



W Stirland Ltd

Blackwell Farm, East Grinstead

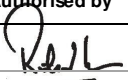
Ground Investigation Report



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Blackwell Farm, East Grinstead

Ground Investigation Report

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EXECUTIVE SUMMARY

SITE INFORMATION	Client	W Stirland Ltd
	Site Details	Blackwell Farm, East Grinstead
	Current Land Use and Description	Vacant parcel of land laid to grass and utilised for recreational purposes.
	Proposed Development	Construction of 10No. low rise residential dwellings with associated private gardens and hard infrastructure
BACKGROUND INFORMATION	Geology	The underlying geology has been recorded to comprise Lower Tunbridge Wells Sand, described as grey silt and yellowish fine silty sand with cemented beds of siltstone and sandstone at intervals. This in turn is reported to be underlain by Wadhurst Clay, which is described as dark grey shales, clays and silty clays with subordinate beds of silt, sandstone and shelly limestone.
	Hydrogeology	The Lower Tunbridge Wells Sand has been designated by the Environment Agency as a Secondary A Aquifer. No groundwater abstraction licences have been reported in proximity of the site and the site is not recorded to be located within a Source Protection Zone.
	Hydrology	A stream is reported approximately 50m to the east of the site by Land Science. No surface water abstractions have been recorded within 1000m of the site. A single discharge consent to controlled waters is recorded in proximity to the site. This relates to the discharge of public sewage and storm sewage overflow to an un-named tributary of Medway via pond, approximately 55m to the east of the site.
	Site History	Land Science report the site to have comprised a series of small fields associated with Blackwell Farm between 1898 and 1931. Two small ponds were noted on site in the southwest and southeast corners of the site. A stream was reportedly present on site, flowing from the northwest corner down to the pond in the southeast corner. By 1962, the pond and stream were reportedly no longer depicted on mapping. No further significant features relating to the site were reported by Land Science. Further internet research undertaken by Land Science in relation to the proposed development reportedly highlighted a number of comments by local residents regarding the possibility that the southern section of the site has been a former pond that had been infilled. An underground sewage pipe is reported within the southern section of the site.
GROUND INVESTIGATION	Ground Investigation Rationale	To allow for characterisation and description of deeper ground materials to aid with pile design and further assessment of organic materials encountered during the initial investigation undertaken by Land Science in 2018.
	Scope of Works	2No. cable percussive boreholes to depths of up to 11.5mbgl and 5No. dynamic sample boreholes to depths of up to 5.0mbgl.
	Ground Conditions	Made ground and potential made ground was recorded across the site to depths of between 3.0mbgl and 5.5mbgl. The upper made ground was generally observed to comprise brown to dark brown sandy, very silty clay to depths of 0.1mbgl underlain by brown to dark brown or orange brown sandy gravelly clay or clayey gravelly sand to depths of between 1.7mbgl and 3.2mbgl. The gravel component within this material was observed to include flint, clinker, sandstone, red brick, concrete and metal. The upper materials were observed to be underlain by potential made ground materials comprising generally brown and blue grey silty clayey sand / silty sandy clay. Localised pockets of peat and decaying root matter as well as a strong organic odour was reported within this material. The Lower Tunbridge Wells Sand was recorded across the site from depths of 3.0mbgl and was generally recorded to comprise medium dense / dense becoming very dense clayey fine to medium sand with occasional to abundant gravel of flint interbedded with stiff dark grey / green grey slightly sandy clayey silt and sandy silty clay to the base of the excavations (maximum 11.5mbgl).

LAND CONTAMINATION	Contamination Characterisation	Laboratory analysis recorded concentrations of lead and PAH's above the relevant GAC's. In addition, cement bound chrysotile was recorded within a single location during the previous investigation undertaken by Land Science. While total and leachable TPH concentrations were recorded to be below the relevant screening values, a residual risk to groundwater cannot be discounted. Concentrations of carbon dioxide and methane have been recorded during the limited monitoring completed by TEC (and Land Science from one monitoring location), associated with the recorded thickness of made ground/ infilled deposits, noted to include organic material.
	Identified Pollutant Linkages	The following relevant pollutant linkages have been identified at the site within this assessment; - Human Health (future site end users and construction workers) - exposure to potential contaminants of concern through ingestion, inhalation and dermal contact pathways; - Controlled waters (underlying Secondary A Aquifer) - vertical and subsequent lateral migration of potential hydrocarbon contamination/ leachable metals within the made ground to the underlying Secondary A Aquifer; and - Human Health (future site users and proposed development structures) - migration, ingress and inhalation of ground gasses associated with the presence of organic made ground.
	Remediation Appraisal / Likely Remedial Approach	Where areas of soft landscaping are proposed in the development, localised exposure to potential contaminants cannot be discounted and a suitable cover system may be required within such areas. Given the contaminant concentrations recorded and previously reported presence of asbestos within the shallow made ground at the site, an engineered cover system is likely to be required, comprising clean imported materials with a geotextile break layer. Further assessment is required to assess whether a potential significant risk to controlled waters exists. Gas protection measures will be required for the proposed scheme, with initial results indicating the site to be potentially Characteristic Situation 2. However, further monitoring is required to confirm the ground gas regime and associated protection measures for the development.
GROUND ENGINEERING	Foundations	Given the significant thickness of made ground and potential made ground materials across the site, it is considered unlikely that conventional foundations would be suitable for the proposed development within this area. Therefore, a piled foundation solution would be recommended. Based on the available information, for budgetary and indicative purposes only, a pile resistance in the order of 250kN is anticipated for a single 300mm CFA pile to a depth of approximately 10mbgl (i.e. founding within the competent Lower Tunbridge Wells Sand and ignoring any skin friction (including negative skin friction) from the made ground deposits).
	Ground Floor Slabs	Given the presence of shrinkable soils and the proposed foundation solution, the use of suspended floor slabs may be appropriate for the scheme, which should incorporate the minimum void dimensions as outlined in the NHBC Standards.
	Preliminary Pavement Design	Given the significant thickness of made ground materials encountered across the site, a CBR value of <2.5% would be considered appropriate for preliminary design purposes.
	Buried Concrete	The results of the sulphate and pH testing from the soils at the site yield an aggressive chemical environment class (ACEC) of AC-2, requiring a design sulphate class of DS-2.

RECOMMENDED FURTHER WORKS		Given the identified residual hydrocarbon contamination recorded within the south / southeast section of the site, and previously reported leachable concentrations of heavy metals, a potential significant risk to controlled waters cannot be discounted. Therefore, further assessment comprising groundwater monitoring would be recommended to confirm whether a significant risk is present. Organic deposits have been recorded within the underlying possible made ground materials, to depths of up to 5.5mbgl. In addition, initial monitoring by TEC and Land Science has recorded carbon dioxide and methane concentrations associated with these deposits and therefore further gas monitoring would be recommended to fully characterise the ground gas regime on site, and inform appropriate ground gas protection measures for the development.
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1 INTRODUCTION

1.1 Terms of Reference

- 1.1.1 TEC has been appointed by W Stirling Ltd to undertake a land contamination and geotechnical assessment of Blackwell Farm, East Grinstead. All works were undertaken in accordance with our proposal letter dated 10 September 2020 and referenced CH.2006010.001A.

1.2 Background

- 1.2.1 The site is situated off Blackwell Farm Road to the east of East Grinstead town centre (Figure 1). The site covers an approximate area of 0.56 hectares, with the centre of the site situated at approximate National Grid Reference 539710, 138810. The nearest postcode is RH19 3HT.
- 1.2.2 The proposed development is understood to comprise the construction of 10 No. low rise residential dwellings with associated private gardens and hard infrastructure (Figure 2).
- 1.2.3 A desk study and preliminary geoenvironmental and geotechnical assessment has previously been prepared for the site by Land Science in September 2018, as detailed within the following report:
- Phase I and Phase II Geotechnical and Geo-Environmental Investigation – Blackwell Farm Road, East Grinstead, RH19 3JW. Prepared for The Guinness Partnership Limited. Report reference LS3734 dated September 2018.
- 1.2.4 Reference should be made to this document for full details regarding the site conditions and assessment works undertaken to date. However, a summary of the salient issues is provided in Section 2.
- 1.2.5 It is assumed that the information contained within the above report may be relied upon for the current assessment. However, TEC holds no liability with regards to the validity or accuracy of third-party information.
- 1.2.6 The aim of these works is to provide further information on land contamination risk and the ground engineering conditions and constraints associated with the site with regard to the proposed development.

1.3 Scope of Works

- 1.3.1 The scope of work undertaken as part of this report is presented below:
- **Land Contamination - Generic Quantitative Risk Assessment:** this phase of assessment involves updating the site conceptual model developed following review of the previous assessment undertaken by Land Science based on the findings of an exploratory ground investigation. Generic assessment criteria and assumptions, if appropriate, are used to identify relevant pollutant linkages.
 - **Ground Engineering:** general recommendations in relation to ground engineering for the proposed development are provided on the basis of the findings of the exploratory ground investigation.
- 1.3.2 The above scope of work has been undertaken in accordance with current guidance such as LCRM - *Land contamination: risk management* (Environment Agency 2020), BS10175+A2 (2017) and, where appropriate NHBC and Eurocode 7.

2 PREVIOUS REPORT SUMMARY

2.1 Site Setting and Environmental Data

2.1.1 A review of the salient information from the previous desk study phase of assessment and ground investigation undertaken by Land Science (Report Reference LS3734) for the site is summarised in Table 2.1 below. Reference should be made to this report for full information.

Table 2.1: Land Science – Previous Geoenvironmental and Geotechnical Assessment Summary

Desk Study – Site Setting and Environmental Data	
Site History	Land Science report the site to have comprised a series of small fields associated with Blackwell Farm between 1898 and 1931. Two small ponds were noted on site in the southwest and southeast corners of the site. A stream was reportedly present on site, flowing from the northwest corner down to the pond in the southeast corner. By 1962, the pond and stream were reportedly no longer depicted on mapping. No further significant features relating to the site were reported by Land Science. Further internet research undertaken by Land Science in relation to the proposed development reportedly highlighted a number of comments by local residents regarding the possibility that the southern section of the site has been a former pond that had been infilled. No further details have been provided. An underground sewage pipe is reported within the southern section of the site.
Surrounding Land Use	The surrounding area was reported to generally comprise open farmland and building associated with Blackwell Farm, which was located immediately north east of the site. By 1962, much of Blackwell Farm was reported to have been redeveloped with a large housing development. Further potentially contaminative land uses identified in proximity to the site included an allotment garden ~150m to the northwest of the site from 1910 to present and a cemetery immediately west of the site from 1931 to present.
Geology and Hydrogeology	The underlying geology has been recorded to comprise the Lower Tunbridge Wells Sand, described as grey silt and yellowish fine silty sand with cemented beds of siltstone and sandstone at intervals, which is classified by the Environment Agency as a Secondary A Aquifer. This in turn is reported to be underlain by Wadhurst Clay, which is described as dark grey shales, clays and silty clays with subordinate beds of silt, sandstone and shelly limestone. No superficial deposits are recorded on site, although it is noted by Land Science that the intrusive works recorded the presence of material considered to be Alluvium. No groundwater abstraction licences have been reported in proximity of the site and the site is not recorded to be located within a Source Protection Zone.
Hydrology	A stream is reported approximately 50m to the east of the site by Land Science. No surface water abstractions have been recorded within 1000m of the site. A single discharge consent to controlled waters is recorded in proximity to the site. This relates to the discharge of public sewage and storm sewage overflow to an unnamed tributary of Medway via pond, approximately 55m to the east of the site.
Ground Gas Generation	Information presented by Land Science indicates the southern section of the site may have comprised a former pond that has been infilled. Infilled material may provide a potential source of ground gas generation subject to thickness and composition. No areas of historic or current landfill have been identified within 250m of the site. A single record of potentially infilled land was recorded on mapping from 1950, which relates to an area of unknown filled ground (pond, marsh, river, stream, dock etc), approximately 15m to the east of the site. The site is reported to be located within a lower Radon affected area as less than 1% of homes exceed the threshold for radon gas. Therefore, no radon protective measures are reported as necessary within the proposed development.

Previous Ground Investigation Summary	
Encountered Ground Conditions	Intrusive works undertaken by Land Science recorded the presence of made ground across the site to depths of between 0.65mbgl and 2.1mbgl, which was generally recorded to comprise light brown clayey gravelly sand underlain by brown gravelly sand with varying amounts of brick, metal, sandstone, glass and clinker. This in turn was reported to be underlain by Alluvium (possible made ground) to the base of the excavations (maximum 4.0mbgl). The encountered material was recorded to comprise orange brown and grey sandy clay with sandstone fragments and pockets of organic matter to depths of up to 2.5mbgl, underlain by dark brown, blue grey and black sandy gravelly clay with sandstone fragments and abundant organic material to recorded depths of between 3.0mbgl and >4.0mbgl. This was reportedly underlain by light orange, brown and grey sandy gravelly clay with occasional sandstone fragments. A strong organic / peaty odour was reported in a number of locations.
Groundwater	Groundwater was encountered within a single location at a depth of 2.3mbgl, rising to a static level of 2.2mbgl after a period of 20 minutes.
Contamination	No visual or olfactory evidence of potential significant contamination was reported by Land Science during the intrusive works. Laboratory analysis of representative made ground materials reportedly recorded the exceedance of the relevant screening values for a number of PAH's and heavy metals. Leachate analysis of samples reported the exceedance of a number of heavy metals when compared to the Environmental Quality Standards (EQS) in a single location. In addition, the presence of Chrysotile (hard/cement type material) was recorded within a single location. Ground gas monitoring within a single location recorded carbon dioxide concentrations of up to 7.0%. No measurable methane was reported.
Identified Potential Hazards/ Sources	Based upon our conceptual understanding of the site following review of the salient information contained within the Land Science report, a number of potential relevant pollutant linkages have been identified. These include the presence of made ground on site, and potentially contaminative land uses in proximity to the site.
Outline Conceptual Model	The potential pollutant linkages identified as part of the previous assessment therefore include: • Human health (current and future site users and construction workers) – potential exposure to contaminants present within underlying made ground materials through ingestion, inhalation and dermal contact pathways; • Controlled waters (underlying Secondary A Aquifer) – leaching of contaminants within the unsaturated zone resulting in vertical and horizontal migration of contaminants through the saturated zone and along preferential pathways; and • Human Health (future site users and proposed development structures) - migration, ingress and inhalation of ground gasses associated with the recorded thickness of made ground/ organic alluvium.

3 GROUND INVESTIGATION METHODOLOGY

3.1 Background

3.1.1 The ground investigation undertaken was designed to provide further information on the ground conditions to aid with the design of the development; and to investigate the potential pollutant linkages identified as part of the initial investigation undertaken by Land Science in 2018.

3.1.2 All site works were undertaken in accordance with BS5930:2015, BS10175+A2:2017 and, where appropriate, Eurocode 7. Works were supervised by a suitably experienced geoenvironmental consultant from TEC.

3.2 Methodology

3.2.1 A summary of the ground investigation works undertaken and the rationale for each location is provided in Table 3.1, as follows:

Table 3.1: Summary of Ground Investigation Works

Investigation Method	Location	Date(s)	Location Rationale	Purpose
Window Sample Borehole (Dando Terrier)	WS11 – WS15	21.10.2020	Positioned to provide supplementary information on the shallow ground conditions encountered by Land Science	Assess for potential contamination associated with identified alluvium/made ground Installation of ground gas monitoring wells
Cable Percussive Borehole	BH01 – BH02	21.10.2020 – 23.10.2020	Positioned within footprint of proposed building	Characterisation of deeper ground conditions for piled foundation information Collection of geochemical and geotechnical samples for analysis

3.2.2 Exploratory hole locations are presented on Figure 2. A detailed description of encountered ground conditions are shown on exploratory hole logs presented in Appendix C.

3.3 Field Testing

3.3.1 A summary of in situ field testing undertaken as part of these ground investigation works is provided in Table 3.2

Table 3.2: Summary of Field Testing

Field Test	Purpose
Standard Penetration Test (SPT)	Provision of strength profile of underlying ground conditions Provision of <i>in situ</i> densities of granular deposits
Photo-Ionisation Detector (PID)	Indication of the presence/concentrations of volatile organic compounds (VOCs)

3.4 Monitoring Works

3.4.1 A summary of the monitoring works completed at the site to date is provided below in Table 3.3;

Table 3.3: Summary of Monitoring Works

Monitoring	Instrument/ Kit	No. of Rounds	Date(s)
Ground Gas	GFM430 Landfill Gas Monitor	1	22.10.2020

3.5 Chemical Testing

3.5.1 Laboratory testing was scheduled on the basis of the previous assessment by Land Science and field observations.

3.5.2 Representative soil and groundwater samples were collected and chemically tested at i2 Analytical Ltd, a UKAS/ MCERTS accredited laboratory, for a selection of the following parameters:

Soils (Totals and Leachate)

- Heavy metals and metalloids;
- Total Organic Carbon (TOC);
- Phenols (monohydric);
- Total Cyanide;
- Sulphate, sulphide, elemental sulphur and pH;
- Speciated Polyaromatic Hydrocarbons (PAH);
- Total Petroleum Hydrocarbons (TPH-CWG), including BTEX and MTBE; and
- Asbestos Screen.

3.5.3 Geochemical certificates of analysis are presented Appendix D.

3.6 Geotechnical Testing

3.6.1 Selected soil samples were submitted for geotechnical analysis at K4 Soils Ltd. Laboratory testing was scheduled upon the basis of field observations for a selection of the following:

- Atterberg limit tests – natural moisture content, liquid limit and plastic limit;
- Particle size distribution (PSD) tests; and
- BRE SD1 Suite B – Water soluble and acid soluble sulphates, total sulphur and pH.

3.6.2 Soil geotechnical certificates of analysis are presented in Appendix E.

3.7 General Sampling

3.7.1 Samples were collected in accordance with the following guidance;

- BS5930:2015 – Code of practice for ground investigations;
- BS-EN 1997-2:2007 - Eurocode 7 — Geotechnical design —Part 2: Ground investigation and testing
- BS ISO 10175:2011+A2:2017 - Investigation of potentially contaminated sites– Code of practice;
- BS ISO 18400-105 Soil quality – Sampling - Packaging, transport, storage and preservation of samples; and
- BS ISO 18400-106 Soil quality – Sampling - Quality control and quality assurance.

4 GROUND INVESTIGATION FINDINGS

4.1 Introduction

4.1.1 A summary of encountered ground conditions for the site is provided below.

4.1.2 Detailed descriptions of encountered ground conditions are shown on exploratory hole logs presented in Appendix C. Photographs of the materials encountered are presented within Appendix A.

Made Ground / Potential Made Ground

4.1.3 Made ground and potential made ground was recorded across the site to depths of between 3.0mbgl and 5.5mbgl. The upper made ground was generally observed to comprise brown to dark brown sandy, very silty clay to depths of 0.1mbgl underlain by brown to dark brown or orange brown sandy gravelly clay or clayey gravelly sand to depths of between 1.7mbgl and 3.2mbgl. The gravel component within this material was observed to include flint, clinker, sandstone, red brick, concrete and metal.

4.1.4 The upper materials were observed to be underlain by potential made ground materials comprising generally brown and blue grey silty clayey sand / silty sandy clay. Localised pockets of peat and decaying root matter as well as a strong organic odour was reported within this material.

Solid Geology (Lower Tunbridge Wells Sand)

4.1.5 The Lower Tunbridge Wells Sand was recorded across the site from depths of 3.0mbgl and was generally recorded to comprise medium dense / dense becoming very dense clayey fine to medium sand with occasional to abundant gravel of flint interbedded with stiff dark grey / green grey slightly sandy clayey silt and sandy silty clay to the base of the excavations (maximum 11.5mbgl).

4.2 Generalised Ground Profile

4.2.1 The general ground profile encountered at the site is summarised in Table 4.1 below.

Table 4.1: Generalised Ground Profile

Depth (mbgl)	Encountered Material
TOPSOIL / MADE GROUND	
0.0 – 0.1	Brown to dark brown sandy, very silty clay.
0.1 - 1.7/3.2	Brown to dark brown or orange brown sandy gravelly clay or clayey gravelly sand with gravel of flint, clinker, sandstone, red brick, concrete and metal.
POTENTIAL MADE GROUND	
1.7/3.2 – 3.0/5.5	Brown and blue grey silty clayey sand / silty sandy clay. Localised pockets of peat and decaying root matter as well as a strong organic odour was reported within this material.
SOLID GEOLOGY – LOWER TUNBRIDGE WELLS SAND	
3.0/5.5 - >10.5/11.5	Medium dense / dense becoming very dense clayey fine to medium sand with occasional to abundant gravel of flint interbedded with stiff dark grey / green grey slightly sandy clayey silt and sandy silty clay.

4.3 Groundwater

4.3.1 Groundwater observations recorded during the ground investigation works and standing depths within the boreholes recorded as part of subsequent monitoring visits are summarised in Table 4.2 overleaf. Groundwater strikes/ observations are also shown on the exploratory hole logs in Appendix C.

Table 4.2: Summary of Groundwater Conditions

Location	Groundwater Strike (mbgl)	Standing Depths (mbgl)	Strata
	21.10.2020	23.10.2020	
WSI1	-	Dry	Made Ground
WSI2	3.0	2.2	
WSI3	3.0	-	
BH01	-	2.8	

4.3.2 It should be noted that groundwater conditions recorded during the investigation may not be representative of long term conditions and that groundwater levels may vary in response to meteorological/ seasonal changes.

4.4 Contamination Observations

4.4.1 Visual and olfactory evidence of potential hydrocarbon contamination was recorded within the south/south-east of the site (BH01, WSI2 and WSI3) during the intrusive investigation at depths of between 1.2mbgl and 3.5mbgl. Screening of soils with a photo-ionisation detector (PID) within these locations recorded relatively low indicative VOC concentrations of between 0.4ppm and 54.8ppm.

5 LAND CONTAMINATION - GENERIC QUANTITATIVE RISK ASSESSMENT

- 5.1.1 The generic quantitative risk assessment comprises a screening of identified contaminants against generic assessment criteria (GAC) that are appropriate to the site setting and the receptors concerned.

5.2 Human Health

Methodology

- 5.2.1 Detailed information on the background legislation and selection of the GAC used within this assessment for human health is presented in Appendix F.

- 5.2.2 The standard land use for the site, for use in this generic assessment, has been defined as “*residential with homegrown produce*” based on the proposed development and in accordance with current guidance.

- 5.2.3 Visual and olfactory evidence of residual hydrocarbon contamination was noted within exploratory locations located within the southern area of the site to depths in the region of 3.5mbgl. Targeted sampling of these soils and of areas of made ground has been undertaken as part of this assessment.

Summary of Results

- 5.2.4 The full human health generic quantitative risk assessment is presented in Appendix F.

Made Ground/ Potential Made Ground

- 5.2.5 The results of the assessment recorded exceedances of the GAC and therefore the following contaminants of potential concern (CoPC) have been identified within the made ground/ potential made ground materials;

- *PAHs – benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene and dibenz(a,h)anthracene; and*
- *Heavy metals – lead.*

- 5.2.6 An asbestos screen completed on samples of the made ground/ at the laboratory recorded no suspected asbestos containing material or detectable asbestos fibres.

- 5.2.7 It is noted that concentrations of petroleum hydrocarbons were all recorded to be below the relevant screening values for human health, including samples collected from the southern area of the site where field observations indicated the presence of potential residual hydrocarbons.

5.3 Controlled Waters

Methodology

- 5.3.1 Detailed information on the background legislation and selection of the GAC used within this assessment for controlled waters is presented in Appendix G.

- 5.3.2 Based on the conceptual understanding, the nearest significant controlled waters receptor is considered to be the underlying Secondary A Aquifer.

Summary of Results

- 5.3.3 The controlled waters generic quantitative risk assessment is presented in Appendix G.

- 5.3.4 The results of the assessment recorded no exceedances of the GAC and therefore no contaminants of potential concern (CoPC) have been identified within the leachate analysis on the sampled made ground.

5.3.5 Notwithstanding this, concentrations of petroleum hydrocarbons have been recorded within the southern area of the site, with a maximum TPH concentration of 1310mg/kg recorded in BH01 at 2.1 – 2.5m depth. Groundwater monitoring would be required to assess for the potential presence of hydrocarbon migration into the underlying aquifer from this area of residual impact.

5.4 Ground Gas

5.4.1 The following potential sources of ground gas have been identified:

On Site Ground Gas Sources

- *Made ground and potential made ground with high proportions of degradable organic content potentially associated with an infilled pond on site.*

Off Site Ground Gas Sources

- *No potentially significant off site ground gas sources have been identified in proximity to the site.*

Ground Gas Monitoring Results

5.4.2 All gas monitoring was undertaken using a calibrated GFM 430 infra-red gas analyser fitted with an internal flow pod. The monitoring results are summarised in Table 5.1 below.

Table 5.1: Summary of Ground Gas Monitoring Data

Borehole	Response Zone/ Strata	Potential source of ground gas	No. of monitoring occasions	Maximum Methane (%)	Maximum Carbon dioxide (%)	Minimum Oxygen (%)	Maximum Flow (l/ hr)	Water levels (mbgl)	Range of atmospheric pressure (mb)
BH01	Made Ground	Potential Infilled Pond	1	0.0	12.6	3.8	0.3	2.8	1000
WS11				0.0	12.5	3.6	0.5	Dry	998
WS12				0.4	11.5	7.9	0.2	2.2	998

5.4.3 Monitoring was undertaken on the 23rd October 2020, during a period of low, although generally rising, atmospheric pressure.

Gas Screening Values (GSVs)

5.4.4 On the basis of the limited gas monitoring undertaken to-date, the site would be characterised in accordance with current guidance as having a worst case GSV of 0.002l/hr for methane (based upon a maximum flow rate of 0.5l/hr and maximum recorded concentration of 0.4%v/v) and 0.063l/hr for carbon dioxide (based upon a maximum flow rate of 0.5l/hr and maximum concentration of 12.6%v/v).

5.4.5 Land Science previously reported a maximum concentration of carbon dioxide of 7.0% from a single monitored borehole on site, with methane concentrations of 0.0% and maximum flow rates of 0.0 – 0.1l/hr. It was tentatively suggested the data may correspond to Characteristic Situation 2 (CS2) although it was acknowledged that further monitoring points and visits would be required to appropriately characterise the ground gas regime.

5.4.6 The results from the additional monitoring round by TEC also indicate a possible CS2 designation for the site, although further monitoring would be required to confirm this (particularly during a period of low and falling atmospheric pressure); and to appropriately inform the scope of ground gas protection measures required for the proposed development.

5.5 Updated Conceptual Model

5.5.1 The findings of the site investigation and the GQRA have been used to update the conceptual model and confirm the relevant pollutant linkages associated with the proposed development.

Identified Sources

5.5.2 Sources of contamination/ ground gas identified on and within the vicinity of the site are summarised below:

On Site Sources

- Made ground; and
- Potential infilled pond.

Off Site Sources

- Potentially contaminative land uses including adjacent cemetery.

Identified Receptors

5.5.3 Receptors identified as part of this updated conceptual model are:

- Current/future site users;
- Construction workers;
- Controlled waters (Secondary A Aquifer); and
- Proposed development/ structures.

Identified Pathways

5.5.4 Potential contaminant pathways relating to the identified receptors and contaminants of concern include:

- Dermal contact – contact with soil, dust or water;
- Ingestion - ingestion of soil, dust or water;
- Inhalation – inhalation of soil, dust or vapours;
- Vertical migration –leaching of hydrocarbon impact within the shallow soils/ unsaturated zone resulting in vertical contaminant migration to the underlying aquifer; and
- Horizontal migration –lateral migration of contaminants within the saturated zone and along preferential pathways such as drainage pipe bedding.

5.5.5 The updated conceptual model is presented in Table 5.2. References to risk estimations are made in accordance with the methodology presented in CIRIA publication C552 (2001) titled '*Contaminated Land Risk Assessment: A Guide to Good Practice*' and summarised in Appendix B.

Table 5.2: Updated Conceptual Model (Hazard Assessment and Risk Estimation)

Identified Hazard/ Source	Identified Receptor	Potential Pathway	Potential Consequence of Source-Pathway-Receptor Pollutant Linkage	Potential Likelihood for Source-Pathway-Receptor Pollutant Linkage	Risk Classification
Made Ground / Potentially Infilled Pond – on site	Current and future site users and construction workers	Exposure to potential contaminants through ingestion, inhalation and dermal contact.	Medium	Likely: Made ground and potential made ground was encountered across the site to a maximum observed depth of 5.5mbgl. Laboratory analysis recorded elevated concentrations of a number of heavy metals and PAHs in excess of the assessment criteria when considering a residential site end use. Furthermore, the presence of Chrysotile (hard/cement type material) was recorded within a single location during the investigation undertaken by Land Science in 2018. Therefore, where soft landscaping is proposed and where made ground remain onsite after finished site levels have been achieved, exposure to potential contaminants cannot be discounted.	Moderate Risk
	Controlled waters	Leaching of potential contaminants from made ground and vertical and lateral migration through the saturated zone to controlled waters.	Medium	Low Likelihood: Residual hydrocarbon contamination has been recorded at depths of between 1.2mbgl and 3.5mbgl within the south of the site. While total concentrations were recorded below the screening values for a residential site end use and leachable concentrations were reported as below laboratory limit of detection, given the presence of the underlying Secondary A Aquifer, a potential significant risk cannot be fully discounted and further assessment should be undertaken. The assessment undertaken by Land Science in 2018 recorded the presence of a number of leachable heavy metals in excess of the screening values deemed protective of the underlying groundwater. The risk to controlled waters from these leachable contaminants concentrations is considered to be low although further monitoring would be recommended to confirm contaminant concentrations present in the groundwater.	Low to Moderate Risk
	Current and future site users, construction workers and proposed development	Migration, ingress and accumulation of ground gasses.	Severe	Likely: A significant thickness of organic made ground / infill materials were recorded on site, particularly within the south of the site. Ground gas monitoring undertaken by TEC, and previously by Land Science (2018), has recorded elevated carbon dioxide concentrations. Further monitoring would be required to fully characterise the ground gas regime for the site.	Moderate Risk
Potentially Contaminative Land Uses – off site	Current and future site users and construction workers and Controlled Waters	Exposure to potential contaminants through ingestion, inhalation and dermal contact. Leaching of potential contaminants from made ground and vertical and lateral migration through the saturated zone to controlled waters.	Medium	Unlikely: While visual and olfactory evidence of residual contamination was recorded during the intrusive works, the identified contamination is considered to be site derived and unlikely to be associated with the migration of contamination from off site sources.	Low Risk

6 LAND CONTAMINATION - CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

Human Health

- 6.1.1 Laboratory analytical results of the encountered made ground materials, during both the TEC and Land Science investigations, recorded the exceedance of a number the relevant GAC for human health (for a residential with homegrown produce site end use) for heavy metals and PAHs. In addition, asbestos containing material was recorded within sampled materials during the previous assessment undertaken by Land Science in 2018.

Controlled Waters

- 6.1.2 Land Science previously reported elevated leachable heavy metal concentrations within the tested made ground materials. In addition, visual and olfactory evidence of potential residual hydrocarbon was recorded within a number of locations within the south / south east of the site during the intrusive investigation, within the vicinity of the area considered likely be associated with an infilled pond. Given the presence of residual contamination at depth (with up to 1310mg/kg TPH recorded); and the underlying Secondary A Aquifer (with recorded potentially permeable sand deposits), a potential risk to controlled waters cannot be fully discounted at this stage and further assessment would be recommended to confirm groundwater quality at the site.
- 6.1.3 Based on the limited ground gas monitoring undertaken to-date together with the conceptual site model, it is possible that the site may potentially be considered as Characteristic Situation 2. However, further monitoring would be recommended to confirm this regime.
- 6.1.4 No radon protective measures are considered necessary within the construction of new homes.

6.2 Remedial Appraisal

- 6.2.1 Localised contaminants of potential concern (CoPC) have been recorded within the near surface materials when considering a residential site end use.
- 6.2.2 Therefore, where soft landscaping is proposed in such areas and where made ground remains after finished site levels have been achieved, localised exposure to potential contaminants cannot be discounted and a suitable cover system may be required within areas of soft landscaping. Given the concentration of contaminants recorded in the shallow made ground, and as Land Science previously identified the presence of asbestos, an engineered cover system may be required comprising clean imported materials with a geotextile break layer.

6.3 General Considerations

- 6.3.1 Given the presence of general made ground, good brownfield site working practices should be adopted by construction workers to mitigate against potential risks.
- 6.3.2 Should water supply pipes be placed within the made ground encountered at the site, due consideration would need to be given to the UK Water Industry Research Ltd (UKWIR) guidance.
- 6.3.3 Based on our conceptual understanding of the site to-date, it would be anticipated that similar ground conditions to those encountered as part of this assessment exist across the site areas where access has been possible. However, should significant thicknesses of made ground be encountered, or visual or olfactory evidence of potentially significant contamination be identified during the development works, further investigation and assessment may be required.

7 GROUND ENGINEERING

7.1 Proposed Development

- 7.1.1 The site currently comprises a vacant parcel of land utilised for recreational purposes.
- 7.1.2 The proposed development is understood to comprise the construction of 10No. low rise residential dwellings with associated private gardens and hard infrastructure (Figure 2).
- 7.1.3 Although no details have been provided to TEC, line loads of up to 75kN per metre run and column loads of up to 200kN have been assumed for the residential development at this preliminary stage and general recommendations with regards to the ground engineering have been made on this basis.

7.2 Site Preparation

- 7.2.1 An underground sewage pipe is present within the southern section of the site and appropriate easement of this feature/ potential realignment will be required during the proposed development works.

7.3 Geotechnical Test Data Summary

- 7.3.1 Laboratory test data are presented in Appendix E while in situ test results are presented on the engineering logs Appendix C.

Plasticity

- 7.3.2 Atterberg Limit tests were undertaken on 7no. cohesive samples collected from the potential made ground/ organic clays and the underlying Lower Tunbridge Wells Sand, summarised in Table 7.1 below:

Table 7.1: Summary of Laboratory Test Results

Moisture Content (%)	Plasticity Index (%)	% passing 425µm sieve	Modified Plasticity Index ⁽¹⁾ (%)	Volume Change Potential ⁽¹⁾
17 – 27	4 – 15	95 – 100	4 – 15	Non-shrinkable – Low

Note 1: Based on recommendations provided in the NHBC Standard

Particle Size Distribution

- 7.3.3 Particle Size Distribution testing was undertaken on 3No. representative samples of the encountered Lower Tunbridge Wells Sand ground materials, summarised in Table 7.2 below:

Table 7.2: Summary of Laboratory Test Results

Sample	Gravel (%)	Sand (%)	Clay (%)	Silt (%)	Soil Description
BH01 at 9.5mbgl	0.3	27.8	49.5	22.4	Slightly sandy silty clay
BH02 at 8.2mbgl	1.0	12.9	48.1	38.0	Slightly gravelly slightly sandy silty clay
BH02 at 10.0mbgl	2.0	73.8	13.8	10.4	Slightly gravelly clayey silty sand

Soil Strength

- 7.3.4 Standard Penetration Testing (SPT's) recorded 'N' values of between 30 and >50 within the underlying Lower Tunbridge Wells Sand, indicating the underlying ground materials are dense to very dense where granular and very stiff where cohesive.

7.4 Foundations

- 7.4.1 Given the significant thickness of made ground / potential made ground materials across the site, it is considered unlikely that conventional foundations would be suitable for the proposed development within this area.
- 7.4.2 Therefore, a piled foundation solution should be utilised within the proposed development. It is recommended that a specialist piling contractor is consulted regarding the most appropriate option and detailed design information. However, at this stage, it is considered that CFA piles may be appropriate for the site and preliminary pile capacities have been estimated using a generalised ground profile for the site.
- 7.4.3 Based on the available information, *for budgetary and indicative purposes only*, a pile resistance in the order of 250kN is anticipated for a single 300mm pile to a depth of approximately 10mbgl (i.e. founding within the competent Lower Tunbridge Wells Sand and ignoring any skin friction from the upper ~5m of made ground materials). It should be noted that no allowance has been given to potential negative skin friction that may be derived from the made ground (including possible infilled organic clays) and therefore piles may need to be sleeved through these deposits, or such loads should be taken into account in the final design.
- 7.4.4 The underlying cohesive deposits have been recorded to be of low volume change potential and therefore suitable voids may be required below and against the sides of ground beams subject to the final design.

7.5 Ground Floor Slabs

- 7.5.1 Given the presence of shrinkable soils and the proposed foundation solution, the use of suspended floor slabs may be appropriate for the scheme, which should incorporate the minimum void dimensions as outlined in the NHBC Standards.

7.6 Preliminary Pavement Design

- 7.6.1 Given the significant thickness of made ground materials encountered across the site, a CBR value of <2.5% would be considered appropriate for preliminary design purposes.
- 7.6.2 It should be noted that all road formations should be proof rolled and soft spots removed and replaced with selected granular fill and, where adoptable, a pavement of sufficient thickness (>450mm) to prevent the penetration of frost should be employed.
- 7.6.3 CBR values of the subgrade should be confirmed by in situ testing when final formation levels are known.

7.7 Excavations

- 7.7.1 Excavations at the site for conventional foundations may be achievable using conventional equipment.
- 7.7.2 Groundwater seepages were recorded at depths of 3.0mbgl, with standing groundwater levels of between 2.2mbgl and 2.8mbgl recorded during subsequent monitoring. Based on observations made during the ground investigations, groundwater ingress into excavations is considered unlikely to be significantly problematic although some dewatering may be required, particularly where excavations are left open for any length of time. It would be recommended that formation levels are protected to mitigate against softening associated with any such water ingress.
- 7.7.3 It should be noted that groundwater levels might fluctuate according to the season and from year to year. This may have implications on recommendations, including those for foundations and excavations. Accordingly, a careful watch should be maintained during any future groundworks and the recommendations presented in this report may be subject to amendment should additional information becoming available.

7.7.4 It is recommended that appropriate shoring/temporary works are used in accordance with current Health and Safety requirements where access for personnel is required into excavations.

7.8 Protection of Buried Concrete

7.8.1 BRE SD1 Suite B testing was undertaken on 13no. samples of the encountered ground materials.

7.8.2 The results of the testing, together with the resulting Aggressive Chemical Environment for Concrete (ACEC) Class and Design Sulphate (DS) Class, as derived in accordance with BRE Special Digest 1, are presented in Table 7.3. The full laboratory results are presented in Appendix D and Appendix E

Table 7.3: Summary of ACEC

Stratum	No. of tests	pH	Water Soluble Sulphate (mg/ l)	Oxidisable Sulphides (%)	Total Potential Sulphates (%)	ACEC	DS
Made Ground	7	6.7 – 8.6	16 – 640	-	-	AC-2	DS-2
Potential Made Ground	2	7.1 – 8.3	30	0.02 – 0.03	0.06	AC-1	DS-1
Lower Tunbridge Wells Sand	3	7.1 – 8.3	<20 – 30	<0.01 – 0.06	<0.01 – 0.09	AC-1	DS-1

8 GROUND ENGINEERING - CONCLUSIONS AND RECOMMENDATIONS

- 8.1.1 Given the significant thickness of made ground and potential made ground materials across the site, it is considered unlikely that conventional foundations would be suitable for the proposed development within this area.
- 8.1.2 Therefore, a piled foundation solution should be utilised within the proposed development. It is recommended that a specialist piling contractor is consulted regarding the most appropriate option and detailed design information. However, at this stage, it is considered that CFA piles may be appropriate for the site and preliminary pile capacities have been estimated using a generalised ground profile for the site.
- 8.1.3 Based on the available information, *for budgetary and indicative purposes only*, a pile resistance in the order of 250kN is anticipated for a single 300mm pile to a depth of approximately 10mbgl (i.e. founding within the competent Lower Tunbridge Wells Sand and ignoring any skin friction from the upper ~5m of made ground materials). It should be noted that no allowance has been given to potential negative skin friction that may be derived from the made ground (including possible infilled organic clays) and therefore piles may need to be sleeved through these deposits, or such loads should be taken into account in the final design.
- 8.1.4 Given the presence of shrinkable soils and the proposed foundation solution, the use of suspended floor slabs may be appropriate for the scheme, which should incorporate the minimum void dimensions as outlined in the NHBC Standards.
- 8.1.5 Given the significant thickness of made ground materials encountered across the site, a CBR value of <2.5% would be considered appropriate for preliminary design purposes.
- 8.1.6 The results of the sulphate and pH testing from the soils at the site yield an aggressive chemical environment class (ACEC) of AC-2, requiring a design sulphate class of DS-2.

9 RECOMMENDED FURTHER WORKS

- 9.1.1 Given the identified residual hydrocarbon contamination recorded within the south / southeast section of the site, and previously reported leachable concentrations of heavy metals, a potential significant risk to controlled waters cannot be discounted. Therefore, further assessment comprising groundwater monitoring would be recommended to confirm whether a significant risk is present.
- 9.1.2 Organic deposits have been recorded within the underlying possible made ground materials, to depths of up to 5.5mbgl. In addition, initial monitoring by TEC and Land Science has recorded carbon dioxide and methane concentrations associated with these deposits and therefore further gas monitoring would be recommended to fully characterise the ground gas regime on site, and inform appropriate ground gas protection measures for the development.

TEC

FIGURES AND DRAWINGS



Approximate Site Location:



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Licence number 100043301



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Site Name:
Blackwell Farm, East Grinstead

Drawing Name:
Site Location Plan

Client Name:
W Stirland Ltd

Project No:
2006010.001

Figure No:
1

Date:
January 2021

Scale:
NTS



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Web: www.tecon.co.uk

Site Name
Blackwell Farm, East Grinstead

Drawing Name
Proposed Development and
Exploratory Hole Location Plan

Client Name:
W Stirland Ltd

Project No:
2006010.001

Figure No
2

Date:
January 2021

Scale:
NTS

Appendix A

Ste Photographs

Blackwell Farm, East Grinstead



Photograph 1: View of the site facing north.



Photograph 2: View of the site facing west.

Blackwell Farm, East Grinstead



Photograph 3: View of the adjacent cemetery, facing west.



Photograph 4: View of the site facing south.



Photograph 5: Photograph of the arising encountered within WS1.



Photograph 6: Photograph of the organic made ground materials encountered within WS2.

Appendix B

Risk Methodologies and Evaluation

Risk Evaluation

The qualitative assessment methodology presented in CIRIA publication C552 (2001) titled '*Contaminated Land Risk Assessment: A Guide to Good Practice*' has been used by TEC for the basis of evaluating potential risk.

The method requires an assessment of the:

- magnitude of the probability or likelihood of the risk occurring (Table 1); and
- magnitude of the potential consequence or severity of the risk occurring (Table 2)

Table 1. Classification of Probability

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place, and is less likely in the short-term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table 2. Classification of Consequence

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. (Note: Water Resources Act contains no scope for considering significance of pollution). Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organisation forming part of such ecosystem (note: the definitions of ecological systems within the draft circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to human health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources. (Note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem, (note: the definitions of ecological systems within draft circular on Contaminated Land, DETR, 2000).	Concentration of a contaminant from site exceeding the generic or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the draft circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (for example foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc), easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discolouration of concrete.

The combination of the two factors is determined using Table 3 and the resulting level of risk is described in Table 4. The evaluation can be applied to each of the scenarios identified in the risk model and the overall risk assessed.

Table 3. Combination of Consequence with Probability

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/ Low Risk
	Likely	High Risk	Moderate Risk	Moderate/ Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/ Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table 4. Description of risks and likely action required

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

Using the risk model the pollutant linkages are identified and a preliminary estimate of risk undertaken. If there is no pollutant linkage identified, then there is no risk. If the estimate of risk for all the linkages and exposure scenarios is very low at this stage then it is likely that no further assessment will be required.

Appendix C

Exploratory Hole Logs



Borehole Log

Borehole No.

BH01

Sheet 1 of 2

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
CP

Location: East Grinstead

Level: mbgl

Scale
1:50

Client: W Stirland Ltd

Dates: 21/10/2020 - 22/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
						0.10			MADE GROUND: Brown to dark brown sandy very silty CLAY. MADE GROUND: Brown to dark brown sandy gravelly clay. Gravel of flint, clinker, concrete, red brick and sandstone.	
		1.20	S	N=2 (1,1/1,0,0,1)					PID at 1.6mbgl = 32.4ppm	1
		2.10	S	N=2 (2,1/1,1,0,0)					PID at 2.1mbgl = 54.8ppm	2
		3.00	S	N=4 (1,1/1,1,1,1)						3
		4.00	S	N=29 (3,3/5,6,7,11)		3.20			POTENTIAL MADE GROUND: brown to dark blue grey silty very clayey fine sand with decayed roots and localised pockets of peat. A faint hydrocarbon odour and black staining were recorded between 3.2mbgl and 4.00mbgl.	4
		5.00	S	N=27 (2,4/5,6,8,8)		4.20			POTENTIAL MADE GROUND: dark blue grey very silty clay with localised pockets of peat.	5
		6.50	S	N=32 (3,5/6,8,8,10)		5.50			Medium dense becoming dense light brown to grey brown silty gravelly very clayey fine to medium SAND. Gravel of fine to medium subrounded flint.	6
		8.00	S	50 (7,12/50 for 175mm)		7.50			Stiff dark grey slightly sandy clayey SILT.	8
		9.50	S	N=44 (5,6/8,12,12,12)						9
										10

Continued on next sheet

Remarks

No groundwater was recorded during drilling. Borehole terminated at 10.8mbgl due to effective refusal.





Borehole Log

Borehole No.

BH01

Sheet 2 of 2

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
CP

Location: East Grinstead

Level: mbgl

Scale
1:50

Client: W Stirland Ltd

Dates: 21/10/2020 - 22/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
		10.50	S	50 (6,7/50 for 205mm)		10.80				
									End of borehole at 10.8 m	11
										12
										13
										14
										15
										16
										17
										18
										19
										20

Remarks

No groundwater was recorded during drilling. Borehole terminated at 10.8mbgl due to effective refusal.





Borehole Log

Borehole No.

BH02

Sheet 1 of 2

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
CP

Location: East Grinstead

Level: mbgl

Scale
1:50

Client: W Stirland Ltd

Dates: 22/10/2020 - 23/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
						0.10			MADE GROUND: Brown to dark brown silty very sandy clay with roots and rootlets.	
						0.50			MADE GROUND: Brown to dark brown silty very gravelly clay. Gravel of flint and red brick.	
		1.20	S	N=6 (2,2/2,1,1,2)					MADE GROUND: Brown to orange brown slightly silty gravelly very sandy clay. Gravel of flint, concrete and red brick.	1
		2.10	S	N=5 (3,2/2,1,1,1)		2.10			POTENTIAL MADE GROUND: dark brown to dark blue grey silty very clayey sand. A strong organic odour was recorded.	2
		3.00	S	N=2 (1,1/0,0,1,1)						3
		4.00	S	N=14 (1,2/2,2,3,7)						4
		5.00	C	N=50 (3,8/50 for 235mm)	Casing=5.00m	4.50			Very dense light grey to green grey silty clayey very gravelly fine to coarse SAND. Gravel of fine to coarse subangular to rounded flint.	5
		6.50	C	50 (25 for 115mm/50 for 175mm)	Casing=6.50m	7.00				6
		7.80	S	50 (8,16/50 for 160mm)					Stiff greenish brown sandy silty CLAY with rare fine gravel of subangular flint.	7
		8.50	S	N=30 (3,4/5,7,9,9)						8
						9.00			Dense light grey to dark grey very silty fine to coarse SAND and fine to coarse subangular to subrounded flint and sandstone GRAVEL.	9
										10

Continued on next sheet

Remarks

No groundwater was recorded during drilling. Borehole was terminated at a depth of 11.5mbgl due to effective refusal.





Borehole Log

Borehole No.

BH02

Sheet 2 of 2

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
CP

Location: East Grinstead

Level: mbgl

Scale
1:50

Client: W Stirland Ltd

Dates: 22/10/2020 - 23/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
		10.00	S	N=50 (5,8/50 for 255mm)						
		11.20	S	N=51 (9,9/51 for 250mm)		11.50				11
									End of borehole at 11.5 m	12
										13
										14
										15
										16
										17
										18
										19
										20

Remarks

No groundwater was recorded during drilling. Borehole was terminated at a depth of 11.5mbgl due to effective refusal.





Borehole Log

Borehole No.

WS11

Sheet 1 of 1

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
WS

Location: East Grinstead

Level: mbgl

Scale
1:33

Client: W Stirland Ltd

Dates: 21/10/2020 - 21/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
		0.10				0.10			MADE GROUND: brown to dark brown silty very sandy clay with occasional roots and rootlets. MADE GROUND: brown to dark brown very silty clayey gravelly sand. Gravel of flint, red brick, ceramics and concrete. Localised pockets of peat was recorded between 1.2mbgl and 1.5mbgl.	1
		1.00	C	N=10 (2,2/2,2,2,4)	Casing=1.00m					
		2.00	C	N=2 (0,0/0,0,1,1)	Casing=2.00m	1.80			POTENTIAL MADE GROUND: light brown to brown grey silty very sandy clay. A strong organic odour was recorded.	2
		3.00	C	N=43 (4,6/9,9,11,14)	Casing=3.00m	3.00			Dense to very dense light brown silty gravelly fine to medium SAND. Gravel of subrounded to rounded fine to coarse sandstone and flint.	3
		3.70	C	50 (11,14/50 for 170mm)	Casing=3.70m	3.70			End of borehole at 3.7 m	4
										5
										6

Remarks

No groundwater was encountered during drilling. Borehole terminated at 3.7mbgl due to effective refusal.





Borehole Log

Borehole No.

WS12

Sheet 1 of 1

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
WS

Location: East Grinstead

Level: mbgl

Scale
1:33

Client: W Stirland Ltd

Dates: 21/10/2020 - 21/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
		0.10							MADE GROUND: Brown to dark brown silty very sandy clay with moderate roots and rootlets. MADE GROUND: Light brown to dark brown very silty, clayey gravelly sand. Gravel of flint, sandstone, red brick and concrete. Metal fragments were recorded from 1.2mbgl. A potential hydrocarbon odour and black staining were recorded from 1.2mbgl. <u>PID at 0.4mbgl = 0.4ppm</u>	1
		1.00	C	N=8 (1,1/2,2,2,2)						
		2.00	C	N=0 (0,0/0,0,0,0)					<u>PID at 2.0mbgl = 15.5ppm</u>	2
		3.00	C	N=0 (0,0/0,0,0,0)					POTENTIAL MADE GROUND: Blue grey to grey silty very sandy clay. A potential hydrocarbon odour and black staining were recorded between 2.8mbgl and 3.5mbgl. <u>PID at 3.8mbgl = 0.0ppm</u>	3
		4.00	C	N=0 (0,0/0,0,0,0)						4
		4.80							POTENTIAL MADE GROUND: black peat.	
		5.00							End of borehole at 5.0 m	5
										6

Remarks

A groundwater strike was recorded at 3.00mbgl.





Borehole Log

Borehole No.

WS13

Sheet 1 of 1

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
WS

Location: East Grinstead

Level: mbgl

Scale
1:33

Client: W Stirland Ltd

Dates: 21/10/2020 - 21/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
						0.10			MADE GROUND: Brown to dark brown silty very sandy clay with roots and rootlets. MADE GROUND: Light brown to dark brown very silty clayey gravelly sand. Gravel of flint, sandstone, red brick and concrete. A potential hydrocarbon odour and black staining were recorded from 1.2mbgl.	
									PID at 1.2mbgl = 7.4ppm	1
									PID at 2.2mbgl = 0.6ppm	2
						2.80			POTENTIAL MADE GROUND: Blue grey to grey silty very sandy clay. A potential hydrocarbon odour and black staining were recorded between 2.8mbgl and 3.5mbgl.	3
						4.00			End of borehole at 4.0 m	4
										5
										6

Remarks

A groundwater strike was recorded at 3.00mbgl. Borehole terminated at 4.0mbgl due to presence of potential contamination.





Borehole Log

Borehole No.

WS14

Sheet 1 of 1

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
WS

Location: East Grinstead

Level: mbgl

Scale
1:33

Client: W Stirland Ltd

Dates: 21/10/2020 - 21/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
		0.10							MADE GROUND: Brown to dark brown silty very sandy clay with root and rootlets. MADE GROUND: Brown to dark brown clayey very gravelly sand. Gravel of red brick, flint and concrete.	1
		1.00	C	N=10 (1,2/1,2,3,4)		1.50			MADE GROUND: Light brown to dark brown gravelly silty very sandy clay. Gravel of flint and red brick.	
		2.00	C	N=14 (4,5/3,3,4,4)		1.70			POTENTIAL MADE GROUND: blue grey to dark grey silty clay with decaying roots. Strong organic odour.	2
		3.00	C	N=11 (2,3/3,2,3,3)						3
		4.00	C	N=6 (1,2/2,2,1,1)						4
		5.00	C	N=43 (4,6/8,11,13,11)		4.50			Dense light brown very silty clayey gravelly fine SAND. Gravel of fine to medium sandstone and flint.	
						5.00			End of borehole at 5.0 m	5
										6

Remarks

No groundwater was encountered.





Borehole Log

Borehole No.

WS15

Sheet 1 of 1

Project Name: Blackwell Farm

Project No.
2060010.001

Co-ords: -

Hole Type
WS

Location: East Grinstead

Level: mbgl

Scale
1:33

Client: W Stirland Ltd

Dates: 21/10/2020 - 21/10/2020

Logged By
GM

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results	Information					
									MADE GROUND: Brown to dark brown clayey very gravelly sand. Gravel of red brick, concrete, flint and ceramics. Rare glass.	1
						1.80			POTENTIAL MADE GROUND: blue grey to dark grey silty clay with decaying roots. Strong organic odour.	2
		3.00	C	N=8 (0,0/0,0,2,6)						3
						3.70				
		4.00		44 (7,11/14,14,16,)		4.00			Dense to very dense light brown slightly silty clayey gravelly fine SAND. Gravel is fine to coarse rounded sandstone and flint. End of borehole at 4.0 m	4
										5
										6

Remarks

No groundwater was encountered. Borehole terminated at 4.0mbgl due to effective refusal.



Appendix D
Geochemical Certificates of Analysis

Gail Mitchell

Tweedie Evans Consulting Ltd
The Old Chapel
35a Southover
Wells
Somerset
BA5 1UH

t: 01749 677 760**f:** 01749 679 345**e:**

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

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

Analytical Report Number : 20-38058

Project / Site name:	Blackwell Faarm East Grinstead	Samples received on:	23/10/2020
Your job number:	206010 001 01	Samples instructed on/ Analysis started on:	27/10/2020
Your order number:		Analysis completed by:	10/11/2020
Report Issue Number:	1	Report issued on:	10/11/2020
Samples Analysed:	3 leachate samples - 10 soil samples		

Signed:

Will Fardon
Technical Reviewer (CS Team)
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.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 20-38058

Project / Site name: Blackwell Faarm East Grinstead

Lab Sample Number				1665414	1665415	1665416	1665417
Sample Reference				WS11	WS11	WS14	WS14
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.50	0.20	0.50
Date Sampled				21/10/2020	21/10/2020	21/10/2020	21/10/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	18	18	8.3	12
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.2

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

pH - Automated	pH Units	N/A	MCERTS	6.7	7.1	7.7	8.6
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	-	570	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.016	0.025	0.035	0.062
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.9	2	0.8	0.9

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	0.35
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.35
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.56	2.8	6.3
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.47	1.3
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.4	5.6	17
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.36	4.9	15
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.23	2.5	8
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.16	2.1	6.5
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.7	9
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	2.8	5.6
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	2.5	8.3
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.1	3.7
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.25	0.95
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.2	4.1

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	1.71	27.8	86
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	20	20	14	13
Barium (aqua regia extractable)	mg/kg	1	MCERTS	100	110	120	89
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.2	1.3	0.95	0.64
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	0.8	1.4	0.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	31	34	20	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	21	22	18	19
Lead (aqua regia extractable)	mg/kg	1	MCERTS	37	61	45	39
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	20	19	18	14

Analytical Report Number: 20-38058

Project / Site name: Blackwell Faarm East Grinstead

Lab Sample Number				1665414	1665415	1665416	1665417
Sample Reference				WS11	WS11	WS14	WS14
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.50	0.20	0.50
Date Sampled				21/10/2020	21/10/2020	21/10/2020	21/10/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	41	51	30	27
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	66	71	67	66

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	-	-	< 1.0	-
Toluene	µg/kg	1	MCERTS	-	-	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	< 1.0	-
p & m-xylene	µg/kg	1	MCERTS	-	-	< 1.0	-
o-xylene	µg/kg	1	MCERTS	-	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	< 1.0	-

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	-	-	32	-
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	< 1.0	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	< 2.0	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	< 8.0	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	< 8.0	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	< 10	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	< 1.0	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	< 2.0	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	12	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	20	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	32	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 20-38058

Project / Site name: Blackwell Faarm East Grinstead

Lab Sample Number				1665418	1665419	1665420	1665421
Sample Reference				WS15	WS12	WS12	BH01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.40	2.80-3.20	1.60-2.00
Date Sampled				21/10/2020	21/10/2020	21/10/2020	21/10/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	15	5.4	40	26
Total mass of sample received	kg	0.001	NONE	0.2	0.2	0.2	0.2

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	7.7	7.6	-	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	-
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	2400	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.054	0.64	-	-
Sulphide	mg/kg	1	MCERTS	< 1.0	110	-	-
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.6	1.2	-	-

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	0.39	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	1.2	0.33	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.46	0.58	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	2.4	1	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.85	31	6	2.2
Anthracene	mg/kg	0.05	MCERTS	< 0.05	8.1	1.8	0.49
Fluoranthene	mg/kg	0.05	MCERTS	1.3	48	8.8	5.8
Pyrene	mg/kg	0.05	MCERTS	1.1	40	7.6	5.2
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.71	20	5.2	3.6
Chrysene	mg/kg	0.05	MCERTS	0.51	16	3.6	2.5
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.46	18	5.5	3.6
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.41	11	2.6	1.8
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.5	16	4.5	3
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	7.4	2.4	1.7
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	1.7	< 0.05	0.42
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	7.8	2.5	1.7

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	5.82	229	52.2	31.9
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8	9.2	-	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	74	160	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.56	0.6	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	1.2	1.1	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-	-
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	18	19	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	13	24	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	30	230	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	13	16	-	-

Analytical Report Number: 20-38058

Project / Site name: Blackwell Faarm East Grinstead

Lab Sample Number				1665418	1665419	1665420	1665421
Sample Reference				WS15	WS12	WS12	BH01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.40	2.80-3.20	1.60-2.00
Date Sampled				21/10/2020	21/10/2020	21/10/2020	21/10/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	24	23	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	53	130	-	-

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	-	< 10	-	-
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	7.5	5.7
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	38	26
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	< 8.0	21	20
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	< 8.0	65	95
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	130	150
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	2.6	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	13	16	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	120	48	25
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	100	160	97
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	240	230	120

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 20-38058

Project / Site name: Blackwell Faarm East Grinstead

Lab Sample Number				1665422	1665423
Sample Reference				BH01	BH01
Sample Number				None Supplied	None Supplied
Depth (m)				2.10-2.50	3.50-4.00
Date Sampled				21/10/2020	21/10/2020
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	20	19
Total mass of sample received	kg	0.001	NONE	0.2	0.2

Asbestos in Soil	Type	N/A	ISO 17025	-	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-
Total Cyanide	mg/kg	1	MCERTS	-	-
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-
Sulphide	mg/kg	1	MCERTS	-	-
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-
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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	2.1	< 0.05
Fluorene	mg/kg	0.05	MCERTS	3.1	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	15	< 0.05
Anthracene	mg/kg	0.05	MCERTS	3.6	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	18	< 0.05
Pyrene	mg/kg	0.05	MCERTS	15	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	7.5	< 0.05
Chrysene	mg/kg	0.05	MCERTS	5.5	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	6.2	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	3.2	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	5.2	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.5	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.5	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	89.3	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-
Chromium (hexavalent)	mg/kg	1.2	MCERTS	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-

Analytical Report Number: 20-38058

Project / Site name: Blackwell Faarm East Grinstead

Lab Sample Number				1665422	1665423
Sample Reference				BH01	BH01
Sample Number				None Supplied	None Supplied
Depth (m)				2.10-2.50	3.50-4.00
Date Sampled				21/10/2020	21/10/2020
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	-	-
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TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	120	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	71	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	640	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	830	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	5.1	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	52	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	89	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	330	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	480	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 20-38058

Project / Site name: Blackwell Faarm East Grinstead

Lab Sample Number				1665424	1665425	1665426
Sample Reference				WS12	BH01	BH01
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.60-2.00	2.10-2.50
Date Sampled				21/10/2020	21/10/2020	21/10/2020
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status			

General Inorganics

pH	pH Units	N/A	ISO 17025	6.4	7.1	-
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	-
Sulphate as SO4	µg/l	100	ISO 17025	96000	35800	-
Total Organic Carbon (TOC)	mg/l	0.1	NONE	4.35	5.07	-

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	-
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	1.6	4.3	-
Barium (dissolved)	µg/l	0.05	ISO 17025	100	57	-
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	-
Boron (dissolved)	µg/l	10	ISO 17025	49	17	-
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	-
Chromium (dissolved)	µg/l	0.4	ISO 17025	0.9	2.7	-
Copper (dissolved)	µg/l	0.7	ISO 17025	2.5	8.7	-
Lead (dissolved)	µg/l	1	ISO 17025	3.9	5.4	-
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	-
Nickel (dissolved)	µg/l	0.3	ISO 17025	8.5	4.5	-
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	-
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7	< 1.7	-
Zinc (dissolved)	µg/l	0.4	ISO 17025	35	100	-

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0



Analytical Report Number: 20-38058

Project / Site name: Blackwell Faarm East Grinstead

Lab Sample Number				1665424	1665425	1665426
Sample Reference				WS12	BH01	BH01
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.60-2.00	2.10-2.50
Date Sampled				21/10/2020	21/10/2020	21/10/2020
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status			
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10	< 10

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	-
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 20-38058

Project / Site name: Blackwell Faarm East Grinstead

* 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 *
1665414	WS11	None Supplied	0.2	Brown clay and loam with gravel and vegetation.
1665415	WS11	None Supplied	0.5	Brown clay and loam with gravel and vegetation.
1665416	WS14	None Supplied	0.2	Brown clay and loam with gravel and vegetation.
1665417	WS14	None Supplied	0.5	Brown clay and loam with gravel.
1665418	WS15	None Supplied	0.3	Brown clay and loam with gravel.
1665419	WS12	None Supplied	0.4	Brown clay and loam with glass and gravel
1665420	WS12	None Supplied	2.80-3.20	Brown clay and loam with gravel and vegetation.
1665421	BH01	None Supplied	1.60-2.00	Brown clay and loam with gravel and vegetation.
1665422	BH01	None Supplied	2.10-2.50	Brown clay and loam with gravel and vegetation.
1665423	BH01	None Supplied	3.50-4.00	Brown clay and loam with gravel.

Analytical Report Number : 20-38058

Project / Site name: Blackwell Faarm East Grinstead

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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.	L038-PL	D	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
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
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
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	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
Hexavalent chromium in soil (Lower Level)	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
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
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
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
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
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In house method.	L005-PL	W	ISO 17025
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS

Analytical Report Number : 20-38058

Project / Site name: Blackwell Faarm East Grinstead

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-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
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
Total cyanide in leachate	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	ISO 17025
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 organic carbon in leachate	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-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.

Sample Deviation Report



Analytical Report Number : 20-38058

Project / Site name: Blackwell Faarm East Grinstead

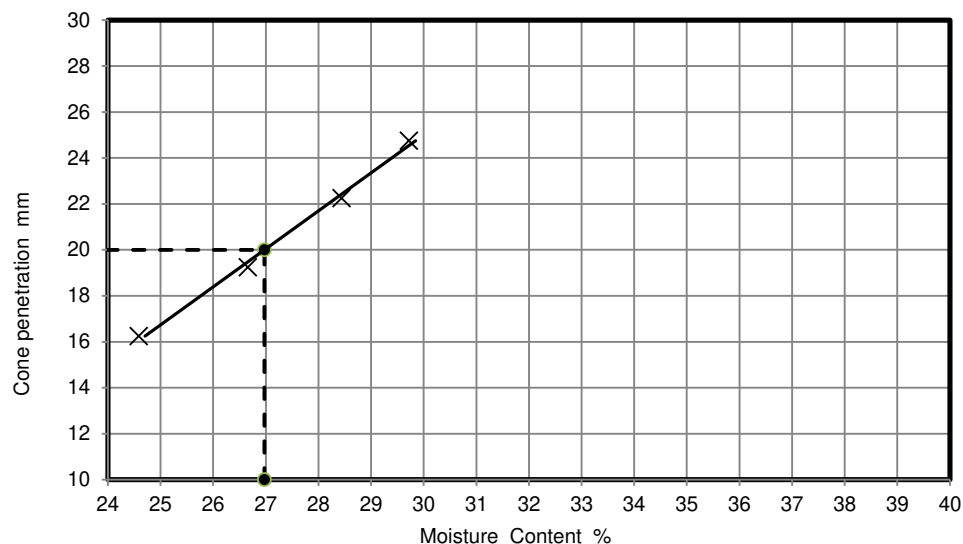
Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS11	None Supplied	S	1665414	c	Sulphide in soil	L010-PL	c
WS11	None Supplied	S	1665414	c	Total cyanide in soil	L080-PL	c
WS11	None Supplied	S	1665415	c	Sulphide in soil	L010-PL	c
WS11	None Supplied	S	1665415	c	Total cyanide in soil	L080-PL	c
WS12	None Supplied	S	1665419	c	Sulphide in soil	L010-PL	c
WS12	None Supplied	S	1665419	c	Total cyanide in soil	L080-PL	c
WS14	None Supplied	S	1665416	c	Sulphide in soil	L010-PL	c
WS14	None Supplied	S	1665416	c	Total cyanide in soil	L080-PL	c
WS14	None Supplied	S	1665417	c	Sulphide in soil	L010-PL	c
WS14	None Supplied	S	1665417	c	Total cyanide in soil	L080-PL	c
WS15	None Supplied	S	1665418	c	Sulphide in soil	L010-PL	c
WS15	None Supplied	S	1665418	c	Total cyanide in soil	L080-PL	c

Appendix E
Geotechnical Laboratory Report



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

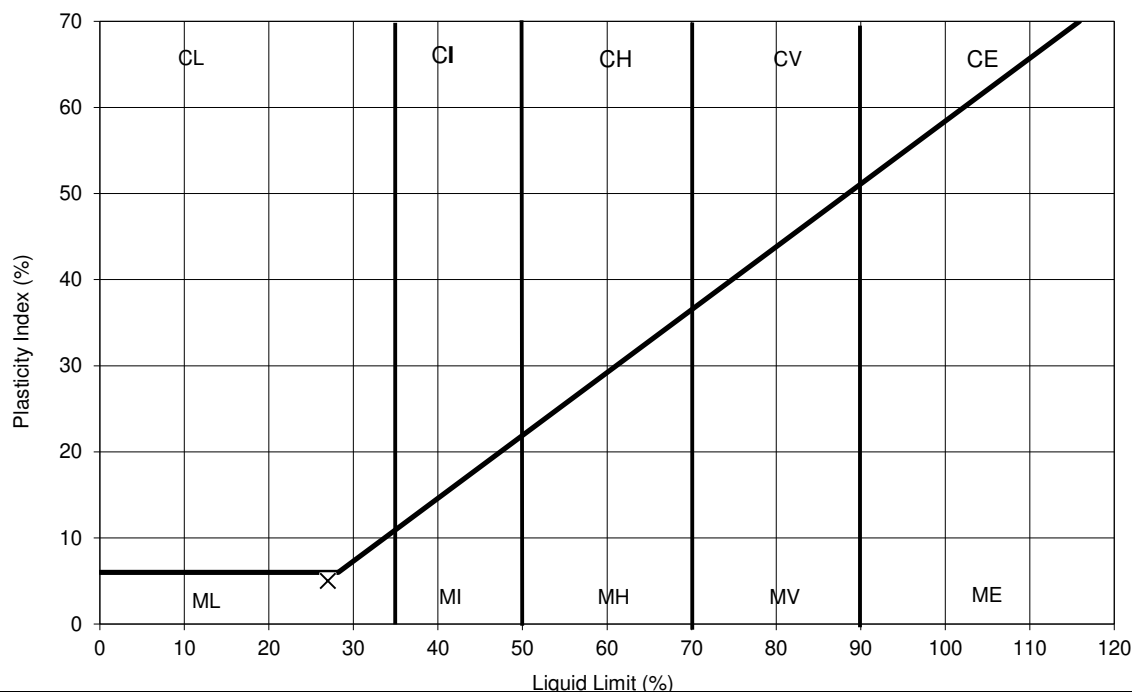
Job No.			29029	
Borehole/Pit No.			BH01	
Sample No.			-	
Site Name	Blackwell Farm		Depth Top	3.50 m
Project No.	2006010	Client	TEC	Depth Base - m
Soil Description	Orangish brown slightly mottled grey slightly gravelly very silty CLAY/clayey SILT (gravel is fm and sub-angular)			Sample Type D
				Samples received 02/11/2020
				Schedules received 06/11/2020
				Project Started 06/11/2020
				Date Tested 26/11/2020



NATURAL MOISTURE CONTENT	27	%
% PASSING 425µm SIEVE	95	%
LIQUID LIMIT	27	%
PLASTIC LIMIT	22	%
PLASTICITY INDEX	5	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Tel: 01923 711 288 Email: James@k4soils.com

Checked and Approved

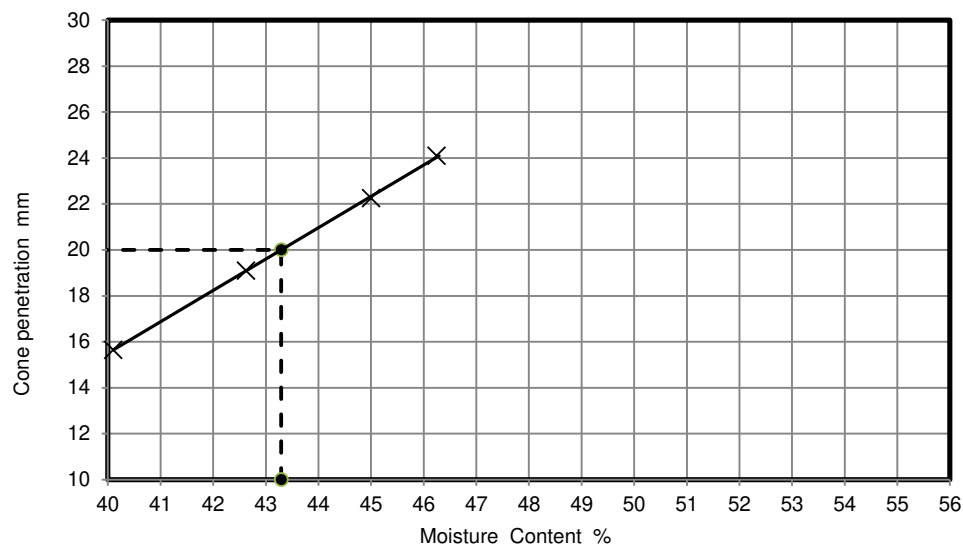
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Date: 27/11/2020



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

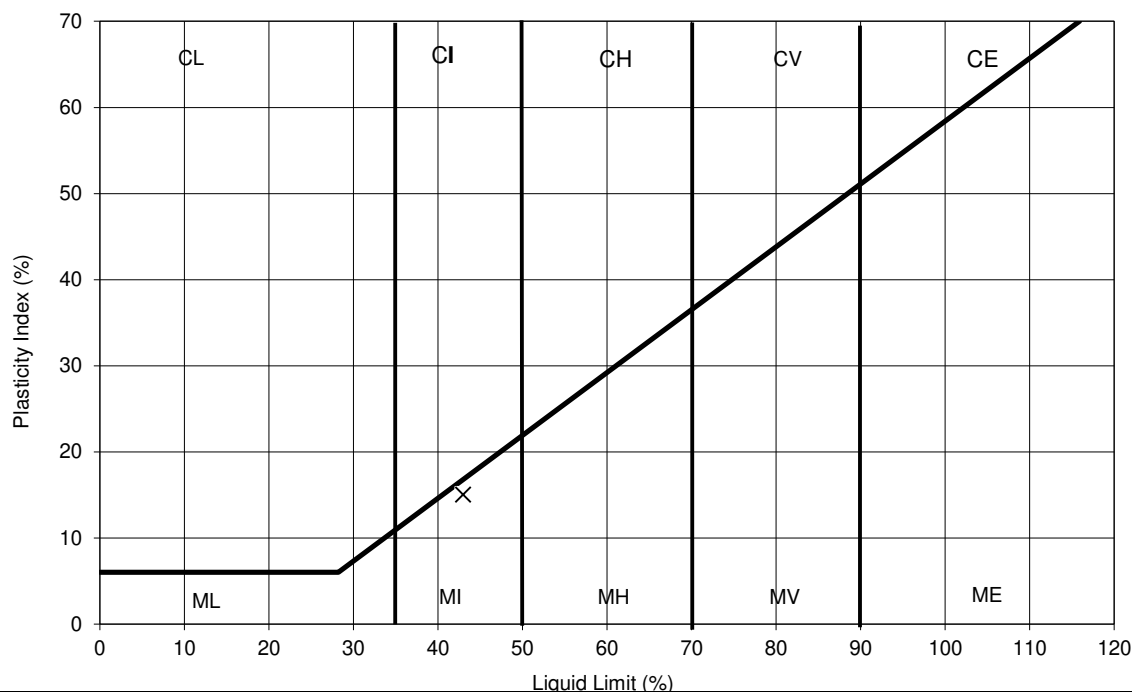
	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX			Job No.	29029	
				Borehole/Pit No.	BH01	
Site Name	Blackwell Farm			Sample No.	-	
Project No.	2006010	Client	TEC	Depth Top	5.00	m
Soil Description	Greyish brown silty CLAY			Depth Base	-	m
				Sample Type	D	
				Samples received	02/11/2020	
				Schedules received	06/11/2020	
				Project Started	06/11/2020	
				Date Tested	26/11/2020	



NATURAL MOISTURE CONTENT	24	%
% PASSING 425µm SIEVE	100	%
LIQUID LIMIT	43	%
PLASTIC LIMIT	28	%
PLASTICITY INDEX	15	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Tel: 01923 711 288 Email: James@k4soils.com

Checked and Approved

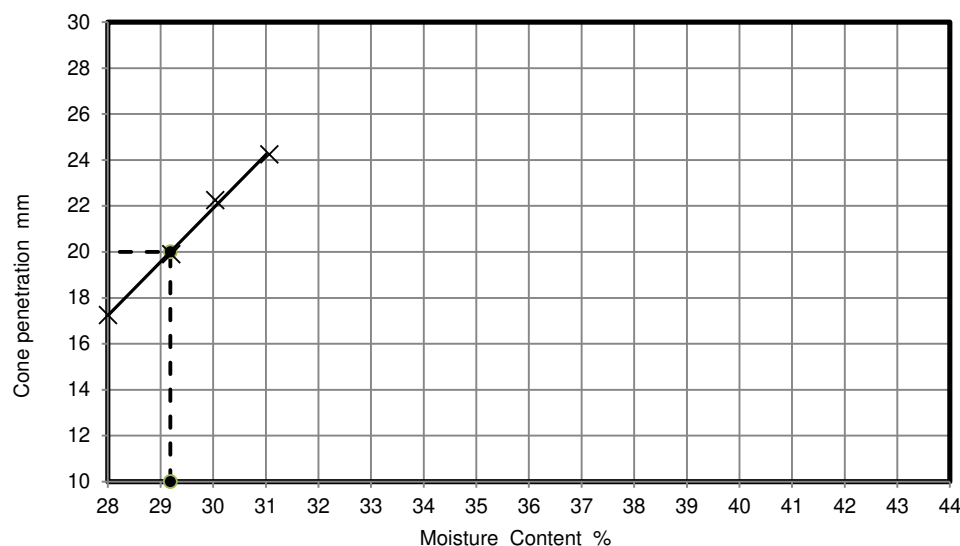
Initials: J.P

Date: 27/11/2020



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

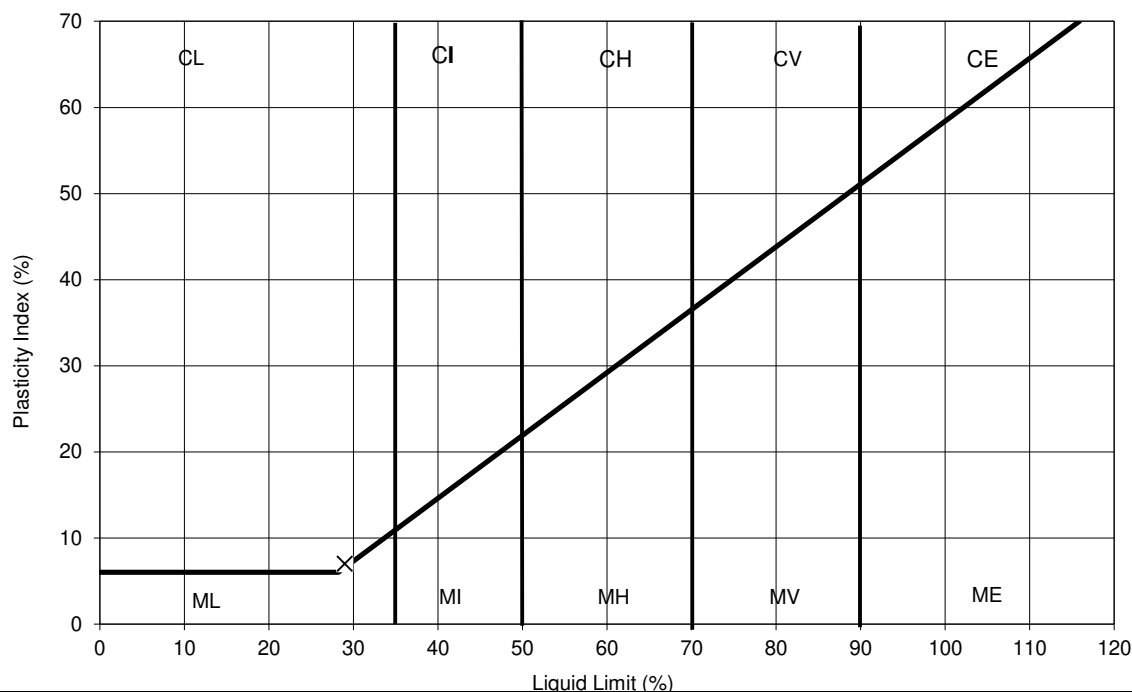
	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX			Job No.	29029	
				Borehole/Pit No.	BH02	
Site Name	Blackwell Farm			Sample No.	-	
Project No.	2006010	Client	TEC	Depth Top	3.00	m
Soil Description	Dark grey slightly mottled orangish brown slightly sandy silty CLAY			Depth Base	-	m
				Sample Type	D	
				Samples received	02/11/2020	
				Schedules received	06/11/2020	
				Project Started	06/11/2020	
				Date Tested	26/11/2020	



NATURAL MOISTURE CONTENT	24	%
% PASSING 425µm SIEVE	100	%
LIQUID LIMIT	29	%
PLASTIC LIMIT	22	%
PLASTICITY INDEX	7	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Tel: 01923 711 288 Email: James@k4soils.com

Checked and Approved

Initials: J.P

Date: 27/11/2020

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5 R2

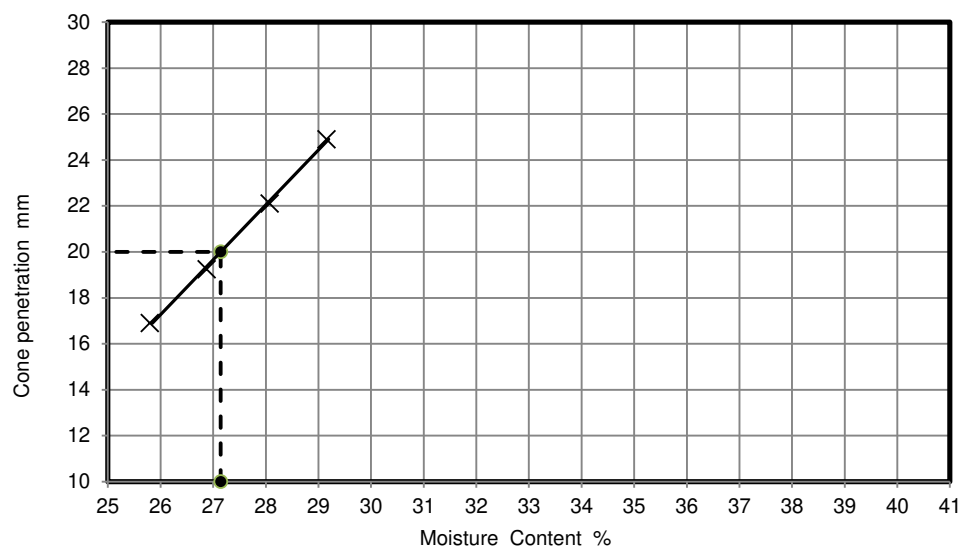


2519



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

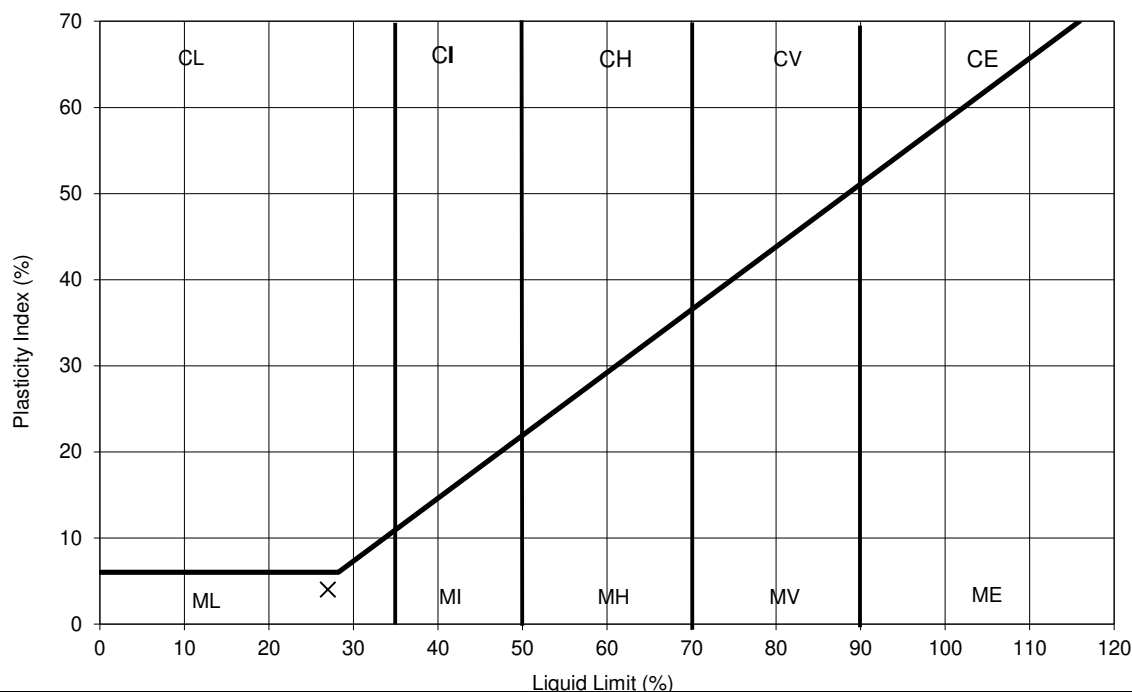
	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX			Job No.	29029	
				Borehole/Pit No.	BH02	
Site Name	Blackwell Farm			Sample No.	-	
Project No.	2006010	Client	TEC	Depth Top	6.50	m
Soil Description	Orangish brown slightly mottled grey slightly sandy silty CLAY			Depth Base	-	m
				Sample Type	D	
				Samples received	02/11/2020	
				Schedules received	06/11/2020	
				Project Started	06/11/2020	
				Date Tested	26/11/2020	



NATURAL MOISTURE CONTENT	17	%
% PASSING 425µm SIEVE	100	%
LIQUID LIMIT	27	%
PLASTIC LIMIT	23	%
PLASTICITY INDEX	4	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

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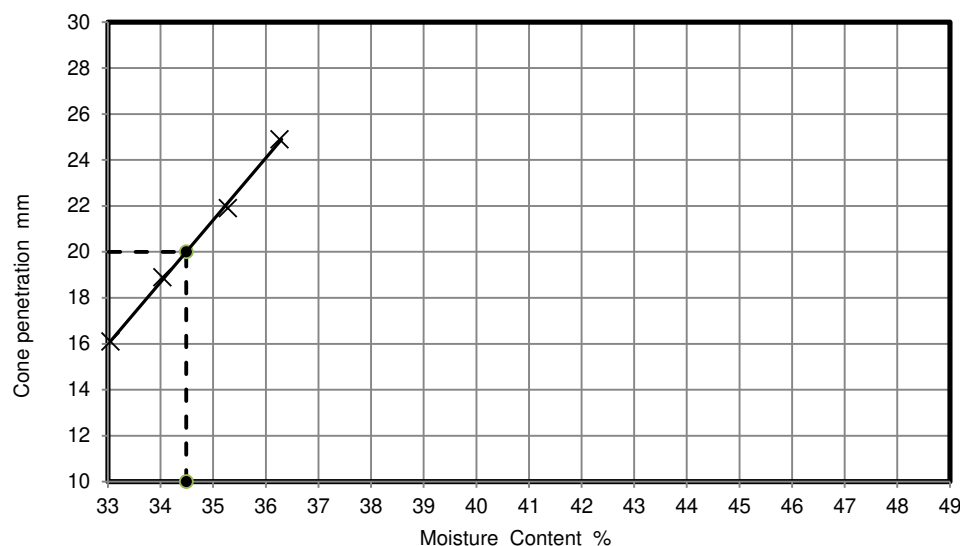


2519



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

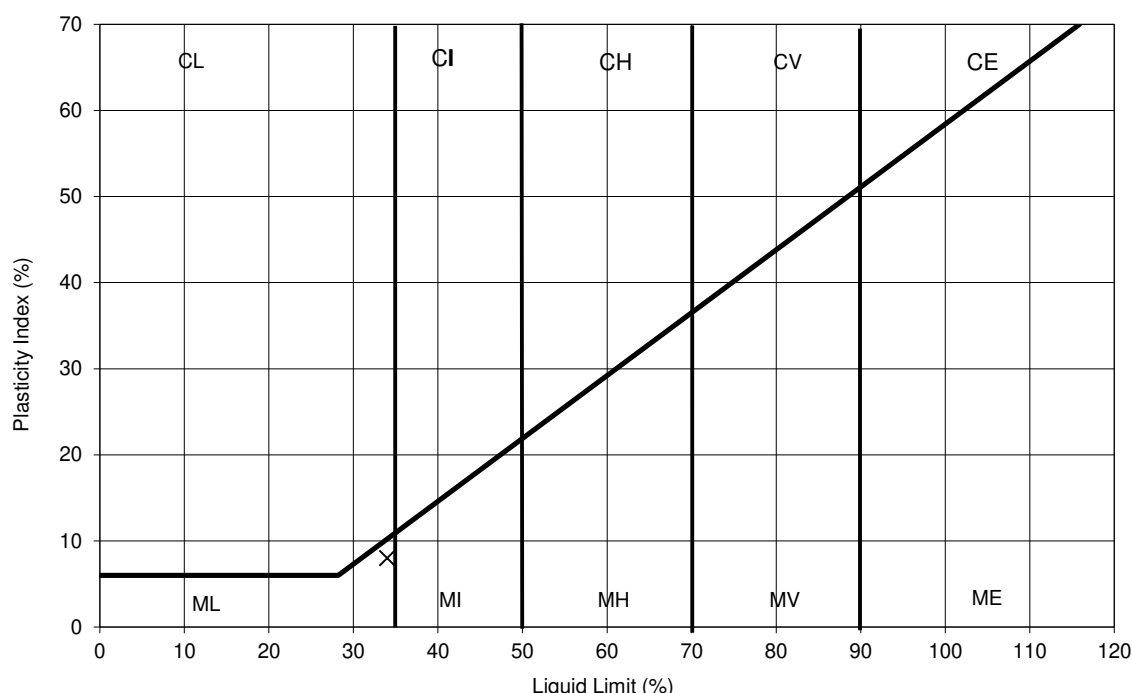
Job No.			29029	
Borehole/Pit No.			BH02	
Sample No.			-	
Site Name	Blackwell Farm		Depth Top	7.50 m
Project No.	2006010	Client	TEC	Depth Base - m
Soil Description	Orangish brown slightly mottled grey slightly sandy silty CLAY		Sample Type	D
			Samples received	02/11/2020
			Schedules received	06/11/2020
			Project Started	06/11/2020
			Date Tested	26/11/2020



NATURAL MOISTURE CONTENT	18	%
% PASSING 425µm SIEVE	100	%
LIQUID LIMIT	34	%
PLASTIC LIMIT	26	%
PLASTICITY INDEX	8	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

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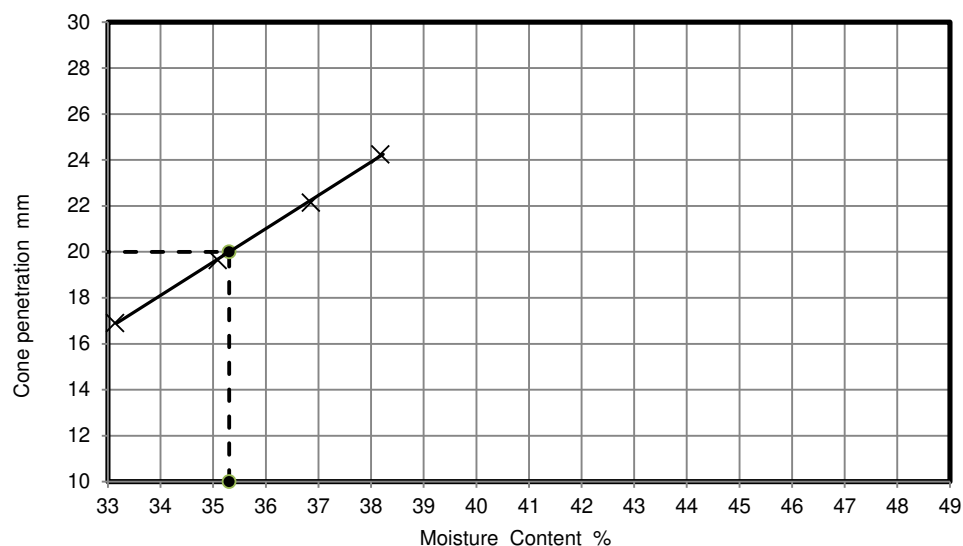


2519



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

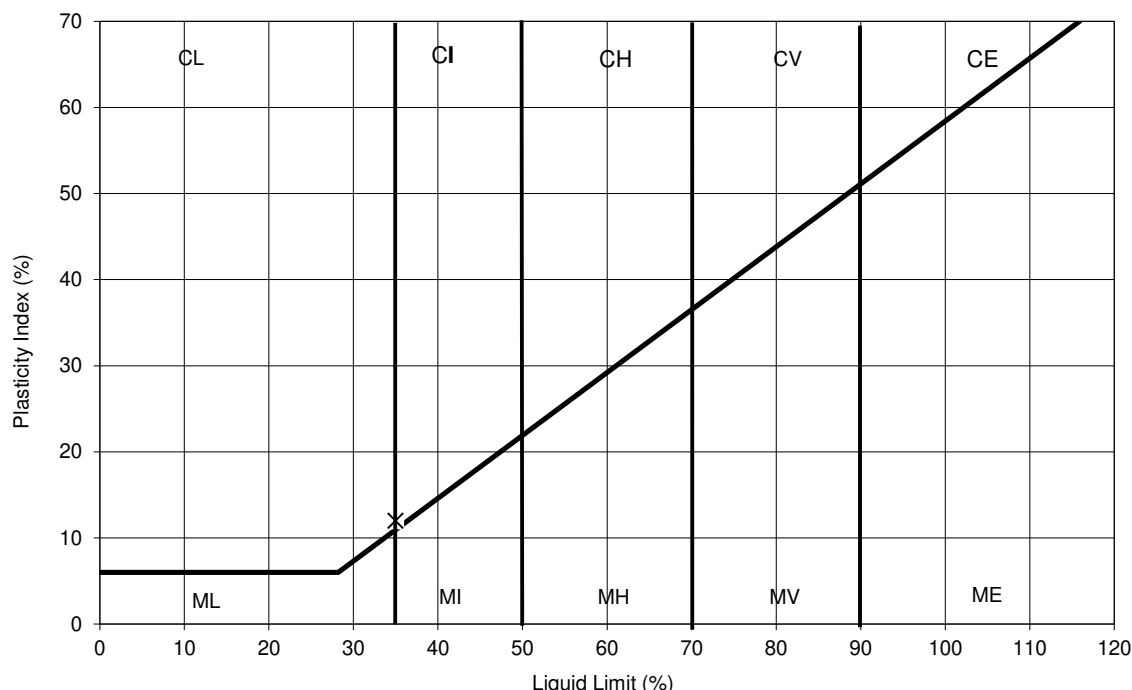
	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX			Job No.	29029	
				Borehole/Pit No.	WS14	
Site Name	Blackwell Farm			Sample No.	-	
Project No.	2006010	Client	TEC	Depth Top	2.50	m
Soil Description	Grey slightly mottled orangish brown slightly sandy silty CLAY			Depth Base	3.50	m
				Sample Type	D	
				Samples received	02/11/2020	
				Schedules received	06/11/2020	
				Project Started	06/11/2020	
				Date Tested	25/11/2020	



NATURAL MOISTURE CONTENT	24	%
% PASSING 425µm SIEVE	100	%
LIQUID LIMIT	35	%
PLASTIC LIMIT	23	%
PLASTICITY INDEX	12	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

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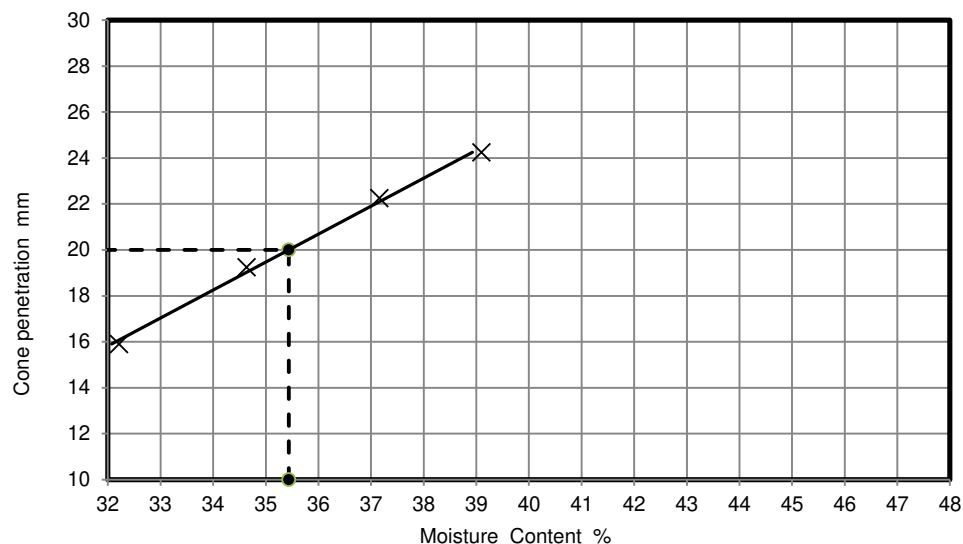


2519



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

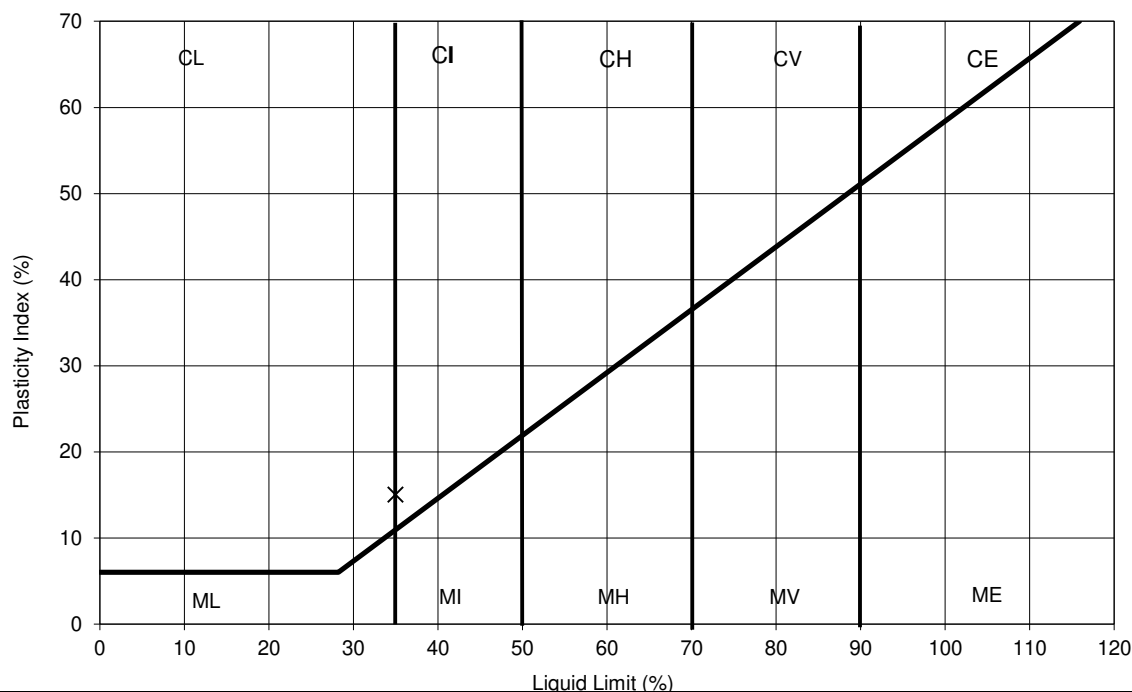
Job No.	29029		
Borehole/Pit No.	WS15		
Sample No.	-		
Depth Top	2.50	m	
Depth Base	3.50	m	
Sample Type	D		
Samples received	02/11/2020		
Schedules received	06/11/2020		
Project Started	06/11/2020		
Date Tested	25/11/2020		
Site Name	Blackwell Farm		
Project No.	2006010	Client	TEC
Soil Description	Dark bluish grey slightly mottled light brown slightly sandy silty CLAY with rare fine gravel		



NATURAL MOISTURE CONTENT	25	%
% PASSING 425µm SIEVE	99	%
LIQUID LIMIT	35	%
PLASTIC LIMIT	20	%
PLASTICITY INDEX	15	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

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MSF-5 R2



2519



Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No. 29029	Project Name Blackwell Farm	Programme	
		Samples received	02/11/2020
Project No. 2006010	Client TEC	Schedule received	06/11/2020
		Project started	06/11/2020
		Testing Started	26/11/2020

Hole No.	Sample				Soil Description	NMC %	Passing 425µm %	LL %	PL %	PI %	Remarks
	Ref	Top m	Base m	Type							
BH01	-	3.50	-	D	Orangish brown slightly mottled grey slightly gravelly very silty CLAY/clayey SILT (gravel is fm and sub-angular)	27	95	27	22	5	
BH01	-	5.00	-	D	Greyish brown silty CLAY	24	100	43	28	15	
BH02	-	3.00	-	D	Dark grey slightly mottled orangish brown slightly sandy silty CLAY	24	100	29	22	7	
BH02	-	6.50	-	D	Orangish brown slightly mottled grey slightly sandy silty CLAY	17	100	27	23	4	
BH02	-	7.50	-	D	Orangish brown slightly mottled grey slightly sandy silty CLAY	18	100	34	26	8	
WS14	-	2.50	3.50	D	Grey slightly mottled orangish brown slightly sandy silty CLAY	24	100	35	23	12	
WS15	-	2.50	3.50	D	Dark bluish grey slightly mottled light brown slightly sandy silty CLAY with rare fine gravel	25	99	35	20	15	

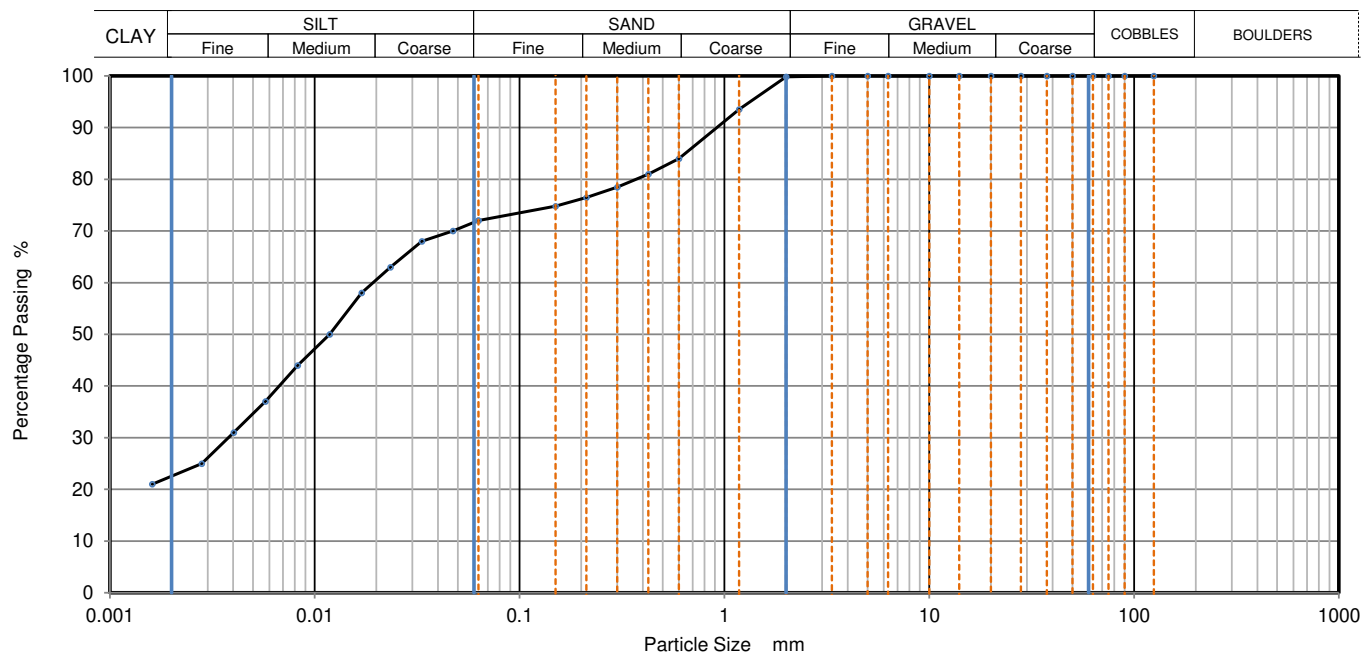
	Test Methods: BS1377: Part 2: 1990: Natural Moisture Content : clause 3.2 Atterberg Limits: clause 4.3, 4.4 and 5.0	Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Tel: 01923 711 288 Email: James@k4soils.com	Checked and Approved Initials J.P Date: 27/11/2020
	2519	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)	MSF-5-R1



PARTICLE SIZE DISTRIBUTION

Job Ref	29029
Borehole/Pit No.	BH01
Sample No.	-
Depth Top	9.50 m
Depth Base	- m
Sample Type	D
Samples received	02/11/2020
Schedules received	06/11/2020
Project started	06/11/2020
Date tested	25/11/2020

Site Name	Blackwell Farm		
Project No.	2006010	Client	TEC
Soil Description	Dark grey slightly sandy silty CLAY		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	72
90	100	0.0474	70
75	100	0.0334	68
63	100	0.0234	63
50	100	0.0169	58
37.5	100	0.0118	50
28	100	0.0083	44
20	100	0.0058	37
14	100	0.0040	31
10	100	0.0028	25
6.3	100	0.0016	21
5	100		
3.35	100		
2	100		
1.18	94		
0.6	84	Particle density (assumed) 2.70 Mg/m ³	
0.425	81		
0.3	79		
0.212	77		
0.15	75		
0.063	72		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.3
Sand	27.8
Silt	49.5
Clay	22.4

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

Remarks
Preparation and testing in accordance with BS1377 unless noted below



K4 Soils Laboratory
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Checked and Approved

Initials: J.P
Date: 27/11/2020

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

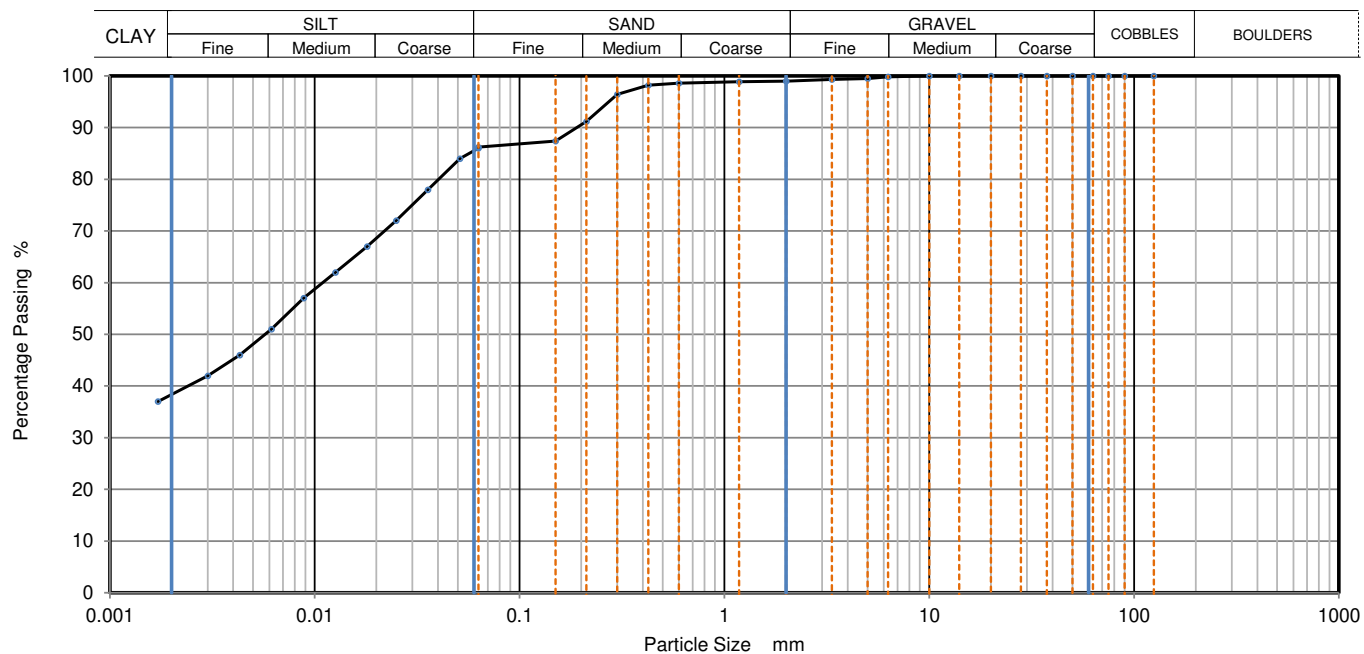
MSF-5-R3



PARTICLE SIZE DISTRIBUTION

Job Ref	29029
Borehole/Pit No.	BH02
Sample No.	-
Depth Top	8.20 m
Depth Base	- m
Sample Type	D
Samples received	02/11/2020
Schedules received	06/11/2020
Project started	06/11/2020
Date tested	25/11/2020

Site Name	Blackwell Farm		
Project No.	2006010	Client	TEC
Soil Description	Greenish brown slightly sandy silty CLAY with rare fine gravel		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	86
90	100	0.0511	84
75	100	0.0357	78
63	100	0.0250	72
50	100	0.0180	67
37.5	100	0.0126	62
28	100	0.0088	57
20	100	0.0062	51
14	100	0.0043	46
10	100	0.0030	42
6.3	100	0.0017	37
5	100		
3.35	99		
2	99		
1.18	99		
0.6	99	Particle density (assumed) 2.70 Mg/m ³	
0.425	98		
0.3	96		
0.212	91		
0.15	87		
0.063	86		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	1.0
Sand	12.9
Silt	48.1
Clay	38.0

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

Remarks
Preparation and testing in accordance with BS1377 unless noted below



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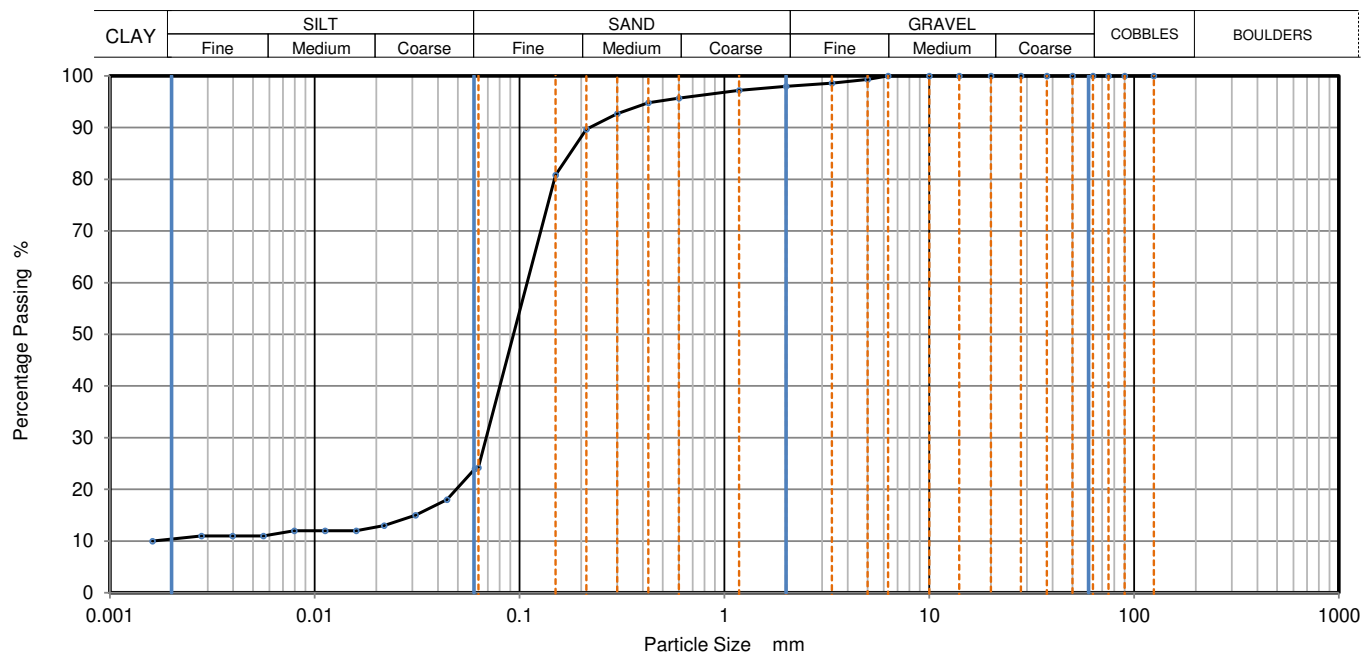
MSF-5-R3



PARTICLE SIZE DISTRIBUTION

Job Ref	29029
Borehole/Pit No.	BH02
Sample No.	-
Depth Top	10.00 m
Depth Base	10.45 m
Sample Type	D
Samples received	02/11/2020
Schedules received	06/11/2020
Project started	06/11/2020
Date tested	19/11/2020

Site Name	Blackwell Farm		
Project No.	2006010	Client	TEC
Soil Description	Greenish grey slightly mottled brown clayey silty SAND with rare fine gravel		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0604	24
90	100	0.0442	18
75	100	0.0310	15
63	100	0.0218	13
50	100	0.0159	12
37.5	100	0.0112	12
28	100	0.0079	12
20	100	0.0056	11
14	100	0.0040	11
10	100	0.0028	11
6.3	100	0.0016	10
5	99		
3.35	99		
2	98		
1.18	97		
0.6	96	Particle density (assumed)	
0.425	95	2.70 Mg/m ³	
0.3	93		
0.212	90		
0.15	81		
0.063	24		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	2.0
Sand	73.8
Silt	13.8
Clay	10.4

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

Remarks
Preparation and testing in accordance with BS1377 unless noted below



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2519

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MSF-5-R3



2683



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THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 20-31000

Issue: 1

Date of Issue: 27/11/2020

Contact: James Phaure

Customer Details: K4 Soils Laboratory Ltd
Unit 8
Watford
Hertfordshire WD18 9RU

Quotation No: Q16-00568

Order No: Not Supplied

Customer Reference: 29029

Date Received: 24/11/2020

Date Approved: 27/11/2020

Details: Blackwell Farm

Approved by:

Mike Varley, Technical Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

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Sample Summary

Report No.: 20-31000, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
220984	BH01 3.50	Not Provided	24/11/2020	Silty clayey loam	a
220985	BH01 5.00	Not Provided	24/11/2020	Clay	a
220986	BBH02 7.50	Not Provided	24/11/2020	Clay	a
220987	BH02 8.50	Not Provided	24/11/2020	Clay	a
220988	WS14 2.50	Not Provided	24/11/2020	Silty loam	a



Results Summary

2683

Report No.: 20-31000, issue number 1

ELAB Reference				220984	220985	220986	220987	220988
Customer Reference								
Sample ID								
Sample Type				DISTURBED	DISTURBED	DISTURBED	DISTURBED	DISTURBED
Sample Location				BH01	BH01	BBH02	BH02	WS14
Sample Depth (m)				3.50	5.00	7.50	8.50	2.50
Sampling Date				Not Provided	Not Provided	Not Provided	Not Provided	Not Provided
Determinand	Codes	Units	LOD					
Soil sample preparation parameters								
Material removed	N	%	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Description of Inert material removed	N		0	None	None	None	None	None
Anions								
Water Soluble Sulphate	M	g/l	0.02	0.03	< 0.02	< 0.02	0.03	0.03
Inorganics								
Total Sulphur	N	%	0.01	0.02	< 0.01	0.01	0.03	0.02
Acid Soluble Sulphate (SO4)	U	%	0.02	0.03	< 0.02	< 0.02	0.03	0.04
Miscellaneous								
pH	M	pH units	0.1	7.1	7.3	7.1	8.3	8.3



Method Summary

Report No.: 20-31000, issue number 1

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	27/11/2020	113	Electromeric
Acid Soluble Sulphate	U	Air dried sample	27/11/2020	115	Ion Chromatography
Water soluble anions	M	Air dried sample	26/11/2020	172	Ion Chromatography
Total organic carbon/Total sulphur	N	Air dried sample	26/11/2020	216	IR

Tests marked N are not UKAS accredited

Report Information

Report No.: 20-31000, issue number 1

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

LOD LOD refers to limit of detection, except in the case of pH soils and pH waters where it means limit of discrimination.
Soil sample results are expressed on an air dried basis (dried at < 30°C), and are uncorrected for inert material removed.
ELAB are unable to provide an interpretation or opinion on the content of this report.
The results relate only to the sample received.
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request
Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

Deviation Codes

-
- | | |
|---|--|
| a | No date of sampling supplied |
| b | No time of sampling supplied (Waters Only) |
| c | Sample not received in appropriate containers |
| d | Sample not received in cooled condition |
| e | The container has been incorrectly filled |
| f | Sample age exceeds stability time (sampling to receipt) |
| g | Sample age exceeds stability time (sampling to analysis) |

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

Appendix F
Generic Quantitative Risk Assessment: Human Health



Project Number: 2006010.001		Lab Sample Number	1665414	1665415	1665416	1665417	1665418	1665419	1665420	1665421	1665422
Project Name: Blackwell Farm, East Grinstead		Sample Reference	WS11	WS11	WS14	WS14	WS15	WS12	WS12	BH01	BH01
Site End Use:	GAC (mg/kg)	Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Residential with homegrown produce		Depth (m)	0.20	0.50	0.20	0.50	0.30	0.40	2.80-3.20	1.60-2.00	2.10-2.50
		Date Sampled	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
Determinand			1	2	3	4	5				
Arsenic	37 ⁽¹⁾	mg/kg	20.00	20.00	14.00	13.00	8.00	9.20	-	-	-
Boron	290 ⁽³⁾	mg/kg	0.60	0.80	1.40	0.80	1.20	1.10	-	-	-
Cadmium	22 ⁽¹⁾	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-
Chromium (total)	910 ⁽³⁾	mg/kg	31.00	34.00	20.00	18.00	18.00	19.00	-	-	-
Chromium (VI)	21 ⁽¹⁾	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	-	-	-
Copper	2400 ⁽³⁾	mg/kg	21.00	22.00	18.00	19.00	13.00	24.00	-	-	-
Lead	200 ⁽¹⁾	mg/kg	37.00	61.00	45.00	39.00	30.00	230.00	-	-	-
Mercury	40 ⁽²⁾	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	-	-	-
Nickel	130 ⁽²⁾	mg/kg	20.00	19.00	18.00	14.00	13.00	16.00	-	-	-
Selenium	350 ⁽²⁾	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	-	-
Zinc	3700 ⁽³⁾	mg/kg	66.00	71.00	67.00	66.00	53.00	130.00	-	-	-
Beryllium	1.7 ⁽³⁾	mg/kg	1.20	1.30	0.95	0.64	0.56	0.60	-	-	-
Vanadium	410 ⁽³⁾	mg/kg	41.00	51.00	30.00	27.00	24.00	23.00	-	-	-
Barium	1300 ⁽⁴⁾	mg/kg	100.00	110.00	120.00	89.00	74.00	160.00	-	-	-
Cyanide (Total)	20 ⁽⁵⁾	mg/kg	< 1	< 1	< 1	< 1	< 1	< 1	-	-	-
Phenol (Monohydric)	120 ⁽³⁾	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	-	-
Sulphide	-	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	110.00	-	-	-
Total Organic Carbon (TOC)	-	%	0.90	2.00	0.80	0.90	0.60	1.20	-	-	-
Naphthalene	2.3 ⁽³⁾	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.39	< 0.05	< 0.05	< 0.05
Acenaphthylene	170 ⁽³⁾	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	1.20	0.33	< 0.05	< 0.05
Acenaphthene	210 ⁽³⁾	mg/kg	< 0.05	< 0.05	< 0.05	0.35	< 0.05	0.46	0.58	< 0.05	2.10
Fluorene	170 ⁽³⁾	mg/kg	< 0.05	< 0.05	< 0.05	0.35	< 0.05	2.40	1.00	< 0.05	3.10
Phenanthrene	95 ⁽³⁾	mg/kg	< 0.05	0.56	2.80	6.30	0.85	31.00	6.00	2.20	15.00
Anthracene	2400 ⁽³⁾	mg/kg	< 0.05	< 0.05	0.47	1.30	< 0.05	8.10	1.80	0.49	3.60
Fluoranthene	280 ⁽³⁾	mg/kg	< 0.05	0.40	5.60	17.00	1.30	48.00	8.80	5.80	18.00
Pyrene	620 ⁽³⁾	mg/kg	< 0.05	0.36	4.90	15.00	1.10	40.00	7.60	5.20	15.00
Benzo(a)anthracene	7.2 ⁽³⁾	mg/kg	< 0.05	0.23	2.50	8.00	0.71	20.00	5.20	3.60	7.50
Chrysene	15 ⁽³⁾	mg/kg	< 0.05	0.16	2.10	6.50	0.51	16.00	3.60	2.50	5.50
Benzo(b)fluoranthene	2.6 ⁽³⁾	mg/kg	< 0.05	< 0.05	1.70	9.00	0.46	18.00	5.50	3.60	6.20
Benzo(k)fluoranthene	77 ⁽³⁾	mg/kg	< 0.05	< 0.05	2.80	5.60	0.41	11.00	2.60	1.80	3.20
Benzo(a)pyrene	2.2 ⁽³⁾	mg/kg	< 0.05	< 0.05	2.50	8.30	0.50	16.00	4.50	3.00	5.20
Indeno(1,2,3-cd)pyrene	27 ⁽³⁾	mg/kg	< 0.05	< 0.05	1.10	3.70	< 0.05	7.40	2.40	1.70	2.50
Dibenz(a,h)anthracene	0.24 ⁽³⁾	mg/kg	< 0.05	< 0.05	0.25	0.95	< 0.05	1.70	< 0.05	0.42	< 0.05
Benzo(ghi)perylene	320 ⁽³⁾	mg/kg	< 0.05	< 0.05	1.20	4.10	< 0.05	7.80	2.50	1.70	2.50
Speciated Total EPA-16 PAHs	-	mg/kg	< 0.80	1.71	27.80	86.00	5.82	229.00	52.20	31.90	89.30
Benzene	0.087 ⁽³⁾	µg/kg	-	-	< 1.0	-	-	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	130 ⁽³⁾	µg/kg	-	-	< 1.0	-	-	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	47 ⁽³⁾	µg/kg	-	-	< 1.0	-	-	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	56 ⁽³⁾	µg/kg	-	-	< 1.0	-	-	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	60 ⁽³⁾	µg/kg	-	-	< 1.0	-	-	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	49 ⁽⁴⁾	µg/kg	-	-	< 1.0	-	-	< 1.0	< 1.0	< 1.0	< 1.0
TPH Aliphatic C5 - C6	42 ⁽³⁾	mg/kg	-	-	< 0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH Aliphatic C6 - C8	100 ⁽³⁾	mg/kg	-	-	< 0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH Aliphatic C8 - C10	27 ⁽³⁾	mg/kg	-	-	< 0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH Aliphatic C10 - C12	130 ⁽³⁾	mg/kg	-	-	< 1.0	-	-	< 1.0	7.50	5.70	< 1.0
TPH Aliphatic C12 - C16	1100 ⁽³⁾	mg/kg	-	-	< 2.0	-	-	< 2.0	38.00	26.00	120.00
TPH Aliphatic C16 - C21	65000 ⁽³⁾	mg/kg	-	-	< 8.0	-	-	< 8.0	21.00	20.00	71.00
TPH Aliphatic C21 - C35	65000 ⁽³⁾	mg/kg	-	-	< 8.0	-	-	< 8.0	65.00	95.00	640.00
TPH Aromatic C5 - C7	70 ⁽³⁾	mg/kg	-	-	< 0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH Aromatic C7 - C8	130 ⁽³⁾	mg/kg	-	-	< 0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH Aromatic C8 - C10	34 ⁽³⁾	mg/kg	-	-	< 0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH Aromatic C10 - C12	74 ⁽³⁾	mg/kg	-	-	< 1.0	-	-	< 1.0	2.60	< 1.0	5.10
TPH Aromatic C12 - C16	140 ⁽³⁾	mg/kg	-	-	< 2.0	-	-	13.00	16.00	< 2.0	52.00
TPH Aromatic C16 - C21	260 ⁽³⁾	mg/kg	-	-	12.00	-	-	120.00	48.00	25.00	89.00
TPH Aromatic C21 - C35	1100 ⁽³⁾	mg/kg	-	-	20.00	-	-	100.00	160.00	97.00	330.00

Notes:

⁽¹⁾ DEFRA C4SLs (2014)

⁽²⁾ Environment Agency SGVs (2009)

⁽³⁾ LQM/ClEH S4ULs (2015)

⁽⁴⁾ CL:AIRE, AGS & EIS (2009)

⁽⁵⁾ Dutch Intervention Value for free cyanide (VROM 2000)

* All GACs based on a sandy soil and Soil Organic Matter (SOM) of 1% where applicable.

Concentration does not exceed GAC

Concentration exceeds GAC

No set GAC

Appendix G
Generic Quantitative Risk Assessment: Controlled Waters

Made Ground Leachability Analysis

Contaminant	WS12 at 0.4mbgl (µg/l)	BH01 at 1.6 – 2.0mbgl (µg/l)	BH01 at 2.1 – 2.5mbgl (µg/l)	SSV (µg/l)	No. of Exceedances
Arsenic	1.6	4.3	-	10 ⁽¹⁾	0
Cadmium	<0.08 ⁽⁵⁾	<0.08 ⁽⁵⁾	-	5.0 ⁽¹⁾	0
Chromium	0.9	2.7	-	50 ⁽¹⁾	0
Copper	2.5	8.7	-	2000 ⁽¹⁾	0
Lead	3.9	5.4	-	10 ⁽¹⁾	0
Mercury	<0.5 ⁽⁵⁾	<0.5 ⁽⁵⁾	-	1.0 ⁽¹⁾	0
Nickel	8.5	4.5	-	20 ⁽¹⁾	0
Zinc	35	100	-	3000 ⁽²⁾	0
Beryllium	<0.2 ⁽⁵⁾	<0.2 ⁽⁵⁾	-	-	0
Selenium	<4.0 ⁽⁵⁾	<4.0 ⁽⁵⁾	-	10 ⁽¹⁾	
Vanadium	<1.7 ⁽⁵⁾	<1.7 ⁽⁵⁾	-	60 ⁽⁴⁾	0
Barium	100	57	-	700 ⁽²⁾	0
Cyanide (Total)	<10 ⁽⁵⁾	<10 ⁽⁵⁾	-	50 ⁽¹⁾	0
Total Phenol (Monohydric)	<10 ⁽⁵⁾	<10 ⁽⁵⁾	-	0.5 ^(1, 6)	0
Sulphate	96000	35800	-	250000 ⁽¹⁾	0
pH	6.4	7.1	-	-	0
Naphthalene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	22.4 ⁽³⁾	0
Acenaphthylene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	-	0
Acenaphthene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	-	0
Fluorene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	-	0
Phenanthrene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	-	0
Anthracene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	0.1 ⁽³⁾	0
Fluoranthene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	0.12 ⁽⁴⁾	0
Pyrene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	-	0
Benzo(a)anthracene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	-	0
Chrysene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	-	0
Benzo(b)fluoranthene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	0.10 ⁽¹⁾	0
Benzo(k)fluoranthene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	0.10 ⁽¹⁾	0
Benzo(a)pyrene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	0.010 ⁽¹⁾	0
Indeno(1,2,3-cd)pyrene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	0.10 ⁽¹⁾	0
Benzo(g,h,i)perylene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	0.10 ⁽¹⁾	0
Dibenz(a,h)anthracene	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	<0.01 ⁽⁵⁾	-	0
Total PAH	<0.2 ⁽⁵⁾	<0.2 ⁽⁵⁾	<0.2 ⁽⁵⁾	-	0
Benzene	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0
Toluene	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0
Ethylbenzene	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0
p & m-xylene	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0
o-xylene	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0
MTBE	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0
TPH Aliphatic C5-C6	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0
TPH Aliphatic C6-C8	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	15000 ⁽²⁾	0
TPH Aliphatic C8-C10	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	15000 ⁽²⁾	0
TPH Aliphatic C10-C12	<10 ⁽⁵⁾	<10 ⁽⁵⁾	<10 ⁽⁵⁾	300 ⁽²⁾	0
TPH Aliphatic C12-C16	<10 ⁽⁵⁾	<10 ⁽⁵⁾	<10 ⁽⁵⁾	300 ⁽²⁾	0
TPH Aliphatic C16-C21	<10 ⁽⁵⁾	<10 ⁽⁵⁾	<10 ⁽⁵⁾	300 ⁽²⁾	0
TPH Aliphatic C21-C35	<10 ⁽⁵⁾	<10 ⁽⁵⁾	<10 ⁽⁵⁾	300 ⁽⁷⁾	0
TPH Aromatic C5-C7	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	300 ⁽⁷⁾	0
TPH Aromatic C7-C8	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0

Contaminant	WS12 at 0.4mbgl (µg/l)	BH01 at 1.6 – 2.0mbgl (µg/l)	BH01 at 2.1 – 2.5mbgl (µg/l)	SSV (µg/l)	No. of Exceedances
TPH Aromatic C8-C10	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	<1.0 ⁽⁵⁾	-	0
TPH Aromatic C10-C12	<10 ⁽⁵⁾	<10 ⁽⁵⁾	<10 ⁽⁵⁾	-	0
TPH Aromatic C12-C16	<10 ⁽⁵⁾	<10 ⁽⁵⁾	<10 ⁽⁵⁾	100 ⁽²⁾	0
TPH Aromatic C16-C21	<10 ⁽⁵⁾	<10 ⁽⁵⁾	<10 ⁽⁵⁾	100 ⁽²⁾	0
TPH Aromatic C21-C35	<10 ⁽⁵⁾	<10 ⁽⁵⁾	<10 ⁽⁵⁾	90 ⁽²⁾	0

Notes:

- 1 Water Supply (Water Quality) Regulations 2018 – Drinking Water Standards (DWS)
- 2 WHO Guidelines for Drinking Water Quality (2016)
- 3 EQS, Annual Average (AA) – Freshwaters
- 4 EQS, Maximum Allowable Concentrations (MAC) – Freshwaters
- 5 Laboratory Limit of Detection
- 6 Laboratory Limit of Detection greater than SSV
- 7 There are no WHO guideline values for aliphatic fractions C16-C35 and therefore, guideline values for aliphatic fractions C8-C16 have been applied.