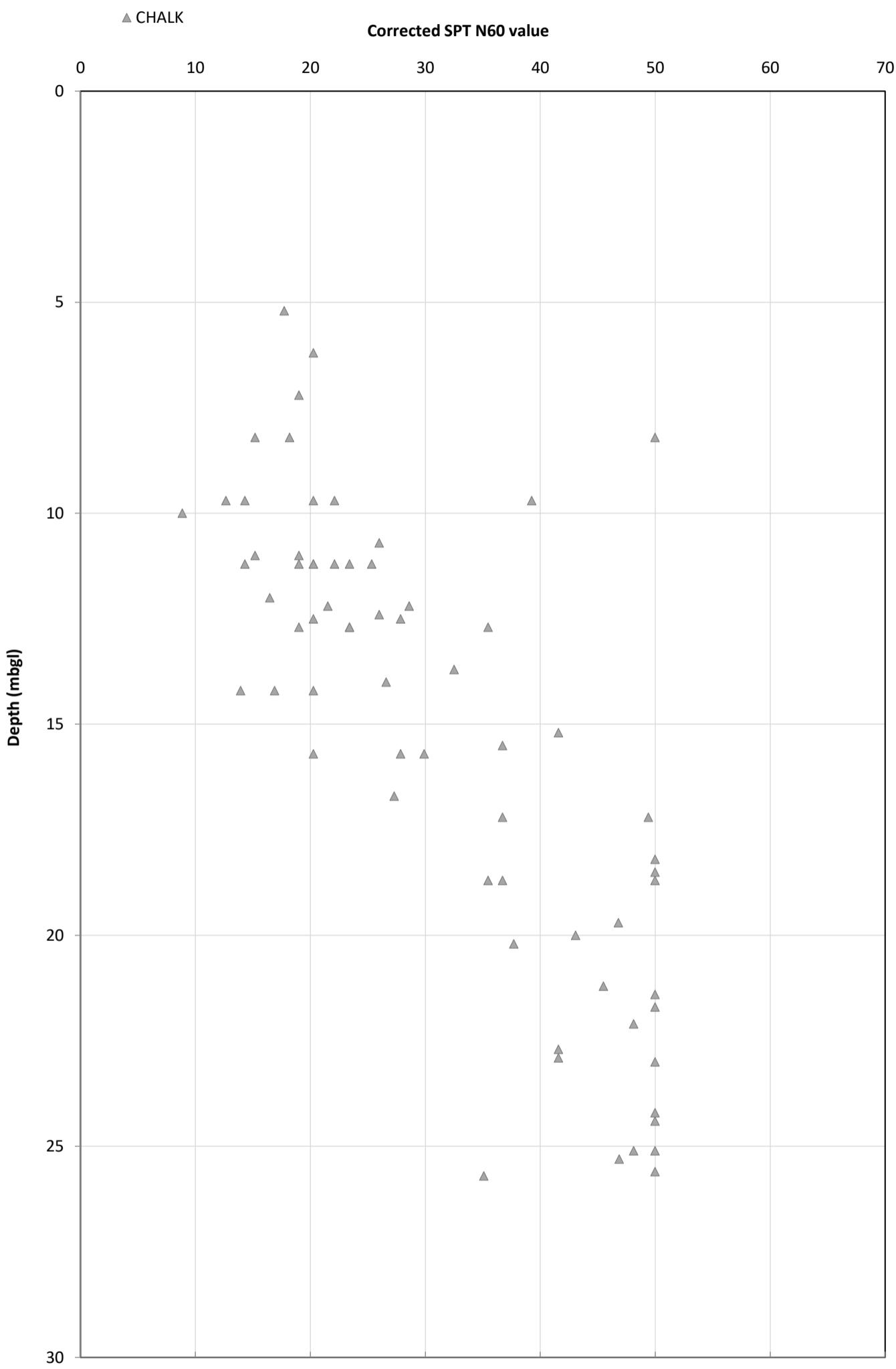
Title:	SPT N60 value vs Elevation for Made Ground and Kempton Park Gravel Member	Plot No: 1	Drawn: SM	Date: 22.09.2020
		Status:	Checked: SPW	Date: 23.09.2020

▲ CHALK (Grade A-C)

Corrected SPT N60 value



Title:	SPT N60 value vs Elevation for Chalk	Plot No: 2	Drawn: SM	Date: 22.09.2020
Status:		Checked: SPW	Date: 23.09.2020	



Title:	SPT N60 value vs Depth (mBGL) for Chalk	Plot No:	3	Drawn:	SM	Date:	23.09.2020
		Status:		Checked:	SPW	Date:	23.09.2020

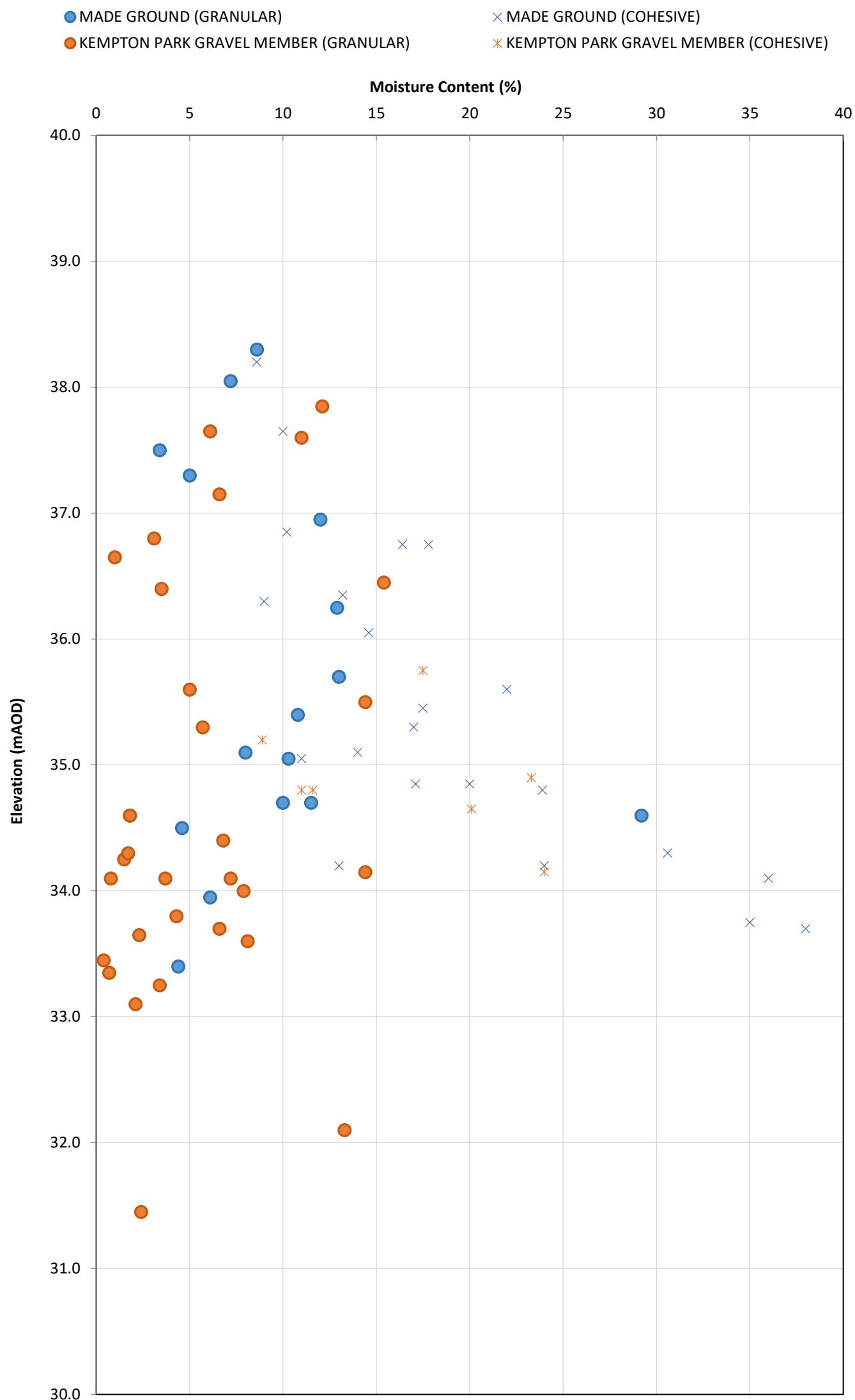


**Project:** Former Gasworks, Marshgate Drive

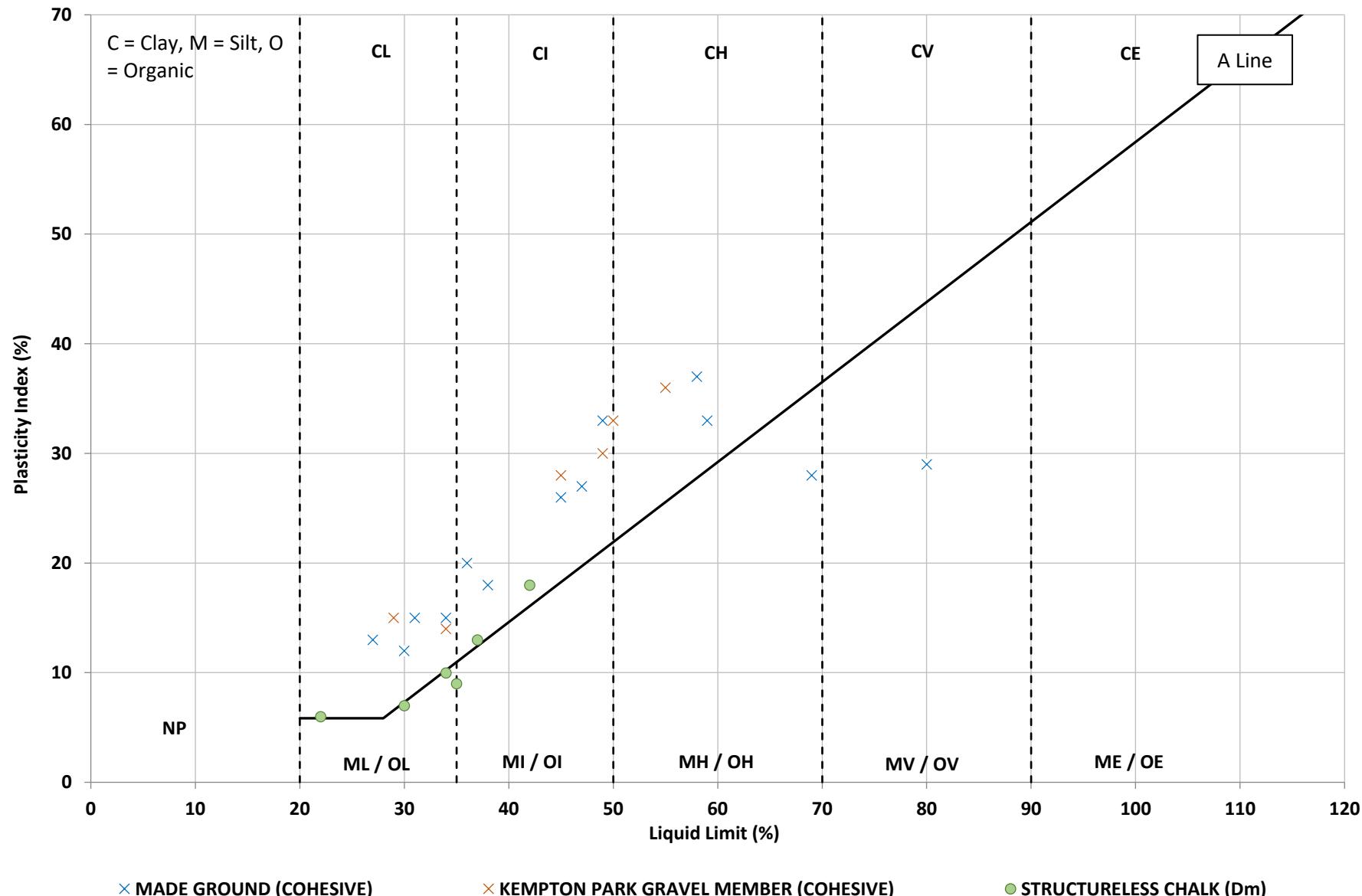
Job No: 1620009115

**Location:** Hertford

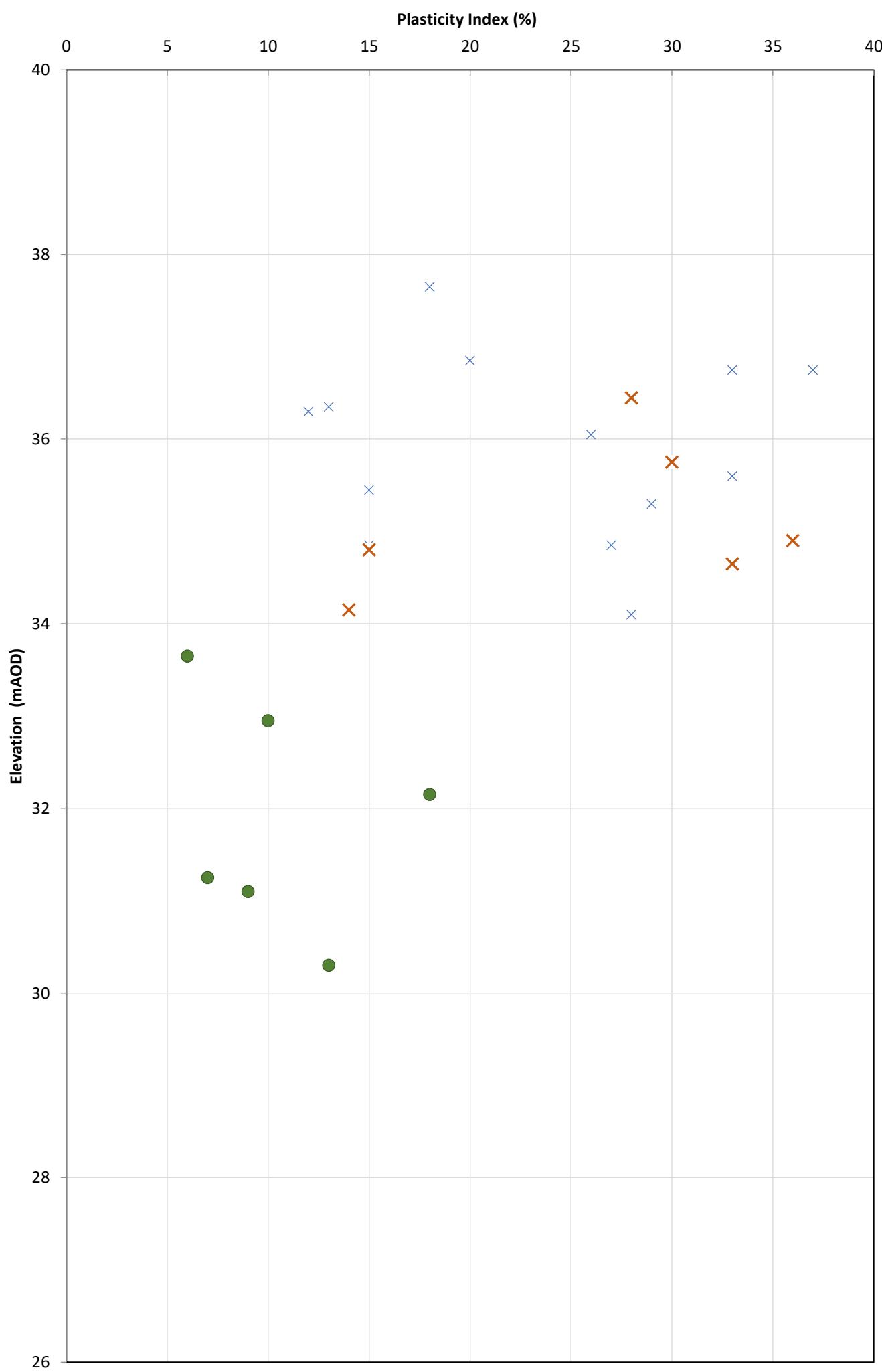
**Client:** St William Homes LLP



<b>Title:</b>	Moisture Content vs Elevation for Made Ground and Kempton Park Gravel Member	<b>Plot No:</b>	4	<b>Drawn:</b>	SM	<b>Date:</b>	22.09.2020
		<b>Status:</b>		<b>Checked:</b>	SPW	<b>Date:</b>	23.09.2020



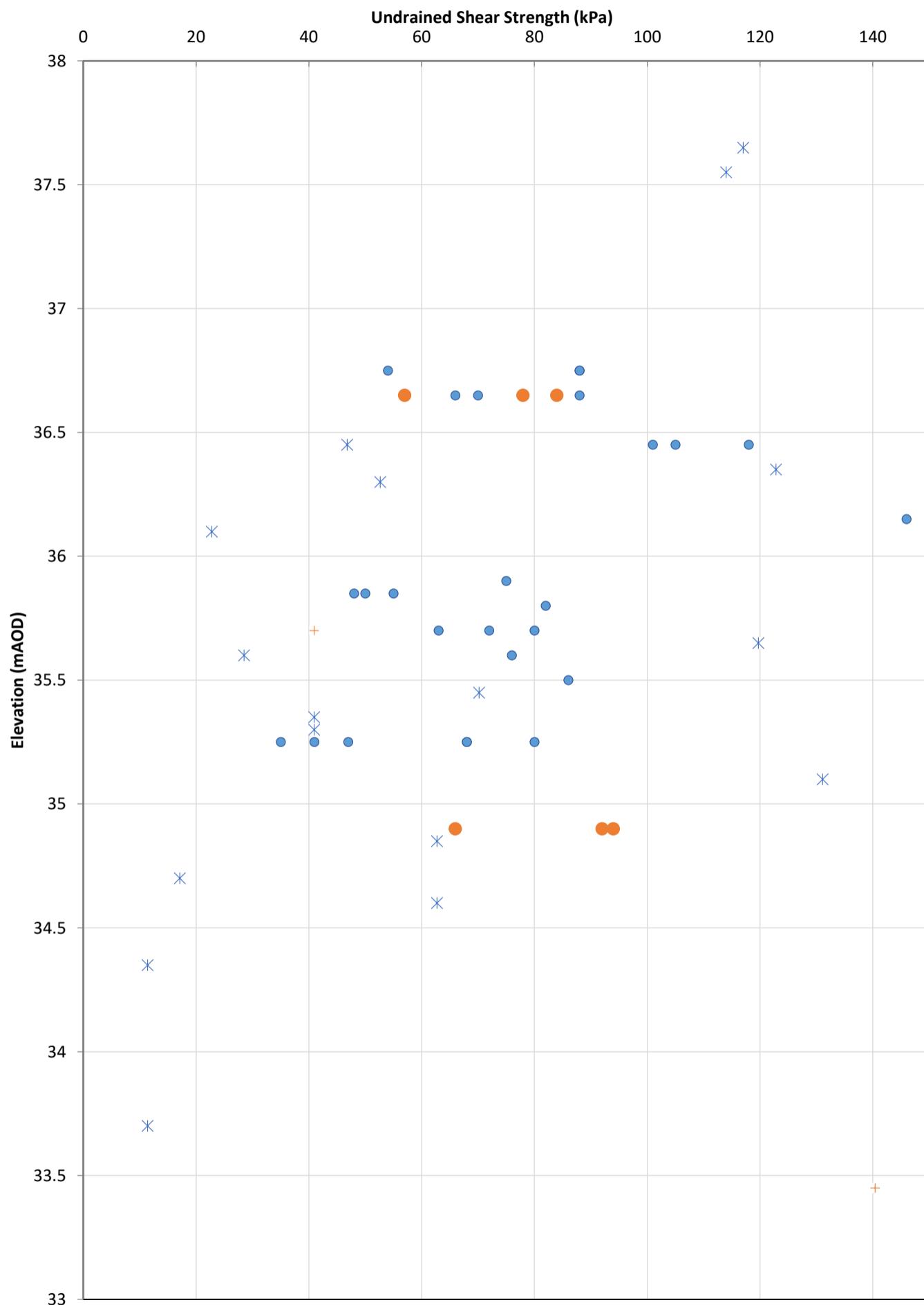
✖ MADE GROUND (COHESIVE)    ✖ KEMPTON PARK GRAVEL MEMBER (COHESIVE)    ● STRUCTURELESS CHALK (Dm)



Title:	Plasticity vs Elevation	Plot No:	6	Drawn:	SM	Date:	22.09.2020
		Status:		Checked:	SPW	Date:	23.09.2020

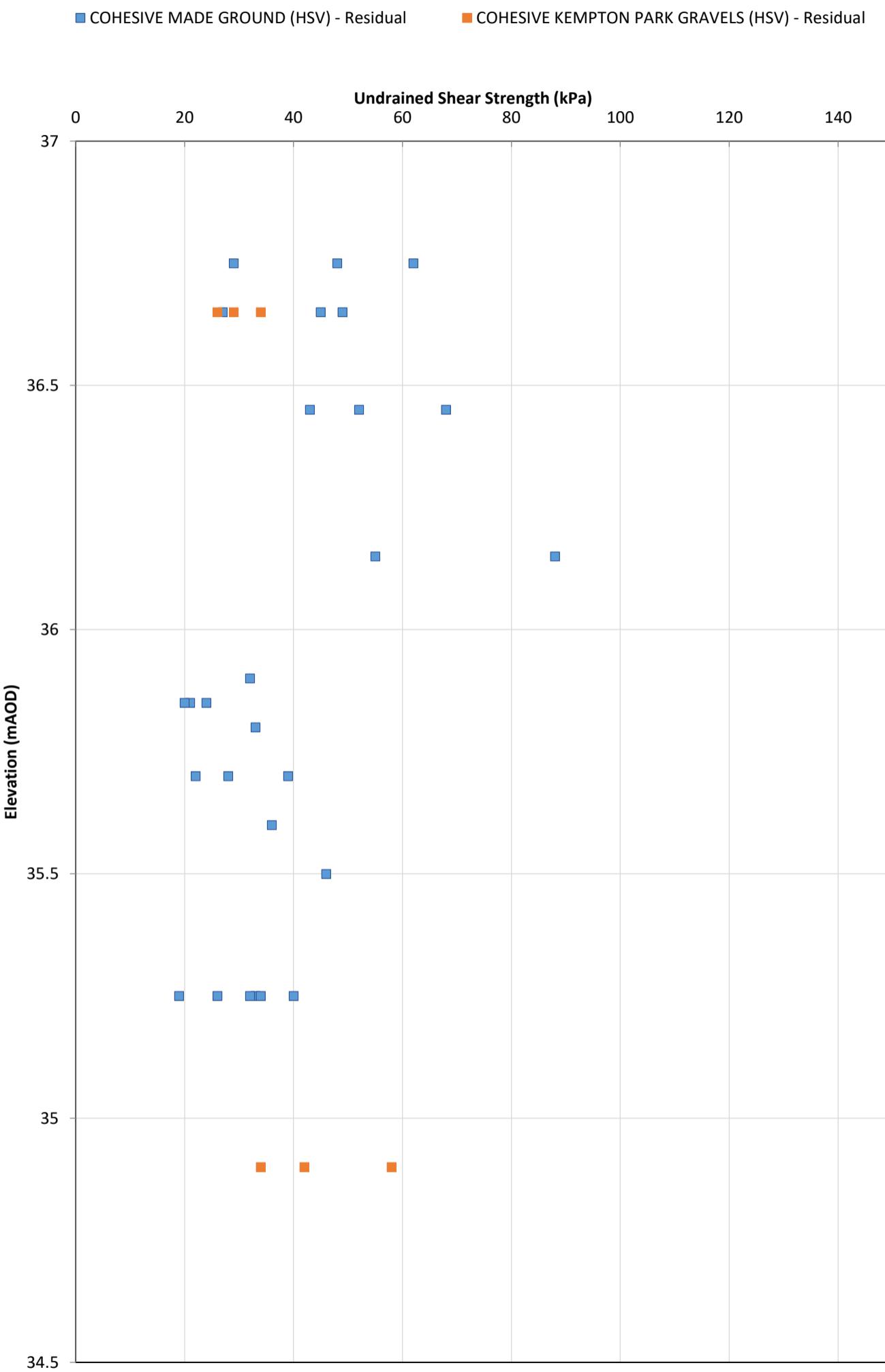
● COHESIVE MADE GROUND (HSV) - Peak                                    ✕ COHESIVE MADE GROUND (SPT)

● COHESIVE KEMPTON PARK GRAVEL MEMBER (HSV) - Peak            + COHESIVE KEMPTON PARK GRAVEL MEMBER (SPT)



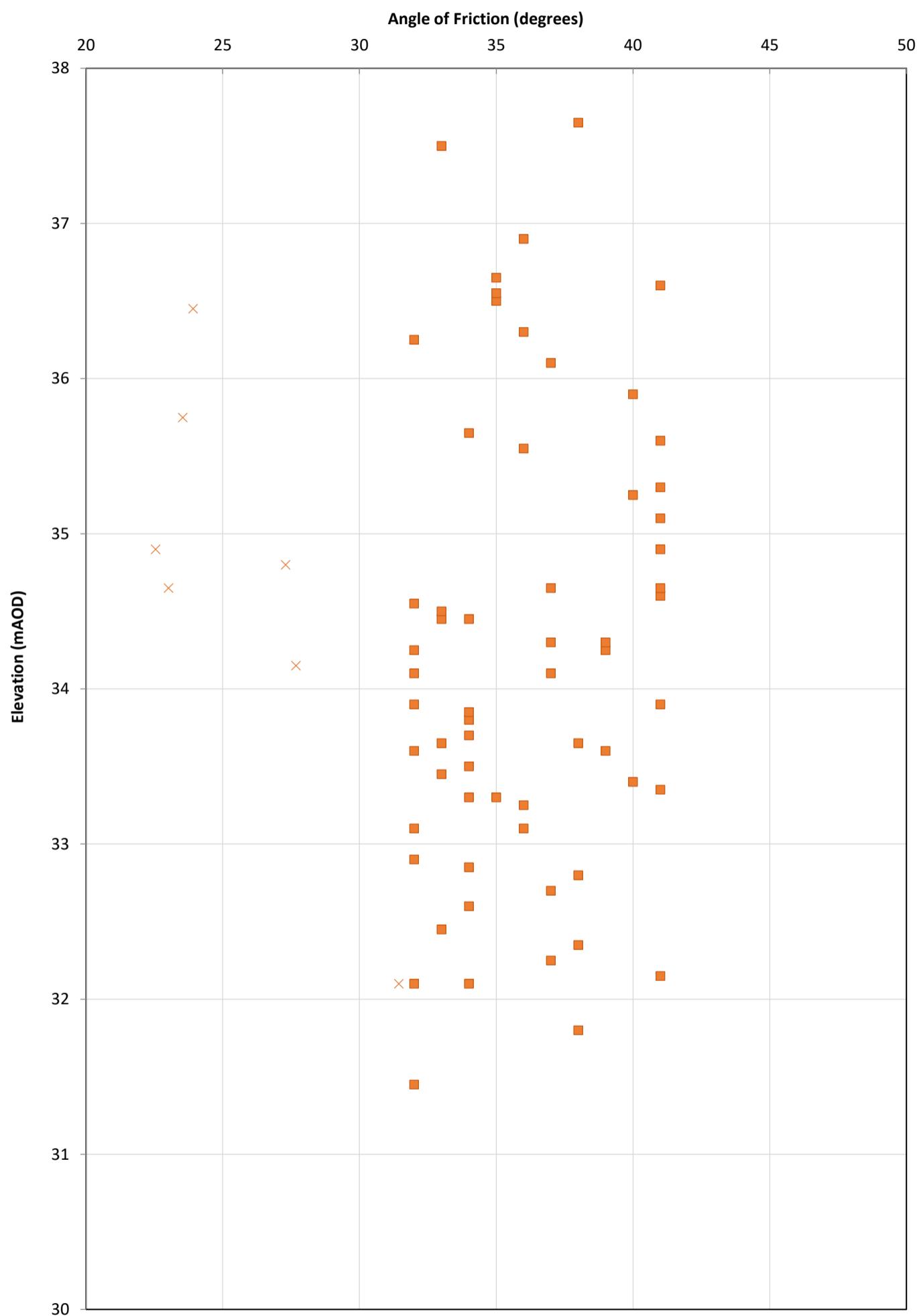
Title:	Undrained Shear Strength vs Elevation for Cohesive Made Ground and Kempton Park Gravel Member	Plot No: 7	Drawn: SM	Date: 22.09.2020
		Status:	Checked: SPW	Date: 23.09.2020

**RAMBOLL** | Project: Former Gasworks, Marshgate Drive | Job No: 1620009115  
 Location: Hertford | Client: St William Homes LLP

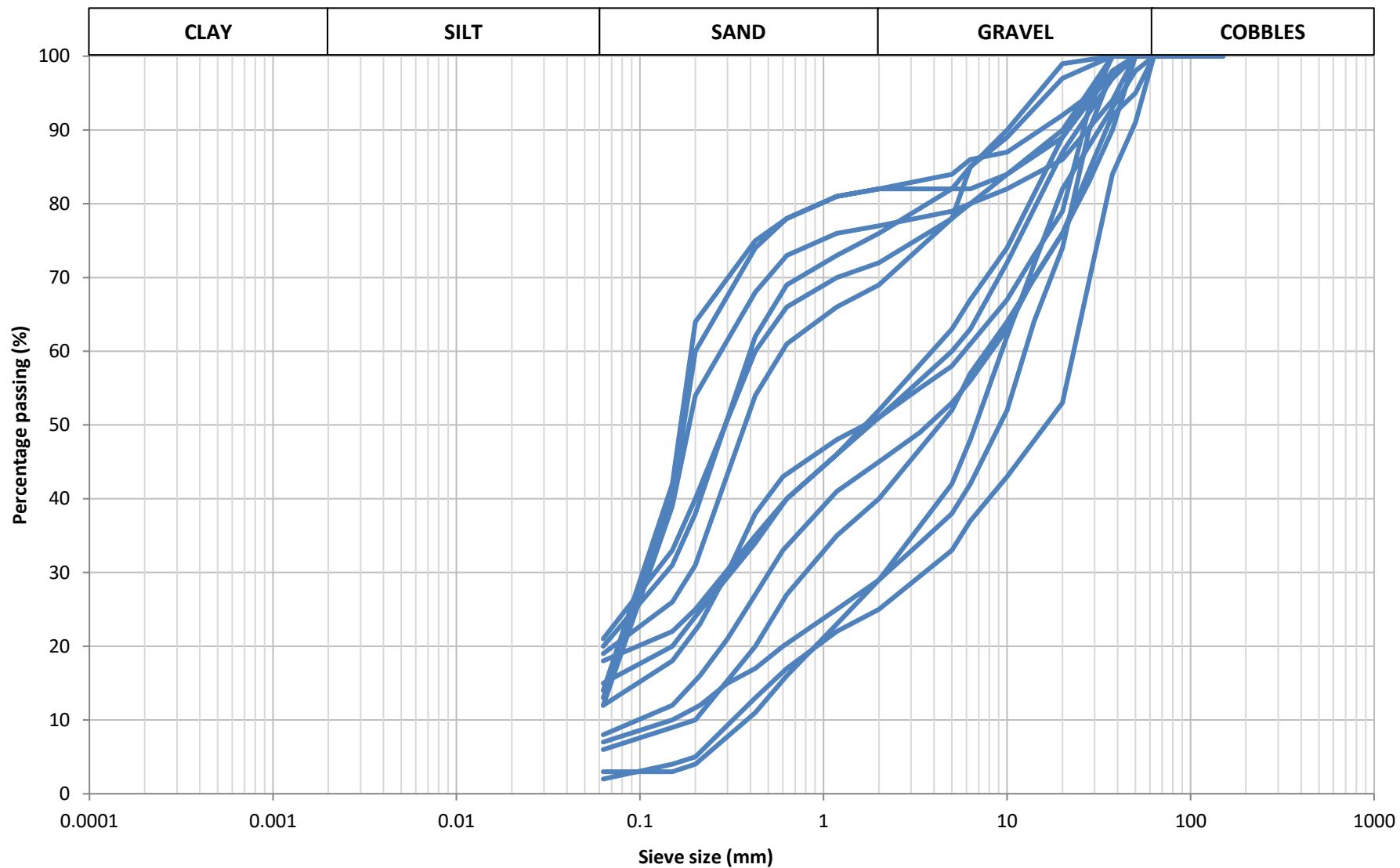


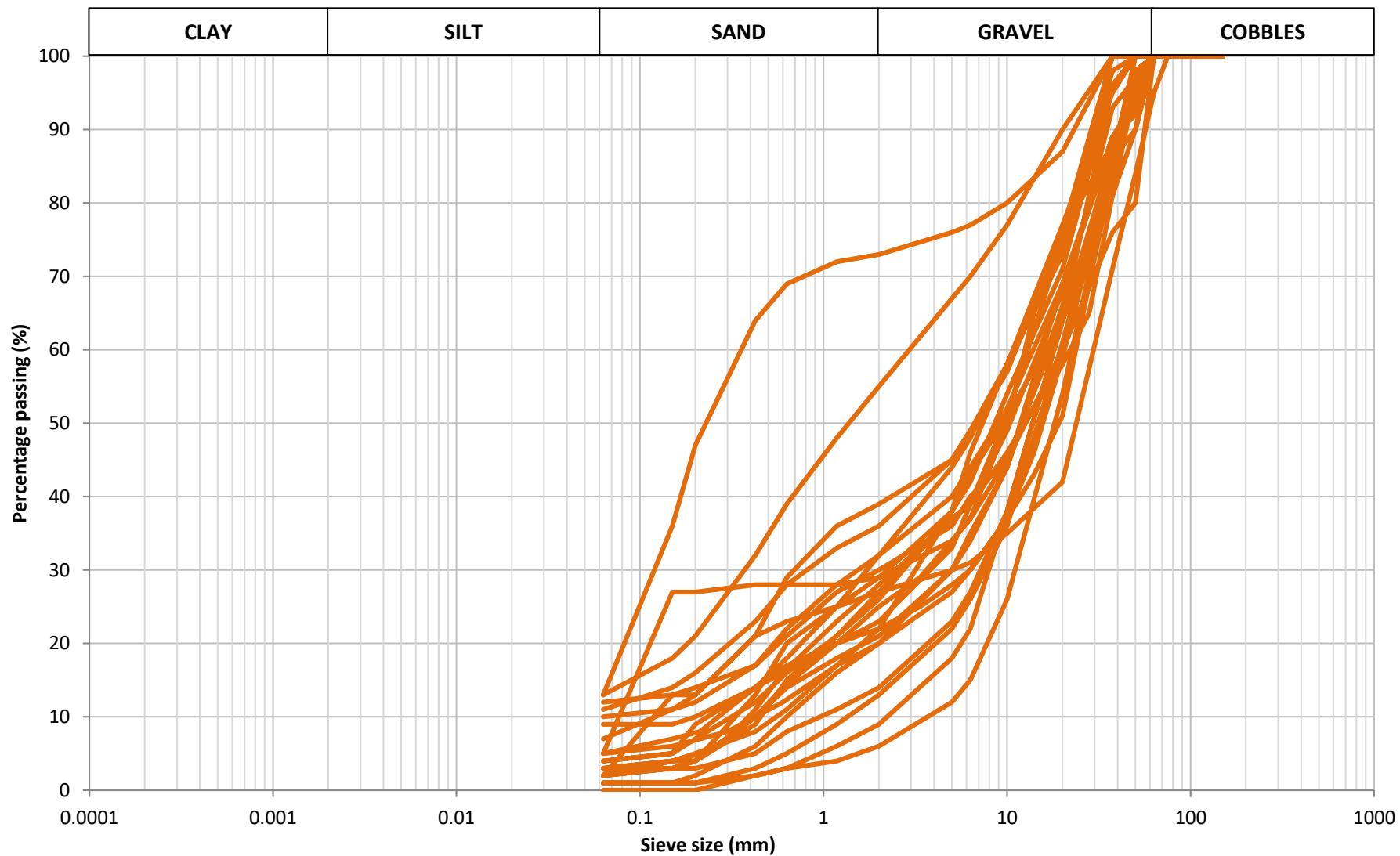
<b>Title:</b>	Undrained Shear Strength (Residual) vs Elevation for Made Ground and Kempton Park Gravel Member	<b>Plot No:</b>	8	<b>Drawn:</b>	SM	<b>Date:</b>	22.09.2020
		<b>Status:</b>		<b>Checked:</b>	SPW	<b>Date:</b>	23.09.2020

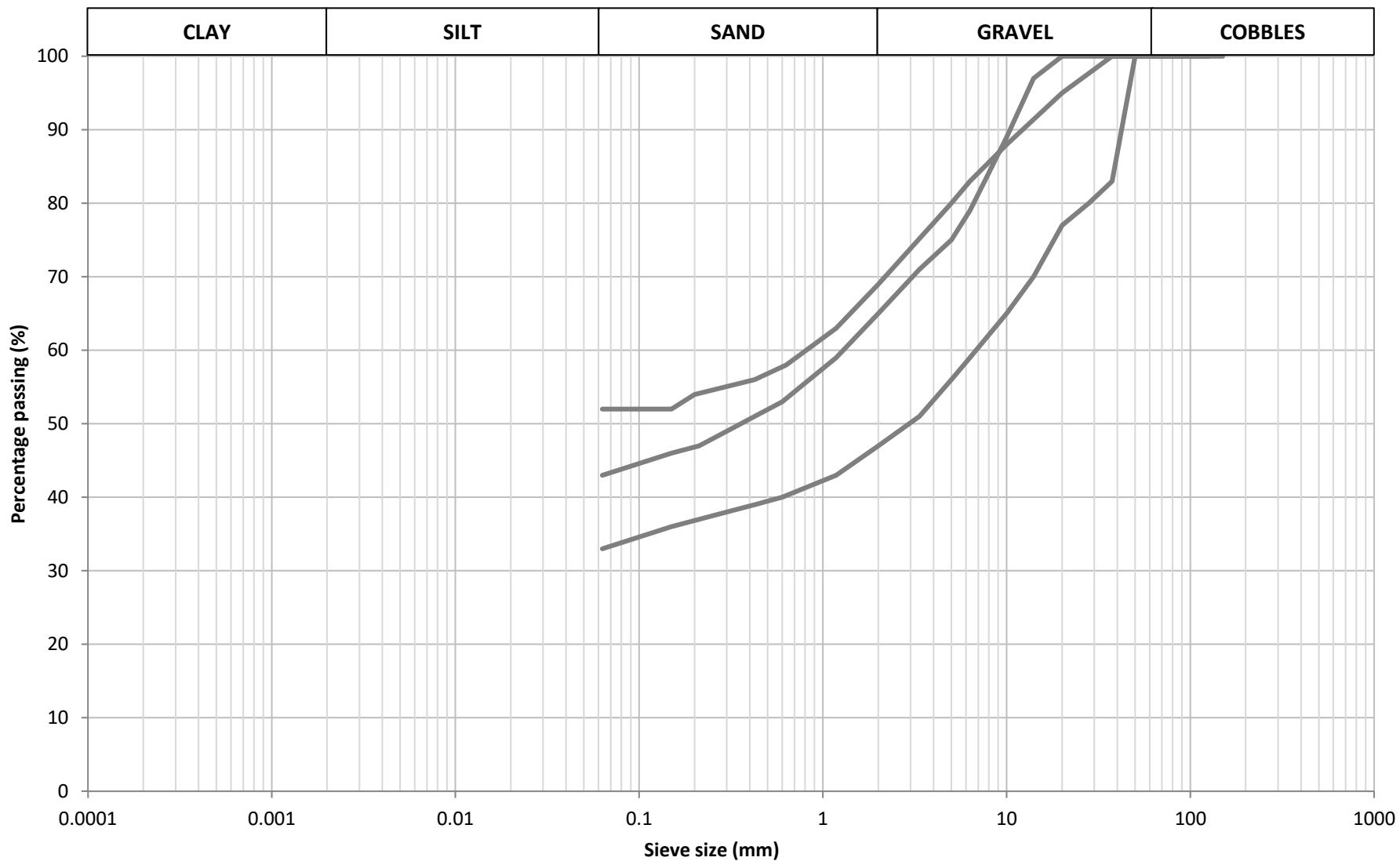
■ KEMPTON PARK GRAVEL MEMBER (GRANULAR) SPT    × KEMPTON PARK GRAVEL MEMBER (COHESIVE) PLASTICITY INDEX



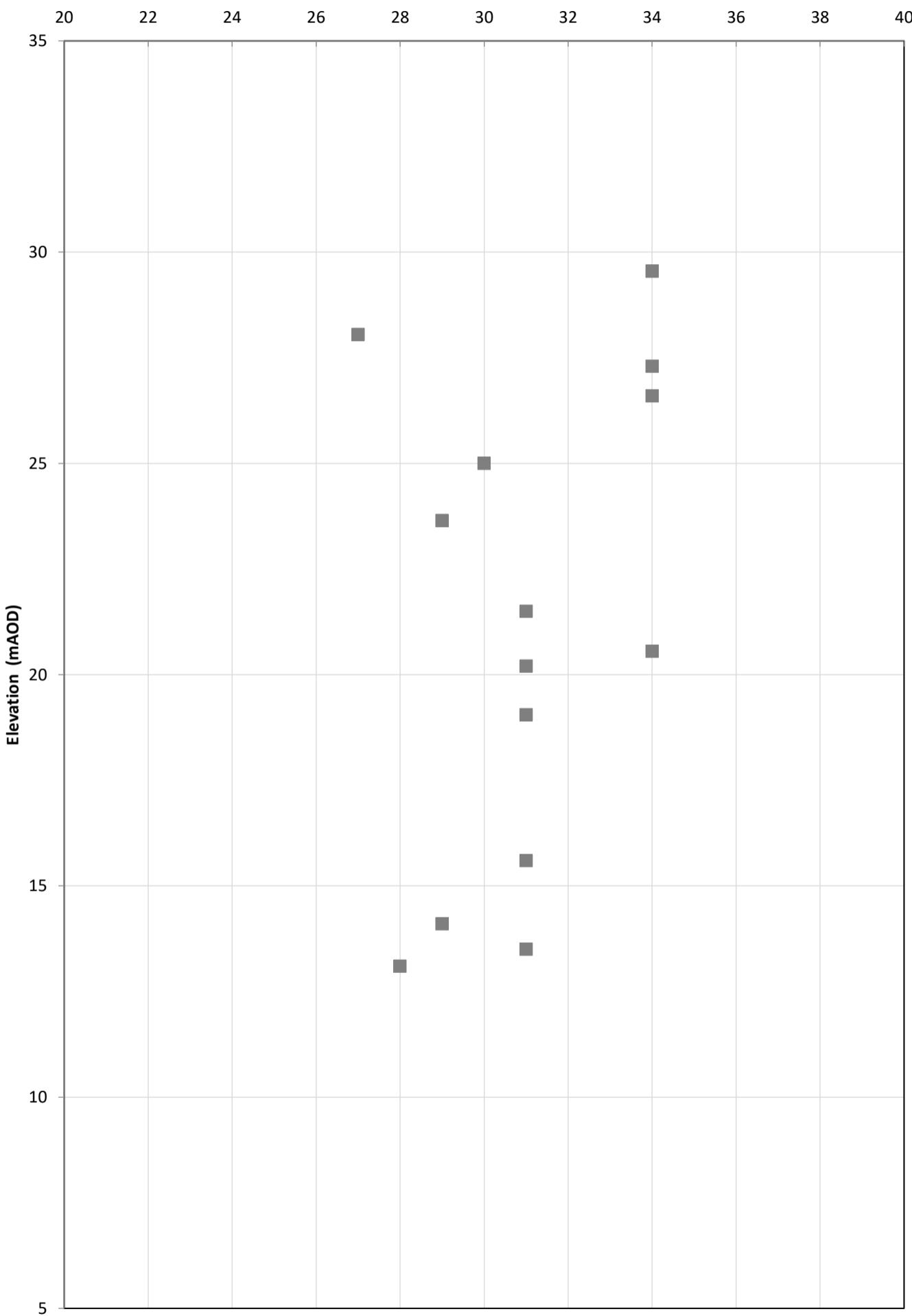
Title:	Angle of Shearing Resistance vs Elevation	Plot No: 9	Drawn: SM	Date: 22.09.2020
	Status:		Checked: SPW	Date: 23.09.2020





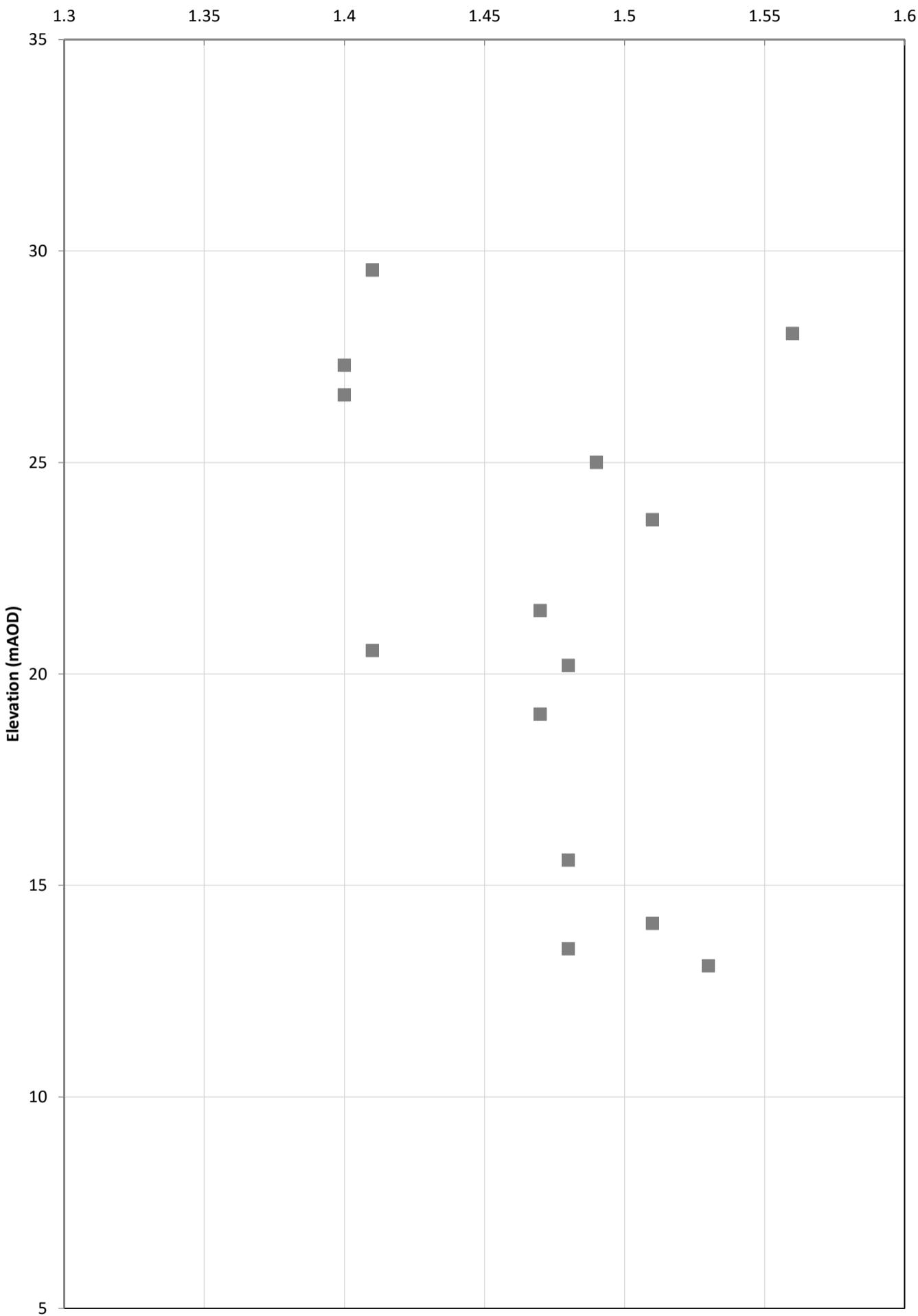


■ CHALK

**Saturated Moisture Content (%)**

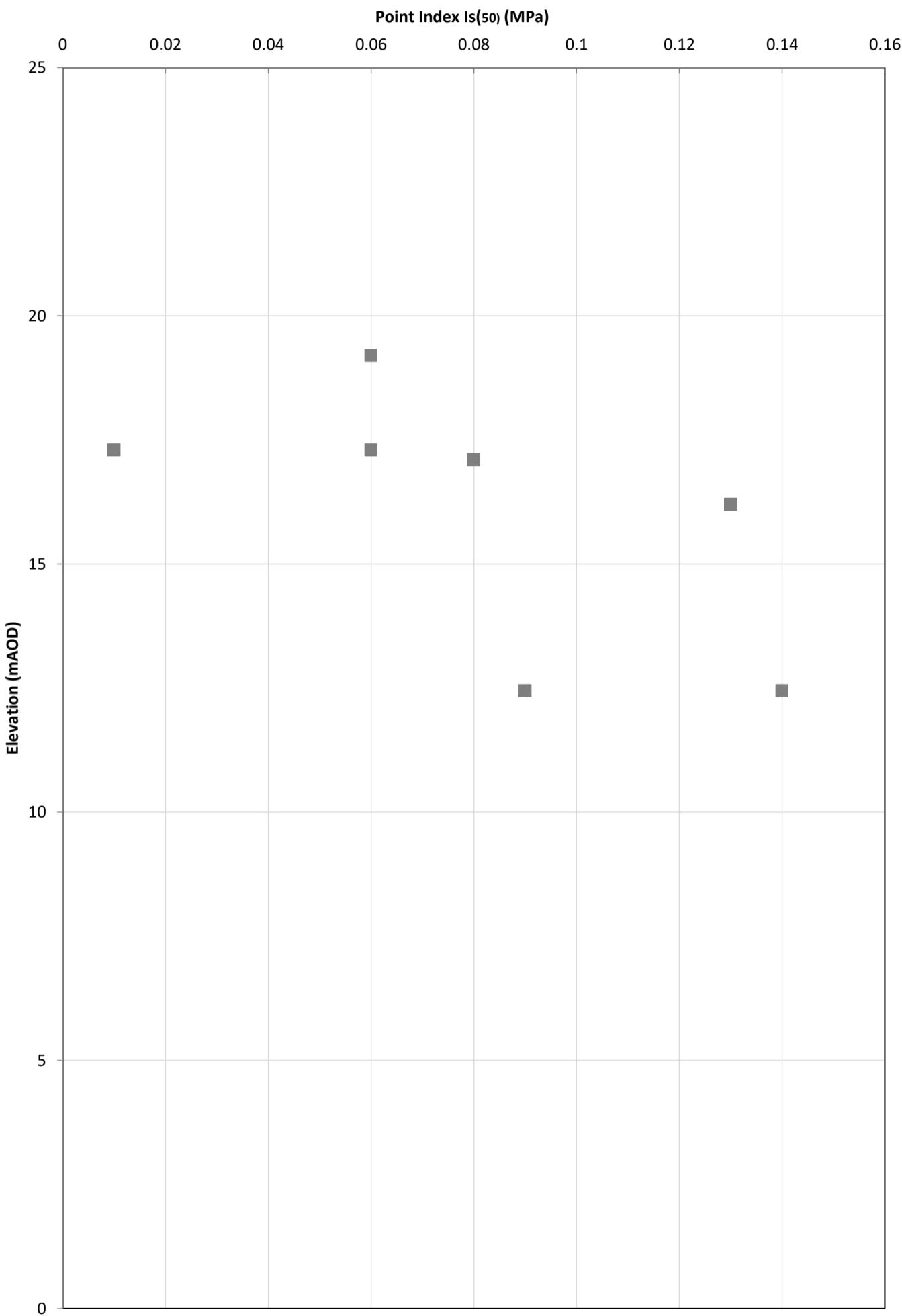
Title:	Saturated Moisture Content vs Elevation for Chalk	Plot No: 13	Drawn: SM	Date: 22.09.2020
Status:		Checked: SPW	Date: 23.09.2020	

■ CHALK

Intact Dry Density ( $Mg/m^3$ )

Title:	Intact Dry Density vs Elevation for Chalk	Plot No: 14	Drawn: SM	Date: 22.09.2020
Status:		Checked: SPW	Date: 23.09.2020	

■ CHALK



Title:	Point Index ( $Is(50)$ ) vs Elevation for Chalk	Plot No: 15	Drawn: SM	Date: 22.09.2020
		Status:	Checked: SPW	Date: 23.09.2020

