



# BWB

CONSULTANCY | ENVIRONMENT  
INFRASTRUCTURE | BUILDINGS

## Environment Group

Strawsons Holdings Ltd  
Phase 3, Witham St Hughs  
Land off Gibson Green, Witham St  
Hughs, Lincs, LN6 9PU

Phase 2 Geo-Environmental Assessment

## Environment Group

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Phase 3, Witham St Hughs  
Land off Gibson Green,  
Witham St Hughs, Lincs, LN6  
9PU  
Phase 2 Geo-Environmental  
Assessment

Birmingham  
Livery Place, 35 Livery Street, Colmore Business  
District, Birmingham, B3 2PB  
T: 0121 233 3322

Leeds  
Whitehall Waterfront, 2 Riverside Way, Leeds LS1  
4EH  
T: 0113 233 8000

London  
11 Borough High Street, London SE1 9SE  
T: 0207 407 3879

Manchester  
4th Floor Carvers Warehouse, 77 Dale Street  
Manchester, M1 2HG  
T: 0161 233 4260

**Nottingham**  
**Waterfront House, Station Street, Nottingham**  
**NG2 3DQ**  
**T: 0115 924 1100**

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P1	December 2017	Final	Patrick Taylor BSc (Hons)	Redmond Parker-Dunn BSc (Hons)	Jamie Rushton BEng CEng MICE	Tim Hull BSc MSc CGeol FGS

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EXECUTIVE SUMMARY	
Site Address, Setting and History	<p>Land off Gibson Green, Witham St Hughs, Lincs, LN6 9PU.</p> <p>The site comprises approximately 70 hectares of farmland largely utilised for arable purposes. Several surface water drains run through the site. A small area of dense woodland was present in the southern area of the site including many Oak trees.</p> <p>Historical uses of the site are limited to a former pond that may have been infilled; otherwise, mapping indicated uses are limited to farming. Significant land uses in the surrounding area comprise nearby RAF Swinderby and industrial buildings to the south, where tanks and ESSs have also been indicated.</p>
Proposed Development	<p>A residential development with associated gardens, landscaping, infrastructure and amenities. Farm buildings in the north east of the site are expected to be retained.</p>
Published Geology, hydrogeology and hydrology	<p>The site is expected to comprise limited thicknesses of Made Ground and Topsoil underlain by the Balderton Sands and Gravels Formation (Secondary A Aquifer) in the west and directly underlain by the bedrock geology of the Lias Group, Scunthorpe Mudstone (unproductive) Formation in the west.</p> <p>No groundwater abstractions listed within 1km of the site and the site is not located within or close to a Source Protection Zone (SPZ).</p> <p>The nearest significant water course is Thurlby Lake located approximately 1.1 km south.</p>
Scope of investigation works	<p>The ground investigation comprised:</p> <ul style="list-style-type: none"> <li>Twenty-five machine excavated trial pits;</li> <li>TRL dynamic probe penetration (TRL DCP) testing at selected locations;</li> <li>and</li> <li>Collection of environmental and geotechnical samples for laboratory testing.</li> </ul> <p>The purpose of the investigation was to assess the underlying ground conditions, target areas of proposed highways and drainage infrastructure and to collect soil samples for geotechnical and environmental analysis to inform preliminary designs for road infrastructure and associated attenuation ponds.</p>
Ground Conditions Encountered	<p>Ground conditions comprised varying depths of Topsoil predominantly overlying the Weathered Scunthorpe Mudstone Formation (east of the site) from 0.20m to 1.0m. Superficial Deposits of the Balderton Sands and Gravels Formation were present underlying the Topsoil and overlying the Weathered Scunthorpe Mudstone Formation in the west of the site. The base of the bedrock was not proven.</p>
Geotechnical Appraisal	<p>CBR values obtained via in-situ testing and laboratory analysis has produced results varying between 5.0% and 75.0% in the west of the site and 1.5% to 42% in the east of the site.</p> <p>A preliminary Design Sulphate Class of DS-1 and ACEC Class AC-1 is recommended for the western side of the site (Balderton Sands and Gravels Formation) and DS5 and ACEC Class AC-5 is recommended within the eastern area of the site (Weathered Scunthorpe Mudstone Formation) given high levels of sulphate identified at several locations within pyritic geology. Further ground investigations should seek to clarify these figures.</p>
Environmental Appraisal	<p>No significant contamination has been identified on site. Direct sources of contamination have not been identified based on the current and historical use of the site as agricultural fields.</p>

## EXECUTIVE SUMMARY

	The findings of the completed ground investigation and indicate that the investigated areas pose a low risk to human health and a low risk to controlled waters receptors.
Recommendation	Further intrusive works will be required prior to development to inform foundation design and further assess the Design Sulphate Class for the site.
This summary should be read in conjunction with BWB's full report (ref. WSH-BWB-ZZ-XX-YE-RP-0002_Ph2) and reflects an assessment of the site based on information received by BWB at the time of production.	

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## 1.0 INTRODUCTION

### Instruction

- 1.1 BWB Consulting (BWB) was instructed by Strawsons Holdings Ltd (the Client) to carry out a Phase 2 Geo-environmental Assessment at the site at Phase 3, Witham St Hughs, Land off Gibson Green, Witham St Hughs, Lincs, LN6 9PU. Details of the project brief are included in BWB proposal reference 20170831/1/NTM2004/RC/RPD.
- 1.2 BWB has previously completed the following desk study for the site, familiarity with this report is assumed :

BWB Consulting Ltd for Strawsons Properties Ltd; Phase I Geo-Environmental Assessment; Phase 3, Witham St Hughs, Land Off Gibson Green, Witham St Hughs, Lincolnshire, LN6 9PU; BIM Ref: NTM2004-BWB-00-XX-RP-EN -0001-Ph1\_V1; dated August 2015.

- 1.2 The proposed development is anticipated to comprise a residential development with associated roads, infrastructures, gardens and amenities. However, the intrusive works focused primarily on the road infrastructure and the attenuation ponds which are proposed. This was undertaken to assist with S78 and S38 agreements.

### Objectives

- 1.2 The objectives of the report are to assess:
  - The prevailing ground and groundwater conditions across the site;
  - The potential presence and extent of contamination in shallow soil a groundwater beneath the site;
  - The significance and magnitude of the observed contamination through comparison of analytical data to appropriate published environmental screening criteria;
  - The strength properties of the soil beneath the site to enable preliminary California Bearing Ratios (CBRs) for the road and pavement infrastructure.
- 1.5 The above objectives will allow the Preliminary Conceptual Site Model presented in the Phase 1 report to be verified and updated. The report has been completed in accordance with BS10175:2011(+A1:2013) Investigation of Potentially Contaminated Sites, Code of Practice and CLR11 "Model Procedures for the Management of Land Contamination".
- 1.2 This report presents the information obtained from a desk study and the supplementary ground investigations and contains relevant factual information from the previous investigations undertaken by others. Sections 2 to 5 of the report, together with the associated Figures and Appendices, provides a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007
- 1.5 The report also includes information required to form a Geotechnical Design Report as defined in BS EN 1997-1:2004, and the salient information, assessments and

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recommendations are presented in Sections 6 to 12 of the report, together with the associated Figures and Appendices.

## Scope of Works

- 1.2 The scope of works was completed between 7<sup>th</sup> and 9<sup>th</sup> November 2017 and comprised the following

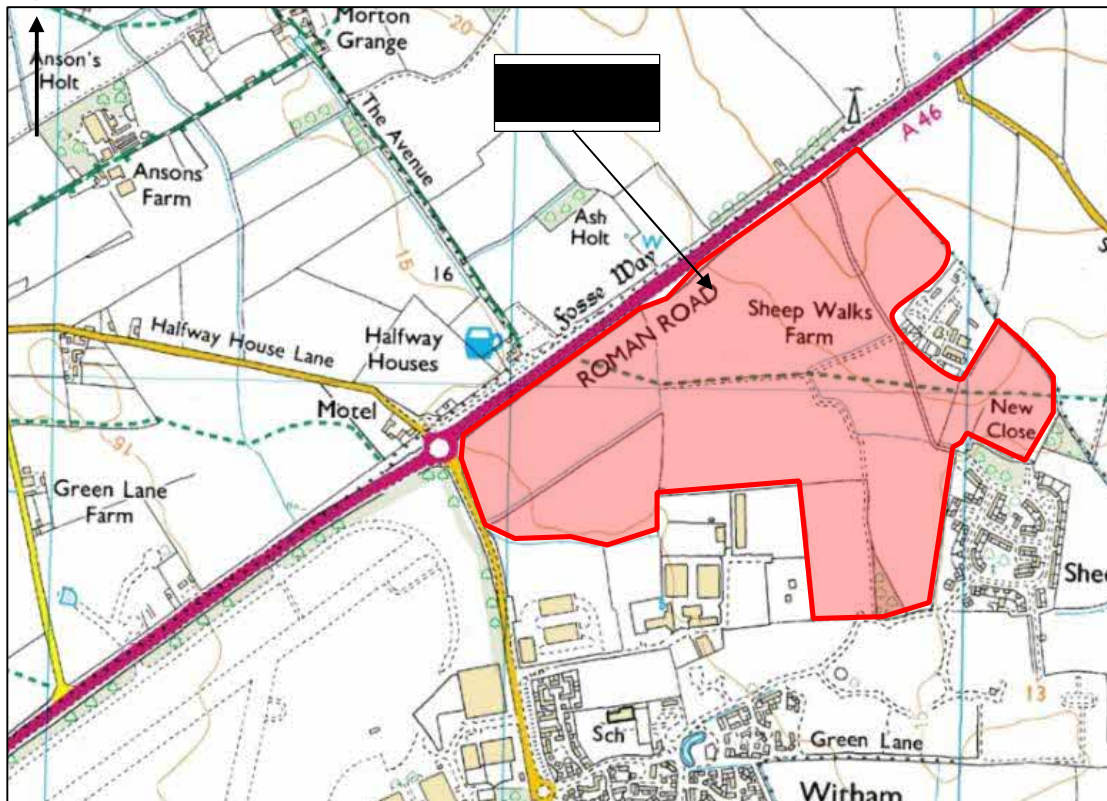
- Non-intrusive survey of excavation locations for underground utilities;
- Supervision of excavations by a qualified archaeologist
- 25 machine excavated trial pits;
- Dynamic Cone Penetrometer (DCP) at selected intrusive locations;
- Chemical analysis of soils; and
- Geotechnical testing of soil.

## 2.0 THE SITE

### Site Location

- 2.1 The site is located to the north of Witham St Hughs in Lincolnshire, at National Grid coordinates 489435, 362870. The location of the site is shown in Figure 1.

Figure 1 Site Location Plan



Reproduced from the Ordnance Survey Open Map - Local with the permission of the controller of Her Majesty's Stationery Office Crown Copyright Reserved.

### Site Description

- 2.2 A detailed description of the key features of the site and its surrounding is included in the Phase 1 Report.
- 2.2 The site is irregularly shaped, occupies an area of approximately 70 hectares and largely comprises farmland. The site is at an elevation of approximately 15m above Ordnance Datum (AOD) and is largely flat, with a slight slope from north-east to south-west.
- 2.2 At the time of the site reconnaissance the site area appeared to be occupied by up to eight individual fields, however, obvious field boundaries could not be identified. With the exception of two fields in the far east of the site, all fields were noted to contain corn crop. The crop in the fields in the east had recently been harvested.

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- 2.2 Several surface water drains run through the site some of which appear to form field boundaries. At the time of the site inspection all surface water drains were noted to be dry and overgrown.
- 2.2 A small area of dense woodland was present in the southern area of the site. Tree species were noted to contain mature Oak trees.
- 2.2 A former asphalt roadway, now overgrown, is present in the east of the site which links a farm complex, located in the east of the site, to the land adjacent to the southeast. This roadway was blocked part way by vegetation and fencing.

## 3.0 GEO-ENVIRONMENTAL SETTING

### Published Geology

- 2.1 Ground conditions were anticipated to comprise limited thicknesses of Made Ground with varying thicknesses of topsoil across the site. Superficial deposits are only present in the western area of the site and comprise the Balderton Sand and Gravel Member. The solid geology present beneath the superficial deposits and at the surface elsewhere on site comprises the Scunthorpe Mudstone Formation of the Lias Group.

### Hydrogeology

- 2.2 The Environment Agency (EA) classifies the superficial deposits in the west of the site as a Secondary A Aquifer and the underlying bedrock as unproductive.
- 2.2 There are no groundwater abstractions listed within 1km of the site and the site is not located within or close to a Source Protection Zone (SPZ).

### Hydrology

- 2.2 Several watercourses and tertiary water courses are noted to be present on site. However, the watercourses observed were noted to be overgrown with limited flow.
- 2.2 The nearest significant watercourses are considered to be Thurlby Lake located approximately 1.1km south and the River Witham located approximately 1.2km south-east of the site.
- 2.2 There are no surface water abstractions listed within close proximity to the site and the site is not indicated to be within a flood zone area.

## 4.0 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

### Introduction

- 2.1 The risk posed by any contaminants in soil or groundwater will depend on the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.
- 2.2 The following sections discuss all the identified potential on and off-site sources, pathways and receptors in the context of the proposed development and plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or controlled waters from the data gained from the desk study. At this stage the assessment is qualitative and aimed to determine all pollutant linkages, irrespective of significance or allowing for uncertainty.
- 2.2 Three impact potentials exist for any given site, these are:
- The site impacting upon itself;
  - The site impacting on its surroundings; and
  - The surroundings impacting on the site.
- 2.2 All three impacts need to be considered in a risk assessment.
- 2.2 A Source, Pathway, Receptor analysis has been undertaken for the site based on the information provided in the preceding sections. This is presented as **Table 1**.
- 2.2 **Sources (S);** These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks).
- 2.2 **Pathways (P);** A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.
- 2.2 **Receptors (R);** Receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by contaminant(s).

**Table 1 Preliminary Conceptual Site Model**

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
<b>On-Site</b> <b>S1:</b> General localised Made Ground – Contaminants may include complex cyanide, PAHs, ammonium, heavy metals, sulphate, asbestos and hydrocarbons. <b>S2:</b> Farming activities – Potential contaminants may include pesticides, herbicides, and hydrocarbons.	<b>P1:</b> Dermal contact, ingestion and inhalation of contaminated soil particulates.	<b>R1:</b> Site end users (commercial and/c residential)	Md	Lw	M/ L	If contamination is identified at the site through investigation that is indicated to present a potential risk it is likely to be localised. The potential risk is likely to be easily mitigated through incorporation of an appropriate cover system in landscaped areas.
		<b>R2:</b> Construction workers, ground workers and maintenance workers.	Mi	Li	M/ L	If a risk to construction workers is identified through investigation and assessment that adoption of appropriate PPE, typical industry practice and good hygiene is likely to mitigate potentially significant risk.
	<b>P2:</b> Inhalation of vapours (indoors and outdoors)	<b>R1:</b> Site end users (commercial and/c residential)	Md	Lw	M/ L	If contamination is identified at the site through investigation that is indicated to present a potential risk through vapour inhalation it is likely to be localised. The potential risk is likely to be easily mitigated through incorporation of vapour resistant membranes in buildings within the impact area or through limited soil removal/remediation.
	<b>P3:</b> Leaching and permeation through soil profile	<b>R3:</b> Secondary A Aquifer underlying the western area of the site.	Mi	Lw	Lw	The risk of impact to the underlying aquifer is limited to the western area of the site as the rest of the site is underlain by Unproductive Strata. Based on the site setting limited potential sources of contamination on-site there is considered to be limited risk to the underlying aquifer. Additionally, the significant surface water courses are at a substantial distance from site. Groundwater in relation to site derived contamination is only considered to be required if significant shallow ground contamination is identified during the site investigation.
<b>R4:</b> Thurlby Lake and the River Witham.	Mi	UI	VL			

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
	<b>P4:</b> Direct contact	<b>R5:</b> Buried water utility pipes (tainting of water supply by organic contaminants)	Md	Lw	M/L	The results of the site investigation should be provided to the water utility provider in order to confirm suitable pipe material at the site.
		<b>R6:</b> Buried concrete (sulphate attack)	Md	Lw	M/L	The intrusive investigation should include an assessment of sulphate and pH of the ground to confirm the concrete type required.
<b>On-Site</b> <b>S3:</b> Methane and carbon dioxide ground gas associated with localised Made Ground	<b>P2:</b> Migration into buildings through foundation cracks, service entry points	<b>R7:</b> Confined space: in buildings, residents	Mi	UI	VL	There is considered to be limited risk from ground gases at the site for which basic gas protection is likely to meet maximum requirement.
<b>Off-Site</b> <b>S4:</b> Nearby airfield and industrial properties including tanks and ESSs – Potential contaminants may include Kerosene and other fuel hydrocarbons, oils, polychlorinated biphenyls (PCBs), PAHs, and heavy metals.	<b>P2:</b> Migration into buildings through foundation cracks, service entry points	<b>R1:</b> Site end users (commercial and residential)	Mi	Lw	L	It is possible that off-site sources of contamination have migrated onto and impact the Secondary beneath the western area of the site. The impact is considered to have limited significance in the context of the proposed development though this should be confirmed by testing of groundwater samples obtained from boreholes installed in the western area of the site.
<p>VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low</p> <p>KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor, Hi = High, Li = Likely, Lw = Low Likelihood, UI = Unlikely</p>						



## 5.0 PHASE II ENVIRONMENTAL AND GEOTECHNICAL GROUND INVESTIGATION

### Scope of Works

- 5.1 Intrusive ground investigation works were undertaken between 7<sup>th</sup> and 9<sup>th</sup> and comprised the following works:

Clearance of investigation locations by a specialist buried services tracing company;  
Inspection of excavations by a qualified archaeologist;  
The advancement of twenty-five machine excavated trial pits (TP01 to TP25 inclusive) to a maximum depth of 4.30mbgl;  
TRL dynamic probe penetration (TRL DCP) testing at selected locations to infer CBR values;  
Collection of environmental soil samples for chemical analysis at a UKAS and MCERTS accredited laboratory; and  
Collection of bulk and disturbed soil samples for geotechnical analysis at a UKAS accredited laboratory.

- 2.2 An exploratory hole location plan is presented as **Drawing 1** and the BWB exploratory hole records are presented as **Appendix 2**.

- 2.2 The site investigation works were carried out in general accordance with 'Code of Practice for Site Investigations' and BS10175:2011 'Investigation of Potentially Contaminated Sites'.

### Chemical Sampling Strategy

- 2.2 As no development has been recorded on the site in historical mapping, sampling positions were positioned to provide site coverage, targeting areas of proposed highways and drainage infrastructure.

- 5.5 During the investigation samples were obtained from various geologies and depths throughout the natural soil profile to determine the typical background chemical concentrations for the site.

### Chemical Analytical Strategy

#### Soil Strategy

- 2.2 Selected soil samples collected from exploratory hole locations were sent to I2 Analytical (UKAS and MCERTS accredited) for chemical analysis. The following chemical analytical testing was undertaken:

Nine soil samples tested for a soil suite (BWB Standard Suite) comprising arsenic, barium, beryllium, water soluble boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water

soluble sulphate (2:1 extract), total phenols, total cyanide, free cyanide, complex cyanide, fraction of organic carbon, pH, Polycyclic Aromatic Hydrocarbons (PAHs) (United States Environment Protection Agency priority 16 compounds) and Total Petroleum Hydrocarbons (TPH) C6-C40;  
Four soil samples for asbestos screening; and  
Four samples tested four pesticides comprising Organochlorine, Organonitrogen and Organophosphorous.

- 5.5 The results of the soil chemical testing are presented as **Appendix 3**.

## Geotechnical Strategy

- 2.2 The trial pits were positioned along the proposed road infrastructure and location of attenuation ponds to assess ground conditions, strength properties and characteristics across the wider site.
- 5.9 In-situ DCP tests were undertaken within selected trial pits to provide a preliminary understanding of potential CBR values for the proposed road infrastructure and pavement design.
- 5.10 Selected disturbed and bulk samples were collected from the investigation locations and sent to the geotechnical project laboratory (I2 Analytical), which is UKAS accredited. The following geotechnical testing was undertaken;

Fifteen samples tested for moisture content;  
Sixteen samples tested for Atterberg (liquid and plastic) limits;  
Eight samples tested for particle size distribution by sieve wet/dry;  
Ten samples tested for particle size distribution by sedimentation;  
Ten samples tested for BRE Suite comprising aqueous sulphate and pH;  
Four CBR (2.5kg) compaction testing;  
Four CBR (4.5kg) compaction testing;  
Three (2.5kg) compaction testing; and  
Three (4.5kg) compaction testing.

- 5.11 The results of the geotechnical testing are included as **Appendix 4**.

## Limitations and Uncertainty

- 5.12 TP24 was terminated at 1.20mbgl due to potential archaeological significance.
- 5.12 Numerous pits in the west of the site terminated at shallow depth due to significant instability within sand and gravel deposits.

## 6.0 GROUND CONDITIONS ENCOUNTERED

### Geological Summary

- 6.1 The ground conditions recorded confirmed the published geology in the Phase 1 report comprising varying depths of Topsoil overlying the Superficial Deposits of the Balderton Sand and Gravel Formation (BSGF) in the west and subsequently overlying the Weathered Scunthorpe Mudstone Formation (WSMF). The Topsoil in the east of the site directly overlay the WSMF.
- 5.9 The recorded ground conditions are summarised in **Table 2** below.

**Table 2** Summary of Ground Conditions

Strata	Top Depth (mbgl)		Base Depth (mbgl)		Thickness (mbgl)	
	Min	Max	Min	Max	Min	Max
Topsoil	0.00		0.20	0.42	0.20	0.42
BSGF	0.30	0.40	1.90	2.90	1.50	2.52
WSMF	0.20	2.90	Not Proven		Not Proven	

### Geological Descriptions

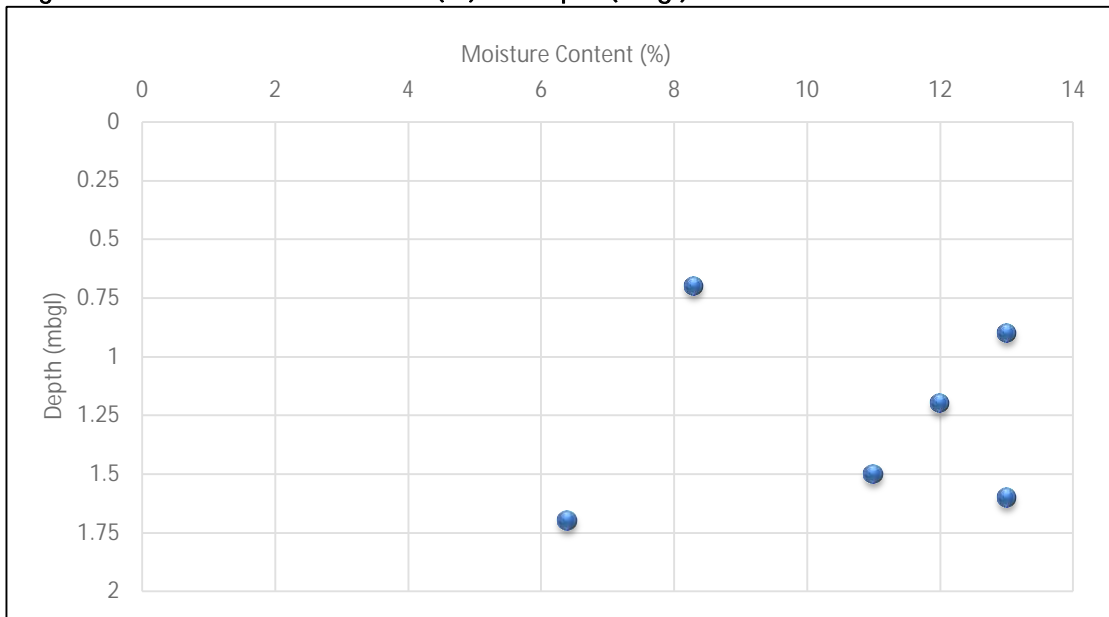
#### Topsoil

- 5.9 Topsoil was encountered consistently across the site at thicknesses c 20m (TP17) and 0.42m (TP 19), overlying the BSGF in the west (TP01-TP08 inclusive) and the WSMF in the east (TP09-TP25 inclusive). The composition also displayed consistency, typically comprising a dark brown, brown or on a rare occasion light brown gravelly sand with varying volumes of silt/ clay or a soft to firm gravelly sandy clay with varying volumes of sand and gravels, with occasional rootlets.
- 5.9 Gravels of mixed lithologies were identified. Gravels comprised fine to coarse sub-angular to sub-rounded sandstone, quartzite, flint, coal and siltstone.
- 5.9 A plastic bag was found within TP25.
- 5.9 Frequent rootlets were present within all exploratory holes.
- 5.9 The depth of topsoil over the site may vary from that encountered at the locations investigated within the scope of this investigation which may result in inaccurate estimations of topsoil quantities on the site.
- 5.9 pH and water-soluble Sulphate from one sample (TP23 – 0.20mbgl) were found to be 7.20 and 0.009g/l respectively.
- 6.9 Geotechnical laboratory testing results are presented as **Appendix 4**.

**Balderton Sand and Gravel Formation**

- 5.12 The BSGF was encountered at eight of the twenty-five locations (TP01-TP08) all located in the west of the site and underlying the Topsoil. The base of the BSGF was only encountered at two locations (TP06 – 2.60mbgl and TP07 – 2.90mbgl) due to substantial collapsing within the pits.
- 6.11 The BSGF were encountered as a light brown, orangish brown, brown and occasionally grey gravelly sand or sandy gravel with varying volumes of clay and silt.
- 5.12 Gravels comprised fine to coarse sub-angular to sub-rounded siltstone, sandstone, flint and quartzite.
- 5.12 Pockets of sandy clay were noted throughout shallow granular deposits within four locations (TP01, TP02, TP03 and TP04).
- 5.12 Moisture content analysis undertaken on six samples between 0.9mbgl and 1.7mbgl with results ranging between 6.4% and 13%. An indication of correlation between depth and moisture content is present on **Figure 2** below.

**Figure 2 Moisture Content (%) vs Depth (mbgl) – BSGF**



- 5.12 The results of the PSD testing undertaken on eight samples at varying depths across all eight locations positioned in the west of the site are shown below in **Table 3**.

**Table 3 Summary of Particle Size Distribution by Sieve wet/dry**

Location ID	Depth (m)	Cobble Content (%)	Gravel Content (%)	Sand Content (%)	Clay / Silt Content (%)
TP01	1.5	0	5.8	90.0	4.20
TP02	1.70	0	44.90	50.80	4.30

TP03	0.90	0	7.4	81.60	11.0
TP04	1.20	0	6.8	77.90	15.30
TP05	1.60	0	5.60	91.40	2.90
TP06	1.50	0	55.20	39.70	5.10
TP07	2.00	0	65.80	29.90	4.30
TP08	0.90	0	61.80	31.20	7.00

5.12 pH and water-soluble Sulphate from six samples were found to vary between 7.5 and 7.8 and 0.016g/l and 0.059g/l respectively. Total Sulphur ranged between <50mg/kg (TP05 – 0.50mbgl) to 110mg/kg (TP02 – 1.70mbgl).

5.12 Geotechnical laboratory testing results are presented as **Appendix 4**.

#### Weathered Scunthorpe Mudstone Formation

5.12 The WSMF was encountered at nineteen locations with all locations predominantly underlying the Topsoil (eastern area of the site) and underlying the BSGF at two locations (TP06 and TP07) with the base of the stratum not proven.

6.19 The WSMF was encountered with an array of colourations including light brown, bluish grey, brown, dark grey, orangish brown with varying compositions. The WSMF was encountered as either a firm to stiff clay or an extremely weak mudstone arising as a poorly laminated or blocky clay/silt both with varying volumes of sands and gravels.

5.12 Gravels encountered within the soil matrix comprised fine to coarse sub-angular to sub-rounded weak sandstone, siltstone, flint and quartzite becoming predominantly weak mudstone with depth.

6.11 Thirteen positions were terminated due to refusal on bedrock ranging in dept between 1.40mbgl (TP13) and 3.52mbgl (TP07). The bedrock encountered was recorded as a weak limestone or weak mudstone arising as a sandy gravel.

5.12 A band of clayey sand was identified between 1.0mbgl and 1.3mbgl within TP12, whilst a band of limestone arisings as a sandy gravel was identified within TP18 between 0.90mbgl and 1.10mbgl.

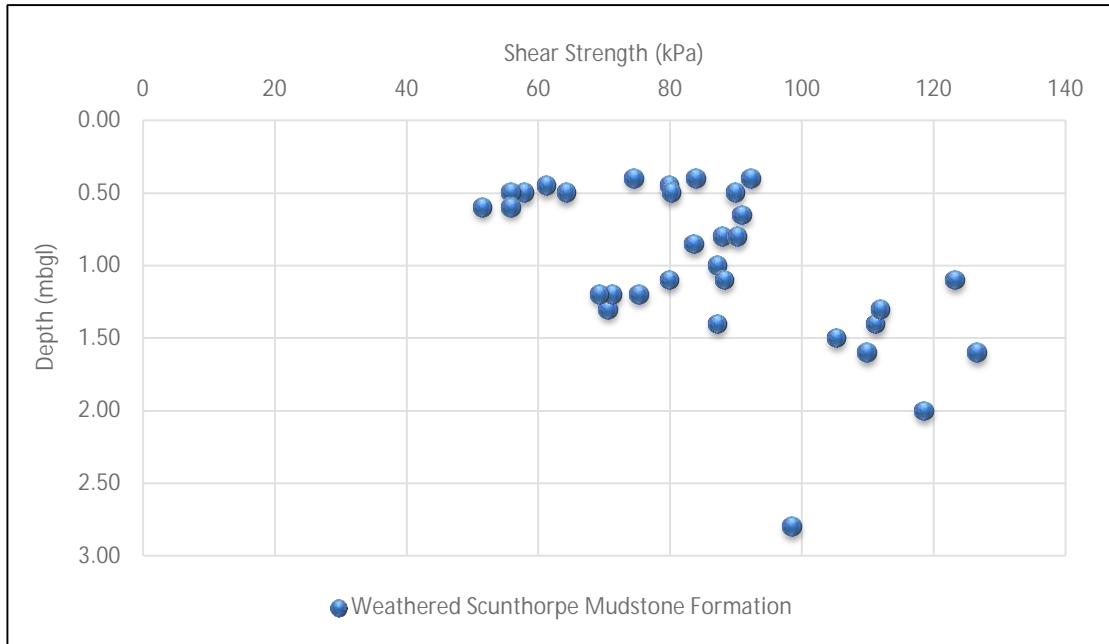
5.12 Shell fragments and whole shells were noted in nine locations between 0.34mbgl (TP24) and 2.90mbgl (TP07).

5.12 Relic rootlets were identified in two locations between 1.30mbgl (TP11) and 1.90mbgl (TP09).

5.12 Two locations (TP17 and TP18) comprised micaceous deposits between depths of 2.60mbgl and 4.20mbgl.

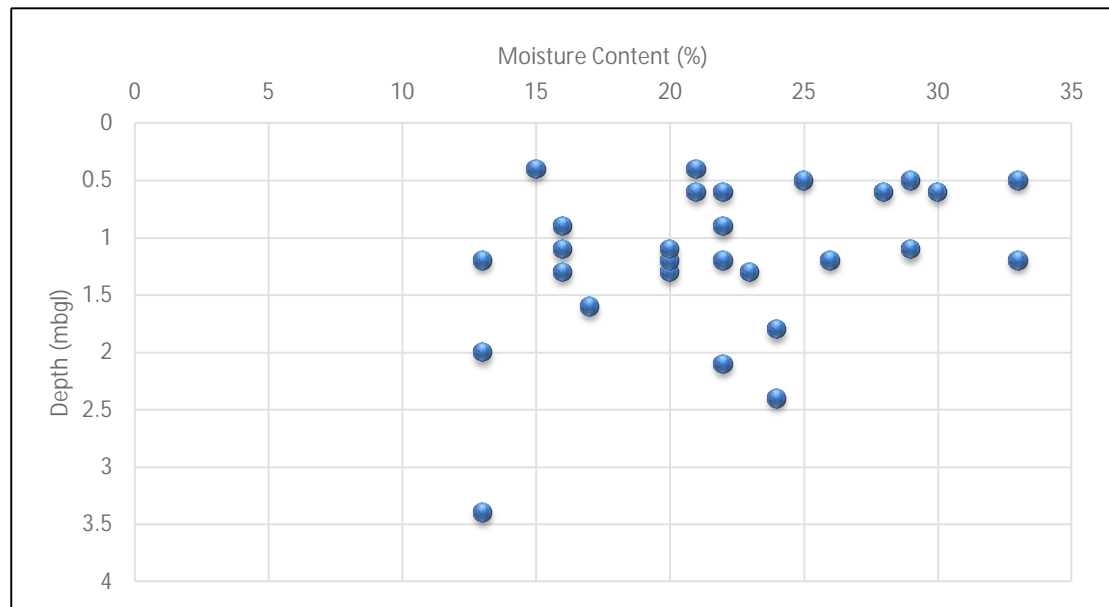
5.12 Where suitable cohesive deposits were encountered hand shear vane tests were undertaken. The tests comprised three tests with the average taken as the peak results and presented as **Figure 3** on the following page. The HSV results obtained are presented on the exploratory hole records presented in **Appendix 2**.

**Figure 3 In Situ Hand Shear Vane Test Results**



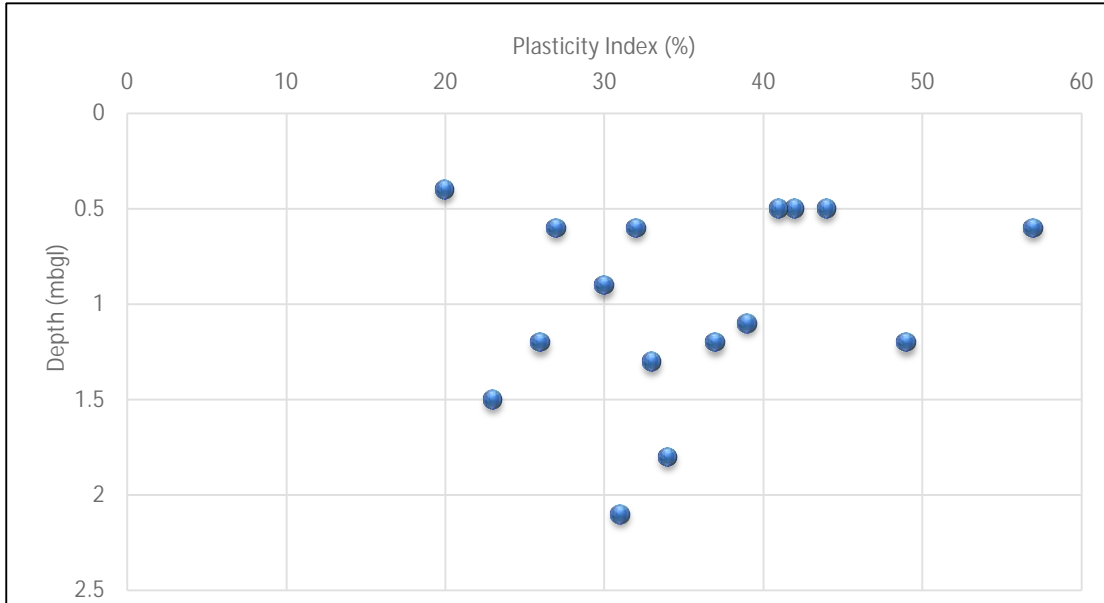
5.12 Moisture content analysis undertaken on twenty-eight samples between 0.4mbgl and 3.4mbgl with results ranging between 13% and 33%. An indication of the correlation between depth and moisture content is present on **Figure 4** below. It can be seen that the moisture content is predominantly at its highest at shallower depths.

**Figure 4 Moisture Content (%) vs Depth (mbgl) – WSMF**



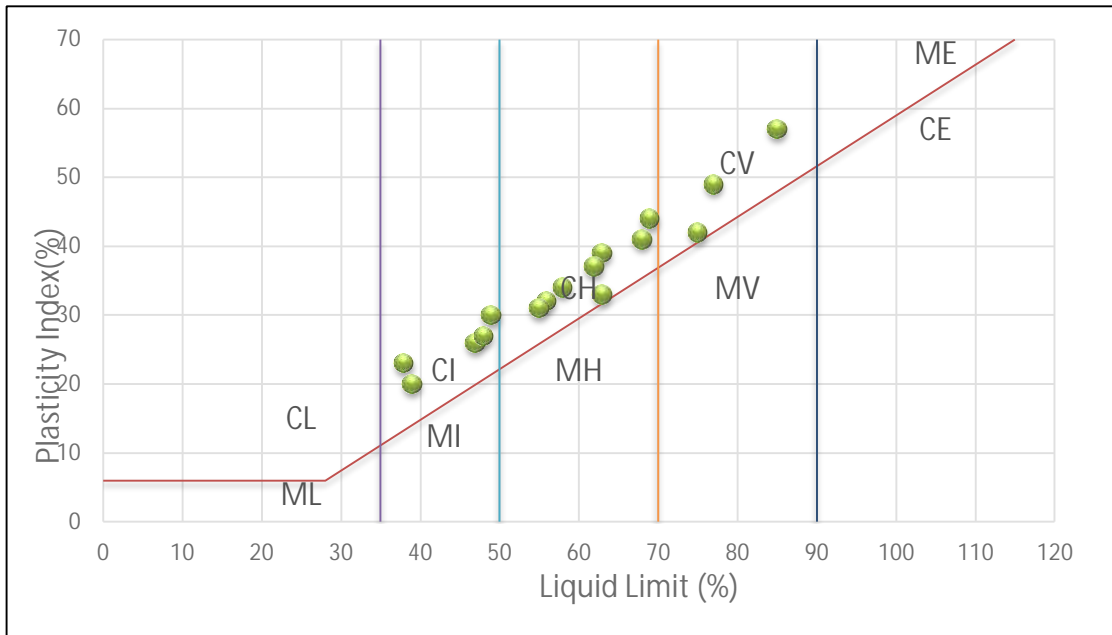
5.12 Sixteen Atterberg Tests testing for the Plasticity Index (PI) were undertaken on samples within the WSMF ranging between 0.40mbgl and 2.10mbgl. The geotechnical laboratory testing has indicated PIs to range between 20% (TP16 - low plasticity) and 57% (TP12 - high plasticity). The PI results and Liquid Limit is presented on **Figure 5** below.

**Figure 5 Plasticity Chart**



6.19 Additionally, the PI vs Depth is presented on **Figure 6** and illustrates the correlation that plasticity tends to decrease with increased depth.

**Figure 6 Plasticity Index (%) vs Depth (mbgl)**



5.12 The results of the PSD sedimentation testing undertaken on ten : depths across eight locations positioned in the east of the site are shown below in **Table 4**.

**Table 4 Summary of Particle Size Distribution by Sedimentation**

Location ID	Depth (m)	Cobble Content (%)	Gravel Content (%)	Sand Content (%)	Silt Content (%)	Clay(%)
TP 10	1.3	0	4.9	12.4	36.5	46.2
TP10	2.0	0	18.3	19.5	34.5	27.7
TP12	1.2	0	32.4	34.0	19.0	14.6
TP13	1.1	0	0.1	5.7	32.5	61.7
TP16	2.4	0	0.2	2.7	47.4	49.7
TP17	2.8	0	0.3	5.9	69.1	24.7
TP18	2.0	0	0.9	10.1	42.9	46.1
TP18	3.4	0	0.7	3.8	56.5	39
TP22	2.0	0	2.5	5.5	41.4	50.6
TP23	2.7	0	5.8	2.	49.8	42.4

- 6.11 Six compaction tests (three – 2.5kg and three 4.5kg) were undertaken on samples ranging in depths between 0.5mbgl and 2.1mbgl. The results indicate that shallower soils display increased moisture content compared to the optimum. A summary of the results is presented below in **Table 5**.

**Table 5 Summary of Compaction Testing (2.5k and 4.5kg)**

Location ID	Depth (m)	As received moisture content (%)	Maximum Dry Density (Mg/m <sup>3</sup> )	Optimum Moisture content (%)
<b>2.5kg (Light) Rammer</b>				
TP 10	1.3	23	1.77	17
TP15	1.2	20	1.74	18
TP20	2.1	22	1.66	20
<b>4.5kg (Heavy) Rammer</b>				
TP12	0.6	30	1.70	17
TP22	0.6	28	1.84	14
TP25	0.5	25	1.79	17

- 5.12 pH and water-soluble Sulphate from six samples were found to vary between 6.8 and 8.3, and 0.019g/l and 1.90g/l respectively. Total Sulphur ranged between 85mg/kg (TP25 – 1.20mbgl) to 19000mg/kg (TP18 – 3.40mbgl).
- 5.12 Geotechnical laboratory testing results are presented as **Appendix 4**.

## In Situ Testing

### Dynamic Cone Penetrometer Testing

- 6.1 Dynamic Cone Penetrometer Tests were undertaken following the removal of the topsoil at a number of exploratory hole locations in order to infer California Bearing Ratio (CBR) values to inform pavement design. The testing was undertaken accordance with Transport Research Laboratory (TRL) methodology. The results of the



testing have been separated into the west (Granular deposits) and east (Cohesive Deposits) and are presented in **Table 6** and **Table 7** below.

**Table 6** *DCP TRL Results Summary – West (Granular Superficial Deposits)*

Strata	Min CBR (%)	Max CBR (%)
Balderton Sand and Gravels Formation	5.0	75.0

\* Results include – TP01, 03, 06 and 08.

**Table 7** *DCP TRL Results Summary - East (Cohesive Deposits)*

Strata	Min CBR (%)	Max CBR (%)
Weathered Scunthorpe Mudstone Formati	1.7	42.8

\* Results include – TP09, 11, 12, 14, 16, 19, 20, 21, 22 and 25.

- 5.9 High CBR readings noted within the cohesive deposits are likely to be a result of gravels positioned within the soil matrix.
- 5.9 DCP-TRL worksheets are presented as **Appendix 5**.
- 5.9 Three samples of the shallow BSGF deposits and five samples from the WSMF were sent for California Bearing Ratio (CBR) analysis, a summary of the results is presented below as **Table 8** below.

**Table 8** *CBR Results Summary*

Location	Depth (m bgl)	Initial Details		Highest CBR Value (%)	Average CBR Value (%)	Final Moisture Content
		Bulk Density (mg/m <sup>3</sup> )	Moisture Content (%)			
<b>Compaction 2.5kg Rammer</b>						
TP03	0.90	2.08	13	36.0	34.0	11
TP07	0.70	2.06	11	33.0	-	11
TP16	0.40	2.05	21	1.5	1.4	19
TP21	1.20	1.96	26	4.2	4.1	24
<b>Compaction 4.5kg Rammer</b>						
TP05	1.60	2.04	13	36.0	33.0	12
TP13	1.10	1.97	29	6.0	5.9	27
TP19	1.10	2.06	21	15.0	-	20
TP25	0.50	2.00	25	6.1	-	24

- 5.9 Geotechnical laboratory testing results are presented as **Appendix 4**.

## Hydrogeology

- 5.9 During the investigation, groundwater was predominantly encountered within the BSGF in the west of the site, at eight locations. However, groundwater was identified at seven locations as a slight seepage up through the encountered bedrock; most likely caused by the release of pressure from the removal of overlying arisings. **Table 9** below provides a summary of the groundwater encountered.

**Table 9** *Encountered Water Strikes*

Location ID	Depth (mbgl)	Description and Strata
TP01	1.50	Seepage within the BSGF in the north of the pit.
TP02	1.50	Fast ingress within the BSGF in the north of the pit.
TP03	1.50	Fast ingress within the BSGF in the north of the pit.
TP04	1.60	Medium ingress within the BSGF in the north and south p wall.
TP05	2.00	Fast ingress within the BSGF .
TP06	2.40	Slight seepage within the BSGF in the north and south p wall.
TP07	2.70	Medium ingress within the BSGF .
TP08	1.60	Medium ingress within the BSGF n in the north-eastern corner of the pit.
TP09	1.90	Slight seepage up through the bedrock.
TP10	1.60	Slight seepage in the north-western corner of the pit withi the WSMF .
	2.30	Slight seepage up through the bedrock
TP14	1.80	Slight seepage up through the bedrock.
TP15	2.00	Slight seepage up through the bedrock.
TP16	2.60	Slight seepage up through the bedrock.
TP18	0.80	Perched groundwater within layer of limestone betw 0.80mbgl and 0.90mbgl.
TP21	1.45	Slight seepage up through the bedrock.
TP22	2.20	Slight seepage up through the bedrock.

## Hydrology

- 5.9 A hydrological assessment did not form part of this investigation.

## Contamination Observations

- 5.9 No visual or olfactory evidence of contamination was noted during the intrusive works.

## 7.0 GEOTECHNICAL ASSESSMENT

### Introduction

- 7.1 The proposed development is anticipated to comprise a residential associated roads, infrastructure, gardens and amenities. The intrusive works focused primarily on the road infrastructure and the attenuation ponds, and therefore only these features of the development will be covered within the geotechnical assessment. A proposed Masterplan is presented as **Appendix 1**.
- 5.9 The preliminary ground investigation completed was designed to assess shallow ground conditions across the site.
- 5.9 The following ground model (**Table 10**) has been adopted for the site, based on the findings of the ground investigation (Section 6.0).

*Table 10 Ground Model*

Strata	Top Depth (mbgl)		Base Depth (mbgl)		Thickness (mbgl)	
	Min	Max	Min	Max	Min	Max
Top soil	0.00		0.20	0.42	0.20	0.42
BSGF	0.30	0.40	1.90	2.90	1.50	2.52
WSMF	0.20	2.90	Not Proven		Not Proven	

### Roads and Pavements

- 5.9 In total 15 TRL DCP tests were undertaken at selected locations across the Site with inferred CBR results ranging between 1.2% and 52.9%.
- 7.5 Based upon guidance within Interim Advice Note 73/06 (IAN73/06) Revision 1 2009, roads should be designed with CBR's between 3% and for 5%, which should be confirmed by in-situ testing once detailed designs are available.
- 5.9 Geotechnical laboratory testing results are presented as **Appendix 4**.

### Drainage

- 7.5 No permeability testing was undertaken as part of this preliminary ground investigation. However, based on the encountered ground conditions, soakaways may not be practicable in areas of cohesive materials.
- 5.9 The Masterplan (**Appendix 1**) indicates that attenuation ponds will be included as part of the proposed development, however, the plan is indicative and may therefore change prior to development.

## Excavations

### Ease of Excavation

- 6.9 Based on the ground conditions encountered during the intrusive investigation conventional plant and equipment is expected to be suitable for shallow excavations.

### Stability of Excavation

- 5.12 Excavations displayed generally poor stability within the BSGF encountered in the west of the site and good stability within the WSMF in the centre and east of the site during the site investigation. Excavations however, may still become unstable if left open for any significant periods. Where personnel entry is required for inspection; excavations should be sufficiently enlarged, and an assessment of safe temporary angles should be made. Alternatively, temporary shoring should be provided.

### Legislation on Personnel Entry to Excavations

- 5.11 It is recommended that no excavations should be entered without appropriate support and a full risk assessment should be completed prior to entry.

## Groundwater

- 5.12 Groundwater has been identified between 1.50mbgl and 2.80mbgl within the BSGF in the west of the site which is considered to be representative of a consistent body of water. Groundwater strikes were recorded as medium to fast in seepage, which caused instability and subsequent collapsing of exploratory holes.
- 5.12 However, groundwater was encountered as minor seepages through the bedrock in the west of the site between 1.60mbgl and 2.60mbgl and is not considered representative of a consistent body, rather the release of pressure from the removal of overlying material.
- 5.12 The presence of water within granular material has the potential to destabilise excavations and where groundwater is encountered during foundation excavations or the creation of developable plateaus, it may require removal. It is considered that conventional dewatering techniques comprising a sump and submersible pump are likely to provide an adequate form of water abstraction from these areas. However, care must be taken to avoid pumping out fine material (i.e. silt) as this could destabilise the localised ground.

## Chemical Attack on Buried Concrete

### Balderton Sands and Gravels Formation (West of the site)

- 7.15 Soil chemical analysis has identified that Water soluble sulphate concentrations in soils varied from 20.0 mg/l to 60.0 mg/l with soil pH values ranging from 7.5 to 7.8. Total sulphur concentrations ranged from <0.01% to 0.04%.

- 
- 5.12 Based on the above, it is recommended that buried concrete is designed to satisfy DS1-AC1 conditions, in accordance with BRE Special Digest 1, 'Concrete in Aggressive Ground Conditions', 2005. It is considered this to be the most appropriate design to resist chemical attack from potential elevated sulphates in the ground.

Weathered Scunthorpe Mudstone Formation

- 7.15 Soil chemical analysis has identified that Water soluble sulphate concentrations in soils varied from 9.3 mg/l to 1900 mg/l with soil pH values ranging from 6.8 to 8.3. Total sulphur concentrations ranged from <0.0085% to 1.90%.
- 5.12 Based on the above, it is recommended that buried concrete is designed to satisfy DS5-AC5 conditions (described as mobile groundwater as the most conservative approach) in accordance with BRE Special Digest 1, 'Concrete in Aggressive Ground Conditions', 2005. It is considered this to be the most appropriate design to resist chemical attack from potential elevated sulphates in the ground.
- 6.19 Two areas of high concentrations were identified, TP10 and TP18 which have impacted the design class. The SMF is part of the Lias Formation and is therefore considered to be potentially pyritic. The two locations identified could potentially be hotspots within the SMF, however, further investigations should seek to clarify this preliminary classification.

## 8.0 CONTAMINANT DISTRIBUTION

### Soils

- 2.1 Seven soil samples from the Topsoil, two from the BSGF and six from the WSMF were sent to a MCERTS accredited laboratory (I2 Analytics) for analysis.
- 2.2 The distribution of soil contaminant concentration results across the wider site area are discussed in the following sections. The soil analytical laboratory results are given in laboratory report number 17-67277 dated 23<sup>rd</sup> November 2017 and is presented as **Appendix 3**.
- 2.2 The site has been compared to generic site assessment criteria (GSAC) end use excluding plant uptake given the initial development of the road infrastructure and attenuation ponds. Details of the derivation of the GSACs are presented in **Appendix 6** along with the assessment sheets, which are presented as **Appendix 7**.

#### Topsoil

- 2.2 Seven samples from the Topsoil were scheduled for chemical analysis. All contaminants passed their relevant screening criteria.
- 2.2 No asbestos containing materials were recorded the seven scheduled samples.
- 2.2 No elevated level of pesticides were noted to be present within the Topsoil samples.

#### Balderton Sand and Gravel Formation

- 2.2 Two samples from the BSGF were scheduled for chemical analysis passed their relevant screening criteria.

#### Weathered Scunthorpe Mudstone Formation

- 2.2 Six samples from the WSMF were scheduled for chemical analysis. The majority of contaminants passed their relevant screening criteria, which is discussed in greater detail below.
- 5.9 Generally, all heavy metals / inorganic compounds have been identified at low concentrations (most below the limit of detection) within a similar order of magnitude. However, one minor exceedance of Beryllium was identified 1.5mg/kg (TP12 - 0.60mbgl).
- 5.10 Total Sulphur was identified to be significantly higher than the limit of detector (50mg/kg) at two locations TP10 (2.00mbgl) and TP18 (3.40mbgl) with concentrations of 17000mg/kg and 19000mg/kg respectively.

### Surface Water

- 8.11 A hydrological assessment did not form part of this investigation.

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## Groundwater

5.10 Groundwater sampling did not form part of this assessment.

## 9.0 HUMAN HEALTH RISK ASSESSMENT

6.1 Soil contaminant data have been compared against Generic Site Assessment Criteria (GSAC) developed by BWB using the CLEA model 1.06 and the updated CLEA framework (2009) for assessing risk from soil contamination to human health. Details of the derivation of the GSACs are presented in **Appendix 6**. The results of the soil chemical laboratory results are provided within **Appendix 3** with a table summarising the results presented as **Appendix 8**.

5.9 The GSACs have been developed with the following assumption changed from the CLEA default parameter set. Soil type is a sandy loam with an organic matter content of 1%. This is considered to be more representative of shallow Made Ground found on most Brownfield sites than the CLEA default of 6% organic matter.

### Pathways

5.9 Contamination data have been compared to generic site assessment criteria (GSAC) for a residential end use without home grown produce (i.e. using all pathways for that end use) based on an organic matter content of 1%. Details of the derivation of the GSACs are presented in **Appendix 6**.

2.2 The site is to be developed for residential end use therefore considered to be a female child in the first six years of life and GSACs for residential without plant uptake have been adopted; given the first Phase of works comprise the development of road infrastructure and attenuation ponds.

5.9 Exposure pathways considered in this assessment are presented in **Table 11**.

**Table 11 Residential Exposure Pathways**

Source:	Shallow Soils			Deep Soils
Pathway	Residential housing with private gardens	Residential housing with communal landscaped area	Residential housing with hard standing areas	Residential housing
Ingestion of Soil			x	x
Ingestion of site derived household dust			x	x
Dermal contact with Soil			x	x
Dermal contact with site derived household dust			x	x
Inhalation of fugitive site dust			x	x



Source:	Shallow Soils			Deep Soils
Inhalation of fugitive site derived household dust			*	*
Inhalation of vapours outside				
Inhalation of vapours inside				

- 5.9 Generally, all heavy metals / inorganic compounds were below the limit of detection or within a similar order of magnitude been identified at low concentrations (most below the limit of detection) within a similar order of magnitude. However, one minor exceedance of Beryllium was identified 1.5mg/kg (TP12 - 0.60mbgl).
- 2.2 The one exceedance of Beryllium identified TP12 (0.60mbgl) is likely to be reflective of natural background levels within the Scunthorpe Mudstone Formation and is not considered to be a risk to human health or controlled waters.
- 2.2 Total Sulphur was identified to be significantly higher than the limit of detection (50mg/kg) at two locations TP10 (2.00mbgl) and TP18 (3.40mbgl) with concentrations of 17000mg/kg and 19000mg/kg respectively.
- 5.9 Elevated levels of Total Sulphur identified at depth in two locations TP10 (2.00mbgl) and TP18 (3.40mbgl) are not considered to represent a risk to human health given the depth that they are encountered. Furthermore, there is no risk to controlled waters as there is no consistent body of water within the eastern part of the site.

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## 10.0 ENVIRONMENTAL RISK ASSESSMENT

- 10.1 An updated assessment of identified pollutant linkages has been made following completion of a ground investigation. The preliminary risk assessment presented in **Section 3** has been updated in the light of the findings of the ground investigation and the revised conceptual site model developed, as presented in **Table 12**.

### Summary of Potentially Significant Pollutant Linkages

- 10.2 There is considered to be limited potential for widespread significant to be present on-site. Direct sources of gross contamination have not been identified based on the current and historical use of the site as agricultural fields.
- 10.2 The findings of the completed ground investigation and subsequent assessment indicate that the investigated areas pose a low risk to human health and very low risk to controlled waters receptors.
- 10.2 There is a limited potential for contamination to be present associated with current and historical off-site development including associated Made Ground.
- 10.2 The updated conceptual site model is presented as **Table 11**.

**Table 12 Revised Conceptual Site Model**

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
<b>On-Site</b> <b>S1:</b> High Sulphate and rare heavy metal exceedances – Beryllium.	<b>P1:</b> Dermal contact, ingestion and inhalation of contaminated soil particulates.	<b>R1:</b> Site end users (commercial and/or residential)	Mi	Lw	L	No significant contamination was identified during the site investigation. However, the use of appropriate PP good hygiene should still be adopted to comply best industry practice.
		<b>R2:</b> Construction workers, ground workers and maintenance workers.	Mi	Lw	L	
	<b>P2:</b> Direct contact	<b>R3:</b> Buried concrete (sulphate attack)	Md	Lw	M	
<b>On-Site</b> <b>S2:</b> Methane and carbon dioxide ground gas associated with localised Made Ground	<b>P3:</b> Migration into buildings through foundation cracks, service entry points	<b>R4:</b> Confined spaces in buildings, residents	Mi	UI	VL	There is considered to be limited risk from ground gases the site for which basic gas protection is likely to maximum requirement. However, the installation of subsequent monitoring of wells should be undertaken as part of the ground investigation prior to development.
<p style="text-align: center;"> <span style="background-color: #800000; color: white; padding: 2px;">VH = Very High</span>,  <span style="background-color: #FF0000; color: white; padding: 2px;">H = High</span>,  <span style="background-color: #FFA500; color: black; padding: 2px;">M = Moderate</span>,  <span style="background-color: #FFD700; color: black; padding: 2px;">M/L = Moderate/Low</span>,  <span style="background-color: #90EE90; color: black; padding: 2px;">L = Low</span>,  <span style="background-color: #90EE90; color: black; padding: 2px;">VL = Very Low</span> </p> <p style="text-align: center;"> KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, UI = Unlikely </p>						

### **Pollutant Linkage Assessment Summary**

The risk to human health is considered to be **LOW** based on the lack of contamination identified at the site. Ground Gas monitoring will still be required prior to development to further delineate any potential risk to human health; although this risk is considered to be low.

The controlled waters risk assessment has identified a **VERY LOW** risk to controlled water receptors given the lack of contamination identified at the site.

## 11.0 ENVIRONMENTAL LIABILITY ASSESSMENT AND DEVELOPMENT CONSTRAINTS

### Statutory Liability

11.1 Under statutory guidance for definition of contaminated land site may be classified into 4 categories. Categories 1 and 2 would meet the definition of contaminated land and categories 3 and 4 would not meet the definition.

10.2 It is considered that the site would fall within Category 4 based on the limited historical development and the lack of contamination identified.

10.2 Contaminated land is defined in Section 78A (2) of Part IIA of the Environmental Protection Act 1990 as:

*'Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under land, that:*

- a) Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- b) Pollution of controlled waters is being or is likely to be, caused'.*

10.2 Harm is defined in Section 78(4) of the Environmental Protection Act 1990 as:

*'Harm to the health of living organisms or other interference with ecological systems of which they form part and, in the case of man, includes harm to his property'.*

11.5 Once an area of land has been identified as contaminated land, appropriate persons will be identified as being responsible for the cost of cleaning up the land by the enforcing authority. The appropriate person will be liable for all or part of the remediation of the land. Two classes of appropriate person have been identified:

Class A appropriate persons are those who cause or knowingly permit the pollutants to be in, on or under the land.

Class B appropriate persons are the owners(s) or occupier(s) of the land.

10.2 Where no Class A appropriate persons can be identified, then Class B appropriate persons may become liable.

11.5 Based on the information available regarding the site, the potential for Statutory Authority action based on 'pollution of controlled waters' or 'significant harm' defined by Part IIA of the Environmental Protection Act 1990 is considered to be **LOW**.

### Third Party Liability

10.2 Based on the information contained in this report, it is the opinion of BWB that the potential for legal action by surrounding landowners, based on the potential for contamination to migrate off-site, is considered to be **LOW** when considering the

limited contamination identified on site, the industrial activity to the south and the RAF base to the west.

## Public Relations

- 11.9 The likelihood of public relations being tarnished due to contamination is are considered to be **LOW**.

## Development Implications

- 11.10 The western half of the site may require complete topsoil removal prior to delineate any further areas of archaeological importance.

## 12.0 CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

- 10.1 Ground conditions were found to comprise Top soil to depths of between 0.20mbgl and 0.42m overlying Balderton Sand and Gravels to depths of 1.90mbgl to 2.90mbgl Over Weathered Scunthorpe Mudstone Formation. Groundwater strikes were recorded at depths between 0.80mbgl and 2.70mbgl.

#### Environmental

- 10.2 Laboratory analysis has identified no significant contamination at the site, with only one minor exceedance of Beryllium identified within the WSMF at one location (TP12 – 0.60mbgl). Elevated levels of Total Sulphur were identified at TP10 (2.00mbgl) and TP18 (3.40mg).
- 10.2 These are not considered to represent a significant risk to human health given the localised nature and the depth that they were encountered respectively.
- 10.2 The above is considered to represent a **Low** risk to human health and a **Very Low** risk to controlled waters.

#### Geotechnical

- 10.2 CBR values obtained via in-situ testing and laboratory analysis has produced results varying between 5.0% and 75.0% in the west of the site and 1.5% to 42.8% in the east of the site, with the high readings correlating to the position of the Superficial BSGF.
- 10.2 A preliminary Design Sulphate Class of DS-1 and ACEC Class AC-1 in the west of the site (BSGF) and DS-5 and ACEC Class AC-4 (WSMF) is recommended within the eastern area of the site given high levels of sulphate identified at several locations within pyritic geology. However, this classification is preliminary in nature and will require further investigation to clarify this.

### Recommendations

- 10.2 An additional ground investigation is recommended to infer foundation design and to provide further information on the Design Sulphate class for buried concrete.
- 10.2 Ground gas and groundwater monitoring wells should be installed during the next phase of works to characterise the ground gas regime of the site.
- 11.9 If any earthworks are envisaged following further masterplan development then earthworks testing should be carried out in order to facilitate the provision of a earthworks specification.

## 13.0 REFERENCE S

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3. British Standards Institution, (BSI), BS 10175:2011+A1:2013, Investigation of Contaminated Sites – Code of Practice
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16. Environment Agency 2008, Human health toxicological assessment of contaminants in soil Science Report – SC050021/SR2



- 
17. Environment Agency 2009, CLEA Software (Version 1.05) Handbook Better Regulation Science Programme Science report: SC050021/SR4
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  19. Environment Agency, 2006, Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination
  20. Health and Safety Executive (HSE) 'Protection of workers and the general public during the Development of Contaminated Land (1991).
  21. Highways England, 2009, Interim Advice Note 73/06 Revision 1: Design Guidance for Road and Pavement Foundations (Draft HD25)
  22. Nathanail, C.P, McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.
  23. NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66: 2008

## DRAWINGS

**DRAWING 1**  
**EXPLORATORY HOLE LOCATION PLAN**



**Notes**

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

**Key Plan**

**Legend**

Denotes Location of Trial Pit

TP\*\*

P1	01.01.00	PRELIMINARY ISSUE	AJ	JB
Rev	Date	Details of issue / revision	Drw	Rev

**Issues & Revisions**

**BWB**  
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[www.bwbconsulting.com](http://www.bwbconsulting.com)

Client  
**STRAWSONS HOLDINGS LTD**

Project Title  
**WITHAM ST HUGHS Ph3 S38**

Drawing Title  
**EXPLORATORY HOLE LOCATION PLAN**

Drawn:	P.TAYLOR	Reviewed:	R.PARKER-DUNN
BWB Ref:	NTH2082	Date:	06.11.17
Scale:	A3	Scale:	A3

Drawing Status  
**PRELIMINARY**

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
<b>WSH-BWB-00-EN-DR-0001</b>	<b>S1</b>	<b>R1</b>

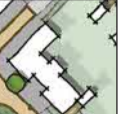
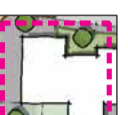
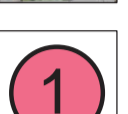






## APPENDICES

**APPENDIX 1**  
**PROPOSED DEVELOPMENT MASTER PLAN**















 Application Site Boundary 68.45ha

**Built Development**

-  Residential 36.05ha  
Up to 1100 homes at circa 31 dwellings per hectare.  
Residential Land includes Primary Street.
-  Residential - Extra Care / Retirement 3.00ha  
Up to 150 units at circa 50 dwellings per hectare.  
To include Retirement Care, Extra Care (Assisted Living) & Retirement Bungalows
-  Proposed Points of Access  
1. Halfway House Lane  
2. Warren Lane
-  Primary Street  
Including Roadside Swale
-  Raised Table Junction Nodes
-  Secondary Lanes
-  Shared Driveways / Green Lanes
-  Home Zones
-  Existing property to be retained

**Green Infrastructure**

-  Existing Public Right of Way Retained
-  New Multi-purpose Recreational Routes
-  Existing Hedgerow, Trees and Vegetation to be Retained
-  Greenspace  
Includes retained vegetation and watercourses, new habitat creation, woodland, hedgerows, tree planting, open space and play areas, grassland, wetlands, SuDS detention basins and sports provision.
-  Proposed Structural Planting  
Woodland, hedgerows and tree cover.
-  Potential Noise Attenuation  
Adjacent to the A46.
-  Proposed Allotments 1.45ha
-  Provision for Adults Football Pitches
-  Proposed Detention Basins
-  Swales and Drainage Ditches
-  Play Areas 1.64ha
-  Children's Equipped Play Areas  
Indicative Location.

Scale: 1:2500 @ A1

0 50 100 150 200 250m

J:\5800\5801\LANDS\Plans\5801-L-06 Indicative Masterplan REV B.indd

Strawsons Property  
Witham St Hughs  
Lincolnshire

INDICATIVE MASTERPLAN

1:2500 @ A1  
4 September 2017 TM / JJ  
5801-L-06 rev B


 masterplanning  
 environmental assessment  
 landscape design  
 urban design  
 ecology  
 architecture  
 arboriculture  
 FPCR Environment and Design Ltd  
 Lockington Hall  
 Lockington  
 Derby DE74 2RH  
 t: 01509 672772  
 f: 01509 674565  
 e: mail@fpcr.co.uk  
 w: www.fpcr.co.uk

APPENDIX 2  
EXPLORATORY HOLE LOGS



Groundwater	Strata	
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Strike	Strike Details	Backj II
--------	-------------------	----------



1.5m  
bgl

--	--

Groundwater	Strata	
-------------	--------	--

Strike	Strike Details	Backj II
--------	-------------------	----------



1.5m  
bgl

--	--

Groundwater	Strata	
-------------	--------	--

Strike	Strike Details	Backj II
--------	-------------------	----------



1.5m  
bgl

--	--

















Groundwater	Strata
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Strike	Strike Details	Backj II
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Groundwater	Strata
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Strike	Strike Details	Backj II
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Groundwater	Strata
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Strike	Strike Details	Backj II
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Groundwater	Strata
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Strike	Strike Details	Backj II
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2.6m  
bgl

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Groundwater	Strata
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Strike	Strike Details	Backj II
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Groundwater	Strata
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Strike	Strike Details	Backj II
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0.8m  
bgj

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Groundwater	Strata
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Strike	Strike Details	Backj II
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Groundwater	Strata
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Strike	Strike Details	Backj II
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--	--

Groundwater	Strata
-------------	--------

Strike	Strike Details	Backj II
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	 1.45m bgl	
--	-----------------------------------------------------------------------------------------------	--

--	--



Groundwater	Strata
-------------	--------

Strike	Strike Details	Backj II
--------	-------------------	----------

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--	--

Groundwater	Strata
-------------	--------

Strike	Strike Details	Backj II
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--	--	--

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Groundwater	Strata
-------------	--------

Strike	Strike Details	Backj II
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APPENDIX 3  
SOIL CHEMICAL ANALYSIS RESULTS



Patrick Taylor  
BWB Consulting Limited  
5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ

i2 Analytical Ltd.  
7 Woodshots Meadow,  
Croxley Green  
Business Park,  
Watford,  
Herts,  
WD18 8YS

t: 01923 225404  
f: 01923 237404  
e: reception@i2analytical.com

e: patrick.taylor@bwiconsulting.com

## Analytical Report Number : 17-67277

Project / Site name:	Witham St Hughs Ph3 S38 Design	Samples received on:	13/11/2017
Your job number:	NTM2082	Samples instructed on:	13/11/2017
Your order number:	POR014675	Analysis completed by:	23/11/2017
Report Issue Number:	1	Report issued on:	23/11/2017
Samples Analysed:	15 soil samples		

Signed: \_\_\_\_\_

Rexona Rahman  
Customer Services Manager  
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.



Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855734			855735			855736			855737			855738		
Sample Reference	TP02			TP04			TP05			TP08			TP10		
Sample Number	3			1			3			1			6		
Depth (m)	1.70-1.70			0.20-0.20			1.60-1.60			0.20-0.20			2.00-2.00		
Date Sampled	06/11/2017			07/11/2017			08/11/2017			08/11/2017			07/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	6.4	11	13	17	13	17	17	17	17	13	13	
Total mass of sample received	kg	0.001	NONE	0.55	1.9	0.58	0.60	0.47	0.60	0.60	0.60	0.60	0.47	0.47	

Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	Not-detected	-
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**General Inorganics**

pH - Automated	pH Units	N/A	MCERTS	7.8	-	7.7	7.5	7.4
Total Cyanide	mg/kg	1	MCERTS	< 1	-	< 1	< 1	< 1
Complex Cyanide	mg/kg	1	MCERTS	< 1	-	< 1	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	-	< 1	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.031	-	0.024	0.025	1.9
Total Sulphur	mg/kg	50	MCERTS	110	-	< 50	380	17000
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.0018	-	0.0012	0.015	0.019

**Total Phenols**

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	< 1.0
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**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05

**Total PAH**

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	-	< 0.80	< 0.80	< 0.80
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	18	-	2.1	14	21
Barium (aqua regia extractable)	mg/kg	1	MCERTS	91	-	19	84	28
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.34	-	0.17	0.82	0.80
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	0.9	1.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	-	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	8.7	-	3.9	33	27
Copper (aqua regia extractable)	mg/kg	1	MCERTS	9.8	-	11	18	20
Lead (aqua regia extractable)	mg/kg	1	MCERTS	9.2	-	5.9	20	13
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	12	-	6.7	15	26
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	15	-	7.0	45	35
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	31	-	20	55	54



Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855734			855735		855736		855737		855738	
Sample Reference	TP02			TP04		TP05		TP08		TP10	
Sample Number	3			1		3		1		6	
Depth (m)	1.70-1.70			0.20-0.20		1.60-1.60		0.20-0.20		2.00-2.00	
Date Sampled	06/11/2017			07/11/2017		08/11/2017		08/11/2017		07/11/2017	
Time Taken	None Supplied			None Supplied		None Supplied		None Supplied		None Supplied	
Analytical Parameter (Soil Analysis)											

**Petroleum Hydrocarbons**

TPH C10 - C40	mg/kg	10	MCERTS	< 10	-	< 10	< 10	< 10
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	< 0.1	< 0.1

**Environmental Forensics**

**Organochlorine Pesticides**

Aldrin	µg/kg	10	NONE	-	< 10	-	-	-
Alpha-HCH (Alpha BHC)	µg/kg	10	NONE	-	< 10	-	-	-
Beta-HCH (Beta-BHC)	µg/kg	10	NONE	-	< 10	-	-	-
Chlordane (sum of cis & trans isomers)	µg/kg	10	NONE	-	< 10	-	-	-
Delta-HCH (Delta-BHC)	µg/kg	10	NONE	-	< 10	-	-	-
Dieldrin	µg/kg	10	NONE	-	< 10	-	-	-
Endosulphan A	µg/kg	10	NONE	-	< 10	-	-	-
Endosulphan B	µg/kg	10	NONE	-	< 10	-	-	-
Endrin	µg/kg	10	NONE	-	< 10	-	-	-
Gamma-HCH (Lindane) (Gamma-BHC)	µg/kg	10	NONE	-	< 10	-	-	-
HCB (Hexachlorobenzene)	µg/kg	10	NONE	-	< 10	-	-	-
Heptachlor	µg/kg	10	NONE	-	< 10	-	-	-
Heptachlor Epoxide	µg/kg	10	NONE	-	< 10	-	-	-
Isodrin	µg/kg	10	NONE	-	< 10	-	-	-
pp-Methoxychlor	µg/kg	10	NONE	-	< 10	-	-	-
o,p-DDE	µg/kg	10	NONE	-	< 10	-	-	-
o,p-DDT	µg/kg	10	NONE	-	< 10	-	-	-
o,p-TDE (o,p-DDD)	µg/kg	10	NONE	-	< 10	-	-	-
p,p-DDE	µg/kg	10	NONE	-	< 10	-	-	-
p,p-DDT	µg/kg	10	NONE	-	< 10	-	-	-
p,p-TDE (p,p-DDD)	µg/kg	10	NONE	-	< 10	-	-	-
Trifluralin	µg/kg	10	NONE	-	< 10	-	-	-

**Organonitrogen Pesticides**

Bentazone	mg/kg	0.1	NONE	-	< 0.10	-	-	-
Pendimethalin	mg/kg	0.1	NONE	-	< 0.10	-	-	-
Triclorpyr	mg/kg	0.1	NONE	-	< 0.10	-	-	-
Triadimefon	mg/kg	0.1	NONE	-	< 0.10	-	-	-

**Organophosphorous pesticides**

Azinphos-methyl	µg/kg	10	NONE	-	< 10	-	-	-
Chlorfenvinphos I (cis)	µg/kg	10	NONE	-	< 10	-	-	-
Chlorfenvinphos II (trans)	µg/kg	10	NONE	-	< 10	-	-	-
Chlorfenvinphos-methyl	µg/kg	10	NONE	-	< 10	-	-	-
Diazinon	µg/kg	10	NONE	-	< 10	-	-	-
Dichlorvos	µg/kg	10	NONE	-	< 10	-	-	-
Dimethoate	µg/kg	10	NONE	-	< 10	-	-	-
E-mevinphos	µg/kg	10	NONE	-	< 10	-	-	-
Z-mevinphos	µg/kg	10	NONE	-	< 10	-	-	-
Fenitrothion	µg/kg	10	NONE	-	< 10	-	-	-
Fenthion	µg/kg	10	NONE	-	< 10	-	-	-
Malathion	µg/kg	10	NONE	-	< 10	-	-	-
Parathion-ethyl	µg/kg	10	NONE	-	< 10	-	-	-
Parathion-methyl	µg/kg	10	NONE	-	< 10	-	-	-
Phorate	µg/kg	10	NONE	-	< 10	-	-	-



Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855734	855735	855736	855737	855738
Sample Reference	TP02	TP04	TP05	TP08	TP10
Sample Number	3	1	3	1	6
Depth (m)	1.70-1.70	0.20-0.20	1.60-1.60	0.20-0.20	2.00-2.00
Date Sampled	06/11/2017	07/11/2017	08/11/2017	08/11/2017	07/11/2017
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)					



Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855739			855740			855741			855742			855743		
Sample Reference	TP11			TP12			TP14			TP15			TP16		
Sample Number	1			1			1			1			1		
Depth (m)	0.20-0.20			0.60-0.60			0.30-0.30			0.10-0.10			0.40-0.40		
Date Sampled	07/11/2017			07/11/2017			08/11/2017			09/11/2017			09/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															
Stone Content	%	0.1	NONE	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	6.0	19	-	16	15	15	15	15	15	15	15	
Total mass of sample received	kg	0.001	NONE	1.8	0.45	-	2.0	0.52	0.52	0.52	0.52	0.52	0.52	0.52	

Asbestos in Soil	Type	N/A	ISO 17025	-	-	Not-detected	-	-
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**General Inorganics**

pH - Automated	pH Units	N/A	MCERTS	-	7.7	-	-	7.9
Total Cyanide	mg/kg	1	MCERTS	-	< 1	-	-	< 1
Complex Cyanide	mg/kg	1	MCERTS	-	< 1	-	-	< 1
Free Cyanide	mg/kg	1	MCERTS	-	< 1	-	-	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.067	-	-	0.042
Total Sulphur	mg/kg	50	MCERTS	-	220	-	-	140
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	-	0.0071	-	-	0.0049

**Total Phenols**

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	-	-	< 1.0
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**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05

**Total PAH**

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	< 0.80	-	-	< 0.80
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	10	-	-	19
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	69	-	-	52
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	1.5	-	-	0.69
Boron (water soluble)	mg/kg	0.2	MCERTS	-	1.4	-	-	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	-	< 4.0	-	-	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	42	-	-	27
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	24	-	-	13
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	13	-	-	12
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	42	-	-	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	-	-	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	47	-	-	45
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	47	-	-	48



Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855739			855740			855741			855742			855743		
Sample Reference	TP11			TP12			TP14			TP15			TP16		
Sample Number	1			1			1			1			1		
Depth (m)	0.20-0.20			0.60-0.60			0.30-0.30			0.10-0.10			0.40-0.40		
Date Sampled	07/11/2017			07/11/2017			08/11/2017			09/11/2017			09/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															

**Petroleum Hydrocarbons**

TPH C10 - C40	mg/kg	10	MCERTS	-	< 10	-	-	< 10
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1

**Environmental Forensics**

**Organochlorine Pesticides**

Aldrin	µg/kg	10	NONE	< 10	-	-	< 10	-
Alpha-HCH (Alpha BHC)	µg/kg	10	NONE	< 10	-	-	< 10	-
Beta-HCH (Beta-BHC)	µg/kg	10	NONE	< 10	-	-	< 10	-
Chlordane (sum of cis & trans isomers)	µg/kg	10	NONE	< 10	-	-	< 10	-
Delta-HCH (Delta-BHC)	µg/kg	10	NONE	< 10	-	-	< 10	-
Dieldrin	µg/kg	10	NONE	< 10	-	-	< 10	-
Endosulphan A	µg/kg	10	NONE	< 10	-	-	< 10	-
Endosulphan B	µg/kg	10	NONE	< 10	-	-	< 10	-
Endrin	µg/kg	10	NONE	< 10	-	-	< 10	-
Gamma-HCH (Lindane) (Gamma-BHC)	µg/kg	10	NONE	< 10	-	-	< 10	-
HCB (Hexachlorobenzene)	µg/kg	10	NONE	< 10	-	-	< 10	-
Heptachlor	µg/kg	10	NONE	< 10	-	-	< 10	-
Heptachlor Epoxide	µg/kg	10	NONE	< 10	-	-	< 10	-
Isodrin	µg/kg	10	NONE	< 10	-	-	< 10	-
pp-Methoxychlor	µg/kg	10	NONE	< 10	-	-	< 10	-
o,p-DDE	µg/kg	10	NONE	< 10	-	-	< 10	-
o,p-DDT	µg/kg	10	NONE	< 10	-	-	< 10	-
o,p-TDE (o,p-DDD)	µg/kg	10	NONE	< 10	-	-	< 10	-
p,p-DDE	µg/kg	10	NONE	< 10	-	-	< 10	-
p,p-DDT	µg/kg	10	NONE	< 10	-	-	< 10	-
p,p-TDE (p,p-DDD)	µg/kg	10	NONE	< 10	-	-	< 10	-
Trifluralin	µg/kg	10	NONE	< 10	-	-	< 10	-

**Organonitrogen Pesticides**

Bentazone	mg/kg	0.1	NONE	< 0.10	-	-	< 0.10	-
Pendimethalin	mg/kg	0.1	NONE	< 0.10	-	-	< 0.10	-
Triclorpyr	mg/kg	0.1	NONE	< 0.10	-	-	< 0.10	-
Triadimefon	mg/kg	0.1	NONE	< 0.10	-	-	< 0.10	-

**Organophosphorous pesticides**

Azinphos-methyl	µg/kg	10	NONE	< 10	-	-	< 10	-
Chlorfenvinphos I (cis)	µg/kg	10	NONE	< 10	-	-	< 10	-
Chlorfenvinphos II (trans)	µg/kg	10	NONE	< 10	-	-	< 10	-
Chlorfenvinphos-methyl	µg/kg	10	NONE	< 10	-	-	< 10	-
Diazinon	µg/kg	10	NONE	< 10	-	-	< 10	-
Dichlorvos	µg/kg	10	NONE	< 10	-	-	< 10	-
Dimethoate	µg/kg	10	NONE	< 10	-	-	< 10	-
E-mevinphos	µg/kg	10	NONE	< 10	-	-	< 10	-
Z-mevinphos	µg/kg	10	NONE	< 10	-	-	< 10	-
Fenitrothion	µg/kg	10	NONE	< 10	-	-	< 10	-
Fenthion	µg/kg	10	NONE	< 10	-	-	< 10	-
Malathion	µg/kg	10	NONE	< 10	-	-	< 10	-
Parathion-ethyl	µg/kg	10	NONE	< 10	-	-	< 10	-
Parathion-methyl	µg/kg	10	NONE	< 10	-	-	< 10	-
Phorate	µg/kg	10	NONE	< 10	-	-	< 10	-





Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855739			855740			855741			855742			855743		
Sample Reference	TP11			TP12			TP14			TP15			TP16		
Sample Number	1			1			1			1			1		
Depth (m)	0.20-0.20			0.60-0.60			0.30-0.30			0.10-0.10			0.40-0.40		
Date Sampled	07/11/2017			07/11/2017			08/11/2017			09/11/2017			09/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															



Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855744			855745			855746			855747			855748		
Sample Reference	TP18			TP18			TP23			TP24			TP25		
Sample Number	1			6			1			1			3		
Depth (m)	0.20-0.20			3.40-3.50			0.15-0.15			0.20-0.20			1.20-1.20		
Date Sampled	08/11/2017			08/11/2017			09/11/2017			07/11/2017			07/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															
Stone Content	%	0.1	NONE	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	-	13	22	21	21	21	21	21	21	21	13	
Total mass of sample received	kg	0.001	NONE	-	0.46	1.8	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.61	

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	-
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**General Inorganics**

pH - Automated	pH Units	N/A	MCERTS	-	7.5	7.2	-	7.5
Total Cyanide	mg/kg	1	MCERTS	-	< 1	< 1	-	< 1
Complex Cyanide	mg/kg	1	MCERTS	-	< 1	< 1	-	< 1
Free Cyanide	mg/kg	1	MCERTS	-	< 1	< 1	-	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.42	0.0093	-	0.042
Total Sulphur	mg/kg	50	MCERTS	-	19000	380	-	85
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	-	0.017	0.021	-	0.0016

**Total Phenols**

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	-	< 1.0
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**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	< 0.05

**Total PAH**

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	< 0.80	< 0.80	-	< 0.80
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**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	12	11	-	3.3
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	27	49	-	21
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	1.1	1.0	-	0.27
Boron (water soluble)	mg/kg	0.2	MCERTS	-	4.9	3.8	-	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	-	< 4.0	< 4.0	-	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	34	32	-	8.5
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	27	19	-	12
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	13	24	-	4.5
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	31	19	-	8.6
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	-	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	31	48	-	11
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	47	53	-	20



Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855744			855745			855746			855747			855748		
Sample Reference	TP18			TP18			TP23			TP24			TP25		
Sample Number	1			6			1			1			3		
Depth (m)	0.20-0.20			3.40-3.50			0.15-0.15			0.20-0.20			1.20-1.20		
Date Sampled	08/11/2017			08/11/2017			09/11/2017			07/11/2017			07/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	-	< 10	< 10	-	< 10
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	< 0.1

Environmental Forensics

Organochlorine Pesticides

Aldrin	µg/kg	10	NONE	-	-	-	< 10	-
Alpha-HCH (Alpha BHC)	µg/kg	10	NONE	-	-	-	< 10	-
Beta-HCH (Beta-BHC)	µg/kg	10	NONE	-	-	-	< 10	-
Chlordane (sum of cis & trans isomers)	µg/kg	10	NONE	-	-	-	< 10	-
Delta-HCH (Delta-BHC)	µg/kg	10	NONE	-	-	-	< 10	-
Dieldrin	µg/kg	10	NONE	-	-	-	< 10	-
Endosulphan A	µg/kg	10	NONE	-	-	-	< 10	-
Endosulphan B	µg/kg	10	NONE	-	-	-	< 10	-
Endrin	µg/kg	10	NONE	-	-	-	< 10	-
Gamma-HCH (Lindane) (Gamma-BHC)	µg/kg	10	NONE	-	-	-	< 10	-
HCB (Hexachlorobenzene)	µg/kg	10	NONE	-	-	-	< 10	-
Heptachlor	µg/kg	10	NONE	-	-	-	< 10	-
Heptachlor Epoxide	µg/kg	10	NONE	-	-	-	< 10	-
Isodrin	µg/kg	10	NONE	-	-	-	< 10	-
pp-Methoxychlor	µg/kg	10	NONE	-	-	-	< 10	-
o,p-DDE	µg/kg	10	NONE	-	-	-	< 10	-
o,p-DDT	µg/kg	10	NONE	-	-	-	< 10	-
o,p-TDE (o,p-DDD)	µg/kg	10	NONE	-	-	-	< 10	-
p,p-DDE	µg/kg	10	NONE	-	-	-	< 10	-
p,p-DDT	µg/kg	10	NONE	-	-	-	< 10	-
p,p-TDE (p,p-DDD)	µg/kg	10	NONE	-	-	-	< 10	-
Trifluralin	µg/kg	10	NONE	-	-	-	< 10	-

Organonitrogen Pesticides

Bentazone	mg/kg	0.1	NONE	-	-	-	< 0.10	-
Pendimethalin	mg/kg	0.1	NONE	-	-	-	< 0.10	-
Triclorpyr	mg/kg	0.1	NONE	-	-	-	< 0.10	-
Triadimefon	mg/kg	0.1	NONE	-	-	-	< 0.10	-

Organophosphorous pesticides

Azinphos-methyl	µg/kg	10	NONE	-	-	-	< 10	-
Chlorfenvinphos I (cis)	µg/kg	10	NONE	-	-	-	< 10	-
Chlorfenvinphos II (trans)	µg/kg	10	NONE	-	-	-	< 10	-
Chlorfenvinphos-methyl	µg/kg	10	NONE	-	-	-	< 10	-
Diazinon	µg/kg	10	NONE	-	-	-	< 10	-
Dichlorvos	µg/kg	10	NONE	-	-	-	< 10	-
Dimethoate	µg/kg	10	NONE	-	-	-	< 10	-
E-mevinphos	µg/kg	10	NONE	-	-	-	< 10	-
Z-mevinphos	µg/kg	10	NONE	-	-	-	< 10	-
Fenitrothion	µg/kg	10	NONE	-	-	-	< 10	-
Fenthion	µg/kg	10	NONE	-	-	-	< 10	-
Malathion	µg/kg	10	NONE	-	-	-	< 10	-
Parathion-ethyl	µg/kg	10	NONE	-	-	-	< 10	-
Parathion-methyl	µg/kg	10	NONE	-	-	-	< 10	-
Phorate	µg/kg	10	NONE	-	-	-	< 10	-



Analytical Report Number: 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Your Order No: POR014675

Lab Sample Number	855744			855745			855746			855747			855748		
Sample Reference	TP18			TP18			TP23			TP24			TP25		
Sample Number	1			6			1			1			3		
Depth (m)	0.20-0.20			3.40-3.50			0.15-0.15			0.20-0.20			1.20-1.20		
Date Sampled	08/11/2017			08/11/2017			09/11/2017			07/11/2017			07/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															



Analytical Report Number : 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
855734	TP02	3	1.70-1.70	Brown sand with gravel.
855735	TP04	1	0.20-0.20	Brown loam and clay.
855736	TP05	3	1.60-1.60	Brown sand.
855737	TP08	1	0.20-0.20	Brown clay with vegetation.
855738	TP10	6	2.00-2.00	Grey clay.
855739	TP11	1	0.20-0.20	Brown clay.
855740	TP12	1	0.60-0.60	Brown clay with vegetation.
855741	TP14	1	0.30-0.30	-
855742	TP15	1	0.10-0.10	Brown clay and sand with vegetation.
855743	TP16	1	0.40-0.40	Brown clay and sand.
855744	TP18	1	0.20-0.20	-
855745	TP18	6	3.40-3.50	Grey clay.
855746	TP23	1	0.15-0.15	Brown clay and loam with vegetation.
855747	TP24	1	0.20-0.20	Brown clay with vegetation.
855748	TP25	3	1.20-1.20	Brown sand with gravel.



Analytical Report Number : 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Complex Cyanide in soil	Determination of complex cyanide by calculation.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L009-PL	D	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS



Analytical Report Number : 17-67277

Project / Site name: Witham St Hughs Ph3 S38 Design

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
TO - Organochlorine pesticides in soil	Determination of OCPs by extraction with hexane followed by GC-MS.	In-house method		W	NONE
TO - Organonitrogen pesticides in soil	Determination of organonitrogen pesticides by LC-Q	In-house method		W	NONE
TO - Organophosphorous pesticides in soil	Determination of OPPs by extraction with DCM followed by GC-MS.	In-house method		W	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding.	L076-PL	W	MCERTS
TPH2 (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX 4  
GEOTECHNICAL LABORATORY TESTING RESULTS





# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



## Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

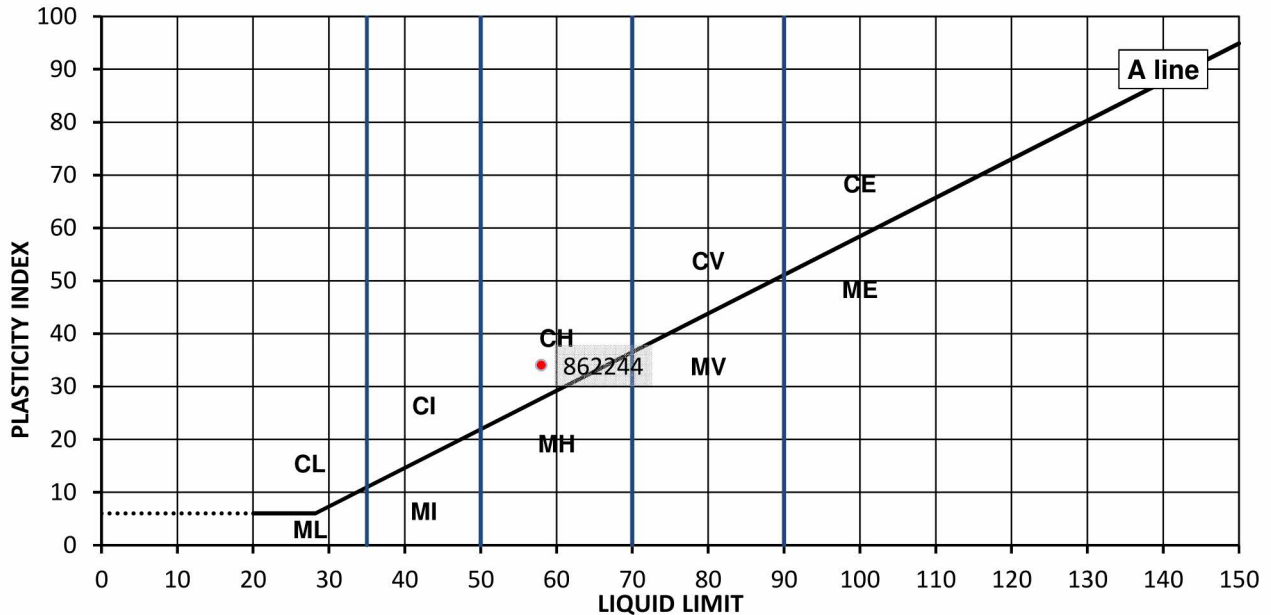
### TEST RESULTS

Laboratory Reference: 862244  
Sample Reference: 28

Description: Dark brown slightly gravelly slightly sandy CLAY  
Location: TP09  
Sample Preparation: Tested after washing to remove >425um

Sample Type: B  
Depth Top [m]: 1.80  
Depth Base [m]: 1.80

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	58	24	34	94



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

Remarks

Approved:



Dariusz Piotrowski  
PL Laboratory  
Manager Geotechnical  
Section

Date Reported: 06/12/2017

Signed:



Darren Berrill  
Geotechnical General  
Manager

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



## Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
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Sampled By: Not Given

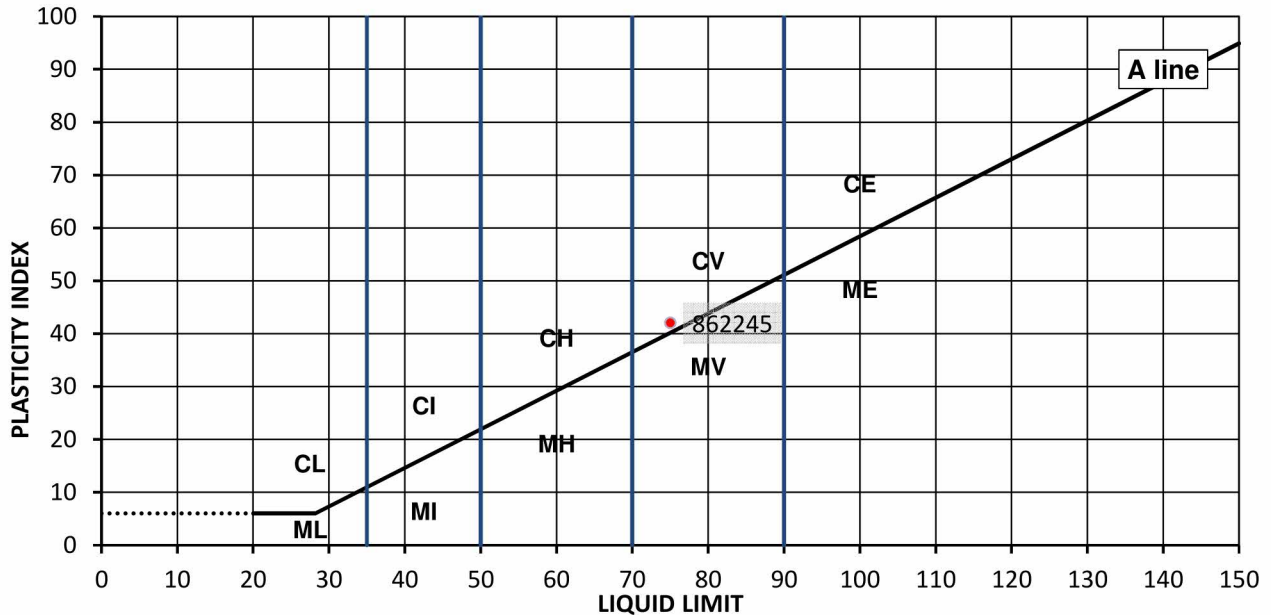
### TEST RESULTS

Laboratory Reference: 862245  
Sample Reference: 30

Description: Yellowish brown slightly gravelly CLAY  
Location: TP10  
Sample Preparation: Tested after washing to remove >425um

Sample Type: B  
Depth Top [m]: 0.50  
Depth Base [m]: 0.50

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
29	75	33	42	94



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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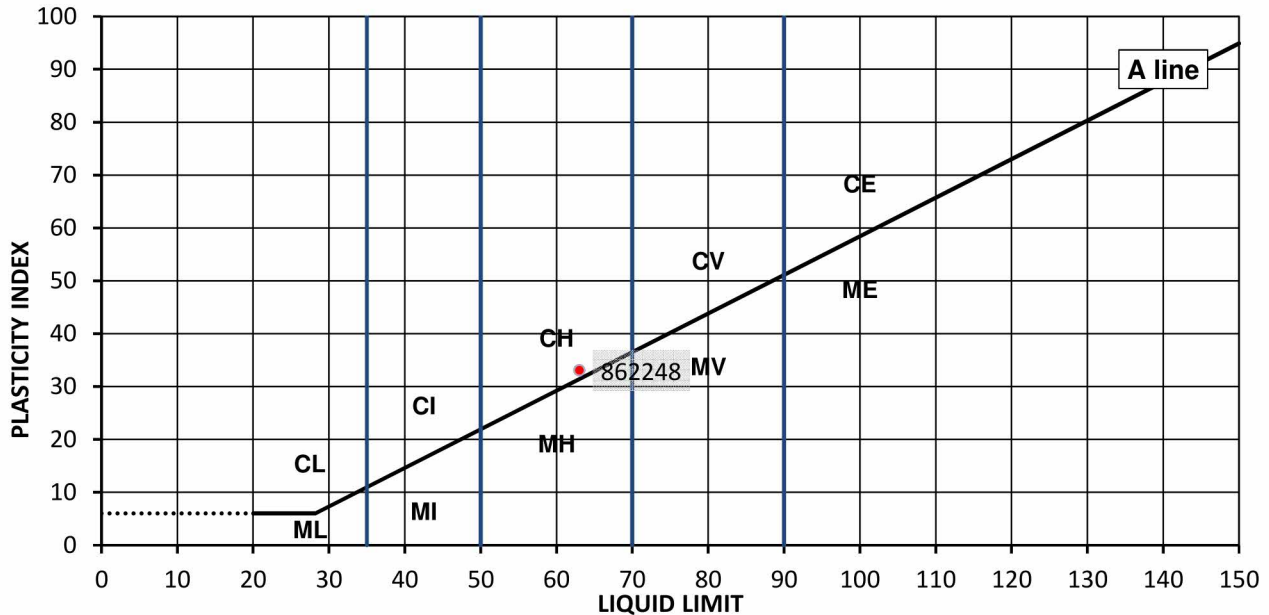
### TEST RESULTS

Laboratory Reference: 862248  
Sample Reference: 36

Description: Dark brown slightly gravelly CLAY  
Location: TP11  
Sample Preparation: Tested after washing to remove >425um

Sample Type: B  
Depth Top [m]: 1.30  
Depth Base [m]: 1.30

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
20	63	30	33	96



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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Client Reference: NTM2082  
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Date Sampled: Not Given  
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Date Tested: 01/12/2017  
Sampled By: Not Given

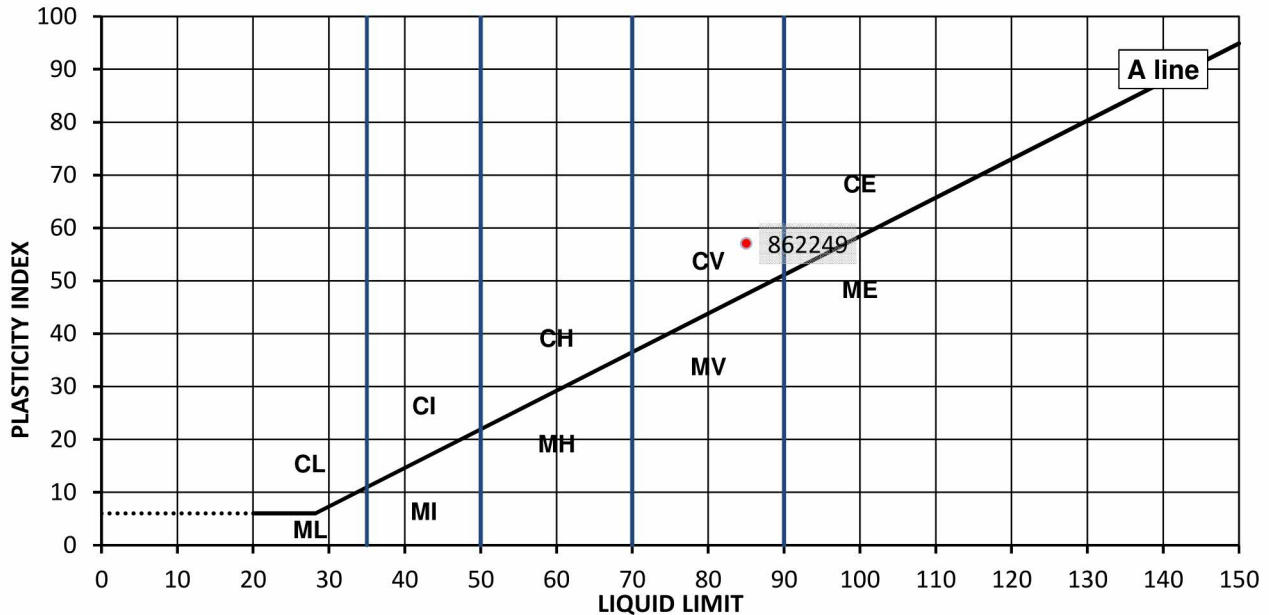
### TEST RESULTS

Laboratory Reference: 862249  
Sample Reference: 39

Description: Dark brown CLAY  
Location: TP12  
Sample Preparation: Tested in natural condition

Sample Type: B  
Depth Top [m]: 0.60  
Depth Base [m]: 0.60

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
30	85	28	57	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
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Date Sampled: Not Given  
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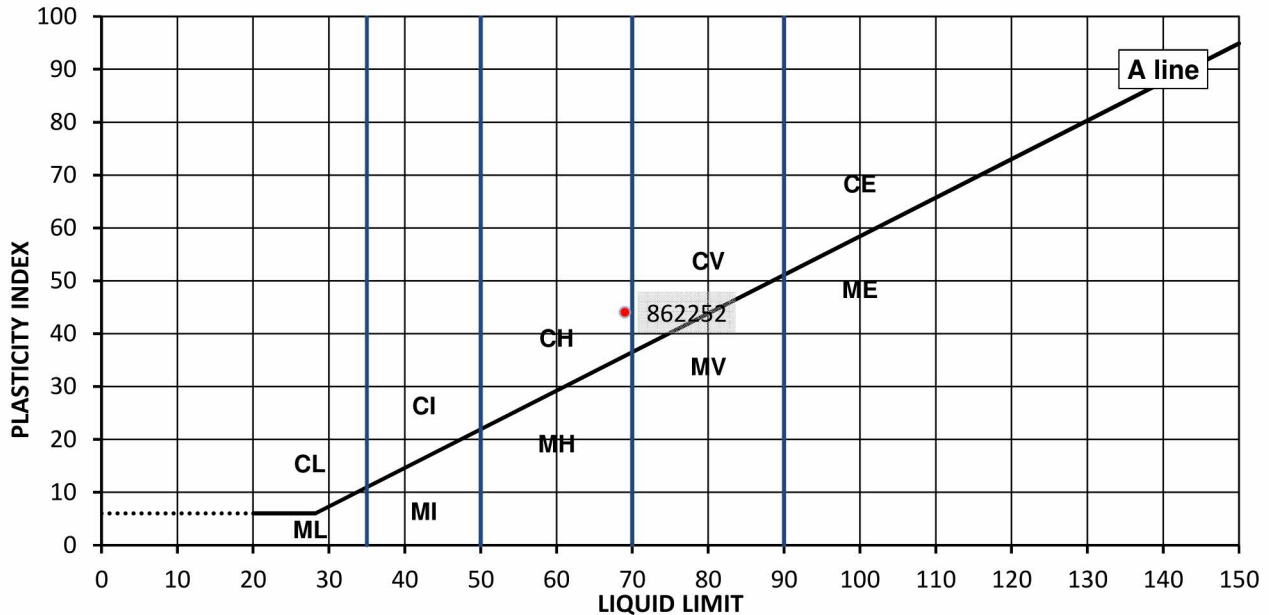
### TEST RESULTS

Laboratory Reference: 862252  
Sample Reference: 46

Description: Yellowish brown CLAY  
Location: TP14  
Sample Preparation: Tested in natural condition

Sample Type: B  
Depth Top [m]: 0.50  
Depth Base [m]: 0.50

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
33	69	25	44	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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Date Sampled: Not Given  
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Sampled By: Not Given

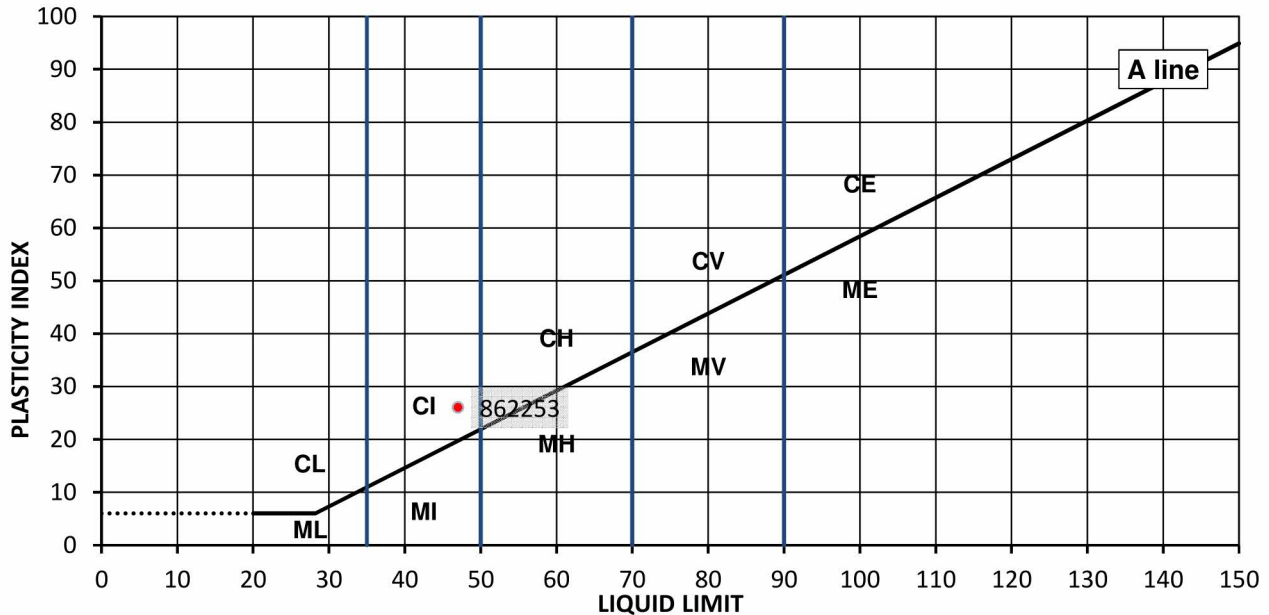
### TEST RESULTS

Laboratory Reference: 862253  
Sample Reference: 49

Description: Dark brown slightly sandy CLAY  
Location: TP15  
Sample Preparation: Tested in natural condition

Sample Type: B  
Depth Top [m]: 1.20  
Depth Base [m]: 1.20

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
20	47	21	26	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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Sampled By: Not Given

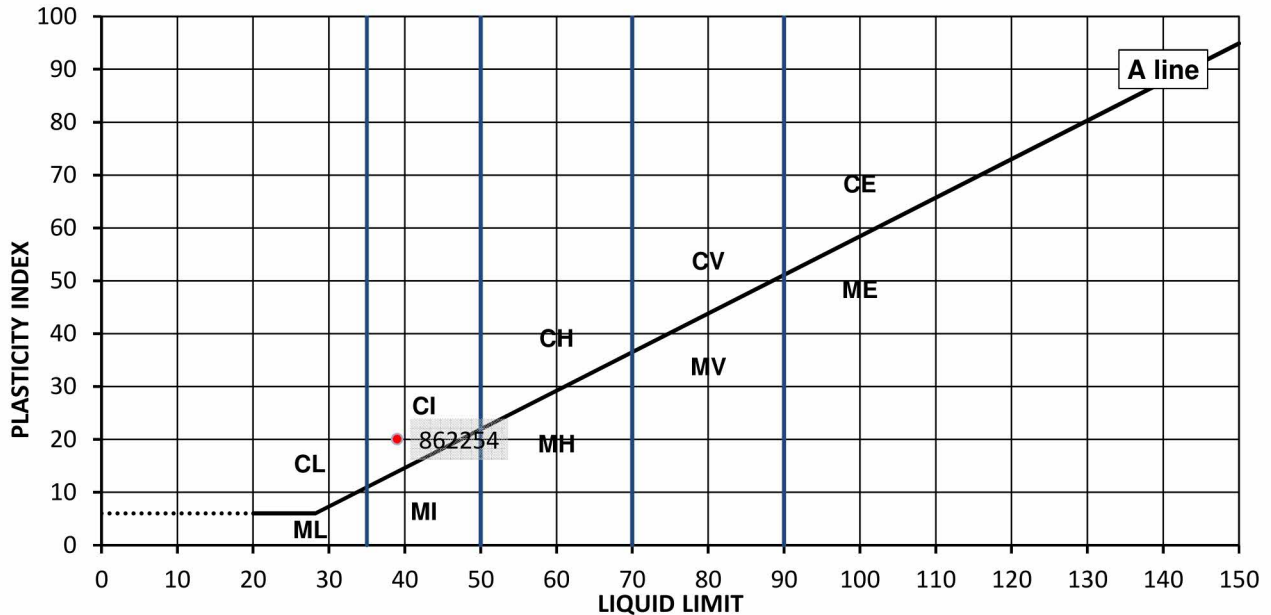
### TEST RESULTS

Laboratory Reference: 862254  
Sample Reference: 52

Description: Yellowish brown slightly gravelly sandy CLAY  
Location: TP16  
Sample Preparation: Tested after washing to remove >425um

Sample Type: B  
Depth Top [m]: 0.40  
Depth Base [m]: 0.40

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
21	39	19	20	77



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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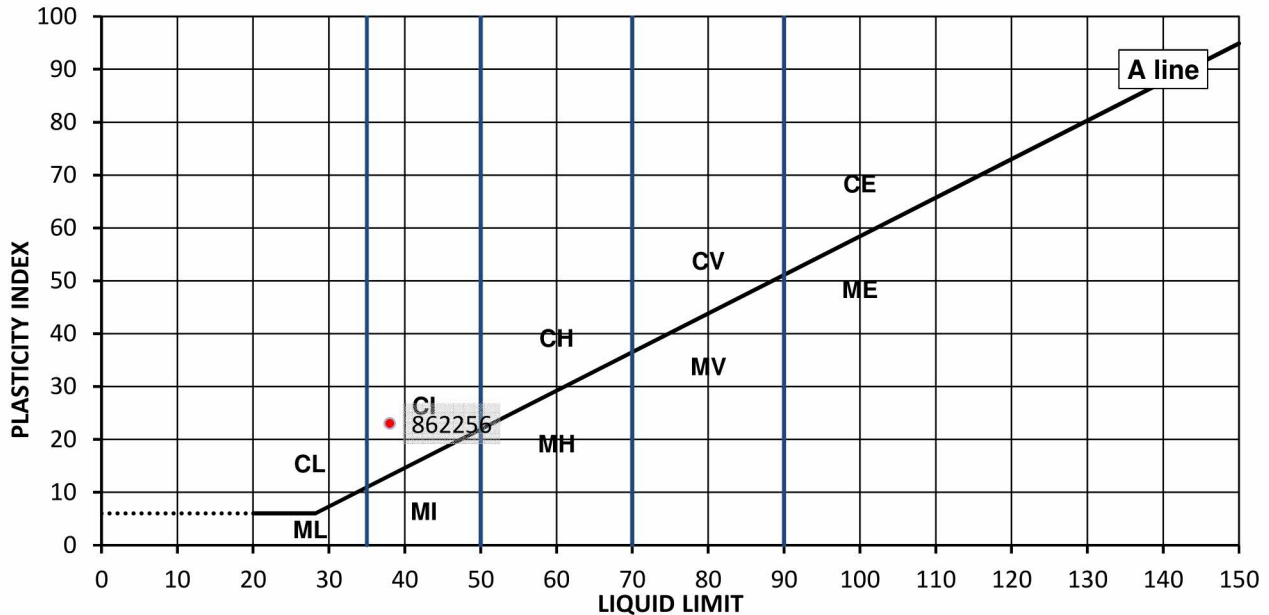
### TEST RESULTS

Laboratory Reference: 862256  
Sample Reference: 55

Description: Dark brown slightly gravelly sandy CLAY  
Location: TP17  
Sample Preparation: Tested after >425um removed by hand

Sample Type: B  
Depth Top [m]: 1.50  
Depth Base [m]: 1.50

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	38	15	23	90



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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Sampled By: Not Given

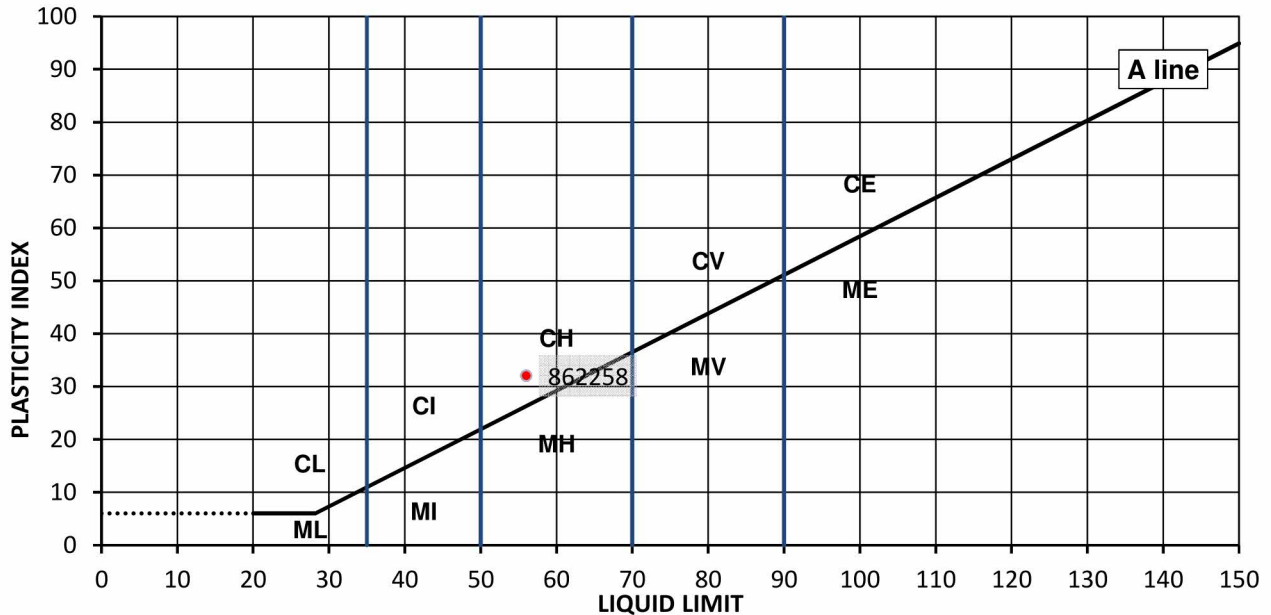
### TEST RESULTS

Laboratory Reference: 862258  
Sample Reference: 60

Description: Yellowish brown slightly gravelly slightly sandy CLAY  
Location: TP18  
Sample Preparation: Tested after >425um removed by hand

Sample Type: B  
Depth Top [m]: 0.60  
Depth Base [m]: 0.60

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	56	24	32	98



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
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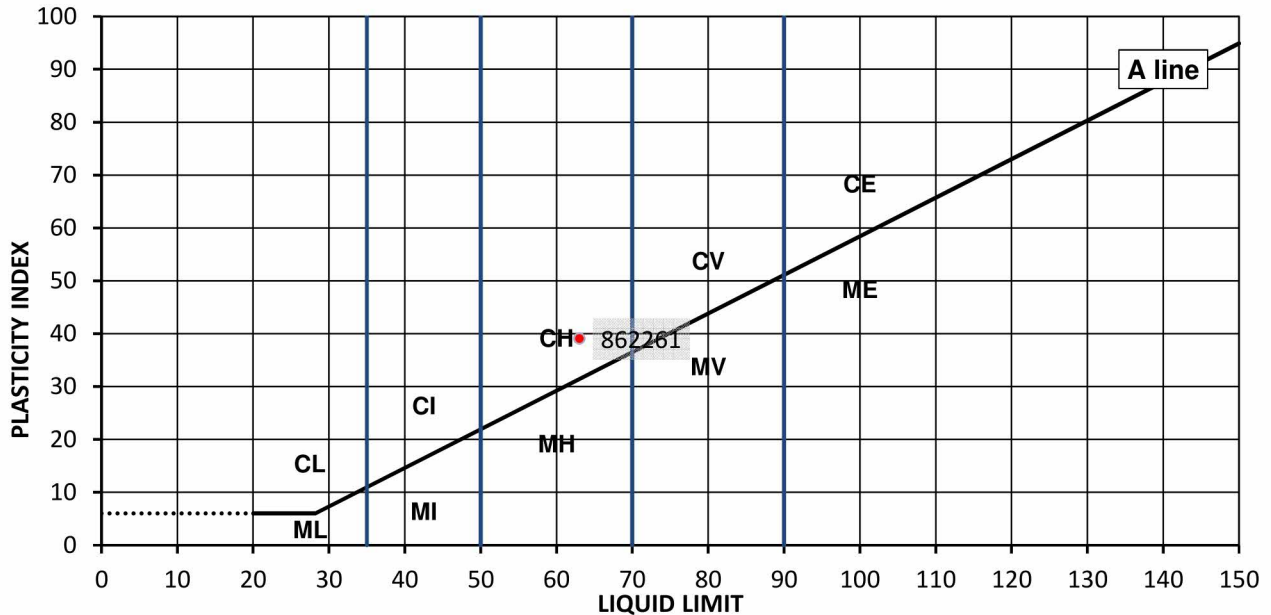
### TEST RESULTS

Laboratory Reference: 862261  
Sample Reference: 64

Description: Dark brown slightly gravelly CLAY  
Location: TP19  
Sample Preparation: Tested after >425um removed by hand

Sample Type: B  
Depth Top [m]: 1.10  
Depth Base [m]: 1.10

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
20	63	24	39	99



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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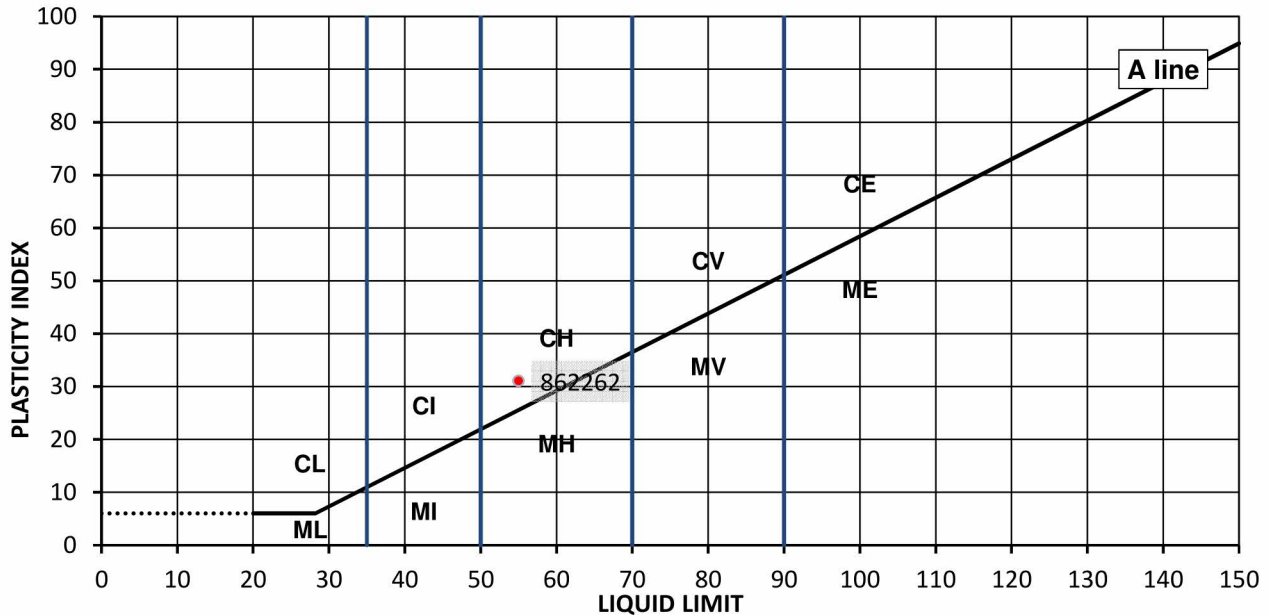
### TEST RESULTS

Laboratory Reference: 862262  
Sample Reference: 67

Description: Dark brown slightly sandy CLAY  
Location: TP20  
Sample Preparation: Tested in natural condition

Sample Type: B  
Depth Top [m]: 2.10  
Depth Base [m]: 2.10

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	55	24	31	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

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Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
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Date Sampled: Not Given  
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Sampled By: Not Given

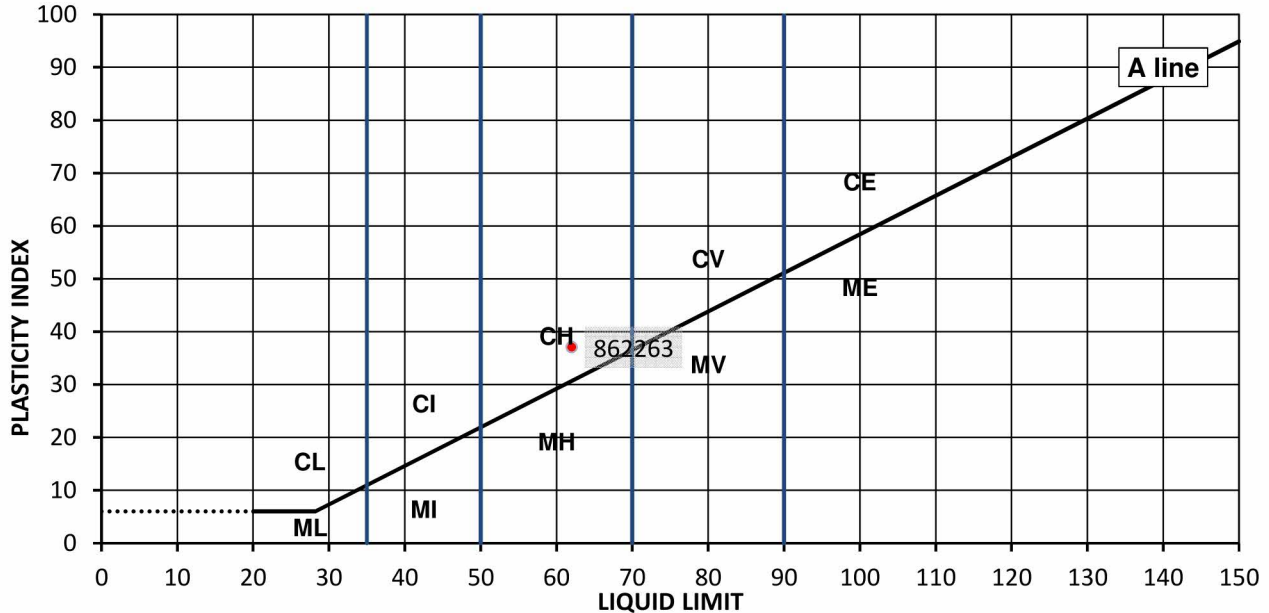
### TEST RESULTS

Laboratory Reference: 862263  
Sample Reference: 69

Description: Dark brown slightly gravelly CLAY  
Location: TP21  
Sample Preparation: Tested after >425um removed by hand

Sample Type: B  
Depth Top [m]: 1.20  
Depth Base [m]: 1.20

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	62	25	37	99



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

Remarks

Approved:



Dariusz Piotrowski  
PL Laboratory  
Manager Geotechnical  
Section

Date Reported: 06/12/2017

Signed:



Darren Berrill  
Geotechnical General  
Manager

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



## Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

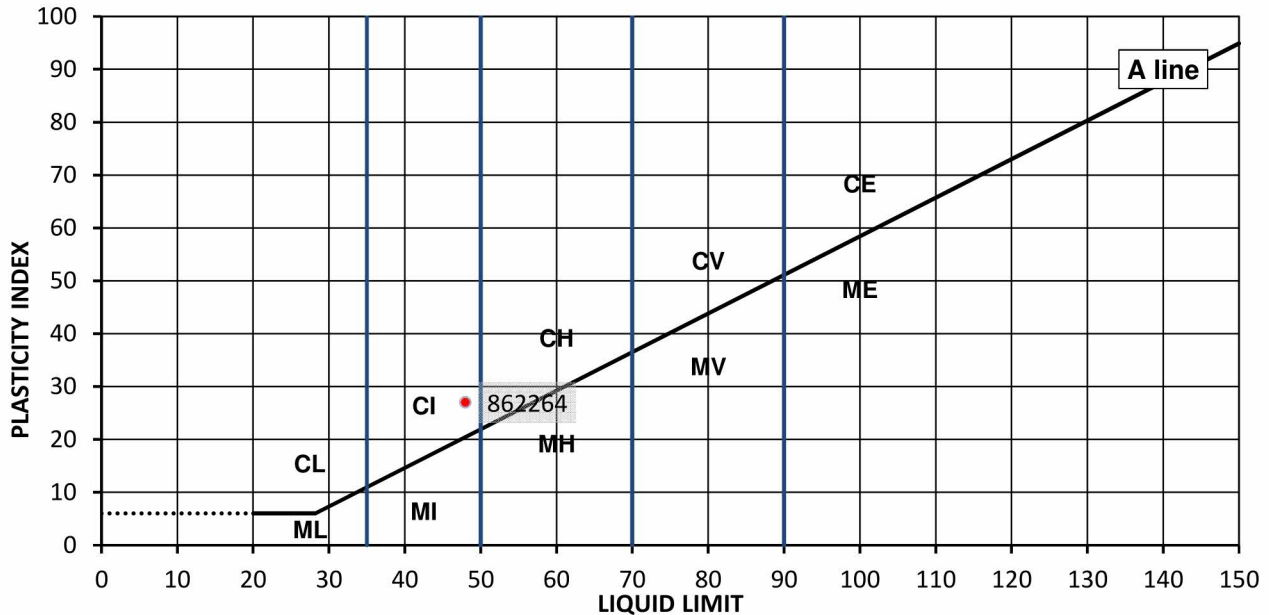
### TEST RESULTS

Laboratory Reference: 862264  
Sample Reference: 72

Description: Yellowish brown slightly sandy CLAY  
Location: TP22  
Sample Preparation: Tested in natural condition

Sample Type: B  
Depth Top [m]: 0.60  
Depth Base [m]: 0.60

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
28	48	21	27	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

Remarks

Approved:



Dariusz Piotrowski  
PL Laboratory  
Manager Geotechnical  
Section

Date Reported: 06/12/2017

Signed:



Darren Berrill  
Geotechnical General  
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# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



## Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

Client: BWB Consulting Limited  
Client Address: 5th Floor  
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Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

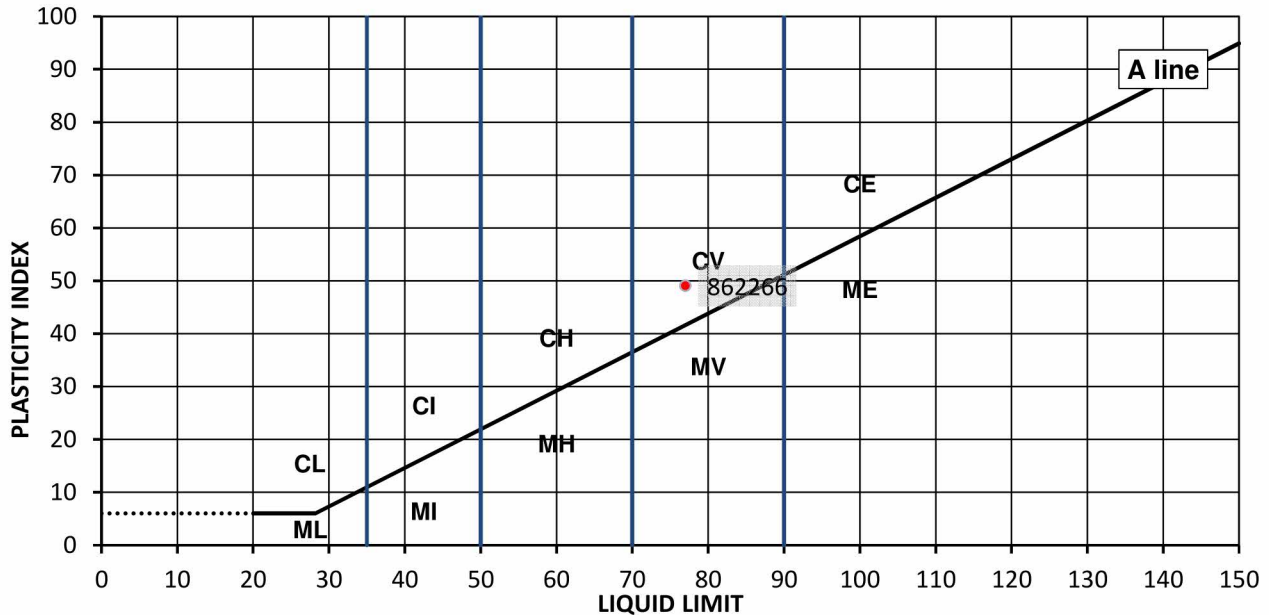
### TEST RESULTS

Laboratory Reference: 862266  
Sample Reference: 78

Description: Dark brown CLAY  
Location: TP23  
Sample Preparation: Tested in natural condition

Sample Type: B  
Depth Top [m]: 1.20  
Depth Base [m]: 1.20

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
33	77	28	49	100



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

Remarks

Approved:

Dariusz Piotrowski  
PL Laboratory  
Manager Geotechnical  
Section

Date Reported: 06/12/2017

Signed:

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Geotechnical General  
Manager

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

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7 Woodshots Meadow  
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Watford Herts WD18 8YS



## Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

Client: BWB Consulting Limited  
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NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

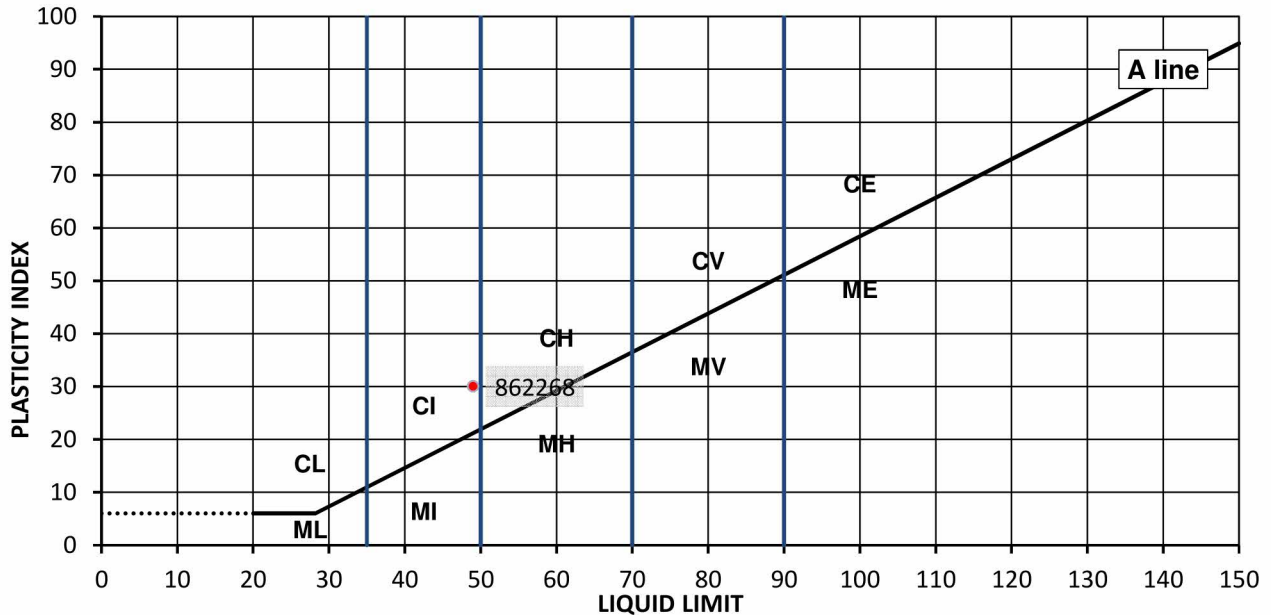
### TEST RESULTS

Laboratory Reference: 862268  
Sample Reference: 81

Description: Yellowish brown slightly gravelly slightly sandy CLAY  
Location: TP24  
Sample Preparation: Tested after >425um removed by hand

Sample Type: B  
Depth Top [m]: 0.90  
Depth Base [m]: 0.90

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	49	19	30	98



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

Remarks

Approved:



Dariusz Piotrowski  
PL Laboratory  
Manager Geotechnical  
Section

Date Reported: 06/12/2017

Signed:



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Geotechnical General  
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# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
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Watford Herts WD18 8YS



## Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

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Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

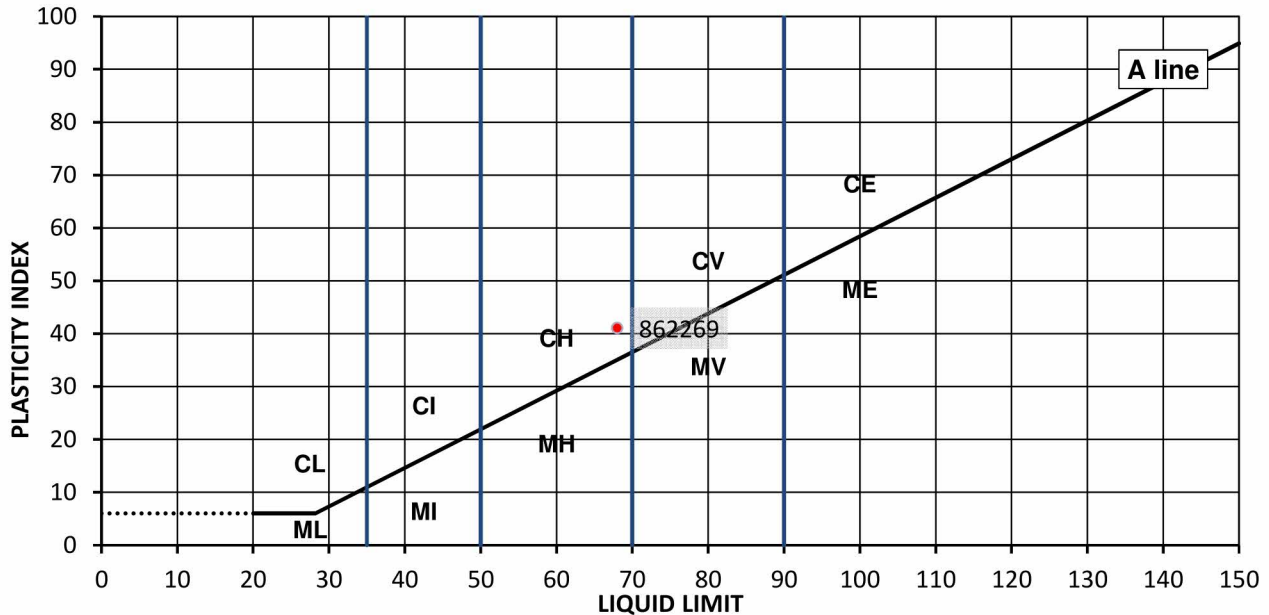
### TEST RESULTS

Laboratory Reference: 862269  
Sample Reference: 83

Description: Dark brown slightly gravelly CLAY  
Location: TP25  
Sample Preparation: Tested after washing to remove >425um

Sample Type: B  
Depth Top [m]: 0.50  
Depth Base [m]: 0.50

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
25	68	27	41	94



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		E	Extremely high		exceeding 90
	Organic	O	append to classification for organic material ( eg CHO )		

Remarks

Approved:



Dariusz Piotrowski  
PL Laboratory  
Manager Geotechnical  
Section

Date Reported: 06/12/2017

Signed:



Darren Berrill  
Geotechnical General  
Manager

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# TEST CERTIFICATE

## Summary of Classification Test Results

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Client: BWB Consulting Limited  
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Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

### Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m3	Mg/m3						
862235	TP01	2	1.50	1.50	B	Yellowish brown slightly clayey gravelly SAND			12					
862237	TP03	7	0.90	0.90	B	Yellowish brown gravelly clayey SAND			11					
862240	TP06	16	1.50	1.50	B	Brown clayey very sandy GRAVEL			7.7					
862243	TP08	24	0.90	0.90	B	Yellowish brown clayey very sandy GRAVEL			7.0					
862244	TP09	28	1.80	1.80	B	Dark brown slightly gravelly slightly sandy CLAY			24	94	58	24	34	
862245	TP10	30	0.50	0.50	B	Yellowish brown slightly gravelly CLAY			29	94	75	33	42	
862248	TP11	36	1.30	1.30	B	Dark brown slightly gravelly CLAY			20	96	63	30	33	
862249	TP12	39	0.60	0.60	B	Dark brown CLAY			30	100	85	28	57	
862252	TP14	46	0.50	0.50	B	Yellowish brown CLAY			33	100	69	25	44	
862253	TP15	49	1.20	1.20	B	Dark brown slightly sandy CLAY			20	100	47	21	26	

Comments:

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Date Reported: 06/12/2017

Signed:

Darren Berrill  
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Summary of Classification Test Results

i2 Analytical Ltd  
7 Woodshots Meadow  
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Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

### Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m3	Mg/m3						
862254	TP16	52	0.40	0.40	B	Yellowish brown slightly gravelly sandy CLAY			21	77	39	19	20	
862256	TP17	55	1.50	1.50	B	Dark brown slightly gravelly sandy CLAY			24	90	38	15	23	
862258	TP18	60	0.60	0.60	B	Yellowish brown slightly gravelly slightly sandy CLAY			22	98	56	24	32	
862260	TP18	62	3.40	3.50	B	Dark grey CLAY			18					
862261	TP19	64	1.10	1.10	B	Dark brown slightly gravelly CLAY			20	99	63	24	39	
862262	TP20	67	2.10	2.10	B	Dark brown slightly sandy CLAY			22	100	55	24	31	
862263	TP21	69	1.20	1.20	B	Dark brown slightly gravelly CLAY			26	99	62	25	37	
862264	TP22	72	0.60	0.60	B	Yellowish brown slightly sandy CLAY			28	100	48	21	27	
862266	TP23	78	1.20	1.20	B	Dark brown CLAY			33	100	77	28	49	
862268	TP24	81	0.90	0.90	B	Yellowish brown slightly gravelly slightly sandy CLAY			22	98	49	19	30	

### Comments:

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Date Reported: 06/12/2017

Signed:

Darren Berrill  
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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**TEST CERTIFICATE**

**Summary of Classification Test Results**

i2 Analytical Ltd  
 7 Woodshots Meadow  
 Croxley Green Business Park  
 Watford Herts WD18 8YS



Client: BWB Consulting Limited  
 Client Address: 5th Floor  
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 Contact: Patrick Taylor  
 Site Name: Witham St Hughs, Ph3 S38 Design  
 Site Address: Not Given

Client Reference: NTM2082  
 Job Number: 17-68371  
 Date Sampled: Not Given  
 Date Received: 09/11/2017  
 Date Tested: 01/12/2017  
 Sampled By: Not Given

**Test results**

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m3	Mg/m3		%	%	%	%	
862269	TP25	83	0.50	0.50	B	Dark brown slightly gravelly CLAY			25	94	68	27	41	

Comments:

Approved:   
 Dariusz Piotrowski  
 PL Laboratory Manager  
 Geotechnical Section

Signed:   
 Darren Berrill  
 Geotechnical General Manager

Date Reported: 06/12/2017

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# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



## Determination of Particle Size Distribution

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

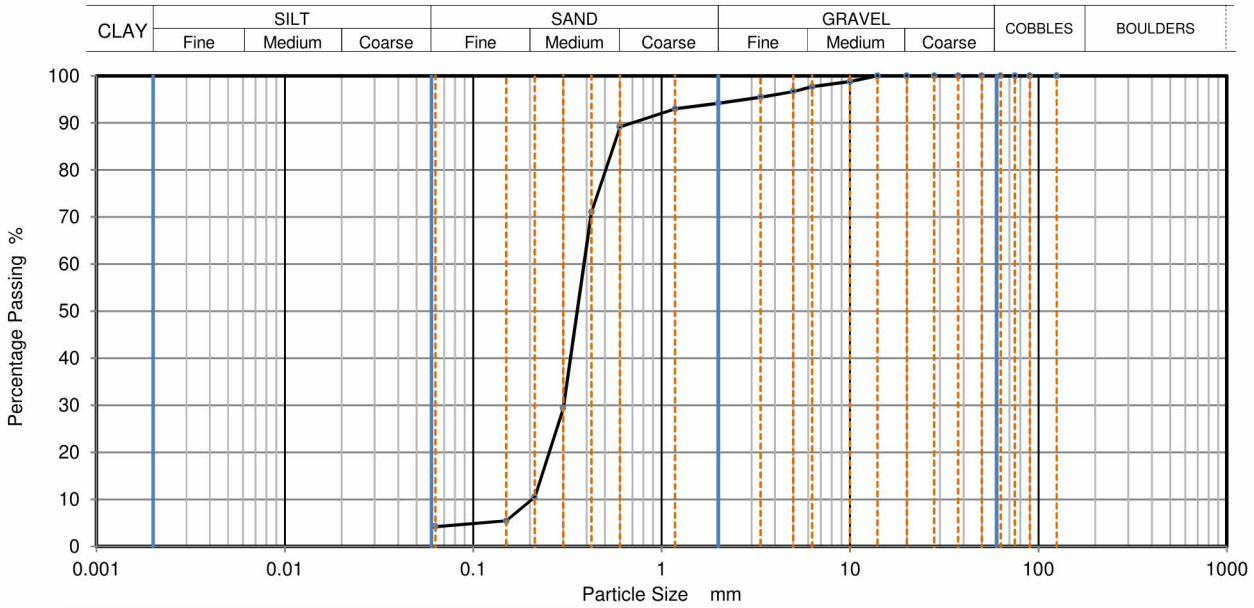
Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862235 Sample Reference: 2

Sample description: Yellowish brown slightly clayey gravelly SAND Sample Type: B

Location: TP01 Depth Top [m]: 1.50  
Supplier: Not Given Depth Base [m]: 1.50



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	98		
5	97		
3.35	96		
2	94		
1.18	93		
0.6	89		
0.425	71		
0.3	29		
0.212	11		
0.15	5		
0.063	4		

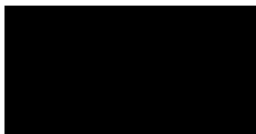
Dry Mass of sample [g]: 259

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	5.80
Sand	90.00
Fines <0.063mm	4.20

Grading Analysis		
D100	mm	14
D60	mm	0.387
D30	mm	0.301
D10	mm	0.205
Uniformity Coefficient		1.9
Curvature Coefficient		1.1

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:



Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:



Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



## Determination of Particle Size Distribution

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

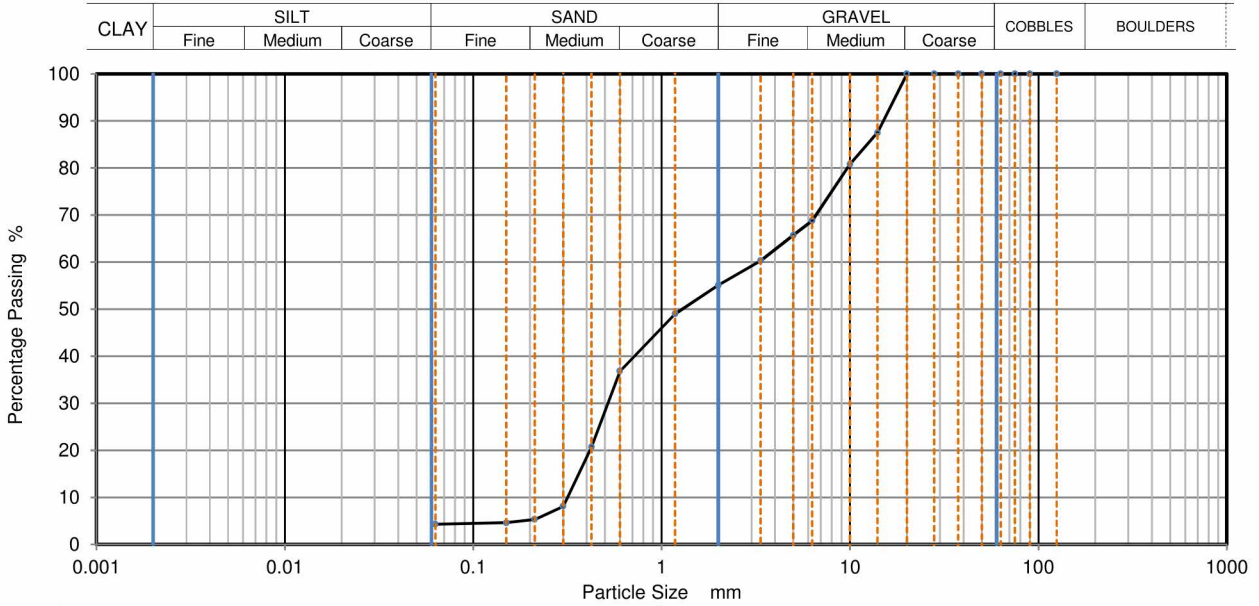
Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862236 Sample Reference: 5

Sample description: Yellowish brown slightly clayey very gravelly SAND Sample Type: B

Location: TP02 Depth Top [m]: 1.70  
Supplier: Not Given Depth Base [m]: 1.70



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	88		
10	81		
6.3	69		
5	66		
3.35	60		
2	55		
1.18	49		
0.6	37		
0.425	21		
0.3	8		
0.212	5		
0.15	5		
0.063	4		

Dry Mass of sample [g]: 1040

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	44.90
Sand	50.80
Fines <0.063mm	4.30

Grading Analysis		
D100	mm	20
D60	mm	3.24
D30	mm	0.519
D10	mm	0.316
Uniformity Coefficient		10
Curvature Coefficient		0.26

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

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## Determination of Particle Size Distribution

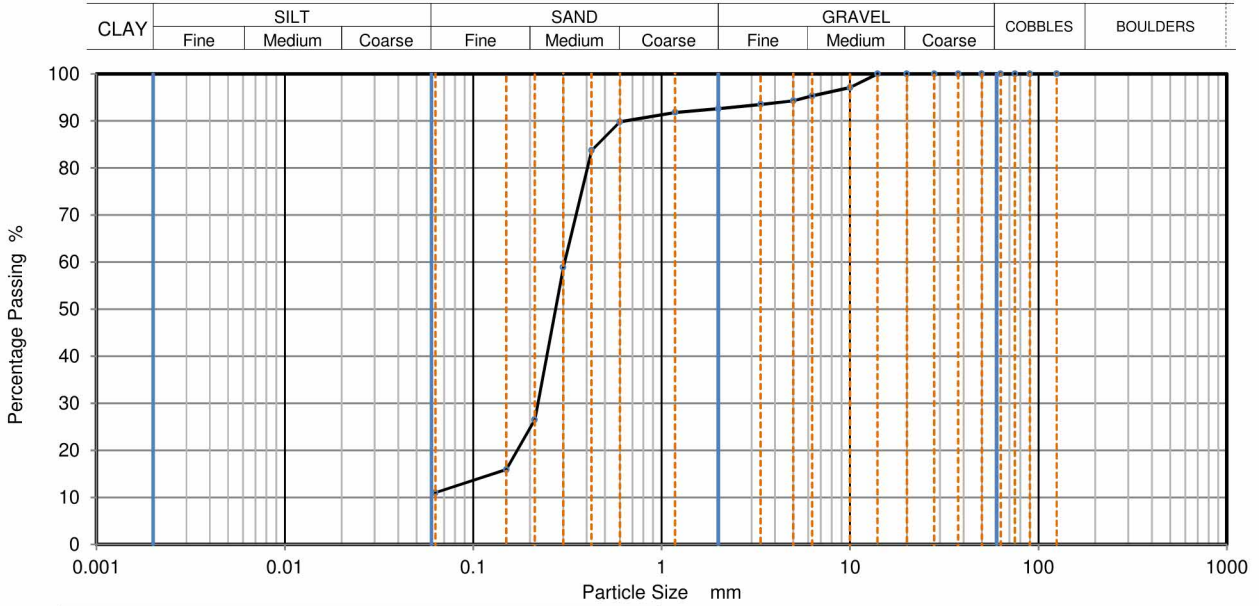
Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 18/03/1900  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862237 Sample Reference: 7

Sample description: Yellowish brown gravelly clayey SAND Sample Type: B  
Location: TP03 Depth Top [m]: 0.90  
Supplier: Not Given Depth Base [m]: 0.90



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	97		
6.3	95		
5	94		
3.35	94		
2	93		
1.18	92		
0.6	90		
0.425	84		
0.3	59		
0.212	27		
0.15	16		
0.063	11		

Dry Mass of sample [g]: 304

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	7.40
Sand	81.60
Fines <0.063mm	11.00

Grading Analysis		
D100	mm	14
D60	mm	0.305
D30	mm	0.22
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved: [Signature]  
Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed: [Signature]  
Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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Watford Herts WD18 8YS



## Determination of Particle Size Distribution

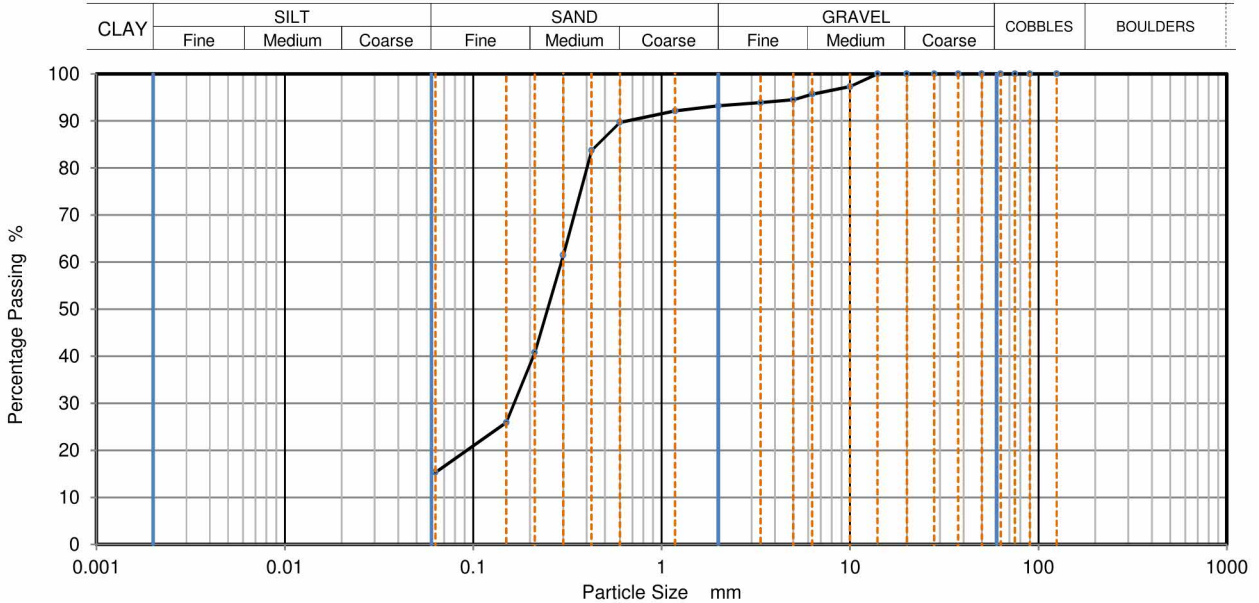
Tested in Accordance with BS1377:Part 2:1990, clause 9.2

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NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862238 Sample Reference: 11

Sample description: Brown gravelly clayey SAND Sample Type: B  
Location: TP04 Depth Top [m]: 1.20  
Supplier: Not Given Depth Base [m]: 1.20



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	97		
6.3	96		
5	95		
3.35	94		
2	93		
1.18	92		
0.6	90		
0.425	84		
0.3	62		
0.212	41		
0.15	26		
0.063	15		

Dry Mass of sample [g]: 324

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	6.80
Sand	77.90
Fines <0.063mm	15.30

Grading Analysis		
D100	mm	14
D60	mm	0.292
D30	mm	0.165
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



## Determination of Particle Size Distribution

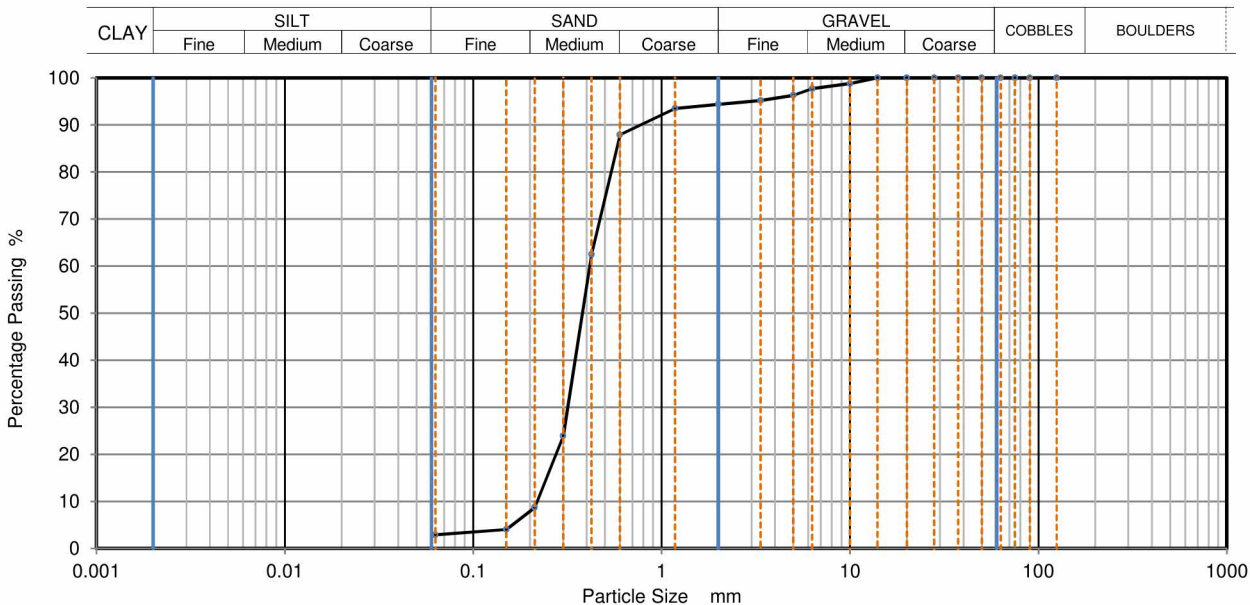
Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862239 Sample Reference: 13

Sample description: Yellowish brown gravelly SAND Sample Type: B  
Location: TP05 Depth Top [m]: 1.60  
Supplier: Not Given Depth Base [m]: 1.60



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	98		
5	96		
3.35	95		
2	94		
1.18	94		
0.6	88		
0.425	63		
0.3	24		
0.212	9		
0.15	4		
0.063	3		

Dry Mass of sample [g]: 306

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	5.60
Sand	91.40
Fines <0.063mm	2.90

Grading Analysis		
D100	mm	14
D60	mm	0.416
D30	mm	0.317
D10	mm	0.219
Uniformity Coefficient		1.9
Curvature Coefficient		1.1

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved: [Signature]  
Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed: [Signature]  
Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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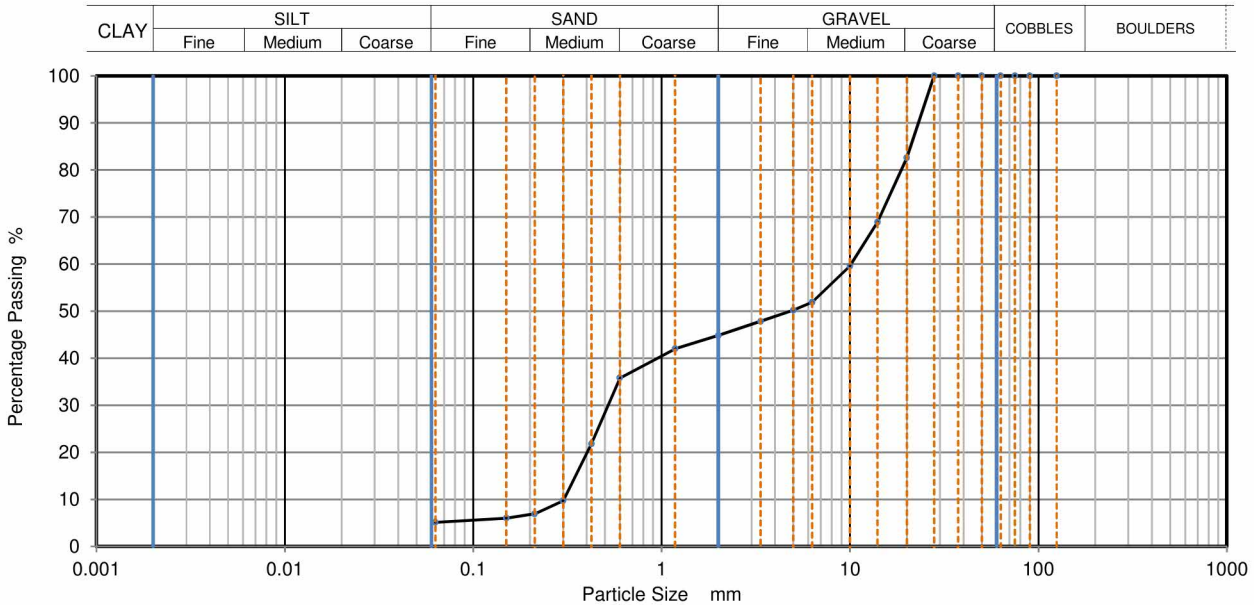
## Determination of Particle Size Distribution

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862240 Sample Reference: 16  
Sample description: Brown clayey very sandy GRAVEL Sample Type: B  
Location: TP06 Depth Top [m]: 1.50  
Supplier: Not Given Depth Base [m]: 1.50



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	83		
14	69		
10	60		
6.3	52		
5	50		
3.35	48		
2	45		
1.18	42		
0.6	36		
0.425	22		
0.3	10		
0.212	7		
0.15	6		
0.063	5		

Dry Mass of sample [g]: 2661

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	55.20
Sand	39.70
Fines <0.063mm	5.10

Grading Analysis		
D100	mm	28
D60	mm	10.1
D30	mm	0.52
D10	mm	0.302
Uniformity Coefficient		34
Curvature Coefficient		0.088

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved: [Signature]  
Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed: [Signature]  
Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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## Determination of Particle Size Distribution

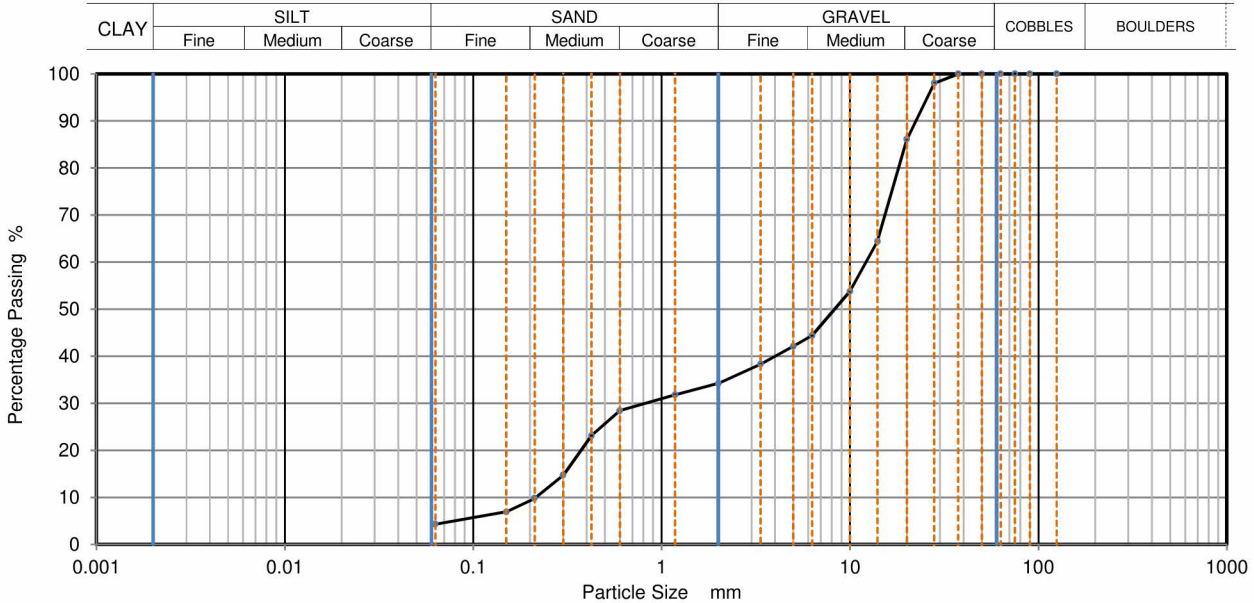
Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

### TEST RESULTS

Laboratory Reference: 862242  
Sample description: Yellowish brown slightly clayey very sandy GRAVEL  
Location: TP07  
Supplier: Not Given  
Sample Reference: 21  
Sample Type: B  
Depth Top [m]: 2.00  
Depth Base [m]: 2.00



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	86		
14	64		
10	54		
6.3	44		
5	42		
3.35	38		
2	34		
1.18	32		
0.6	28		
0.425	23		
0.3	15		
0.212	10		
0.15	7		
0.063	4		

Dry Mass of sample [g]: 4107

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	65.80
Sand	29.90
Fines <0.063mm	4.30

Grading Analysis		
D100	mm	37.5
D60	mm	12.2
D30	mm	0.824
D10	mm	0.215
Uniformity Coefficient		57
Curvature Coefficient		0.26

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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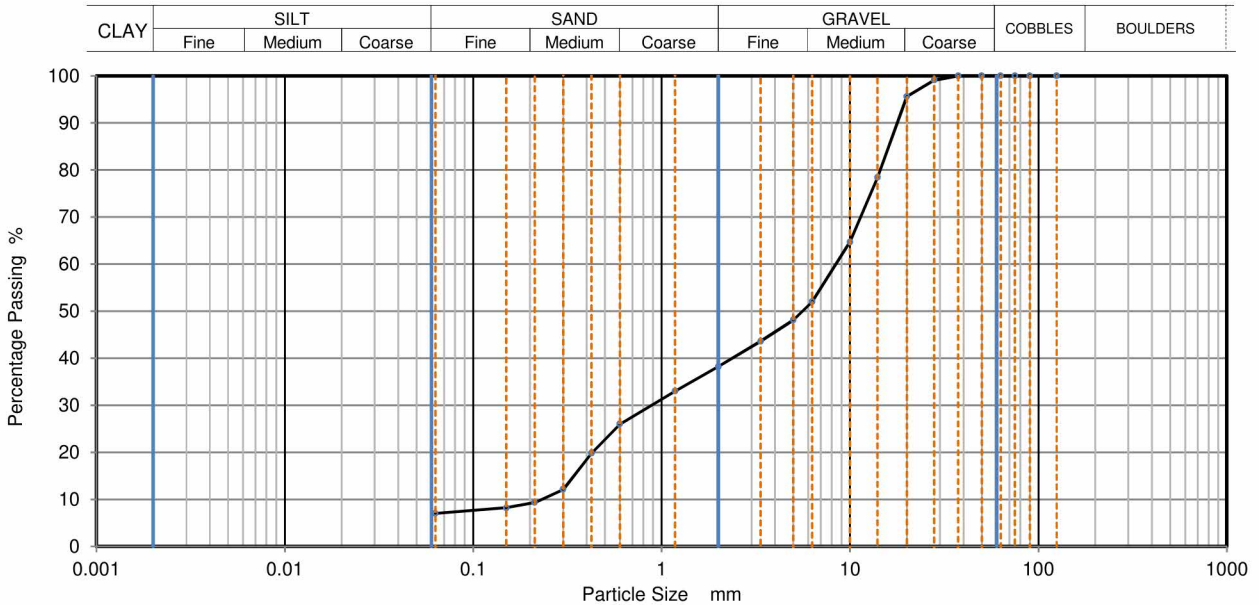
## Determination of Particle Size Distribution

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862243 Sample Reference: 24  
Sample description: Yellowish brown clayey very sandy GRAVEL Sample Type: B  
Location: TP08 Depth Top [m]: 0.90  
Supplier: Not Given Depth Base [m]: 0.90



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	96		
14	78		
10	65		
6.3	52		
5	48		
3.35	44		
2	38		
1.18	33		
0.6	26		
0.425	20		
0.3	12		
0.212	9		
0.15	8		
0.063	7		

Dry Mass of sample [g]: 2659

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	61.80
Sand	31.20
Fines <0.063mm	7.00

Grading Analysis		
D100	mm	37.5
D60	mm	8.42
D30	mm	0.884
D10	mm	0.23
Uniformity Coefficient		37
Curvature Coefficient		0.4

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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## Determination of Particle Size Distribution

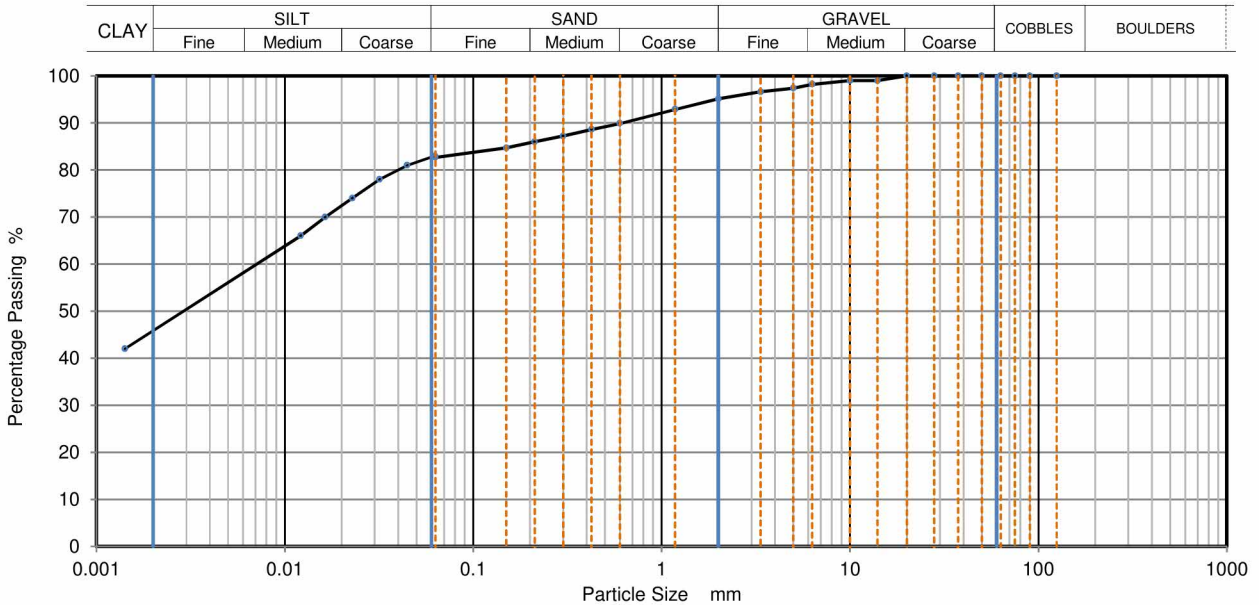
Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862246 Sample Reference: 32

Sample description: Dark brown slightly gravelly slightly sandy CLAY Sample Type: B  
Location: TP10 Depth Top [m]: 1.30  
Supplier: Not Given Depth Base [m]: 1.30



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0625	83
90	100	0.0446	81
75	100	0.0318	78
63	100	0.0228	74
50	100	0.0164	70
37.5	100	0.0121	66
28	100	0.0014	42
20	100		
14	99		
10	99		
6.3	98		
5	97		
3.35	97		
2	95		
1.18	93		
0.6	90	Particle density (assumed)	
0.425	89	2.65	Mg/m3
0.3	87		
0.212	86		
0.15	85		
0.063	83		

Dry Mass of sample [g]: 247

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	4.90
Sand	12.40
Silt	36.50
Clay	46.20

Grading Analysis	
D100	mm 20
D60	mm 0.00716
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Determination of Particle Size Distribution

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Watford Herts WD18 8YS



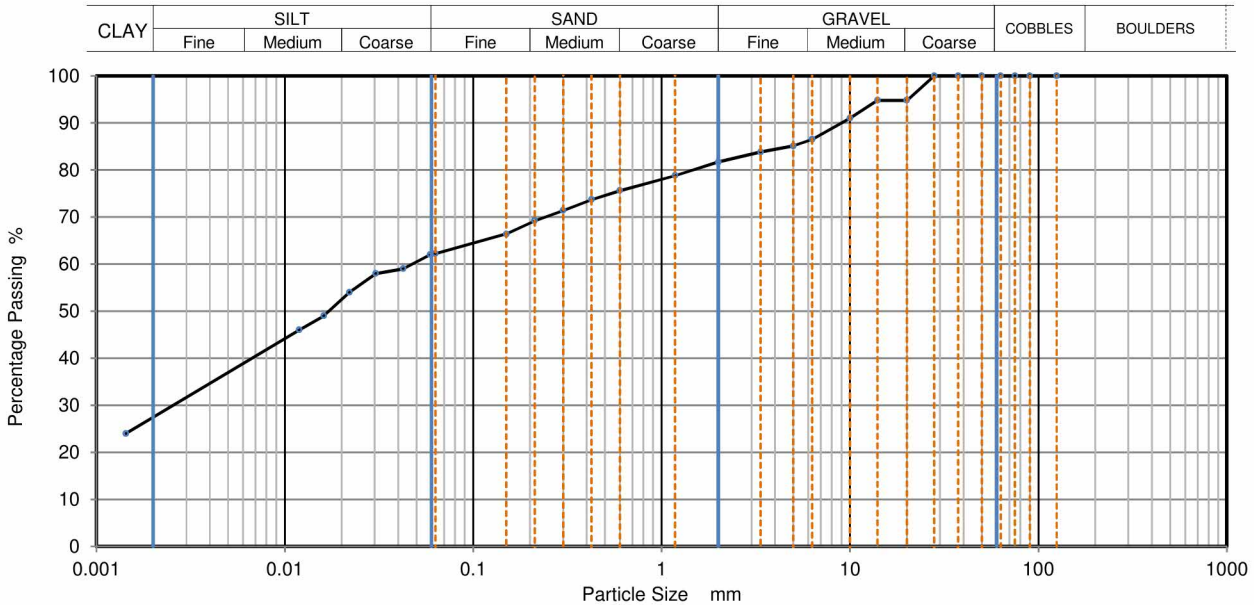
Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862247 Sample Reference: 33

Sample description: Dark grey slightly gravelly slightly sandy CLAY Sample Type: B  
Location: TP10 Depth Top [m]: 2.00  
Supplier: Not Given Depth Base [m]: 2.00



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0590	62
90	100	0.0425	59
75	100	0.0303	58
63	100	0.0220	54
50	100	0.0161	49
37.5	100	0.0119	46
28	100	0.0014	24
20	95		
14	95		
10	91		
6.3	87		
5	85		
3.35	84		
2	82		
1.18	79		
0.6	76	Particle density (assumed)	
0.425	74	2.65	Mg/m <sup>3</sup>
0.3	71		
0.212	69		
0.15	66		
0.063	62		

Dry Mass of sample [g]: 310

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	18.30
Sand	19.50
Silt	34.50
Clay	27.70

Grading Analysis		
D100	mm	28
D60	mm	0.0452
D30	mm	0.0025
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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## Determination of Particle Size Distribution

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

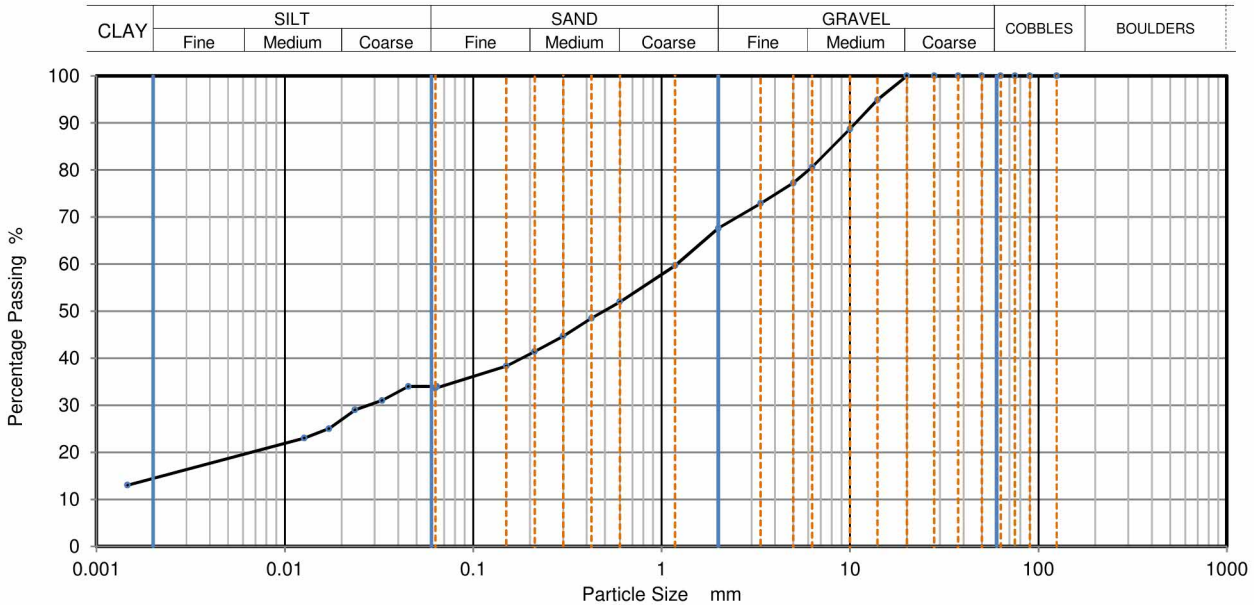
Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862250 Sample Reference: 40

Sample description: Dark brown very gravelly very clayey SAND Sample Type: B

Location: TP12 Depth Top [m]: 1.20  
Supplier: Not Given Depth Base [m]: 1.20



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0640	34
90	100	0.0453	34
75	100	0.0328	31
63	100	0.0235	29
50	100	0.0171	25
37.5	100	0.0127	23
28	100	0.0015	13
20	100		
14	95		
10	89		
6.3	81		
5	77		
3.35	73		
2	68		
1.18	60		
0.6	52	Particle density (assumed)	
0.425	49	2.65	Mg/m3
0.3	45		
0.212	41		
0.15	38		
0.063	34		

Dry Mass of sample [g]: 226

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	32.40
Sand	34.00
Silt	19.00
Clay	14.60

Grading Analysis	
D100	mm 20
D60	mm 1.2
D30	mm 0.0284
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below  
The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



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# TEST CERTIFICATE

## Determination of Particle Size Distribution

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
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Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

### TEST RESULTS

Laboratory Reference: 862251

Sample Reference: 42

Sample description: Dark brown slightly sandy CLAY

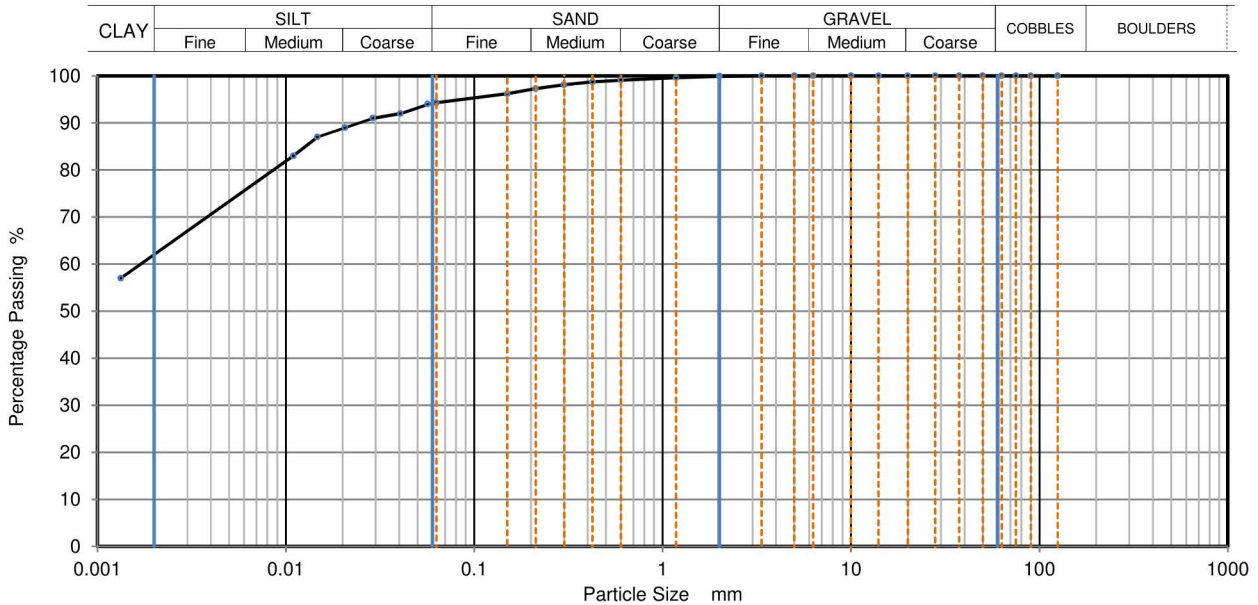
Sample Type: B

Location: TP13

Depth Top [m]: 1.10

Supplier: Not Given

Depth Base [m]: 1.10



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0567	94
90	100	0.0405	92
75	100	0.0289	91
63	100	0.0206	89
50	100	0.0147	87
37.5	100	0.0110	83
28	100	0.0013	57
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density (assumed)	
0.425	99	2.65	Mg/m3
0.3	98		
0.212	97		
0.15	96		
0.063	94		

Dry Mass of sample [g]: 185

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.10
Sand	5.70
Silt	32.50
Clay	61.70

Grading Analysis	
D100	mm 3.35
D60	mm 0.00175
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section



Signed:

Darren Berrill  
Geotechnical General  
Manager



Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Determination of Particle Size Distribution

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Watford Herts WD18 8YS

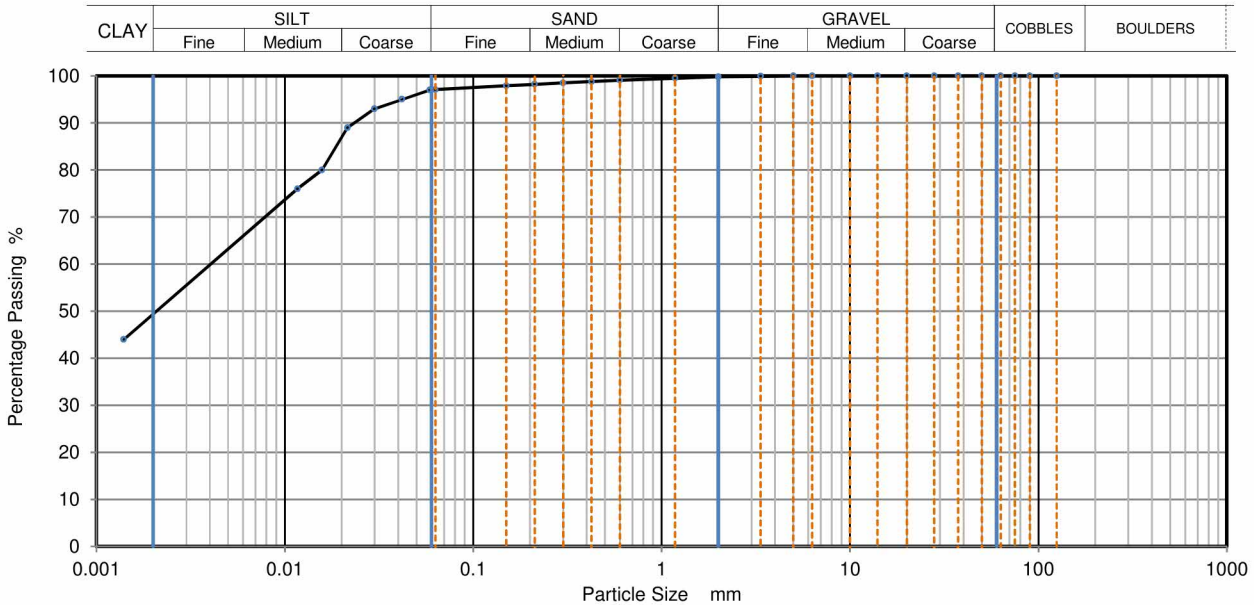


Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862255 Sample Reference: 53  
Sample description: Dark brown CLAY Sample Type: B  
Location: TP16 Depth Top [m]: 2.40  
Supplier: Not Given Depth Base [m]: 2.40



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0587	97
90	100	0.0419	95
75	100	0.0299	93
63	100	0.0215	89
50	100	0.0157	80
37.5	100	0.0117	76
28	100	0.0014	44
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density (assumed)	
0.425	99	2.65	Mg/m <sup>3</sup>
0.3	99		
0.212	98		
0.15	98		
0.063	97		

Dry Mass of sample [g]: 201

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.20
Sand	2.70
Silt	47.40
Clay	49.70

Grading Analysis	
D100	mm 5
D60	mm 0.004
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section



Signed:

Darren Berrill  
Geotechnical General  
Manager



Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



## Determination of Particle Size Distribution

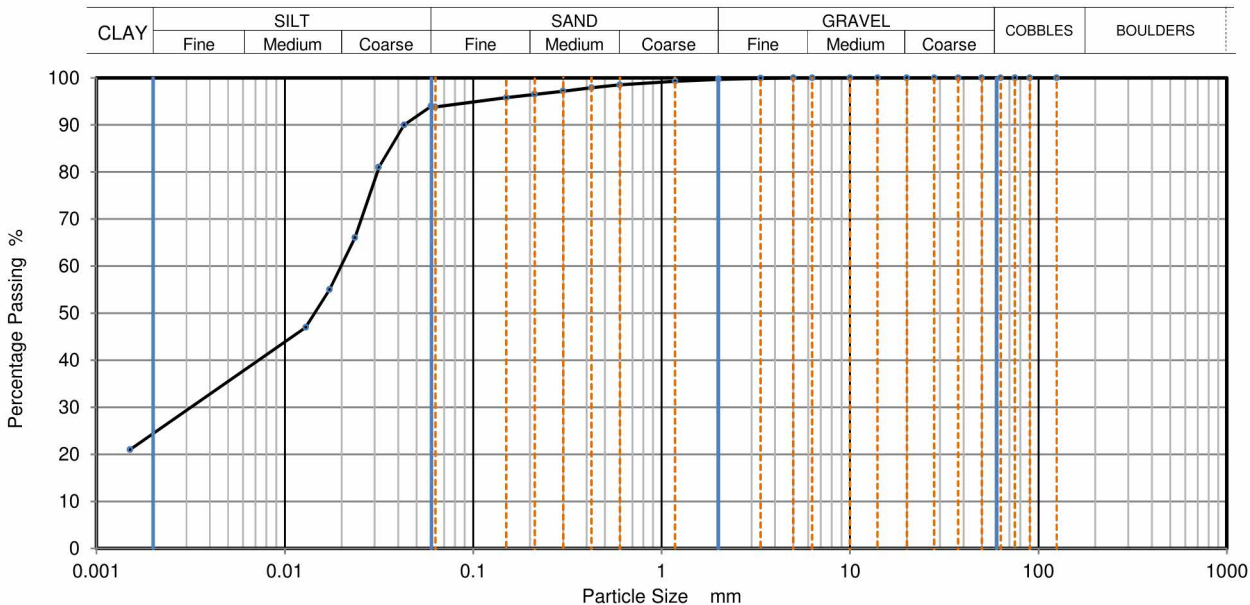
Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862257 Sample Reference: 56

Sample description: Dark brown slightly sandy silty CLAY Sample Type: B  
Location: TP17 Depth Top [m]: 2.80  
Supplier: Not Given Depth Base [m]: 2.80



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0598	94
90	100	0.0431	90
75	100	0.0315	81
63	100	0.0235	66
50	100	0.0172	55
37.5	100	0.0129	47
28	100	0.0015	21
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99	Particle density (assumed)	
0.425	98	2.65	Mg/m3
0.3	97		
0.212	97		
0.15	96		
0.063	94		

Dry Mass of sample [g]: 219

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.30
Sand	5.90
Silt	69.10
Clay	24.70

Grading Analysis		
D100	mm	5
D60	mm	0.0197
D30	mm	0.00313
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved: [Signature]  
Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed: [Signature]  
Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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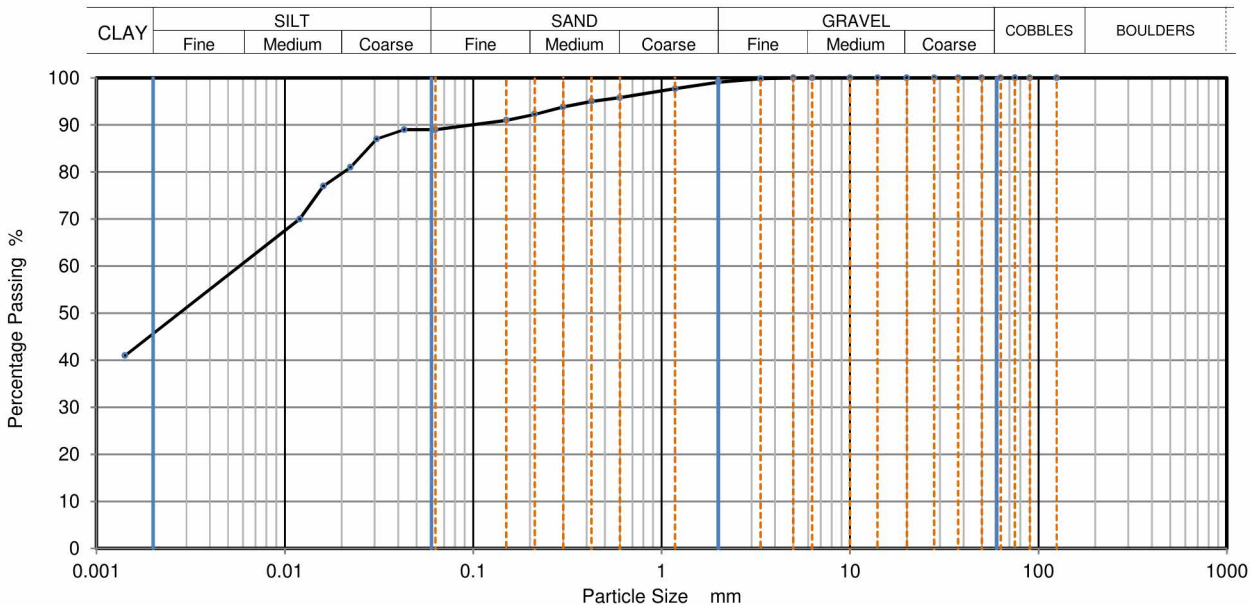
## Determination of Particle Size Distribution

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862259 Sample Reference: 61  
Sample description: Dark grey slightly sandy CLAY Sample Type: B  
Location: TP18 Depth Top [m]: 2.00  
Supplier: Not Given Depth Base [m]: 2.00



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0609	89
90	100	0.0430	89
75	100	0.0307	87
63	100	0.0223	81
50	100	0.0160	77
37.5	100	0.0120	70
28	100	0.0014	41
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	98		
0.6	96	Particle density (assumed)	
0.425	95	2.65	Mg/m3
0.3	94		
0.212	92		
0.15	91		
0.063	89		

Dry Mass of sample [g]: 192

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.90
Sand	10.10
Silt	42.90
Clay	46.10

Grading Analysis	
D100	mm 6.3
D60	mm 0.00559
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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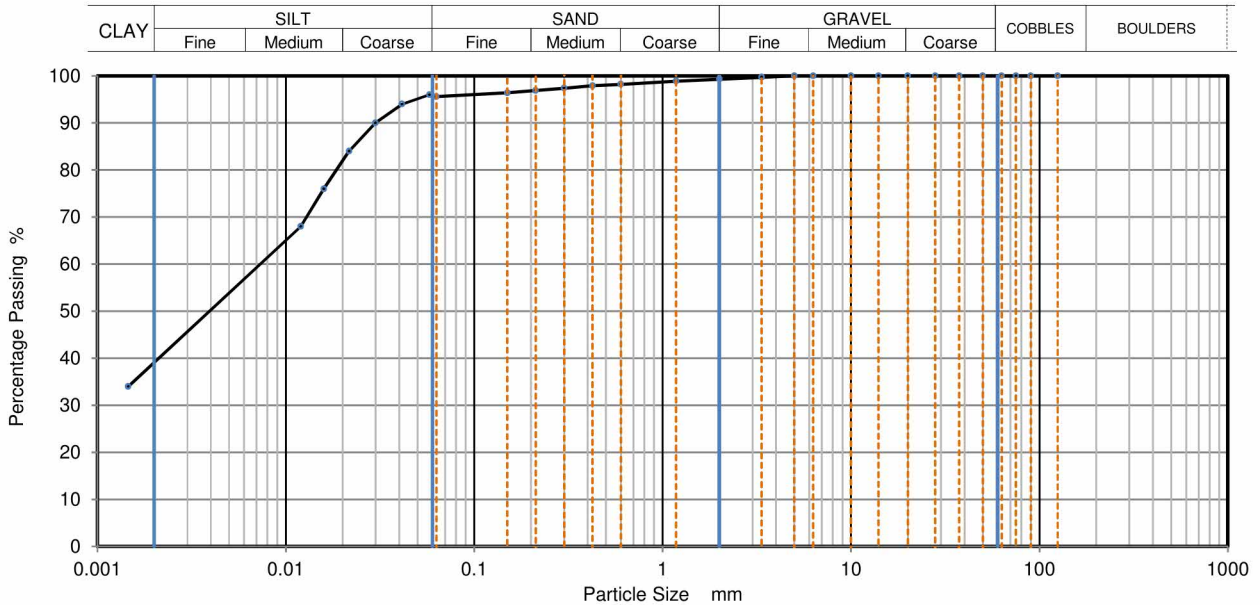
## Determination of Particle Size Distribution

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862260 Sample Reference: 62  
Sample description: Dark grey CLAY Sample Type: B  
Location: TP18 Depth Top [m]: 3.40  
Supplier: Not Given Depth Base [m]: 3.50



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0579	96
90	100	0.0414	94
75	100	0.0298	90
63	100	0.0217	84
50	100	0.0159	76
37.5	100	0.0120	68
28	100	0.0015	34
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98	Particle density (assumed)	
0.425	98	2.65	Mg/m3
0.3	97		
0.212	97		
0.15	96		
0.063	96		

Dry Mass of sample [g]: 207

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.70
Sand	3.80
Silt	56.50
Clay	39.00

Grading Analysis	
D100	mm 5
D60	mm 0.00741
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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## Determination of Particle Size Distribution

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

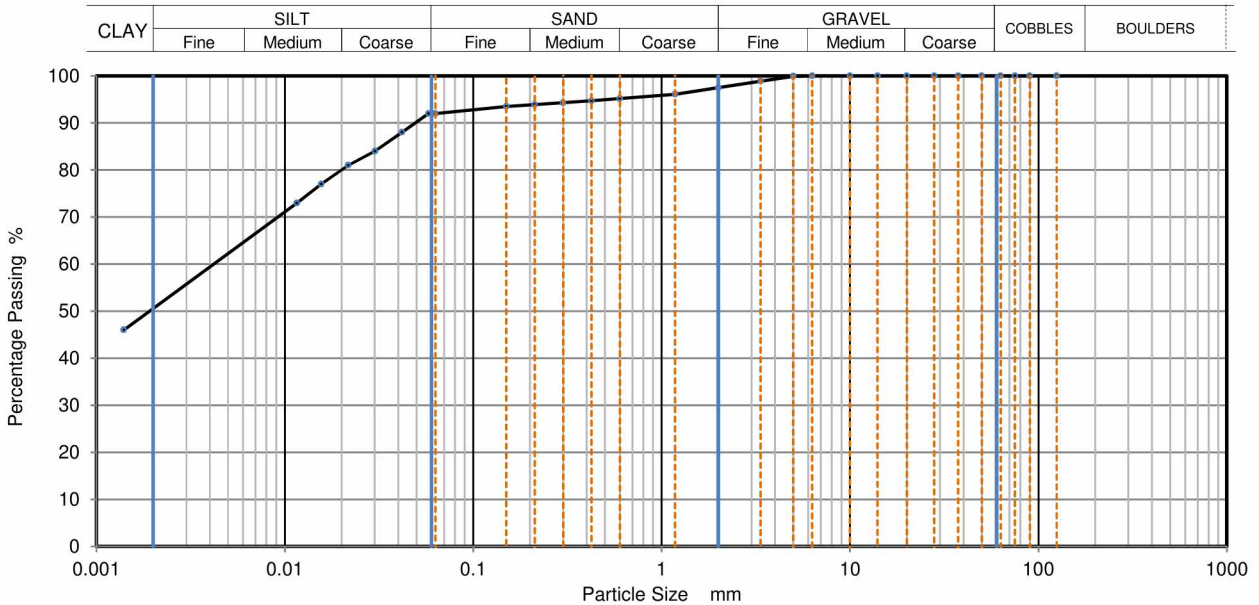
Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862265 Sample Reference: 75

Sample description: Mottled brown slightly gravelly slightly sandy CLAY Sample Type: B

Location: TP22 Depth Top [m]: 2.00  
Supplier: Not Given Depth Base [m]: 2.00



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0580	92
90	100	0.0418	88
75	100	0.0301	84
63	100	0.0217	81
50	100	0.0156	77
37.5	100	0.0116	73
28	100	0.0014	46
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	98		
1.18	96		
0.6	95	Particle density (assumed)	
0.425	95	2.65	Mg/m3
0.3	94		
0.212	94		
0.15	94		
0.063	92		

Dry Mass of sample [g]: 198

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	2.50
Sand	5.50
Silt	41.40
Clay	50.60

Grading Analysis	
D100	mm 6.3
D60	mm 0.00422
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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## Determination of Particle Size Distribution

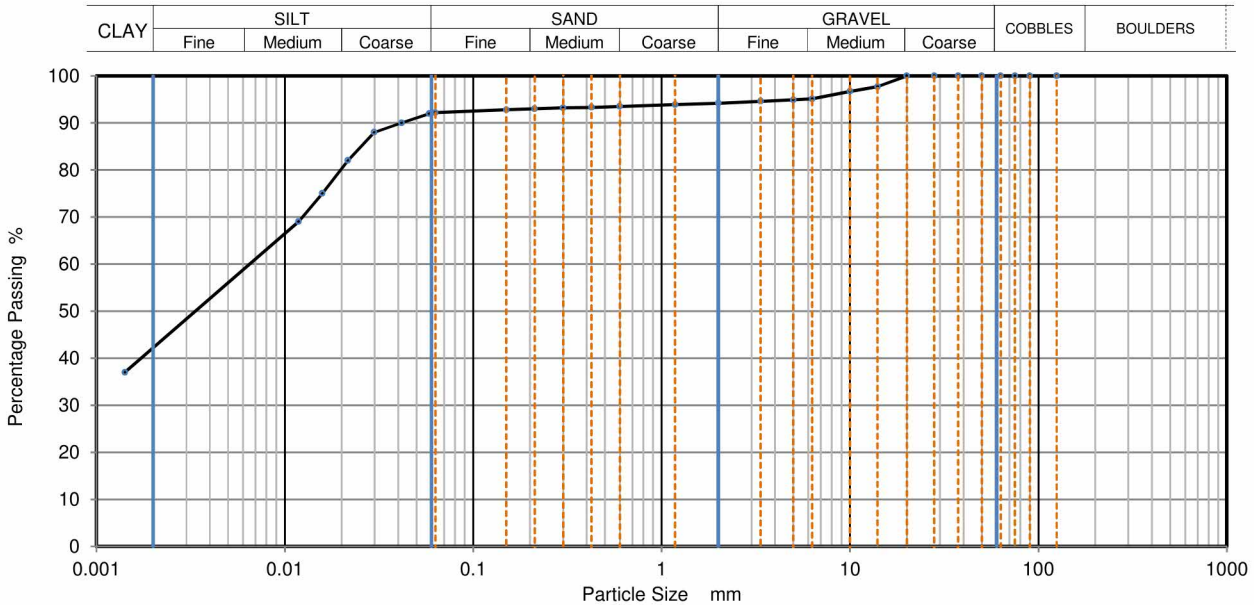
Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

**TEST RESULTS** Laboratory Reference: 862267 Sample Reference: 79

Sample description: Dark grey slightly gravelly CLAY Sample Type: B  
Location: TP23 Depth Top [m]: 2.70  
Supplier: Not Given Depth Base [m]: 2.70



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0584	92
90	100	0.0417	90
75	100	0.0297	88
63	100	0.0216	82
50	100	0.0158	75
37.5	100	0.0118	69
28	100	0.0014	37
20	100		
14	98		
10	97		
6.3	95		
5	95		
3.35	95		
2	94		
1.18	94		
0.6	94	Particle density (assumed)	
0.425	93	2.65	Mg/m3
0.3	93		
0.212	93		
0.15	93		
0.063	92		

Dry Mass of sample [g]: 209

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	5.80
Sand	2.00
Silt	49.80
Clay	42.40

Grading Analysis	
D100	mm 20
D60	mm 0.00658
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

## Determination of California Bearing Ratio

Tested in Accordance with BS 1377-4: 1990: Clause 7

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

### Test Results:

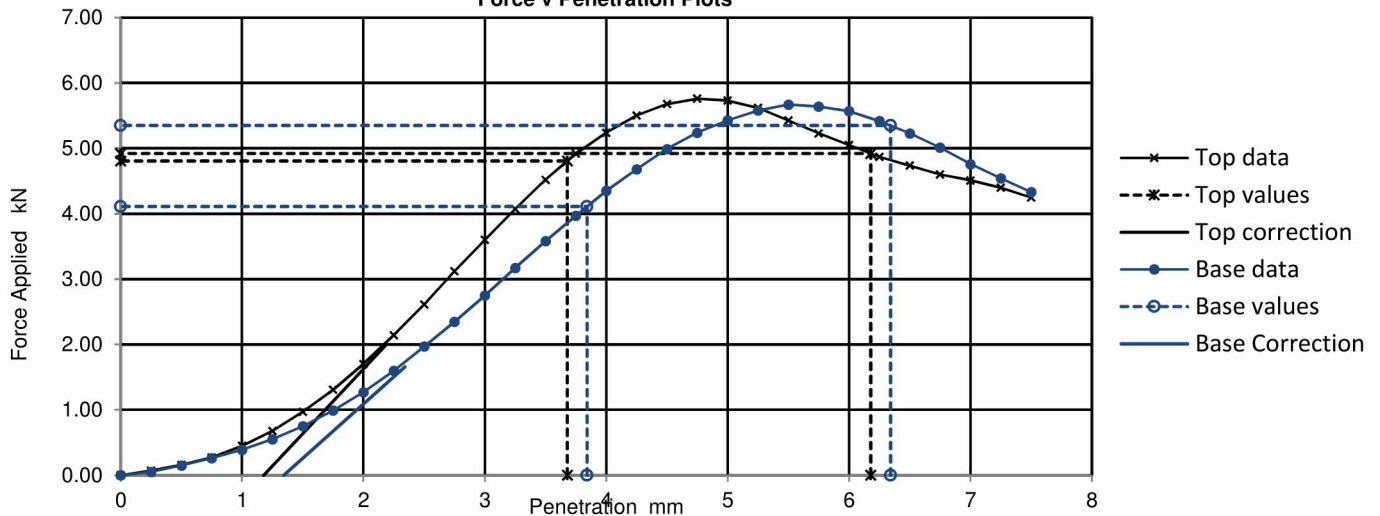
Laboratory Reference: 862237  
Hole No.: TP03  
Sample Reference: 7

Depth Top [m]: 0.90  
Depth Base [m]: 0.90  
Sample Type: B

### Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 2.5kg rammer	Period of soaking	days
		Time to surface	days
Sample Description:	Yellowish brown gravelly clayey SAND	Amount of swell recorded	mm
Material retained on 20mm sieve removed	2 %	Dry density after soaking	Mg/m3
Initial Specimen details	Bulk density 2.08 Mg/m3	Surcharge applied	8 kg
	Dry density 1.85 Mg/m3		4.8 kPa
	Moisture content 13 %		

Force v Penetration Plots



Results

Curve correction applied	CBR Values, %				Moisture Content %
	2.5mm	5mm	Highest	Average	
TOP	36.0	25.0	36.0	34.0	11
BASE	31.0	27.0	31.0		12

Remarks:

Test/ Specimen specific remarks:

Approved:



Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:



Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Determination of California Bearing Ratio

Tested in Accordance with BS 1377-4: 1990: Clause 7

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

### Test Results:

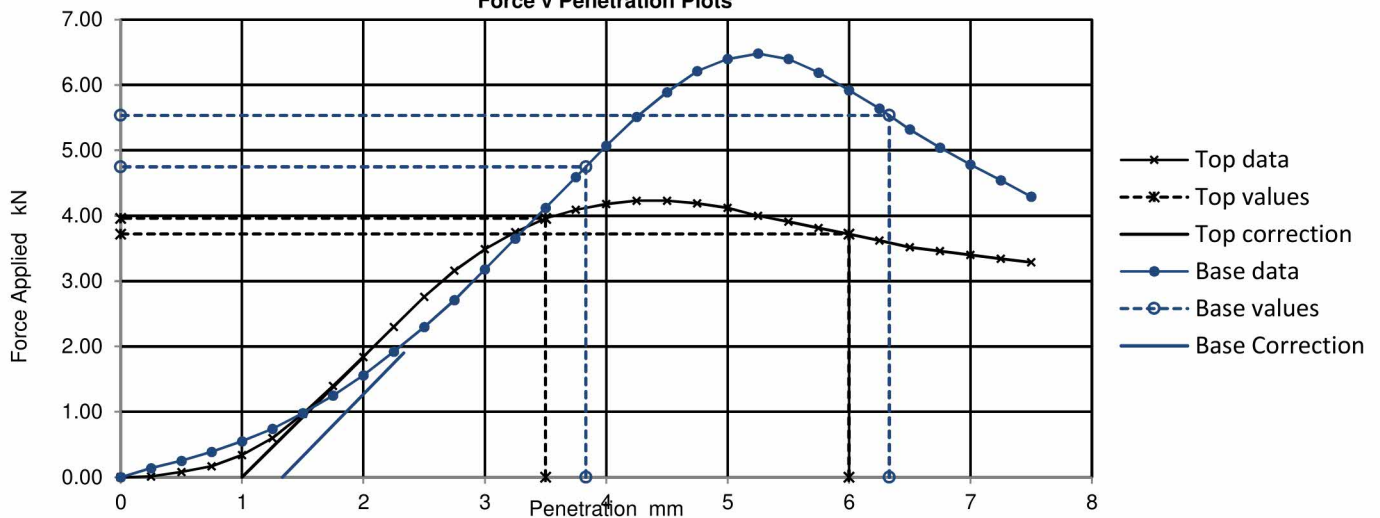
Laboratory Reference: 862239  
Hole No.: TP05  
Sample Reference: 13

Depth Top [m]: 1.60  
Depth Base [m]: 1.60  
Sample Type: B

### Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 4.5kg rammer	Period of soaking	days
		Time to surface	days
Sample Description:	Yellowish brown gravelly SAND	Amount of swell recorded	mm
Material retained on 20mm sieve removed	1 %	Dry density after soaking	Mg/m <sup>3</sup>
Initial Specimen details	Bulk density 2.04 Mg/m <sup>3</sup>	Surcharge applied	8 kg
	Dry density 1.80 Mg/m <sup>3</sup>		4.9 kPa
	Moisture content 13 %		

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	Yes	30.0	19.0	30.0	33.0	10
BASE	Yes	36.0	28.0	36.0		12

Remarks:

Test/ Specimen specific remarks:

Approved:

Signed:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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Client: BWB Consulting Limited  
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Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

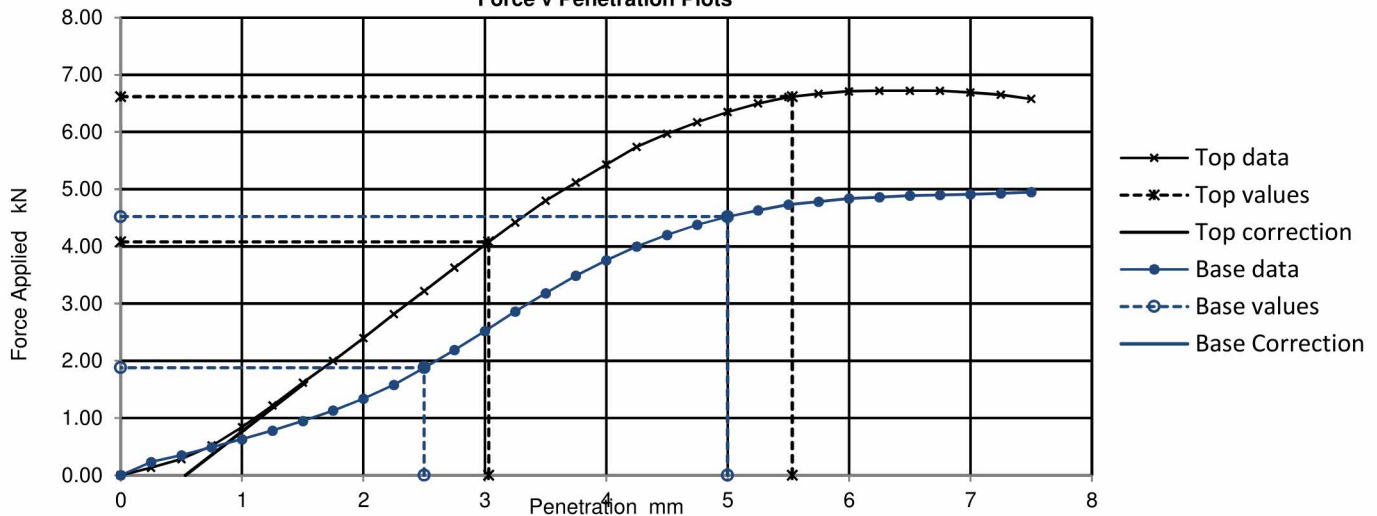
### Test Results:

Laboratory Reference: 862241  
Hole No.: TP07  
Sample Reference: 19  
Depth Top [m]: 0.70  
Depth Base [m]: 0.70  
Sample Type: B

### Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 2.5kg rammer	Period of soaking	days
		Time to surface	days
Sample Description:	Yellowish brown gravelly SAND	Amount of swell recorded	mm
Material retained on 20mm sieve removed	5 %	Dry density after soaking	Mg/m3
Initial Specimen details	Bulk density 2.06 Mg/m3	Surcharge applied	8 kg
	Dry density 1.86 Mg/m3		4.9 kPa
	Moisture content 11 %		

Force v Penetration Plots



Results

Curve correction applied	CBR Values, %				Moisture Content %
	2.5mm	5mm	Highest	Average	
TOP	Yes	31.0	33.0	33.0	11
BASE	No	14.0	23.0	23.0	

Remarks: Test/ Specimen specific remarks:

Approved: [Signature]  
Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed: [Signature]  
Darren Berrill  
Geotechnical General Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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## Determination of California Bearing Ratio

Tested in Accordance with BS 1377-4: 1990: Clause 7

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Client: BWB Consulting Limited  
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Nottingham  
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Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

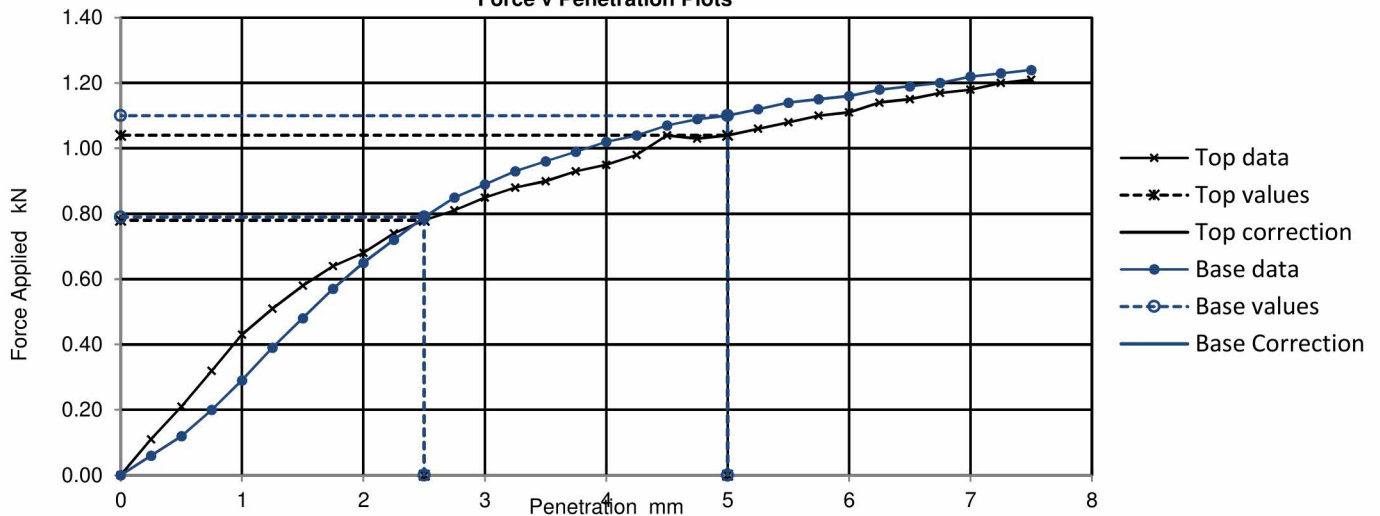
### Test Results:

Laboratory Reference: 862251  
Hole No.: TP13  
Sample Reference: 42  
Depth Top [m]: 1.10  
Depth Base [m]: 1.10  
Sample Type: B

### Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 4.5kg rammer	Period of soaking	days
		Time to surface	days
Sample Description:	Dark brown slightly sandy CLAY	Amount of swell recorded	mm
Material retained on 20mm sieve removed	0 %	Dry density after soaking	Mg/m3
Initial Specimen details	Bulk density 1.97 Mg/m3	Surcharge applied	8 kg
	Dry density 1.52 Mg/m3		4.9 kPa
	Moisture content 29 %		

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	5.9	5.2	5.9	5.9	26
BASE	No	6.0	5.5	6.0		27

Remarks: Test/ Specimen specific remarks:

Approved:

Signed:

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Determination of California Bearing Ratio

Tested in Accordance with BS 1377-4: 1990: Clause 7

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Watford Herts WD18 8YS



Client: BWB Consulting Limited  
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Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

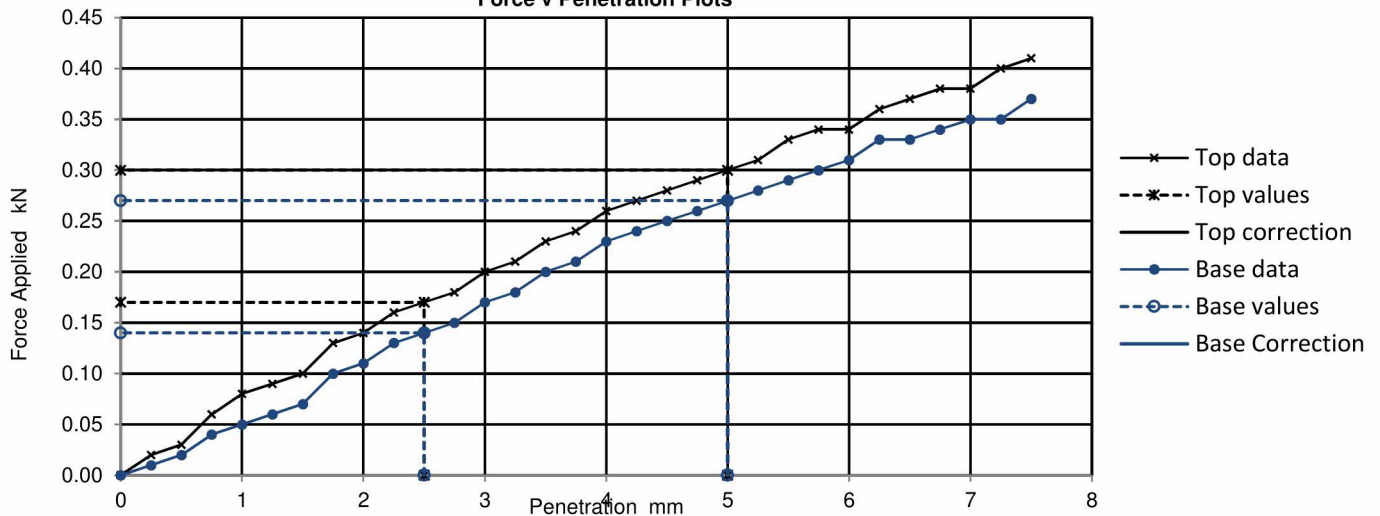
### Test Results:

Laboratory Reference: 862254  
Hole No.: TP16  
Sample Reference: 52  
Depth Top [m]: 0.40  
Depth Base [m]: 0.40  
Sample Type: B

### Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 2.5kg rammer	Period of soaking	days
		Time to surface	days
Sample Description:	Yellowish brown slightly gravelly sandy CLAY	Amount of swell recorded	mm
Material retained on 20mm sieve removed	19 %	Dry density after soaking	Mg/m3
Initial Specimen details	Bulk density 2.05 Mg/m3	Surcharge applied	8 kg
	Dry density 1.70 Mg/m3		4.9 kPa
	Moisture content 21 %		

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	1.3	1.5	1.5	1.4	19
BASE	No	1.1	1.4	1.4		19

Remarks: Test/ Specimen specific remarks:

Approved: [Signature]

Signed: [Signature]

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

## Determination of California Bearing Ratio

Tested in Accordance with BS 1377-4: 1990: Clause 7

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

### Test Results:

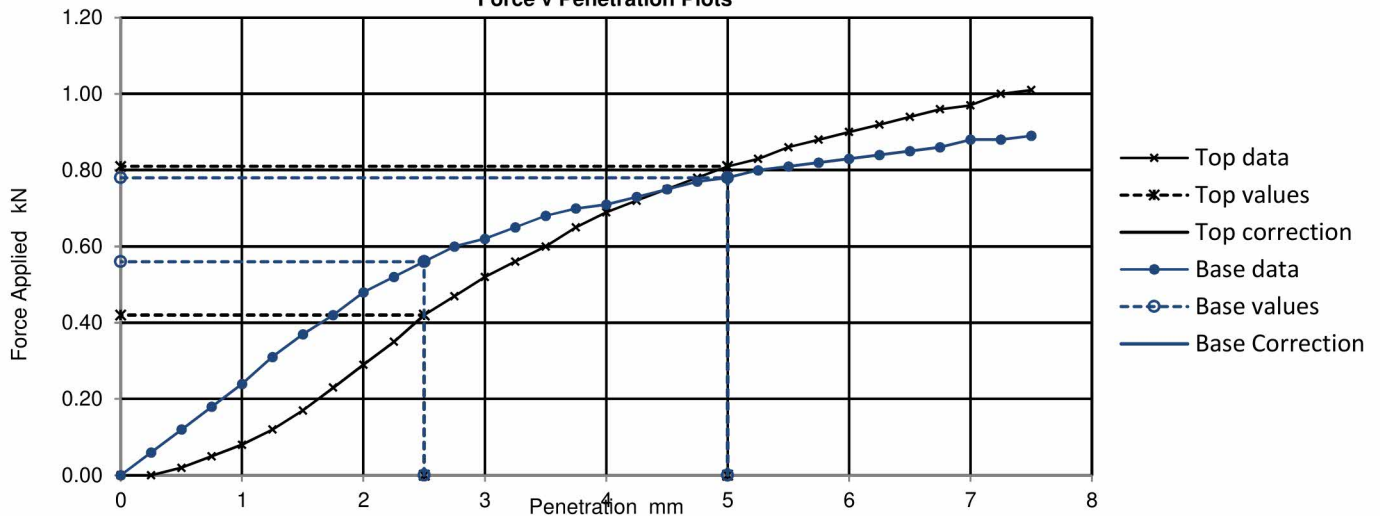
Laboratory Reference: 862263  
Hole No.: TP21  
Sample Reference: 69

Depth Top [m]: 1.20  
Depth Base [m]: 1.20  
Sample Type: B

### Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 2.5kg rammer	Period of soaking	days
		Time to surface	days
Sample Description:	Dark brown slightly gravelly CLAY	Amount of swell recorded	mm
Material retained on 20mm sieve removed	0 %	Dry density after soaking	Mg/m3
Initial Specimen details	Bulk density 1.96 Mg/m3	Surcharge applied	8 kg
	Dry density 1.55 Mg/m3		4.9 kPa
	Moisture content 26 %		

Force v Penetration Plots



Results

Curve correction applied	CBR Values, %				Moisture Content %
	2.5mm	5mm	Highest	Average	
TOP	No	3.2	4.1	4.1	4.1
BASE	No	4.2	3.9	4.2	
					25
					24

Remarks: Test/ Specimen specific remarks:

Approved: [Signature]  
Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed: [Signature]  
Darren Berrill  
Geotechnical General Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

## Determination of California Bearing Ratio

Tested in Accordance with BS 1377-4: 1990: Clause 7

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

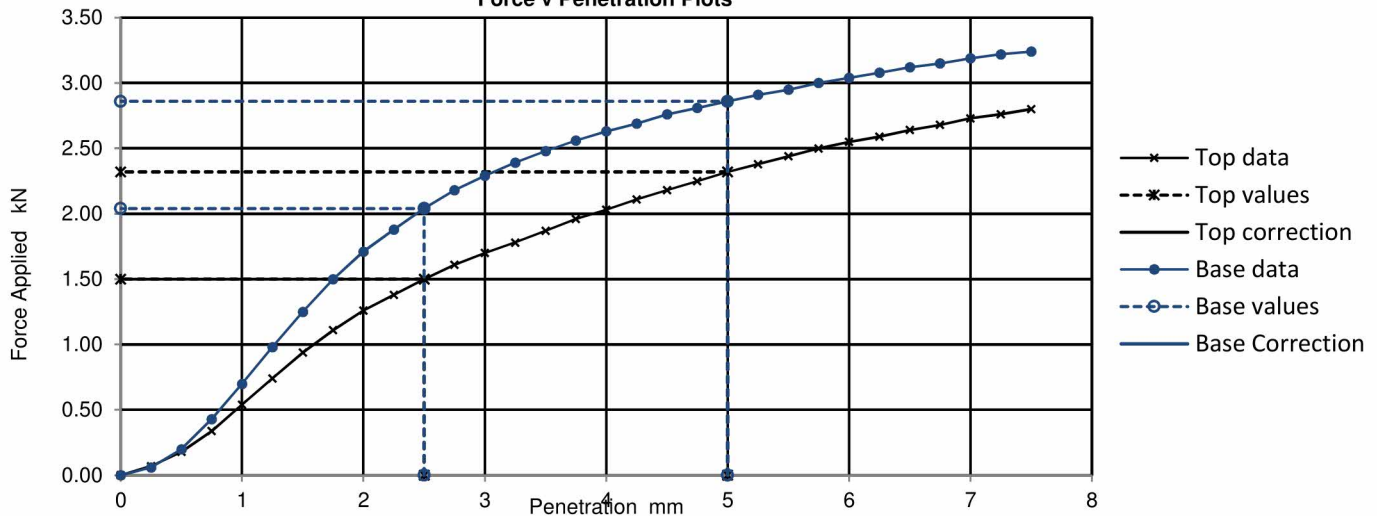
### Test Results:

Laboratory Reference: 862261  
Hole No.: TP19  
Sample Reference: 64  
Depth Top [m]: 1.10  
Depth Base [m]: 1.10  
Sample Type: B

### Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 4.5kg rammer	Period of soaking	days
		Time to surface	days
Sample Description:	Dark brown slightly gravelly CLAY	Amount of swell recorded	mm
Material retained on 20mm sieve removed	0 %	Dry density after soaking	Mg/m3
Initial Specimen details	Bulk density 2.06 Mg/m3	Surcharge applied	8 kg
	Dry density 1.71 Mg/m3		4.9 kPa
	Moisture content 21 %		

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	11.0	12.0	12.0		20
BASE	No	15.0	14.0	15.0		20

Remarks: Test/ Specimen specific remarks:

Approved: \_\_\_\_\_ Signed: \_\_\_\_\_

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Darren Berrill  
Geotechnical General Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Determination of California Bearing Ratio

Tested in Accordance with BS 1377-4: 1990: Clause 7

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 01/12/2017  
Sampled By: Not Given

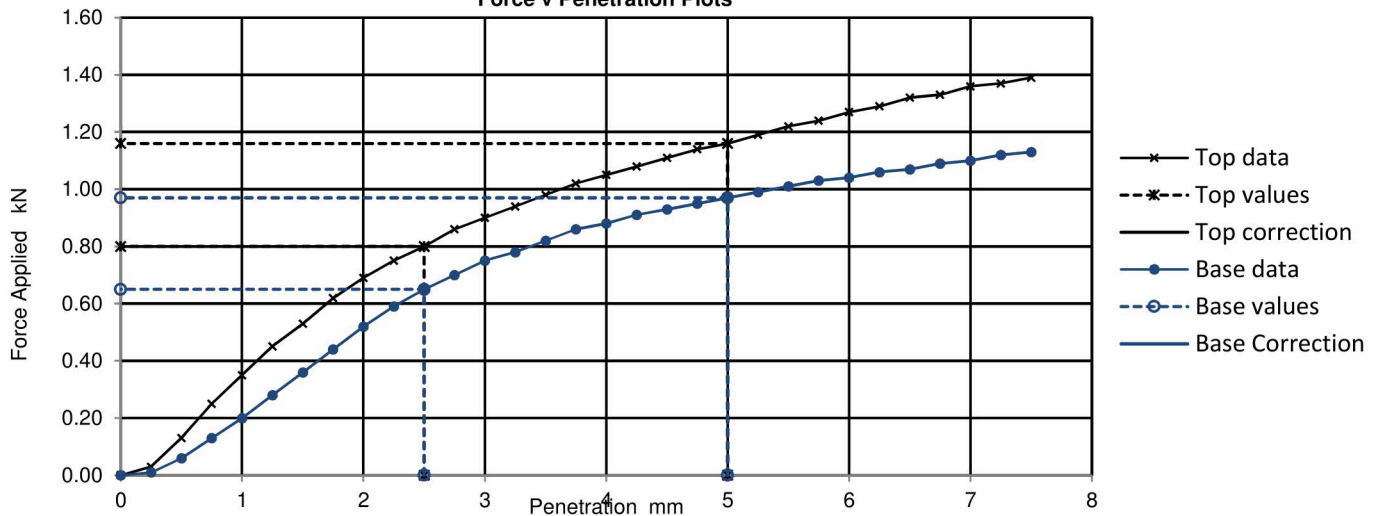
### Test Results:

Laboratory Reference: 862269  
Hole No.: TP25  
Sample Reference: 83  
Depth Top [m]: 0.50  
Depth Base [m]: 0.50  
Sample Type: B

### Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 4.5kg rammer	Period of soaking	days
		Time to surface	days
Sample Description:	Dark brown slightly gravelly CLAY	Amount of swell recorded	mm
Material retained on 20mm sieve removed	0 %	Dry density after soaking	Mg/m3
Initial Specimen details	Bulk density 2.00 Mg/m3	Surcharge applied	8 kg
	Dry density 1.60 Mg/m3		4.9 kPa
	Moisture content 25 %		

Force v Penetration Plots



Results

Curve correction applied	CBR Values, %				Moisture Content %
	2.5mm	5mm	Highest	Average	
TOP	No	6.1	5.8	6.1	24
BASE	No	4.9	4.9	4.9	

Remarks: Test/ Specimen specific remarks:

Approved: [Signature]  
Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed: [Signature]  
Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Dry Density / Moisture Content Relationship Light Compaction

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



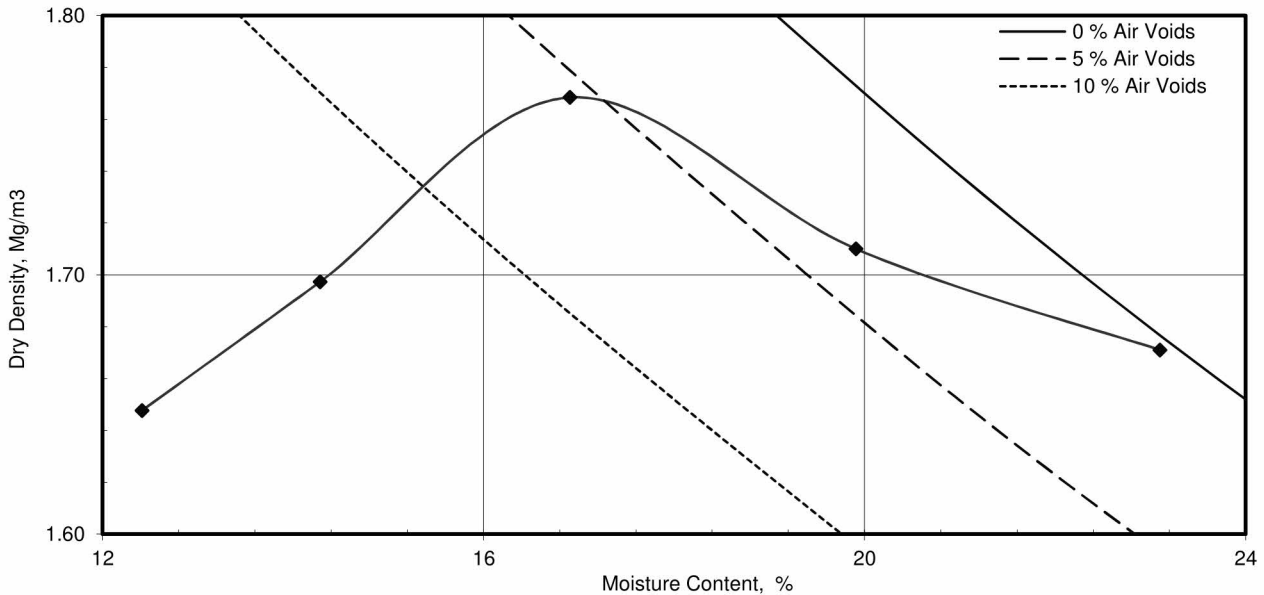
Tested in accordance with BS 1377-4:1990: Clause 3.3 using 2.5kg[light] Rammer

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 04/12/2017  
Sampled By: Not Given

### TEST RESULTS

Laboratory Reference: 862246  
Hole No.: TP10  
Sample Reference: 32  
Sample Description: Dark brown slightly gravelly slightly sandy CLAY  
Depth Top [m]: 1.30  
Depth Base [m]: 1.30  
Sample Type: B



Preparation	Material used was natural	
Mould Type	1 Litre	
Samples Used	Composite specimens tested	
Material Retained on 37.5 mm Sieve	%	3
Material Retained on 20.0 mm Sieve	%	4
Particle Density - Assumed	Mg/m³	2.74
As received Moisture Content	%	23
<b>Maximum Dry Density</b>	Mg/m³	<b>1.77</b>
<b>Optimum Moisture Content</b>	%	<b>17</b>

Remarks: Insufficient material - compacted in proctor mould

Approved: [Signature]  
Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed: [Signature]  
Darren Berrill  
Geotechnical General  
Manager

Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Dry Density / Moisture Content Relationship Light Compaction

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



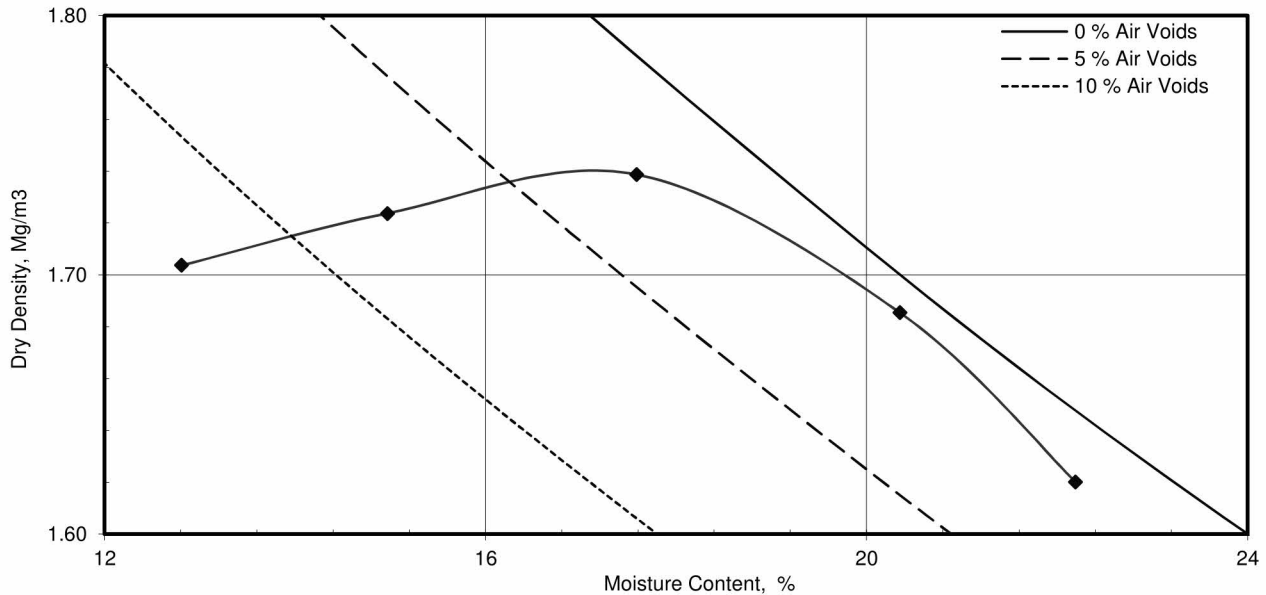
Tested in accordance with BS 1377-4:1990: Clause 3.3 using 2.5kg[light] Rammer

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 02/12/2017  
Sampled By: Not Given

### TEST RESULTS

Laboratory Reference: 862253  
Hole No.: TP15  
Sample Reference: 49  
Sample Description: Dark brown slightly sandy CLAY  
Depth Top [m]: 1.20  
Depth Base [m]: 1.20  
Sample Type: B



Preparation	Material used was natural	
Mould Type	1 Litre	
Samples Used	Composite specimens tested	
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m <sup>3</sup>	2.60
As received Moisture Content	%	20
<b>Maximum Dry Density</b>	Mg/m <sup>3</sup>	<b>1.74</b>
<b>Optimum Moisture Content</b>	%	<b>18</b>

Remarks:

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section



Signed:

Darren Berrill  
Geotechnical General  
Manager



Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

## Dry Density / Moisture Content Relationship Light Compaction

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



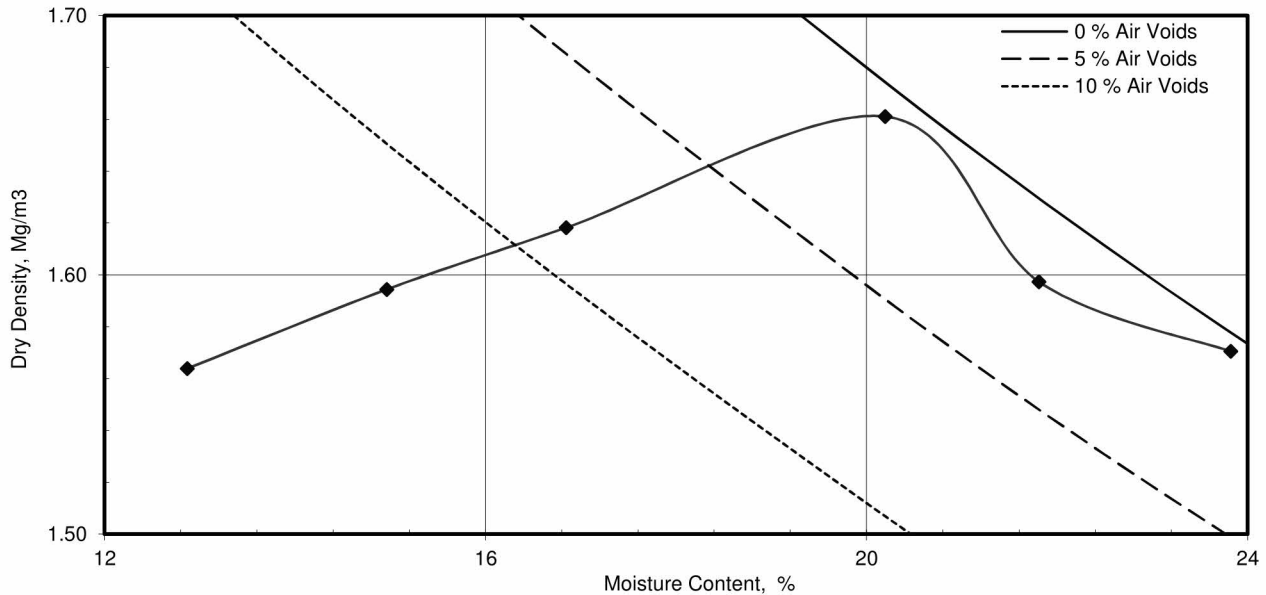
Tested in accordance with BS 1377-4:1990: Clause 3.3 using 2.5kg[light] Rammer

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 04/12/2017  
Sampled By: Not Given

### TEST RESULTS

Laboratory Reference: 862262  
Hole No.: TP20  
Sample Reference: 67  
Sample Description: Dark brown slightly sandy CLAY  
Depth Top [m]: 2.10  
Depth Base [m]: 2.10  
Sample Type: B



Preparation	Material used was natural	
Mould Type	1 Litre	
Samples Used	Composite specimens tested	
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m <sup>3</sup>	2.53
As received Moisture Content	%	22
<b>Maximum Dry Density</b>	Mg/m <sup>3</sup>	<b>1.66</b>
<b>Optimum Moisture Content</b>	%	<b>20</b>

Remarks:

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section



Signed:

Darren Berrill  
Geotechnical General  
Manager



Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

## Dry Density / Moisture Content Relationship Heavy Compaction

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Environmental Science

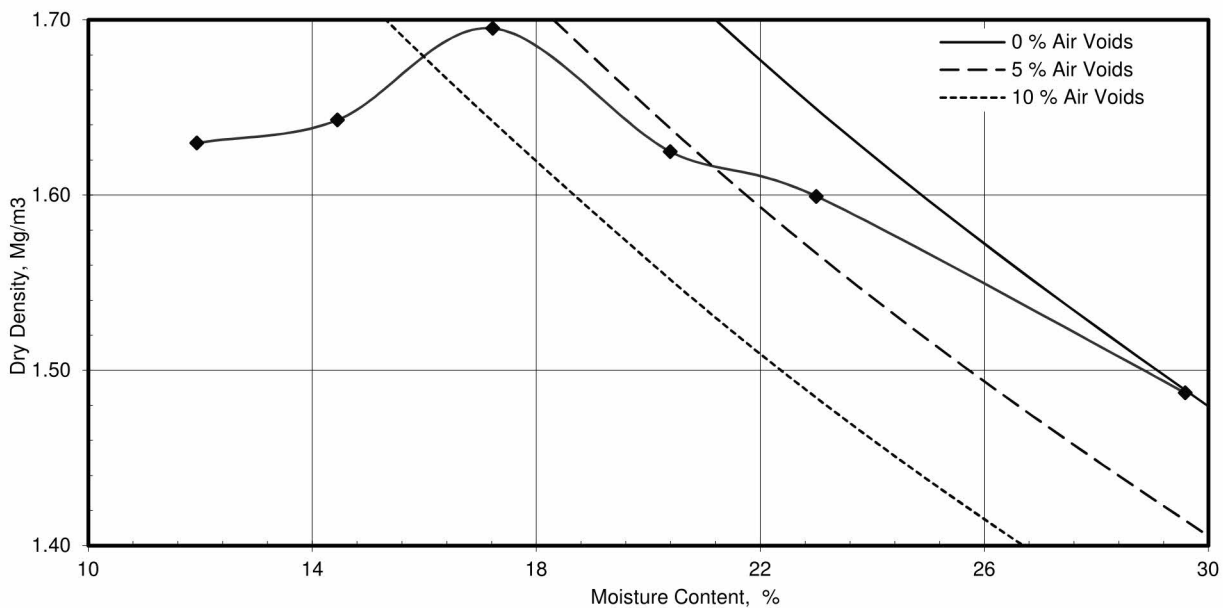
Tested in accordance with BS 1377-4: 1990: Clause 3.5 using 4.5kg [heavy] Rammer

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 02/12/2017  
Sampled By: Not Given

### TEST REPORTS

Laboratory Reference: 862249  
Hole No.: TP12  
Sample Reference: 39  
Sample Description: Dark brown CLAY  
Depth Top [m]: 0.60  
Depth Base [m]: 0.60  
Sample Type: B



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m <sup>3</sup>	2.66
As received Moisture Content	%	30
<b>Maximum Dry Density</b>	Mg/m <sup>3</sup>	<b>1.70</b>
<b>Optimum Moisture Content</b>	%	<b>17</b>

Remarks:

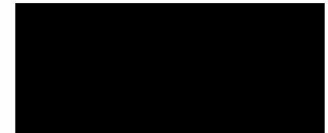
Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section



Signed:

Darren Berrill  
Geotechnical General  
Manager



Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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4041

# TEST CERTIFICATE

## Dry Density / Moisture Content Relationship Heavy Compaction

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Environmental Science

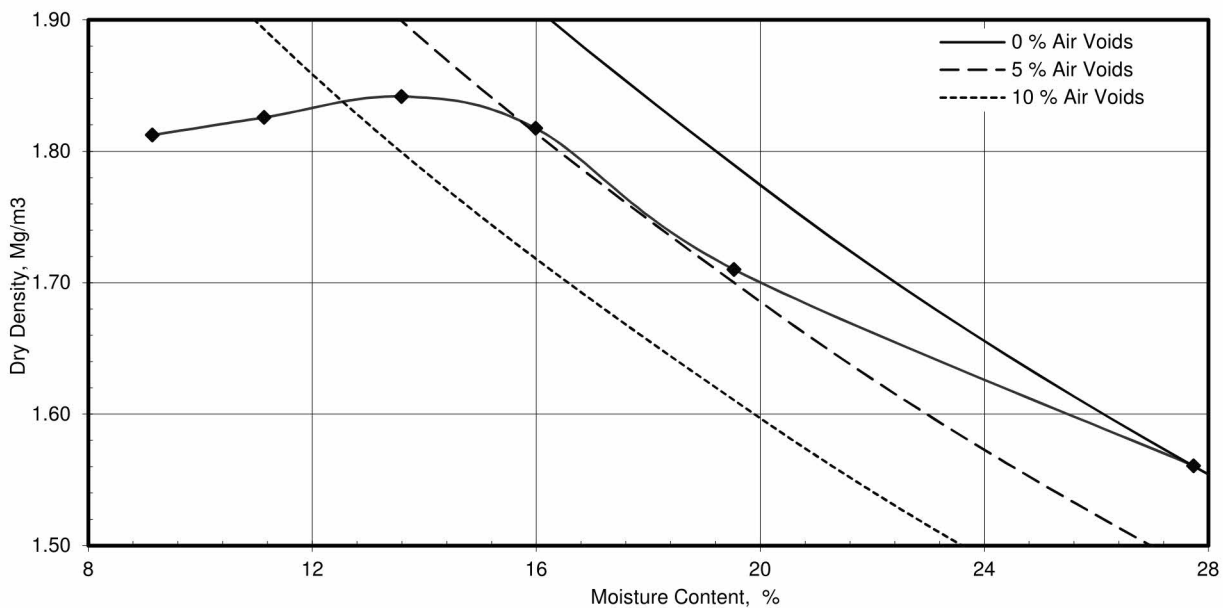
Tested in accordance with BS 1377-4: 1990: Clause 3.5 using 4.5kg [heavy] Rammer

Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 04/12/2017  
Sampled By: Not Given

### TEST REPORTS

Laboratory Reference: 862264  
Hole No.: TP22  
Sample Reference: 72  
Sample Description: Yellowish brown slightly sandy CLAY  
Depth Top [m]: 0.60  
Depth Base [m]: 0.60  
Sample Type: B



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m <sup>3</sup>	2.75
As received Moisture Content	%	28
<b>Maximum Dry Density</b>	Mg/m <sup>3</sup>	<b>1.84</b>
<b>Optimum Moisture Content</b>	%	<b>14</b>

Remarks:

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section



Signed:

Darren Berrill  
Geotechnical General  
Manager



Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



4041

# TEST CERTIFICATE

## Dry Density / Moisture Content Relationship Heavy Compaction

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Environmental Science

Tested in accordance with BS 1377-4: 1990: Clause 3.5 using 4.5kg [heavy] Rammer

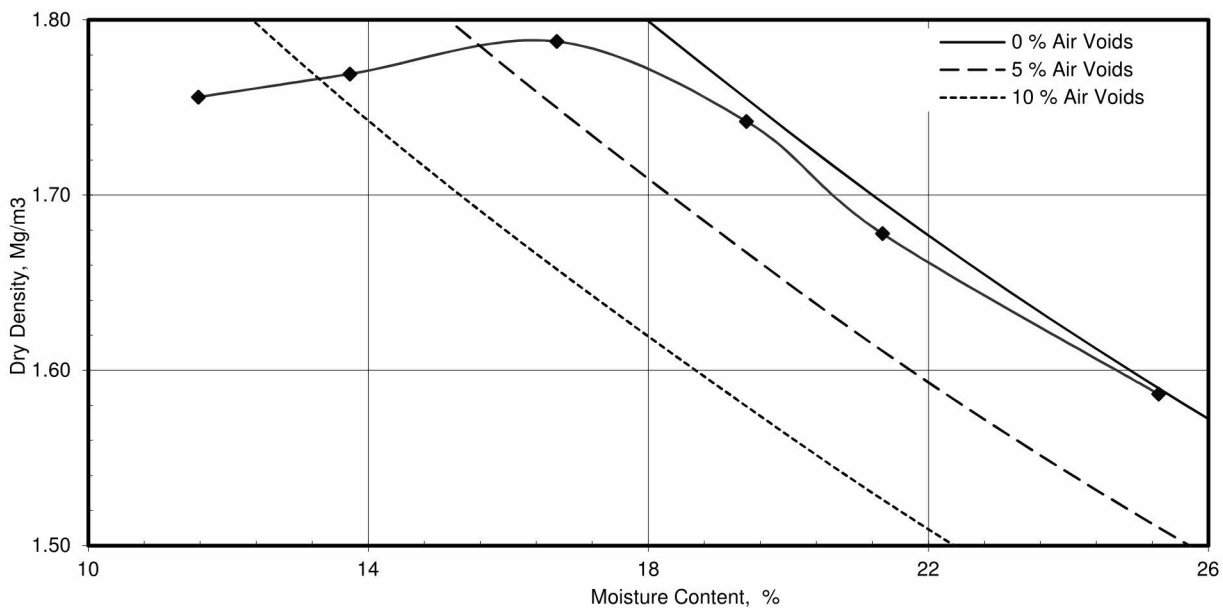
Client: BWB Consulting Limited  
Client Address: 5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ  
Contact: Patrick Taylor  
Site Name: Witham St Hughs, Ph3 S38 Design  
Site Address: Not Given

Client Reference: NTM2082  
Job Number: 17-68371  
Date Sampled: Not Given  
Date Received: 09/11/2017  
Date Tested: 03/12/2017  
Sampled By: Not Given

### TEST REPORTS

Laboratory Reference: 862269  
Hole No.: TP25  
Sample Reference: 83  
Sample Description: Dark brown slightly gravelly CLAY

Depth Top [m]: 0.50  
Depth Base [m]: 0.50  
Sample Type: B



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m <sup>3</sup>	2.66
As received Moisture Content	%	25
<b>Maximum Dry Density</b>	Mg/m <sup>3</sup>	<b>1.79</b>
<b>Optimum Moisture Content</b>	%	<b>17</b>

Remarks:

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section



Signed:

Darren Berrill  
Geotechnical General  
Manager



Date Reported: 06/12/2017

for and on behalf of i2 Analytical Ltd

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**Patrick Taylor**  
BWB Consulting Limited  
5th Floor  
Waterfront House  
Nottingham  
NG2 3DQ

i2 Analytical Ltd.  
7 Woodshots Meadow,  
Croxley Green  
Business Park,  
Watford,  
Herts,  
WD18 8YS

**t:** 01923 225404  
**f:** 01923 237404  
**e:** reception@i2analytical.com

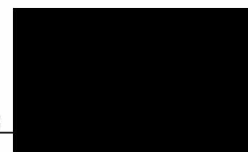
**e:** patrick.taylor@bwiconsulting.com

## **Analytical Report Number : 17-68284**

Replaces Analytical Report Number : 17-68284, issue no. 1

<b>Project / Site name:</b>	Witham St. Hughs Phase 3 S38 Design	<b>Samples received on:</b>	20/11/2017
<b>Your job number:</b>	NTM2082	<b>Samples instructed on:</b>	20/11/2017
<b>Your order number:</b>	POR014856	<b>Analysis completed by:</b>	01/12/2017
<b>Report Issue Number:</b>	2	<b>Report issued on:</b>	05/12/2017
<b>Samples Analysed:</b>	10 soil samples		

**Signed:**



Jordan Hill  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 17-68284

Project / Site name: Witham St. Hughs Phase 3 S38 Design

Your Order No: POR014856

Lab Sample Number	861754			861755			861756			861757			861758		
Sample Reference	TP01			TP04			TP07			TP10			TP11		
Sample Number	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Depth (m)	1.50-1.50			1.20-1.20			0.70-0.70			0.60-0.60			1.30-1.30		
Date Sampled	08/11/2017			07/11/2017			07/11/2017			07/11/2017			07/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	11	12	8.3	21	16							
Total mass of sample received	kg	0.001	NONE	0.44	0.35	0.52	0.26	0.39							

**General Inorganics**

pH - Automated	pH Units	N/A	MCERTS	7.8	7.8	7.5	7.8	7.8
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.016	0.059	0.039	0.035	0.086



Analytical Report Number: 17-68284

Project / Site name: Witham St. Hughs Phase 3 S38 Design

Your Order No: POR014856

Lab Sample Number	861759			861760			861761			861762			861763		
Sample Reference	TP16			TP17			TP19			TP23			TP24		
Sample Number	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Depth (m)	0.40-0.40			1.60-1.60			1.10-1.10			1.20-1.20			0.90-0.90		
Date Sampled	09/11/2017			08/11/2017			08/11/2017			09/11/2017			07/11/2017		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)															
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	15	17	16	22	16	22	16	22	16	16	16	
Total mass of sample received	kg	0.001	NONE	0.31	0.36	0.52	0.37	0.31	0.37	0.31	0.37	0.31	0.31	0.31	

**General Inorganics**

pH - Automated	pH Units	N/A	MCERTS	7.8	7.5	6.8	8.0	8.3
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.019	0.14	0.12	0.078	0.075



Analytical Report Number : 17-68284

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\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
861754	TP01	None Supplied	1.50-1.50	Brown sand.
861755	TP04	None Supplied	1.20-1.20	Brown sandy clay.
861756	TP07	None Supplied	0.70-0.70	Brown sand with gravel.
861757	TP10	None Supplied	0.60-0.60	Brown clay.
861758	TP11	None Supplied	1.30-1.30	Grey clay with gravel.
861759	TP16	None Supplied	0.40-0.40	Brown clay.
861760	TP17	None Supplied	1.60-1.60	Brown clay with gravel.
861761	TP19	None Supplied	1.10-1.10	Brown clay.
861762	TP23	None Supplied	1.20-1.20	Brown clay with vegetation.
861763	TP24	None Supplied	0.90-0.90	Brown clay and sand with vegetation.



Analytical Report Number : 17-68284

Project / Site name: Witham St. Hughs Phase 3 S38 Design

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



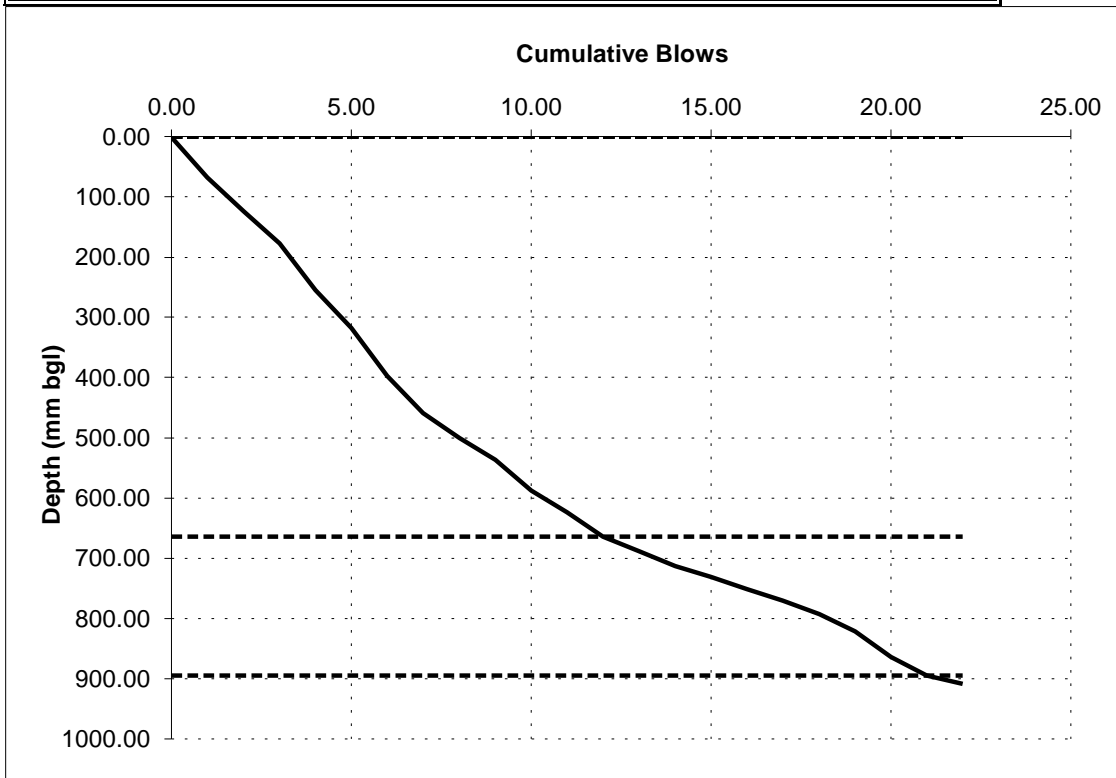
APPENDIX 5  
DCP-TRL TEST RESULTS

**Dynamic Cone Penetrometer**



PROJECT NUMBER	NTM2082
PROJECT TITLE	Witham St Hughs Ph3 S38 Design
TEST REFERENCE	TP09
DATE	07-Nov-17
MATERIAL/ STRATA TYPE	Sandy Gravelly Clay
START DEPTH (mm bgl)	0.30
WEATHER/ GROUND CONDITION	Dry

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)
1	11	11	664	664	4.0
2	9	20	231	895	9.8
3	1	21	13	908	20.1



CBR Interpretation based on the TRL Equation:  $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$





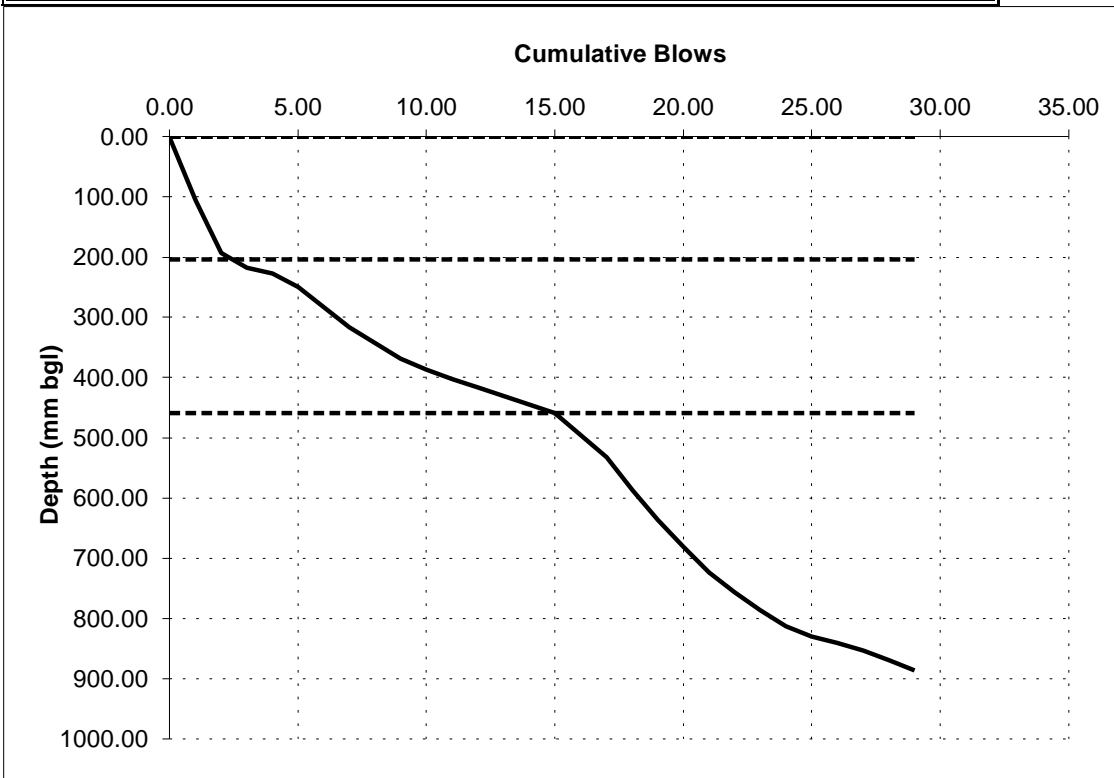


**Dynamic Cone Penetrometer**



PROJECT NUMBER	NTM2082
PROJECT TITLE	Witham St Hughs Ph3 S38 Design
TEST REFERENCE	TP16
DATE	09-Nov-17
MATERIAL/ STRATA TYPE	Gravelly Sandy Clay
START DEPTH (mm bgl)	0.35
WEATHER/ GROUND CONDITION	Dry

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)
1	2	2	204	204	2.3
2	10	12	255	459	9.8
3	16	28	427	886	9.4



CBR Interpretation based on the TRL Equation:  $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$





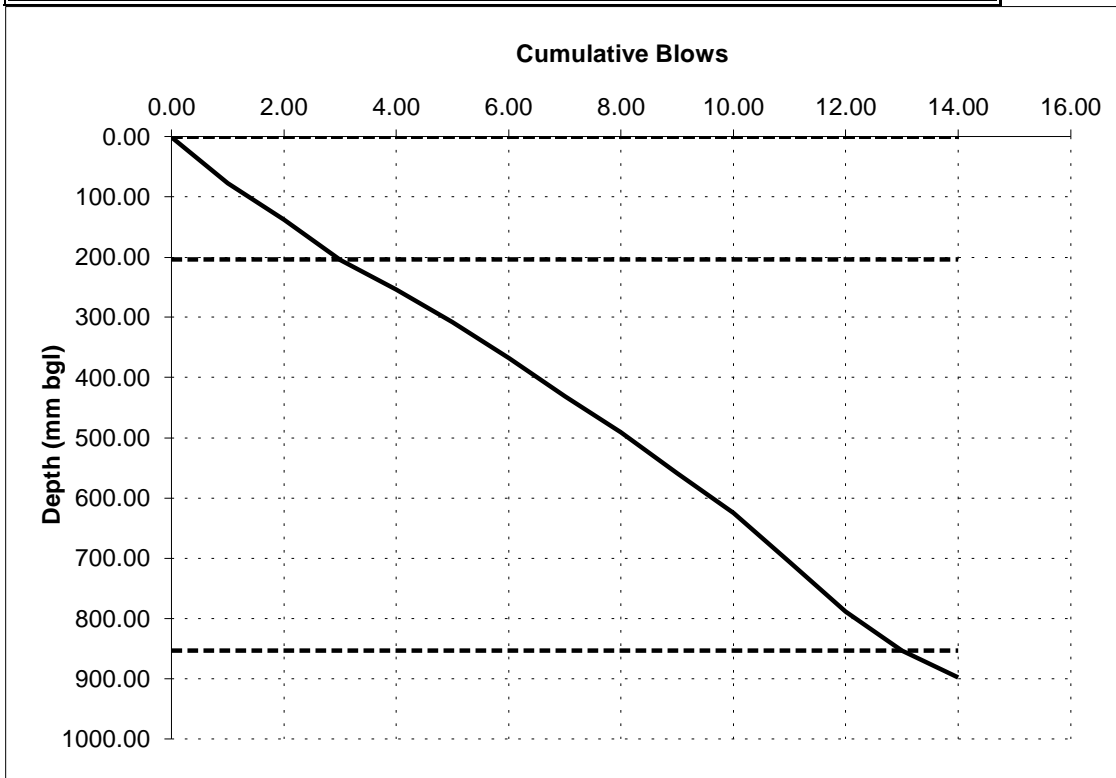


**Dynamic Cone Penetrometer**



PROJECT NUMBER	<b>NTM2082</b>
PROJECT TITLE	<b>Witham St Hughs Ph3 S38 Design</b>
TEST REFERENCE	<b>TP21</b>
DATE	09-Nov-17
MATERIAL/ STRATA TYPE	Sandy Clay
START DEPTH (mm bgl)	0.35
WEATHER/ GROUND CONDITION	Dry

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)
1	2	2	204	204	<b>2.3</b>
2	10	12	649	853	<b>3.7</b>
3	1	13	45	898	<b>5.4</b>



CBR Interpretation based on the TRL Equation:  $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$



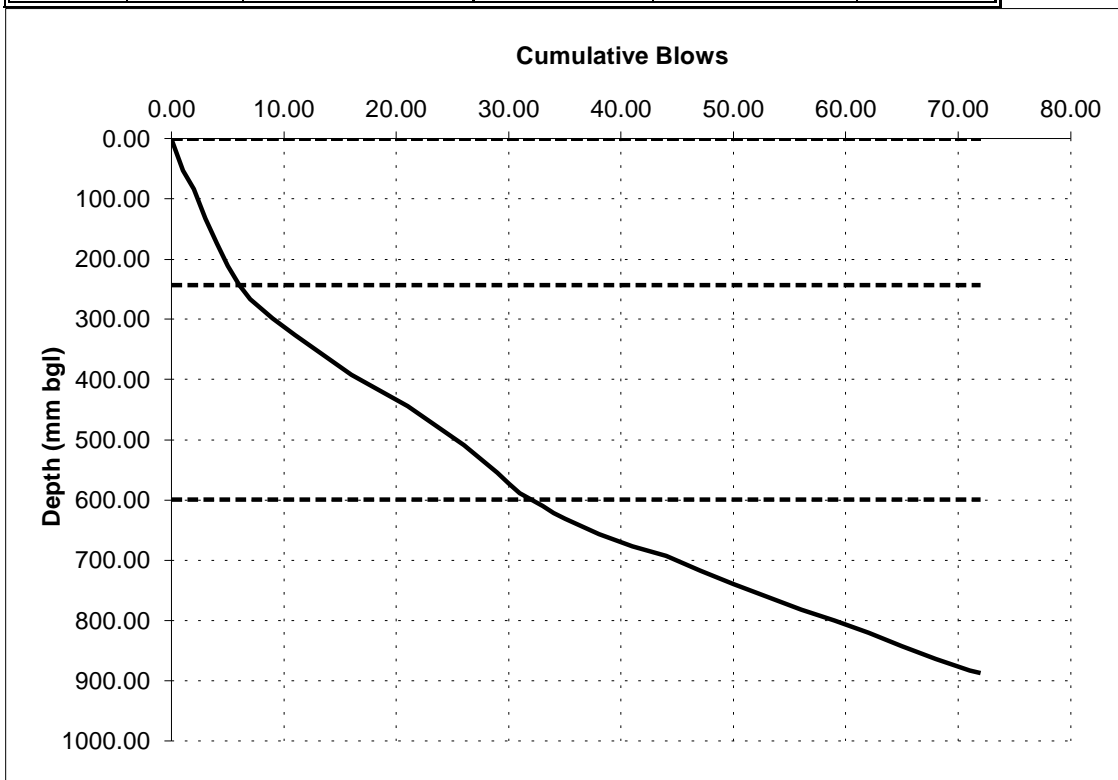


### Dynamic Cone Penetrometer



PROJECT NUMBER	NTM2082
PROJECT TITLE	Witham St Hughs Ph3 S38 Design
TEST REFERENCE	TP01
DATE	07-Nov-17
MATERIAL/ STRATA TYPE	Gravelly Sand
START DEPTH (mm bgl)	0.42
WEATHER/ GROUND CONDITION	Dry

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)
1	5	5	243	243	5.0
2	26	31	356	599	19.0
3	40	71	288	887	37.5



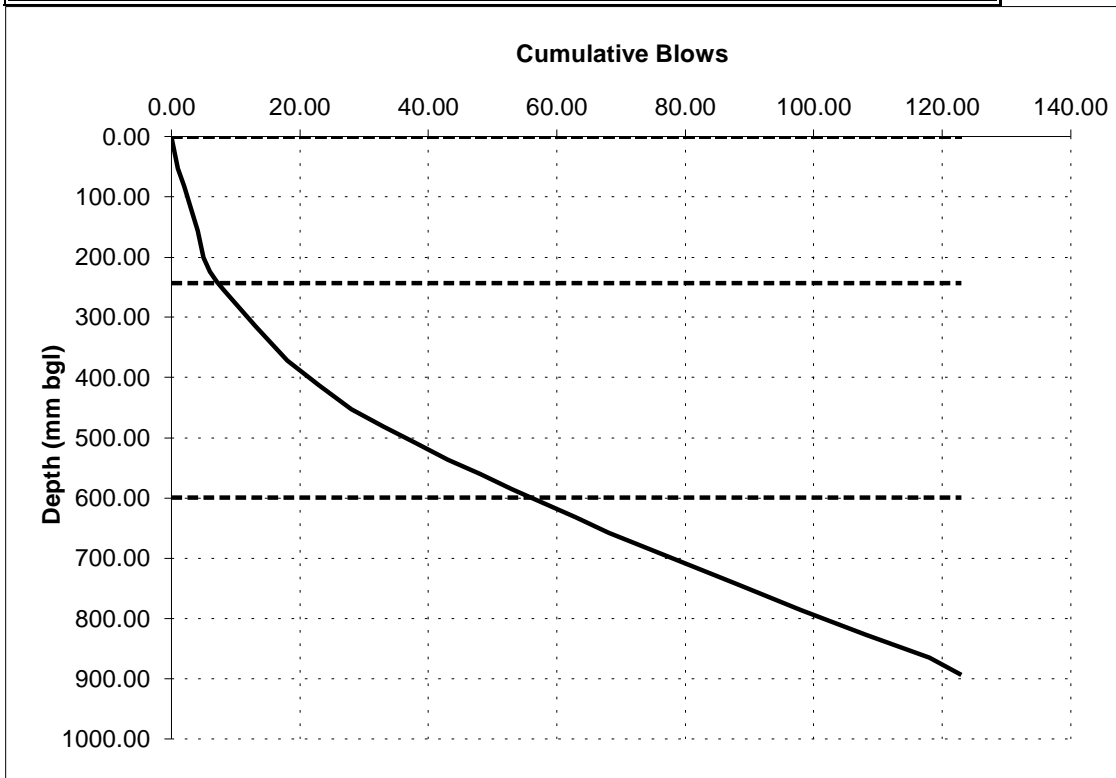
CBR Interpretation based on the TRL Equation:  $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

### Dynamic Cone Penetrometer



PROJECT NUMBER	NTM2082
PROJECT TITLE	Witham St Hughs Ph3 S38 Design
TEST REFERENCE	TP03
DATE	08-Nov-17
MATERIAL/ STRATA TYPE	Gravelly Clayey Sand
START DEPTH (mm bgl)	0.45
WEATHER/ GROUND CONDITION	Dry

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)
1	7	7	243	243	7.1
2	46	53	356	599	34.7
3	65	118	288	887	62.6



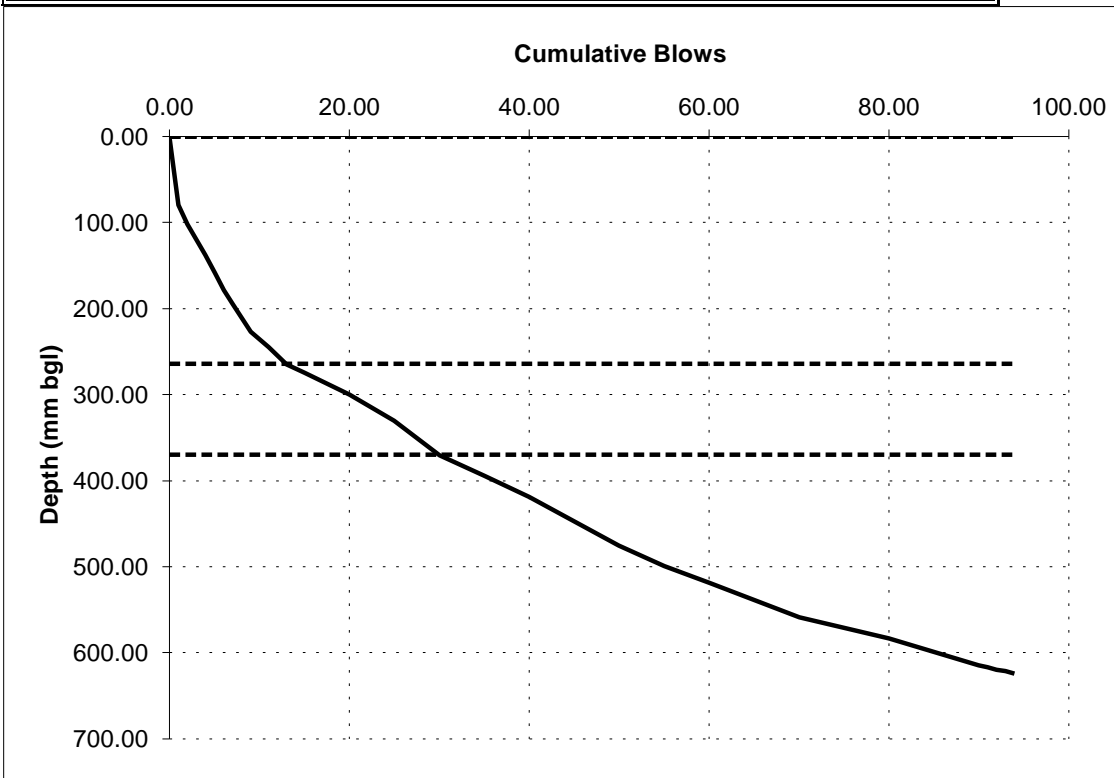
CBR Interpretation based on the TRL Equation:  $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

**Dynamic Cone Penetrometer**



PROJECT NUMBER	NTM2082
PROJECT TITLE	Witham St Hughs Ph3 S38 Design
TEST REFERENCE	TP06
DATE	08-Nov-17
MATERIAL/ STRATA TYPE	Gravelly Sand
START DEPTH (mm bgl)	0.45
WEATHER/ GROUND CONDITION	Dry
Terminated due to bouncing of weight	

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)
1	11	11	264	264	10.5
2	14	25	106	370	35.5
3	68	93	254	624	75.0



CBR Interpretation based on the TRL Equation:  $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$



APPENDIX 6  
DERIVATION OF BWB GSAC



# BWB HUMAN HEALTH GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

## Human Health Generic Screening Criteria

The Environment Agency published the revised CLEA framework for assessing the risk to human health from soil contamination in January 2009. The framework comprises a technical background document (EA, 2009a), toxicological assessment EA 2009b and CLEA spreadsheet model (EA 2009c). The new framework supersedes the 2002 CLEA model and subsequent briefing notes. The 2002 CLEA software and CLEA 2005 have also been withdrawn. All previously published Soil Guideline Values (SGV) have been withdrawn. The EA plan to issue revised SGVs for selected substances in a rolling programme from early in 2009. To date SGVs have been issued for the following substances.

- Arsenic
- cadmium
- nickel
- selenium
- benzene
- toluene
- ethylbenzene
- xylene
- dioxins and dioxin like PCBS
- Phenol
- Mercury
- 

In the absence of an SGV for a particular contaminant Generic assessment criteria have been generated by BWB using the CLEA framework. This is a similar approach to Generic screening criteria published by LQM/CIEH and CLAIRE/EIC.

## Conceptual Site Model

The standard exposure pathways and Conceptual Models for human exposure to contaminants for different site uses are set out in the updated technical background to the CLEA model (Environment Agency 2009a).

## Descriptive Conceptual Models (From Environment Agency 2009a)

### Residential

This generic scenario assumes a typical residential property consisting of a two-storey house built on a ground bearing slab with a private garden consisting of lawn, flower beds and a small fruit and vegetable patch. The occupants are assumed to be parents with young children, who make regular use of the garden area.

The key assumptions for BWB GSACs are

Critical receptor is a young female child (aged zero to six years old)

Exposure duration is six years

Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce, consumption of soil attached to home grown produce, skin contact with soils and indoor dusts, and inhalation of indoor and outdoor dust and vapours.

Soil type is a Sandy Loam with 1% organic matter

Building type is a two storey small terraced house

## Commercial/industrial

There are many different kinds of workplace and work-related activities. This generic scenario assumes a typical commercial or light industrial property consisting of a three storey building at which employees spend most time indoors and are involved in office based or relatively light physical work.

The key assumptions for BWB GSACs are

Critical receptor is a working female adult (aged 16 to 65 years)

Exposure duration is a working lifetime of 49 years

Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts, and inhalation of dust and vapours.

Soil type is a Sandy Loam with 1% organic matter

Building type is a three storey office (post 1970) (Representative of new buildings)

The 2009a report identifies 10 potential exposure pathways by which contaminated soils may impact human health and also sets out which pathways are applicable for four standard land uses. The pathways for the residential and commercial end uses are shown below.

## Screening Criteria Modelling

The CLEA model version 1.06 has been used to calculate BWB GSACs. BWB have used the model to calculate Individual criteria for each relevant pathway so, for example, in a residential with vegetable uptake scenario we would need six individual criteria: -

- Ingestion of soil and dust
- Ingestion of contaminated vegetables and soil attached to vegetables
- Dermal contact indoors and outdoors
- Particulate dust inhalation indoors and outdoors
- Vapour inhalation indoors
- Vapour inhalation outdoors

The final overall assessment criteria is calculated by adding together the reciprocal of the individual criteria for each pathway, therefore if several of the individual criteria are of similar magnitude the final criteria may be substantially lower than the lowest individual criteria so that total exposure is below the respective health threshold.

$$1/\text{GSAC} = \sum 1/\text{ASC}_{\text{ingestion}} + 1/\text{ASC}_{\text{inhalation}} + 1/\text{ASC}_{\text{dermal}}$$

By adopting this methodology BWB are able to provide a more flexible site specific approach to generic human health risk assessment.

## Pathway Selection - Generic Site Assessment Criteria

Pathway	Residential	Commercial / Industrial
Ingestion of Soil	Yes	Yes
Ingestion of site derived household dust	Yes	Yes
Ingestion of contaminated homegrown produce	Optional	No
Ingestion of soil attached to homegrown produce	Optional	No
Dermal contact with Soil	Yes	Yes
Dermal contact with site derived household dust	Yes	Yes
Inhalation of fugitive soil dust	Yes	Yes
Inhalation of fugitive site derived household dust	Yes	Yes
Inhalation of vapours outside	Yes	Yes
Inhalation of vapours inside	Yes	Yes

## Health Criteria Values

The general hierarchy for selecting health criteria values is as follows:

1. EA / DEFRA TOX report
2. Other UK authoritative body e.g. Committee on toxicity, Food Standards Agency
3. EU authoritative body
4. Other EU body e.g. RIVM
5. Other US/International Body

In the absence of updated TOX reports which take into account the recommendations of EA report (2009b) TOX reports produced under the old regime have been used and GSACs will be updated accordingly as further authoritative information is issued.

## REFERENCES

Environment Agency, 2009a, Updated Technical Background to the CLEA Model, Science Report SC050021/SR3 ISBN 978-1-84432-856-7

Environment Agency, 2009b, Human health Toxicological Assessment of Contaminants in Soil, Science Report SC050021/SR2 ISBN 978-1-84432-858-1

Environment Agency 2009c, CLEA Software Handbook (version 1.06) Science Report SC050021/SR4, ISBN 978-1-84432-857-4

EIC/AGS/CL:AIRE (2010), Soil Generic Assessment Criteria for Human Health Risk Assessment. Environment Industries Commission (EIC), Association of Geotechnical and Geoenvironmental Specialists (AGS), Contaminated Land: Applications in Real Environments (CL:AIRE). Published by CL:AIRE. ISBN: 978-1-905046-20-1.

Nathanail, C.P., McCaffrey,C., Ashmore,M.H., Cheng, Y.Y., Gillett, A., Ogden,R. & Scott,D. (2009). The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition). Land Quality Press, Nottingham. ISBN: 0-9547474-7-X.

Residential Pathway Specific Assessment Sub Criteria derived March 2009	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion	Ingestion of Contaminated Vegetables and soil attached to vegetables	Dermal contact	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg	mg/kg
Arsenic	NR	NR	4.04E+01	4.29E+02	2.62E+02	8.50E+01	3.24E+01	N/A
Barium	NR	NR	1.35E+04	1.48E+03	NR	4.25E+06	1.33E+03	N/A
Beryllium	NR	NR	1.56E+02	1.03E+03	NR	2.89E+01	2.38E+01	N/A
Boron	NR	NR	1.08E+04	1.50E+02	NR	3.40E+06	1.48E+02	N/A
Cadmium	NR	NR	1.20E+02	1.22E+01	1.64E+04	1.82E+02	1.04E+01	N/A
Chromium III	NR	NR	1.44E+04	1.91E+04	NR	4.53E+06	8.18E+03	N/A
Chromium VI	NR	NR	3.06E+02	4.05E+02	NR	4.25E+01	3.42E+01	N/A
Copper	NR	NR	1.08E+04	5.13E+03	NR	3.40E+06	3.47E+03	N/A
Lead							4.50E+02	N/A
Inorganic Mercury	NR	NR	2.62E+02	5.81E+02	NR	2.55E+03	1.69E+02	N/A
Nickel	NR	NR	8.09E+02	1.64E+03	3.15E+04	1.27E+02	1.27E+02	N/A
Selenium	NR	NR	5.97E+02	8.51E+02	NR	1.88E+05	3.50E+02	N/A
Vanadium	NR	NR	2.30E+02	1.82E+02	NR	8.29E+03	1.00E+02	N/A
Zinc	NR	NR	4.37E+04	5.82E+03	NR	1.38E+07	5.13E+03	N/A
Cyanide (free)							4.30E+01	N/A
Cyanide (Complex)							2.13E+02	N/A
Phenol	5.89E+02	5.52E+05	9.17E+04	4.53E+02	6.63E+02	3.22E+05	1.84E+02	4.16E+04
Ethylbenzene	1.70E+02	1.79E+06	1.34E+04	1.07E+02	2.62E+04	9.01E+06	6.52E+01	5.18E+02
m-xylene	5.56E+01	5.04E+05	2.42E+04	2.05E+02	4.71E+04	2.19E+06	4.36E+01	6.25E+02
p-xylene	5.34E+01	4.94E+05	2.42E+04	1.93E+02	4.71E+04	2.19E+06	4.17E+01	5.76E+02
o-xylene	5.98E+01	5.23E+05	2.42E+04	1.87E+02	4.71E+04	2.19E+06	4.52E+01	4.78E+02
TPH (EC5-6) aliphatic	2.97E+00	2.53E+06	6.74E+05	9.69E+03	1.01E+06	1.12E+08	2.97E+00	3.10E+02
TPH (>EC6-8) aliphatic	7.75E+00	4.08E+06	6.74E+05	3.30E+04	1.01E+06	1.12E+08	7.75E+00	1.51E+02
TPH (>EC8-10) aliphatic	2.14E+00	4.99E+05	6.74E+03	2.29E+03	1.01E+04	6.08E+06	2.13E+00	8.17E+01
TPH (>EC10-12) aliphatic	1.27E+01	1.22E+06	6.74E+03	1.75E+04	1.01E+04	6.08E+06	1.26E+01	4.98E+01

Residential Pathway Specific Assessment Sub Criteria derived March 2009	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion	Ingestion of Contaminated Vegetables and soil attached to vegetables	Dermal contact	Particulate Dust Inhalation	Residential IGSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	6.38E+01	2.73E+06	6.74E+03	2.23E+05	1.01E+04	6.08E+06	6.28E+01	2.21E+01
TPH (>EC16-21) aliphatic	7.35E+03	7.74E+07	1.35E+05	1.16E+07	2.02E+05	4.25E+07	6.73E+03	9.15E+00
TPH (>EC21-35) aliphatic	7.35E+03	7.74E+07	1.35E+05	1.16E+07	2.02E+05	4.25E+07	6.73E+03	9.15E+00
TPH (>EC35-44) aliphatic	7.35E+03	7.74E+07	1.35E+05	1.16E+07	2.02E+05	4.25E+07	6.73E+03	9.15E+00
TPH (>EC6-7) aromatic (benzene)	2.69E-01	5.63E+03	3.91E+01	1.13E-01	7.61E+01	5.95E+04	7.92E-02	1.22E+03
TPH (>EC7-8) aromatic (toluene)	6.26E+02	8.62E+06	3.00E+04	1.48E+02	5.84E+04	5.81E+07	1.19E+02	8.69E+02
TPH (>EC8-10) aromatic	3.64E+00	2.91E+05	2.70E+03	7.45E+01	4.04E+03	1.21E+06	3.46E+00	6.18E+02
TPH (>EC10-12) aromatic	2.18E+01	7.11E+05	2.70E+03	9.71E+01	4.04E+03	1.21E+06	1.76E+01	3.71E+02
TPH (>EC12-16) aromatic	1.23E+02	1.68E+06	2.70E+03	1.67E+02	4.04E+03	1.21E+06	6.77E+01	1.70E+02
TPH (>EC16-21) aromatic	9.47E+02	3.34E+06	2.02E+03	3.45E+02	3.03E+03	6.37E+05	2.09E+02	5.99E+01
TPH (>EC21-35) aromatic	1.21E+05	2.50E+07	2.02E+03	2.66E+03	3.03E+03	6.37E+05	8.26E+02	4.82E+00
TPH (>EC35-44) aromatic	1.21E+05	2.50E+07	2.02E+03	2.66E+03	3.03E+03	6.37E+05	8.26E+02	4.82E+00
Naphthalene	1.64E+00	3.17E+04	2.64E+03	2.72E+01	3.96E+03	2.93E+04	1.54E+00	7.64E+01
Acenaphthylene	1.36E-01	8.48E+02	2.70E+02	8.15E+00	4.04E+02	2.97E+02	1.33E-01	2.39E+02
Acenaphthene	5.27E+00	1.84E+04	2.70E+03	2.34E+02	4.04E+03	2.97E+03	5.13E+00	1.57E+02
Fluorene	8.67E+03	1.77E+07	5.39E+03	8.53E+02	8.07E+03	1.70E+06	6.26E+02	1.53E+02
Phenanthrene	3.44E+01	3.91E+04	2.70E+03	6.69E+02	4.04E+03	2.97E+03	3.17E+01	1.46E+02
Anthracene	3.41E+05	2.69E+08	4.04E+04	1.30E+04	6.06E+04	1.27E+07	8.27E+03	7.71E+00
Fluoranthene	1.59E+01	7.09E+03	2.70E+02	5.59E+01	4.04E+02	2.97E+02	1.11E+01	1.89E+01
Pyrene	1.52E+02	6.71E+04	2.70E+03	4.96E+02	4.04E+03	2.97E+03	1.04E+02	2.20E+00
Benzo(a)anthracene	1.12E+01	1.57E+03	2.70E+01	2.72E+01	4.04E+01	2.97E+01	4.50E+00	1.71E+00
Chrysene	5.91E+02	1.37E+04	2.70E+02	1.87E+02	4.04E+02	2.97E+02	6.00E+01	4.40E-01
Benzo(b)fluoranthene	1.72E+02	1.93E+03	2.70E+01	3.81E+01	4.04E+01	2.97E+01	7.81E+00	1.22E+00
Benzo(k)fluoranthene	2.83E+02	2.30E+03	2.70E+01	5.52E+01	4.04E+01	2.97E+01	8.51E+00	6.87E-01
Benzo(a)pyrene	2.44E+01	2.13E+02	2.70E+00	4.75E+00	4.04E+00	2.97E+00	8.26E-01	9.11E-01

Residential Pathway Specific Assessment Sub Criteria derived March 2009	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion	Ingestion of Contaminated Vegetables and soil attached to vegetables	Dermal contact	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
Indeno(123-cd)pyrene	1.43E+02	1.79E+03	2.70E+01	3.13E+01	4.04E+01	2.97E+01	7.41E+00	6.14E-02
Dibenzo(ah)anthracene	1.22E+01	2.65E+02	2.70E+00	7.15E+00	4.04E+00	2.97E+00	8.47E-01	3.93E-03
Benzo(g,h,i)perylene	2.56E+07	1.66E+08	4.04E+03	2.41E+04	6.06E+03	1.27E+06	2.20E+03	1.87E-02
Tetrachloroethene (PCE)	1.35E+00	2.65E+05	1.82E+03	1.07E+01	3.55E+03	2.50E+06	1.20E+00	4.24E+02
Trichloroethene (TCE)	1.10E-01	2.22E+04	7.01E+02	2.85E+00	1.05E+03	2.21E+05	1.06E-01	1.54E+03
cis-1,2-Dichloroethene	1.20E-01	2.33E+04	7.30E+02	1.75E+00	1.42E+03	2.30E+05	1.12E-01	3.94E+03
Vinyl Chloride (VC)	5.43E-04	3.59E+02	1.89E+00	3.70E-03	3.67E+00	1.27E+04	4.73E-04	1.36E+03
1,1,2,2-Tetrachloroethane (PCA)	2.76E+00	1.17E+05	7.67E+02	2.72E+00	1.49E+03	2.41E+05	1.37E+00	2.67E+03
1,1,1-Trichloroethane (TCA)	6.33E+00	1.79E+06	8.09E+04	3.22E+02	1.57E+05	2.46E+07	6.21E+00	1.43E+03
1,2-Dichloroethane	6.46E-03	8.09E+02	1.62E+01	3.07E-02	3.15E+01	5.10E+03	5.34E-03	3.41E+03
Carbon Tetrachloride	1.81E-02	5.07E+03	1.90E+02	1.06E+00	3.70E+02	6.93E+04	1.78E-02	1.52E+03

ASC exceeds soil saturation limit

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived March 2009	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion	Dermal contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg
Arsenic	NR	NR	6.67E+02	1.35E+04	6.95E+02	6.35E+02	N/A
Barium	NR	NR	2.22E+05	NR	3.48E+07	2.21E+05	N/A
Beryllium	NR	NR	3.97E+03	NR	2.36E+02	2.23E+02	N/A
Boron	NR	NR	2.38E+05	NR	3.72E+07	2.37E+05	N/A
Cadmium	NR	NR	4.00E+02	2.42E+05	3.87E+02	2.30E+02	N/A
Chromium III	NR	NR	3.09E+05	NR	4.83E+07	3.07E+05	N/A
Chromium VI	NR	NR	6.25E+03	NR	3.48E+02	3.29E+02	N/A
Copper	NR	NR	1.78E+05	NR	2.78E+07	1.77E+05	N/A
Lead						7.50E+02	N/A
Inorganic Mercury	NR	NR	4.41E+03	NR	2.09E+04	3.64E+03	N/A
Nickel	NR	NR	2.25E+04	2.73E+06	1.79E+03	1.79E+03	N/A
Selenium	NR	NR	1.31E+04	NR	2.05E+06	1.30E+04	N/A
Vanadium	NR	NR	5.94E+03	NR	9.20E+04	5.58E+03	N/A
Zinc	NR	NR	8.79E+05	NR	1.38E+08	8.74E+05	N/A
Cyanide (free)						4.30E+01	N/A
Cyanide (Complex)						2.13E+02	N/A
Phenol	2.72E+05	1.43E+06	1.54E+06	4.23E+04	3.28E+06	3.20E+03	4.16E+04
Ethylbenzene	2.90E+04	3.83E+06	2.22E+05	1.34E+06	7.58E+07	2.50E+04	5.18E+02
m-xylene	1.04E+04	1.18E+06	4.00E+05	2.42E+06	2.02E+07	9.99E+03	6.25E+02
p-xylene	9.99E+03	1.16E+06	4.00E+05	2.42E+06	2.02E+07	9.63E+03	5.76E+02
o-xylene	1.12E+04	1.22E+06	4.00E+05	2.42E+06	2.02E+07	1.07E+04	4.78E+02
TPH (EC5-6) aliphatic	5.47E+02	5.26E+06	1.11E+07	5.17E+07	9.14E+08	5.47E+02	3.10E+02
TPH (>EC6-8) aliphatic	1.42E+03	8.49E+06	1.11E+07	5.17E+07	9.14E+08	1.42E+03	1.51E+02
TPH (>EC8-10) aliphatic	3.93E+02	1.04E+06	1.11E+05	5.17E+05	4.97E+07	3.91E+02	8.17E+01
TPH (>EC10-12) aliphatic	2.33E+03	2.53E+06	1.11E+05	5.17E+05	4.97E+07	2.27E+03	4.98E+01



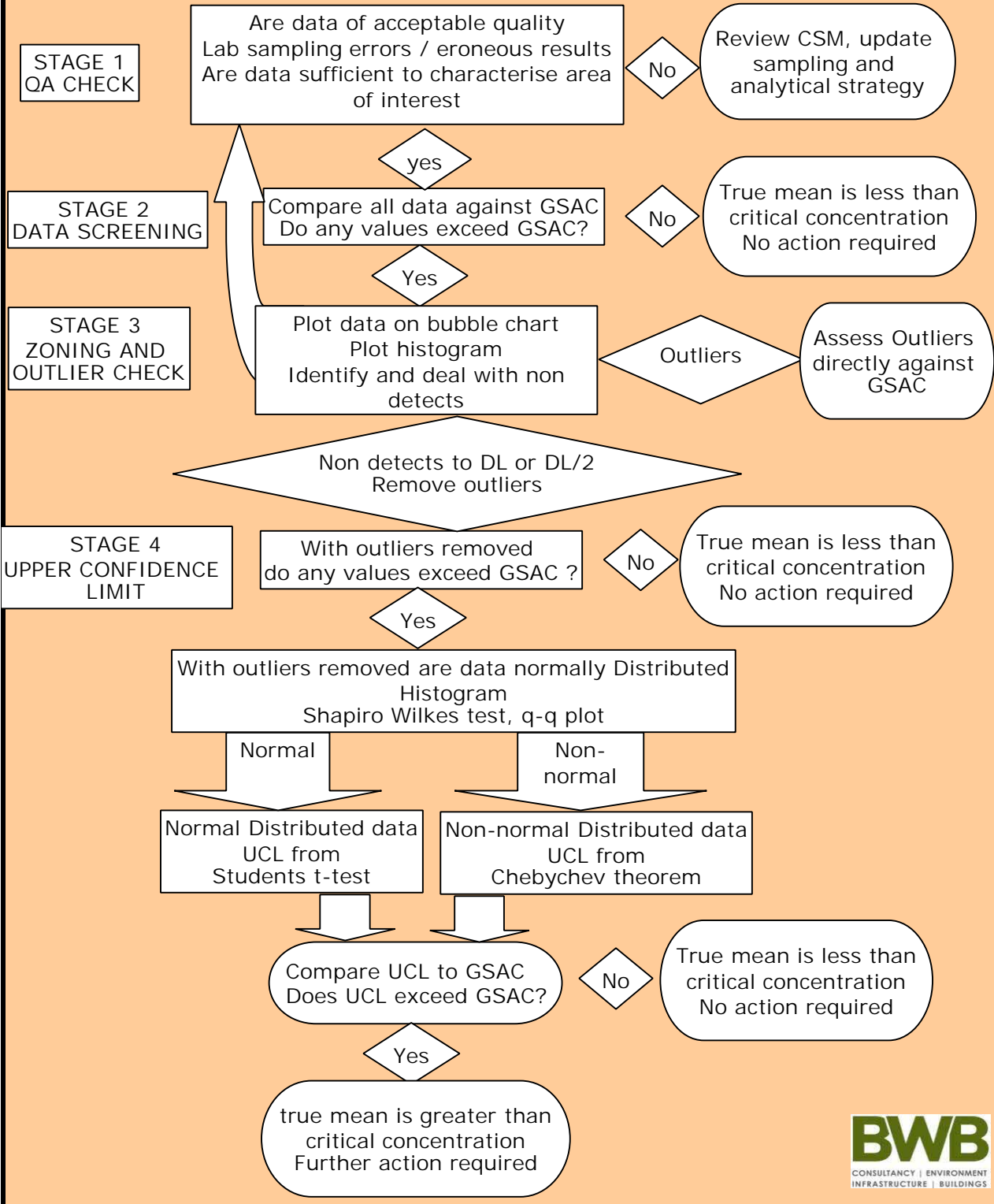
Commercial/Industrial Pathway Specific Assessment Sub Criteria derived March 2009	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion	Dermal contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	1.17E+04	5.68E+06	1.11E+05	5.17E+05	4.97E+07	1.04E+04	2.21E+01
TPH (>EC16-21) aliphatic	1.35E+06	1.61E+08	2.22E+06	1.03E+07	3.48E+08	7.72E+05	9.15E+00
TPH (>EC21-35) aliphatic	1.35E+06	1.61E+08	2.22E+06	1.03E+07	3.48E+08	7.72E+05	9.15E+00
TPH (>EC35-44) aliphatic	1.35E+06	1.61E+08	2.22E+06	1.03E+07	3.48E+08	7.72E+05	9.15E+00
TPH (>EC6-7) aromatic (benzene)	4.75E+01	1.17E+04	6.44E+02	3.90E+03	4.87E+05	4.36E+01	1.22E+03
TPH (>EC7-8) aromatic (toluene)	1.09E+05	1.83E+07	4.95E+05	3.00E+06	4.84E+08	8.62E+04	8.69E+02
TPH (>EC8-10) aromatic	6.69E+02	6.05E+05	4.44E+04	2.07E+05	9.91E+06	6.56E+02	6.18E+02
TPH (>EC10-12) aromatic	4.03E+03	1.48E+06	4.44E+04	2.07E+05	9.91E+06	3.62E+03	3.71E+02
TPH (>EC12-16) aromatic	2.27E+04	3.50E+06	4.44E+04	2.07E+05	9.91E+06	1.39E+04	1.70E+02
TPH (>EC16-21) aromatic	1.81E+05	6.96E+06	3.33E+04	1.55E+05	5.21E+06	2.36E+04	5.99E+01
TPH (>EC21-35) aromatic	3.64E+07	5.20E+07	3.33E+04	1.55E+05	5.21E+06	2.73E+04	4.82E+00
TPH (>EC35-44) aromatic	3.64E+07	5.20E+07	3.33E+04	1.55E+05	5.21E+06	2.73E+04	4.82E+00
Naphthalene	3.22E+02	7.85E+04	4.42E+04	2.06E+05	2.85E+05	3.17E+02	7.64E+01
Acenaphthylene	2.69E+01	1.77E+03	4.44E+03	2.07E+04	2.43E+03	2.60E+01	2.39E+02
Acenaphthene	8.32E+02	3.83E+04	4.44E+04	2.07E+05	2.43E+04	7.71E+02	1.57E+02
Fluorene	1.39E+06	3.70E+07	8.88E+04	4.14E+05	1.39E+07	6.90E+04	1.53E+02
Phenanthrene	7.91E+03	8.13E+04	4.44E+04	2.07E+05	2.43E+04	4.83E+03	1.46E+02
Anthracene	7.22E+07	5.60E+08	6.67E+05	3.10E+06	1.04E+08	5.41E+05	7.71E+00
Fluoranthene	4.38E+03	1.47E+04	4.44E+03	2.07E+04	2.43E+03	1.02E+03	1.89E+01
Pyrene	4.29E+04	1.40E+05	4.44E+04	2.07E+05	2.43E+04	1.01E+04	2.20E+00
Benzo(a)anthracene	3.47E+03	3.27E+03	4.44E+02	2.07E+03	2.43E+02	1.34E+02	1.71E+00
Chrysene	2.23E+05	2.85E+04	4.44E+03	2.07E+04	2.43E+03	1.38E+03	4.40E-01
Benzo(b)fluoranthene	6.56E+04	4.02E+03	4.44E+02	2.07E+03	2.43E+02	1.41E+02	1.22E+00
Benzo(k)fluoranthene	1.09E+05	4.78E+03	4.44E+02	2.07E+03	2.43E+02	1.42E+02	6.87E-01
Benzo(a)pyrene	9.37E+03	4.43E+02	4.44E+01	2.07E+02	2.43E+01	1.41E+01	9.11E-01

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived March 2009	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion	Dermal contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
Indeno(123-cd)pyrene	5.46E+04	3.72E+03	4.44E+02	2.07E+03	2.43E+02	1.40E+02	6.14E-02
Dibenzo(ah)anthracene	4.49E+03	5.51E+02	4.44E+01	2.07E+02	2.43E+01	1.42E+01	3.93E-03
Benzo(g,h,i)perylene	9.73E+09	3.46E+08	6.66E+04	3.10E+05	1.04E+07	5.46E+04	1.87E-02
Tetrachloroethene (PCE)	2.59E+02	6.38E+05	3.08E+04	1.87E+05	2.37E+07	2.57E+02	4.24E+02
Trichloroethene (TCE)	1.89E+01	4.63E+04	1.16E+04	5.38E+04	1.81E+06	1.88E+01	1.54E+03
cis-1,2-Dichloroethene	2.32E+01	5.26E+04	1.30E+04	7.88E+04	2.04E+06	2.32E+01	3.94E+03
Vinyl Chloride (VC)	1.03E-01	7.47E+02	3.11E+01	1.88E+02	1.04E+05	1.03E-01	1.36E+03
1,1,2,2-Tetrachloroethane (PCA)	4.69E+02	2.49E+05	1.28E+04	7.76E+04	2.01E+06	4.49E+02	2.67E+03
1,1,1-Trichloroethane (TCA)	1.11E+03	3.81E+06	1.33E+06	8.07E+06	2.07E+08	1.11E+03	1.43E+03
1,2-Dichloroethane	1.14E+00	1.68E+03	2.67E+02	1.61E+03	4.17E+04	1.14E+00	3.41E+03
Carbon Tetrachloride	4.81E+00	1.65E+04	3.15E+03	1.91E+04	8.85E+05	4.80E+00	1.52E+03

 ASC exceeds soil saturation limit

APPENDIX 7  
CLEA FLOW CHART & SCREENING WORKSHEETS

STATISTICAL APPROACH FOR ASSESSING RISK TO HUMAN HEALTH FROM CONTAMINATED LAND 2008  
 CIEH/CLAIRE Guidance on Comparing Soil Contamination Data with a Critical Concentration May 2008



# Human Health Generic QRA Worksheet



Phase 3 - Witham St Hughs	NTM2082
All samples were used as one averaging area.	

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GSAC Type (BWB, LQM S4UL, C4SL, Bespoke)	BWB_GSAC
Key Receptor/CSM (Residential/Commercial/POS)	Residential
Organic Matter % (If unknown use 1%)	1

Exposure Pathway Selection for BWB GSAC (Residential/Commercial scenarios only)	
Soil Ingestion, dermal contact, particulate inhalation	TRUE
Ingestion of site grown vegetables and soil attached to vegetables	FALSE
Inhalation of vapours Indoors	TRUE
Inhalation of vapours Outdoors	TRUE

Default pathways	
Residential	Commercial
TRUE	TRUE
Optional	FALSE
TRUE	TRUE
TRUE	TRUE

Generic Assessment Criteria



Phase 3 - Witham St Hughs  
NTM2082

Residential  
mg/kg

Source

Arsenic	3.50E+01	BWB_GSAC
Barium	1.34E+03	BWB_GSAC
Beryllium	1.21E+00	BWB_GSAC
Boron	1.08E+04	BWB_GSAC
Cadmium	6.19E+01	BWB_GSAC
Chromium VI	4.01E+00	BWB_GSAC
Chromium III	6.37E+02	BWB_GSAC
Copper	5.16E+03	BWB_GSAC
Lead*	2.00E+02	DEFRA_C4SL
Inorganic Mercury	5.59E+01	BWB_GSAC
Nickel	1.27E+02	BWB_GSAC
Selenium	4.30E+02	BWB_GSAC
Vanadium	5.49E+02	BWB_GSAC
Zinc	4.04E+04	BWB_GSAC
Cyanide (Free)	4.30E+01	BWB_GSAC
Cyanide (Complex)	2.13E+02	BWB_GSAC
Phenols (Total)	2.25E+02	BWB_GSAC
Benzene	2.66E-01	BWB_GSAC
Toluene	6.18E+02	BWB_GSAC
Ethyl benzene	5.82E+01	BWB_GSAC
Total Xylene	5.55E+01	BWB_GSAC
TPH (EC5-6) aliphatic	2.88E+01	BWB_GSAC
TPH (>EC6-8) aliphatic	7.02E+01	BWB_GSAC
TPH (>EC8-10) aliphatic	1.81E+01	BWB_GSAC
TPH (>EC10-12) aliphatic	8.84E+01	BWB_GSAC
TPH (>EC12-16) aliphatic	6.45E+02	BWB_GSAC
TPH (>EC16-21) aliphatic	4.45E+04	BWB_GSAC
TPH (>EC21-35) aliphatic	4.45E+04	BWB_GSAC
TPH (>EC35-44) aliphatic	4.45E+04	BWB_GSAC
TPH (>EC6-7) aromatic (benzene)	2.66E-01	BWB_GSAC
TPH (>EC7-8) aromatic (toluene)	6.07E+02	BWB_GSAC
TPH (>EC8-10) aromatic	3.16E+01	BWB_GSAC
TPH (>EC10-12) aromatic	1.59E+02	BWB_GSAC
TPH (>EC12-16) aromatic	9.27E+02	BWB_GSAC
TPH (>EC16-21) aromatic	1.29E+03	BWB_GSAC
TPH (>EC21-35) aromatic	1.34E+03	BWB_GSAC
TPH (>EC35-44) aromatic	1.34E+03	BWB_GSAC
Total TPH	5.00E+02	BWB_GSAC
Naphthalene	1.64E+00	BWB_GSAC
Acenaphthylene	1.95E+03	BWB_GSAC
Acenaphthene	2.02E+03	BWB_GSAC
Fluorene	1.85E+03	BWB_GSAC
Phenanthrene	8.34E+02	BWB_GSAC
Anthracene	1.98E+04	BWB_GSAC
Fluoranthene	9.73E+02	BWB_GSAC
Pyrene	2.33E+03	BWB_GSAC
Benzo(a)anthracene	7.27E+00	BWB_GSAC
Chrysene	1.93E+01	BWB_GSAC
Benzo(b)fluoranthene	2.56E+00	BWB_GSAC
Benzo(k)fluoranthene	6.83E+01	BWB_GSAC
Benzo(a)pyrene	2.05E+00	BWB_GSAC
Indeno(1,2,3-c,d)pyrene	2.89E+01	BWB_GSAC

Generic Assessment Criteria



Phase 3 - Witham St Hughs  
NTM2082

Residential  
mg/kg

Source

Dibenzo(a,h)anthracene	2.01E-01	BWB_GSAC
Benzo(g,hi)perylene	2.30E+02	BWB_GSAC
Coal Tar (B(a)P as surrogate marker	7.54E-01	BWB_GSAC
Tetrachloroethene (PCE)	1.26E-01	BWB_GSAC
Trichloroethene (TCE)	1.21E-02	BWB_GSAC
cis -1,2-Dichloroethene	1.20E-01	BWB_GSAC
Vinyl Chloride (VC)	5.43E-04	BWB_GSAC
1,1,2,2-Tetrachloroethane (PCA)	2.74E+00	BWB_GSAC
1,1,1-Trichloroethane (TCA)	6.33E+00	BWB_GSAC
1,2-Dichloroethane	6.46E-03	BWB_GSAC
Carbon Tetrachloride	1.81E-02	BWB_GSAC
Carbon disulphide	1.01E-01	BWB_GSAC

Location	Sample depth	Easting	Northing	Strata Type	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium VI	Chromium III	Copper	Lead	Inorganic Mercury	Nickel	Selenium	Vanadium	Zinc	Cyanide (Free)	Cyanide (Complex)	Phenols (Total)
Detection Limit					0.2	1.5	0.2	0.2	0.1	1	0.15	0.2	0.3	0.03	0.2	0.5	0.8	1	0.1	0.1	0.3
GSAC					35.05	1344.03	1.21	10754.59	61.94	4.01	637.35	5158.21	200.00	55.88	127.44	430.08	548.61	40400.13	43.00	213.00	225.03
TP02	1.70-1.70				18	91	0.34	0.2	0.2	4	8.7	9.8	9.2	0.3	12	1	15	31	1	1	1
TP04	0.20-0.20																				
TP05	1.60-1.60				2.1	19	0.17	0.2	0.2	4	3.9	11	5.9	0.3	6.7	1	7	20	1	1	1
TP08	0.20-0.20				14	84	0.82	0.9	0.2	4	33	18	20	0.3	15	1	45	55	1	1	1
TP10	2.00-2.00				21	28	0.8	1.6	0.2	4	27	20	13	0.3	26	1	35	54	1	1	1
TP11	0.20-0.20																				
TP12	0.60-0.60				10	69	1.4	1.4	0.2	4	42	24	13	0.3	42	1	47	47	1	1	1
TP14	0.30-0.30																				
TP15	0.10-0.10																				
TP16	0.40-0.40				19	52	0.69	0.3	0.2	4	27	13	12	0.3	18	1	45	48	1	1	1
TP18	0.20-0.20																				
TP18	3.40-3.50				12	27	1.1	4.9	0.2	4	34	27	13	0.3	31	1	31	47	1	1	1
TP23	0.15-0.15				11	49	1	3.8	0.2	4	32	19	24	0.3	19	1	48	53	1	1	1
TP24	0.20-0.20																				
TP25	1.20-1.20				3.3	21	0.27	0.2	0.2	4	8.5	12	4.5	0.3	8.6	1	11	20	1	1	1





Location	Sample depth	TPH (>EC35-44) aromatic	Total TPH	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene (as surrogate marker)	Tetrachloroethene (PCE)	Trichloroethene (TCE)	cis-1,2-Dichloroethene	Vinyl Chloride (VC)	1,1,2,2-Tetrachloroethane (PCA)	1,1,1-Trichloroethane (TCA)	1,2-Dichloroethane	
Detection Limit		0.1	10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
GSAC		1336.68	500.00	1.64	1951.34	2020.86	1854.93	834.37	19836.52	973.45	2328.67	7.27	19.28	2.56	68.30	2.05	28.88	0.20	229.50	0.75	1.26E-01	1.21E-02	1.20E-01	5.43E-04	2.74E+00	6.33E+00	6.46E-03	
TP02	1.70-1.70		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
TP04	0.20-0.20																											
TP05	1.60-1.60		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
TP08	0.20-0.20		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
TP10	2.00-2.00		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
TP11	0.20-0.20																											
TP12	0.60-0.60		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
TP14	0.30-0.30																											
TP15	0.10-0.10																											
TP16	0.40-0.40		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
TP18	0.20-0.20																											
TP18	3.40-3.50		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
TP23	0.15-0.15		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
TP24	0.20-0.20																											
TP25	1.20-1.20		10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05								



APPENDIX 8  
SOIL CHEMICAL RESULTS SUMMARY

Determinand	Number of tests	Range (mg/kg)	Residential GSAC (mg/kg)	Detection Limit (mg/kg)	Min	Max	No. of Exceedances	No. Non detects	< or not
Arsenic	9	2.1 to 21	3.50E+01	0.2	2.1	21	0	0	
Barium	9	19 to 91	1.34E+03	1.5	19	91	0	0	
Beryllium	9	0.17 to 1.5	1.21E+00	0.2	0.17	1.5	1	0	
Boron	9	<0.2 to 4.9	1.08E+04	0.2	0.2	4.9	0	3	<
Cadmium	9	0.2 to 0.2	6.19E+01	0.1	0.2	0.2	0	0	
Chromium VI	9	4 to 4	4.01E+00	1	4	4	0	0	
Chromium III	9	3.9 to 42	6.37E+02	0.15	3.9	42	0	0	
Copper	9	9.8 to 27	5.16E+03	0.2	9.8	27	0	0	
Lead*	9	4.5 to 24	2.00E+02	0.3	4.5	24	0	0	
Inorganic Mercury	9	0.3 to 0.3	5.59E+01	0.03	0.3	0.3	0	0	
Nickel	9	6.7 to 42	1.27E+02	0.2	6.7	42	0	0	
Selenium	9	1 to 1	4.30E+02	0.5	1	1	0	0	
Vanadium	9	7 to 48	5.49E+02	0.8	7	48	0	0	
Zinc	9	20 to 55	4.04E+04	1	20	55	0	0	
Cyanide (Free)	9	1 to 1	4.30E+01	0.1	1	1	0	0	
Cyanide (Complex)	9	1 to 1	2.13E+02	0.1	1	1	0	0	
Phenols (Total)	9	1 to 1	2.25E+02	0.3	1	1	0	0	
Benzene	0	0 to 0	2.66E-01	0.01	0	0	0	0	
Toluene	0	0 to 0	6.18E+02	0.01	0	0	0	0	
Ethyl benzene	0	0 to 0	5.82E+01	0.01	0	0	0	0	
Total Xylene	0	0 to 0	5.55E+01	0.01	0	0	0	0	
TPH (EC5-6) aliphatic	0	0 to 0	2.88E+01	0.01	0	0	0	0	
TPH (>EC6-8) aliphatic	0	0 to 0	7.02E+01	0.01	0	0	0	0	
TPH (>EC8-10) aliphatic	0	0 to 0	1.81E+01	0.01	0	0	0	0	
TPH (>EC10-12) aliphatic	0	0 to 0	8.84E+01	1.5	0	0	0	0	
TPH (>EC12-16) aliphatic	0	0 to 0	6.45E+02	1.2	0	0	0	0	
TPH (>EC16-21) aliphatic	0	0 to 0	4.45E+04	1.5	0	0	0	0	
TPH (>EC21-35) aliphatic	0	0 to 0	4.45E+04	3.4	0	0	0	0	
TPH (>EC35-44) aliphatic	0	0 to 0	4.45E+04	3.4	0	0	0	0	
TPH (>EC6-7) aromatic (benzene)	0	0 to 0	2.66E-01	0.01	0	0	0	0	
TPH (>EC7-8) aromatic (toluene)	0	0 to 0	6.07E+02	0.01	0	0	0	0	
TPH (>EC8-10) aromatic	0	0 to 0	3.16E+01	0.9	0	0	0	0	
TPH (>EC10-12) aromatic	0	0 to 0	1.59E+02	0.5	0	0	0	0	
TPH (>EC12-16) aromatic	0	0 to 0	9.27E+02	0.6	0	0	0	0	
TPH (>EC16-21) aromatic	0	0 to 0	1.29E+03	1.4	0	0	0	0	
TPH (>EC21-35) aromatic	0	0 to 0	1.34E+03	1.4	0	0	0	0	
TPH (>EC35-44) aromatic	0	0 to 0	1.34E+03	0.1	0	0	0	0	
Total TPH	9	<10 to 10	5.00E+02	10	10	10	0	9	<
Naphthalene	9	0.05 to 0.05	1.64E+00	0.1	0.05	0.05	0	0	
Acenaphthylene	9	0.05 to 0.05	1.95E+03	0.1	0.05	0.05	0	0	
Acenaphthene	9	0.05 to 0.05	2.02E+03	0.1	0.05	0.05	0	0	
Fluorene	9	0.05 to 0.05	1.85E+03	0.1	0.05	0.05	0	0	
Phenanthrene	9	0.05 to 0.05	8.34E+02	0.1	0.05	0.05	0	0	
Anthracene	9	0.05 to 0.05	1.98E+04	0.1	0.05	0.05	0	0	
Fluoranthene	9	0.05 to 0.05	9.73E+02	0.1	0.05	0.05	0	0	
Pyrene	9	0.05 to 0.05	2.33E+03	0.1	0.05	0.05	0	0	
Benzo(a)anthracene	9	0.05 to 0.05	7.27E+00	0.1	0.05	0.05	0	0	
Chrysene	9	0.05 to 0.05	1.93E+01	0.1	0.05	0.05	0	0	
Benzo(b)fluoranthene	9	0.05 to 0.05	2.56E+00	0.1	0.05	0.05	0	0	
Benzo(k)fluoranthene	9	0.05 to 0.05	6.83E+01	0.1	0.05	0.05	0	0	
Benzo(a)pyrene	9	0.05 to 0.05	2.05E+00	0.1	0.05	0.05	0	0	
Indeno(1,2,3-c,d)pyrene	9	0.05 to 0.05	2.89E+01	0.1	0.05	0.05	0	0	
Dibenzo(a,h)anthracene	9	0.05 to 0.05	2.01E-01	0.1	0.05	0.05	0	0	
Benzo(g,h,i)perylene	9	0.05 to 0.05	2.30E+02	0.1	0.05	0.05	0	0	
Coal Tar (B(a)P as surrogate mark	9	0.05 to 0.05	7.54E-01	0.1	0.05	0.05	0	0	
Tetrachloroethene (PCE)	0	0 to 0	1.26E-01	0.001	0	0	0	0	
Trichloroethene (TCE)	0	0 to 0	1.21E-02	0.001	0	0	0	0	
cis-1,2-Dichloroethene	0	0 to 0	1.20E-01	0.001	0	0	0	0	
Vinyl Chloride (VC)	0	0 to 0	5.43E-04	0.001	0	0	0	0	
1,1,2,2-Tetrachloroethane (PCA)	0	0 to 0	2.74E+00	0.001	0	0	0	0	

# BWB

