PHASE II GEO-ENVIRONMENTAL SITE ASSESSMENT

The Croft
Welton Road
Birkenhead
Wirral
CH62 3PL

Prepared for:

Report Ref: 12-999-r1
Date Issued: February 2019

e3p | Environmental | Energy | Engineering

E3P

Heliport Business Park,
Liverpool Road,
Eccles,
Manchester,
M30 7RU

Tel : + 00 (0) 161 707 9612
http:\\www. e3p.co.uk

Registered in England
No.: 807255262

QUALITY ASSURANCE

REMARKS	Final
DATE	February 2019
PREPARED BY	E. Moss
QUALIFICATIONS	BSc.(Hons), FGS
SIGNATURE	
CHECKED BY	R. Horseman
QUALIFICATIONS	BSc (Hons), FGS
SIGNATURE	
AUTHORISED BY	M Dyer
QUALIFICATIONS	BSc, FGS, AIEMA, MIEnvSc, CEnv
SIGNATURE	
PROJECT NUMBER	13-066
IMS Template Reference: QR009-5	

EXECUTIVE SUMMARY		
Site Address	Land off of Welton Road, Birkenhead, Wirral, CH62 3PL	
Grid Reference	335020E, 382820N	
Site Area	2.27 Ha	
Current Site Use	The site is roughly rectangular in shape and is located to the west of Welton Road on the southern edge of the existing Croft Retail Park. The site can be accessed from the north east via Welton Road. The land is currently undeveloped and surfaced by short grassland. The north and south of the site are bordered by mature trees and a metal barrier borders the east of the site. There is a single-story brick electrical substation present in the north east of the site, operated by SP Energy Networks. Steel drainage man hole covers were identified in the north east and south west of the site The site is predominantly flat in topography; however embankments are present in the southern and eastern boundaries which are circa 2m higher than the remainder of the site. This change in elevation is likely to be due to the site being cut into the surroundings in the 1980's during the development of the wider Croft Retail and Leisure Park.	
Proposed Development	Redsun Developments are considering the proposed acquisition and future development of the land at Croft Business Park, Brombrough for mixed use commercial and retail buildings with associated roads and utility infrastructure. Drawing 12-999-02 (Appendix III) identifies the proposed development layout.	
Environmental Setting	*Drift Geology*	N/A
	Bedrock Geology	Chester Formation – Sandstone, Pebbly (Gravelly) of the Sherwood Sandstone bedrock
	Hydrogeology	The site is underlain by a Principal Aquifer (Solid). There are 22 groundwater abstraction points situated within 1km of the subject site. The closest five of which are located within 366m of the site, operated by Bromborough Business Park Ltd and utilised for industrial, commercial and public services. The remaining groundwater abstraction points are operated by the following: CSM, Bakemark UK Ltd, Arkady Craigmillar, UML Ltd, Pochin (Bromborough) Limited, Bromborough Business Park Ltd, Unilever Research, UML Ltd, J P Whitter (Waterwell Engineers) Ltd. The water abstracted is generally utilised for food and drink, cooling, manufacturing and construction.
	Hydrology	There are no surface water features situated within 250m of the site.
	Flood Risk	Unaffected by flooding from rivers.
	Subsidence Hazard	No Hazard to very low hazard.

EXECUTIVE SUMMARY	
Site History	A review of the pertinent Ordnance Survey mapping dating from circa 1876 displayed the site to comprise an undeveloped field with a field boundary intersecting the western sector of the site, which is no longer present in 1899. In 1956 a building (use unknown) and electrical sub-station are located in the north east of the site and a slope present in the south suggesting that the site has been re-profiled as part of redevelopment. In 1980 there is a slope present in the west of the site. In 1988 the building was extended in a southward's direction. In 2000 there is a car park situated in the north east of the site and the building was noted to be a distribution and storage warehouse. A review of google earth imagery displays that the building and adjacent car park are no longer present in 2003.
Previous Reports	Pertinent points from the previously completed by AECOM Infrastructure and Environment UK limited are summarised in Section 2 and where necessary have been included within the E3P assessment.
Utility Locations	A full GPR survey has not been undertaken for the site however a review of available online services identified a high voltage power main which intersects the north west of the site, supplying the onsite electrical substation. There is a water main which borders the east and intersects the north west and north eastern sector of the site
Landfill Sites & Ground Gases	There are no historic or existing landfill sites within 250m of the site.
Radon	Unaffected – no special precautions required.
Coal Mining / Land Stability	The site does not lie within a Coal Authority reporting area.
E3P Intrusive Ground Investigation	
Site Investigation Works	E3P has completed a supplementary intrusive Ground Investigation comprising mechanically excavated trial pits, window sample boreholes, in-situ CBR, falling head permeability tests and environmental monitoring installations.
Ground Conditions	**Made Ground** Made Ground topsoil was identified in the north east, south east, south west and central northern sector of the site in the location of former development. Made Ground topsoil was identified between ground level and 0.30m bgl and comprises brown sandy gravel with frequent cobbles with gravel and cobbles of sandstone and brick. Deeper Made Ground was also identified in the proximity of the former building in the north east of the site (TP101, TP102, TP103 and WS101) and south east of the site (WS102, WS103 and TP105) between 0.30m and 0.80m bgl. Deeper Made Ground between 0.30m and 0.90m bgl was also noted in the central northern sector of the site (TP108, TP115 and WS106) in proximity of the former car park. This Made Ground comprised red sandy gravel with frequent cobbles with gravel of sandstone, brick and concrete and cobbles of sandstone. **Topsoil** Topsoil was identified throughout the site between ground level and 0.30m bgl. An isolated area of deeper topsoil was identified in the north of the site (TP109 and TP110) near the bordering trees to depths of 0.60m bgl. Topsoil comprised brown slightly clayey fine to medium SAND with frequent rootlets.

EXECUTIVE SUMMARY	
Ground Conditions	**Drift** Drift deposits were only encountered within WS105 in the north east and WS111 in the north west of the site between 0.30m and 0.90m bgl. This deposit comprised brown clayey fine to medium SAND. **Solid** All exploratory hole locations were underlain by weathered SANDSTONE between 0.20m and 2.00m bgl comprising red sandy gravel with frequent cobbles, with gravel and cobbles of sandstone. **Groundwater** There were no groundwater strikes encountered within any of the exploratory hole locations.
Human Health	A Tier I Human Health Risk Assessment has been undertaken using the chemical analysis results of the soils and comparing to the relevant Tier I criteria. This assessment has identified the presence of asbestos. Asbestos in the form of loose chrysotile fibres has been identified in the Made Ground topsoil (0.10m bgl) in WS110 at a concentration of at 0.029%. A hotspot excavation will be required in the proximity of WS110 to remove the impacted topsoil with placement >1.00m beneath an area of low sensitivity such as public open space or the proposed car park to ensure the contaminant pose no unacceptable risk to the future site users. Site specific control procedures and appropriate validation monitoring will be required to demonstrate the absence of risk to construction workers.
Controlled Waters	A Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground to Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) which did not identify any elevated levels of contaminants. There is considered to be a low risk to controlled waters and the wider environment.
Ground Gas	Ground gas monitoring thus far has indicated the site would be classed as Characteristic Situation 1, suggesting no gas protection measures will be required. However, the final ground gas regime will be confirmed following the completion of the ground gas monitoring programme.
Potable Water Infrastructure	This will need to be confirmed following the completion of a UKWIR Risk Assessment. It is likely the PE pipe would be sufficient for the development.
Geotechnical Assessment	
Underground Obstructions & Anomalies	Sub-surface obstructions were not exposed during the intrusive Ground Investigation however; their existence cannot be ruled out, due to the historical development in the north and central sector of the site.
Allowable Bearing Pressure (ABP)	Based on the assessment of the net ABP, the suitable target founding stratum has been identified as the underlying medium dense to very dense weathered SANDSTONE. The underlying weathered sandstone has been identified as being medium dense to very dense with an ABP ranging from 192kN/m² to 560kN/m² between 0.40m and 2.45m bgl. All window sample probeholes were terminated due to refusals on the bedrock between 0.5m and 2.0m bgl.

EXECUTIVE SUMMARY	
Foundation Options	The site is predominantly flat but embankments are present at the southern and eastern boundaries, which are circa 2m higher than the site. A phase of cut and fill enabling works may be required in order to create a proposed development platform suitable for a commercial development and adjacent car parks. This will generally comprise decreasing levels on south and western side. During a phase of cut fill enabling works to create a developable platform, all below ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of the proposed development. At this time it is not possible to accurately define the foundation types due to the absence of a final development levels, however based on our extensive experience of similar sites we would anticipate that the final foundation solution would be a combination of pad and strip foundations bearing on medium dense to dense GRAVEL (weathered SANDSTONE) or deeper pad and trench fill to support re-enforced strip foundations in areas of variable ground
Building Floor Slabs	A ground bearing slab will be viable but it will need to be constructed on a granular sub base with the thickness designed by a structural engineer to ensure that settlement tolerances are taken into consideration and that sufficient surface clays have been removed from tree influence areas to mitigate any seasonal volume changes in the clay influence zones.
Heave Precautions	Due to the presence of granular strata across the entire site, heave precautions will not be required during the construction of the proposed dwellings.
Soakaway Drainage	Three falling head permeability tests were conducted which displayed varied results. WS101 has poor soakaway potential, WS105 had moderate soakaway potential and WS111 had good soakaway potential. Therefore, it is considering that soakaway drainage may not be suitable for the proposed development. However, the application of soakaway drainage will ultimately be dependent on the specific requirements of the development. All soakaways should be designed in accordance with BRE Special Digest 365 – *Soakaway Design*.
Sulphate Assessment	Concrete classification will be DS1 AC1s.
CBR Design %	Granular soils can be re-engineered to ensure 5% within the sub-grade during favourable climatic conditions. Natural clay soils will provide a CBR in the order of 3-5% during drier climatic periods, however If water is allowed to shed onto the formation, the CBR will reduce to <2% which will require specialist engineering of the sub-grade.
Waste Characterisation	Any material that is to be disposed to landfill should undergo assessment using Technical Guidance WM3: Waste Classification - Guidance on the classification and assessment of waste.
Civil Engineering	Shallow Bedrock has been identified throughout the site at depths less than 0.5m below current ground levels. The presence of bedrock will impede excavation for drainage infrastructure using traditional excavation plant and equipment.

Cut / Fill Earthworks.	As part of the site enabling works, a process of cut and fill will be required to construct the optimum development platform. Organic topsoil's will required segregation and removal from the development areas due to the materials unsuitability for use as an engineering material. The granular materials will largely conform to a Class 1 engineering material and as such can be compacted in accordance with the correct design method or site performance criteria to ensure compaction for ground bearing structures and infrastructure. A site-specific geotechnical design with verification performance testing will be required. If earthworks are carried out during wetter climatic conditions, it is possible that stabilising agents (lime & OPC) will be required to ensure the control of Moisture Content to achieve the required degree of compaction. It would be possible to utilise the materials on-site to construct a bound modified sub-base replacement layer to minimise the requirement for import of construction aggregates.
Recommendations	Based on the findings of the intrusive site investigation, the following additional works are recommended to be completed in due course: • Plot Specific Foundation Schedule (upon receipt of the final development levels); • Materials Management Plan; • Geotechnical Earthworks Strategy (Infrastructure). • Remediation & Enabling Works strategy; and • Full three dimensional earthworks Cut / Fill Model.

Table of Contents

APPENDICES

1. INTRODUCTION

1.1 Background

E3P has been commissioned by Redsun Developments to undertake a detailed Phase II Geo-Environmental Site Investigation for a parcel of land situated to the south of Croft Retail and Leisure Park.

This report is required to determine potential contaminated land liabilities, remediation requirements and geotechnical engineering works that will be required as part of the proposed development for mixed use commercial and retail buildings with associated roads and utility infrastructure.

The scope of work consisted of following elements:

- *Detailed review of historic information;*
- *Design of suitable intrusive Ground Investigation;*
- *Window sample probeholes with and construction of environmental monitoring installations;*
- *Mechanically excavated trial pits;*
- *In-situ Geotechnical Testing;*
- *Chemical & Geotechnical Laboratory analysis;*
- *Groundwater monitoring and sampling;*
- *Ground gas monitoring;*
- *Falling Head permeability tests*
- *Contamination Risk Assessment & Conceptual Site Model;*
- *Geotechnical Assessment & Interpretation; and,*
- *Factual and interpretive reporting.*

1.2 Proposed Development

E3P understands that Redsun Developments are considering the proposed acquisition and future development of the land at Croft Business Park, Brombrough for mixed use commercial and retail buildings with associated roads and utility infrastructure. Drawing 12-999-002 (Appendix III) identifies the proposed development layout.

A snapshot of the proposed development layout is indicated in Figure 1.1 overleaf:

Figure 1.1 Snapshot of Proposed Development (scheme 1)

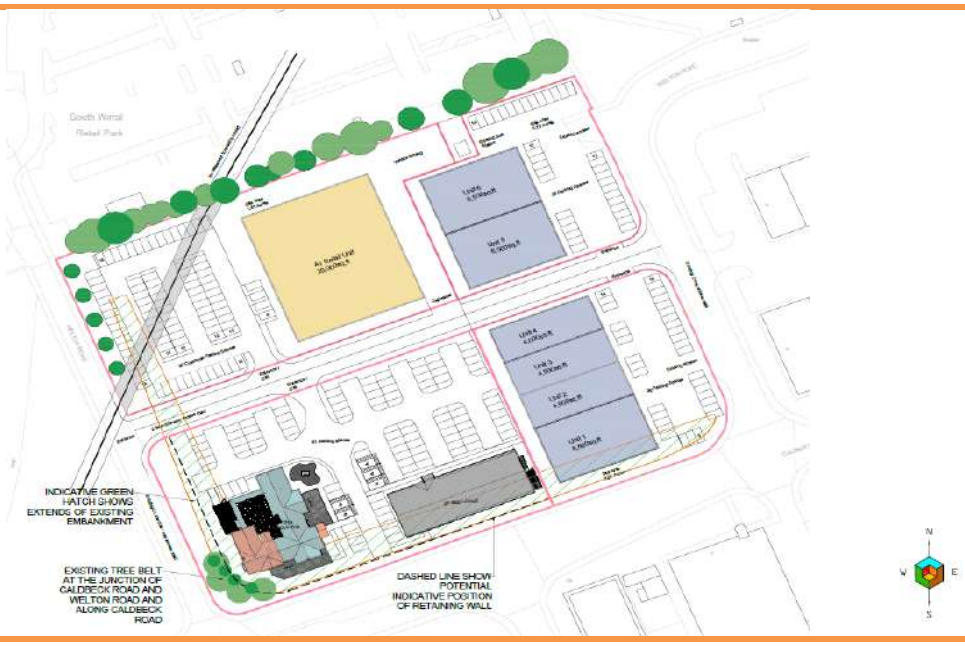


Figure 1.2 Snapshot of Proposed Development (scheme 1)

1.3 Objectives

The objectives of the Geo-Environmental Investigation are to:

- Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified;
- Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors;

- Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs; and,
- Provide recommendations regarding future works required.

1.4 Previous Reports

The following reports has previously been completed for the site:

AECOM – *Phase 1 Geo-Environmental and Geotechnical Desk- based Assessment. Ref: 60534984, dated April 2018.*

The pertinent points of the AECOM report have been included within Section 3.0 of this report.

1.5 Limitations

The limitations of this report are presented in Appendix I.

1.6 Confidentiality

E3P has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.

2. E3P GROUND INVESTIGATION

2.1 Phase I Desk Study Summary - Synopsis

- There are no superficial deposits recorded at the site.
- The bedrock geology beneath the site is indicated to comprise Chester Formation-Sandstone, Pebbly (Gravelly) of the Sherwood Sandstone bedrock. This formation is classified as a Principal Aquifer.
- The online BGS 'Geology of Britain' viewer shows five available boreholes located within 500m radius of the site which display the site to be underlain by a thin veneer of topsoil and residual soil overlying sandstone of the Chester Formation.
- the site does not lay within an area that could be affected by present underground mining or is likely to be affected by any planned future underground coal mining.
- There are 23 entries of water abstractions located within 1km radius of the site.
- There are no active or historical landfills present on site or located within a 250m radius of the site.
- The site has a 'low' risk with respect to flooding from rivers with the probability of less than 1 in 1,000 (0.1%).
- The site was located in an area anticipated to be affected by potential unexploded ordnance.
- The site is located in a lower probability radon area with less than 1% of properties are estimated to be at or above the action level.

2.2 General

A Ground Investigation has been designed based on the findings of the desk study with exploratory holes advanced to target specific potential contaminant sources summarised in Table 2.1. The investigation has also been used to collect geotechnical information to assist in the design and construction of the proposed development.

Exploratory fieldwork was completed between on the 13th December 2018.

The works are summarised in Table 2.1.

Table 2.1 Summary of Fieldwork

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAX DEPTH (mbgl)	MONITORING WELLS RESPONSE ZONE (mbgl)
Former car park in the north east (1999-2003)	TP101	Mechanically Excavated Trial Pit	1.00	N/A
	TP109		1.50	N/A
	WS105	Window Sample Probehole	1.00	0.5-1.0
Former unspecified building in the north east (1956-2003)	TP102	Mechanically Excavated Trial Pit	1.60	N/A
	TP103		1.70	N/A
	TP104		1.50	N/A
	TP107		0.80	N/A
	TP109		1.50	N/A
	WS101	Window Sample Probehole	2.00	0.5-2.0
	WS104		1.00	N/A
	WS106		1.00	0.5-1.0
Former hardstanding area in the south east (1990-2003)	TP105	Mechanically Excavated Trial Pit	1.10	N/A
	WS102	Window Sample Probehole	1.00	0.5-1.0
	WS103		2.00	N/A
Slope south (1980-present)	TP113	Mechanically Excavated Trial Pit	0.70	N/A
	WS108	Window Sample Probehole	0.80	N/A
Slope west (1950-present)	WS109	Window Sample Probehole	0.50	N/A
General ground conditions including the presence / nature of obstructions	TP106 TP110-TP112, TP114-TP115	Mechanically Excavated Trial Pit	1.10	N/A
	WS107	Window Sample Probehole	1.00	0.5-1.0
	WS110		1.00	0.5-1.0
	WS111		1.00	0.5-1.0
	WS112		1.00	0.5-1.0

Mechanically excavated trial pits were advanced to investigate ground conditions and to retrieve environmental samples, spatially distributed to offer the maximum site coverage whilst also being advanced to target specific contaminant sources.

Window sample probeholes were advanced to undertaken in-situ detailed geotechnical testing, obtain environmental samples and install groundwater and ground gas monitoring wells.

The sampling locations are illustrated in Drawing 12-999-004 (Appendix III). The ground conditions encountered are indicated on the logs which are provided in Appendix IV.

Return visits were made to monitor installations for groundwater level and gas concentrations.

2.3 In-Situ Standard Penetration Testing (SPT)

In-situ geotechnical testing was conducted using the Standard Penetration Test (SPT) and where the ground is granular, a 60^{o} cone (SPT(C)) was used instead of the sampling tube.

The results are shown in the probehole logs in Appendix IV and presented in Table 3.2 and discussed in Section 5.0.

2.4 In-Situ California Bearing Ratio (CBR)

In-situ CBR tests were undertaken at selected locations using a plate bearing test. Tests were undertaken at depths of between 300mmm and 1m below ground level in order to intersect the likely pavement sub formation level. The results are presented in Table 3.4 and test certificates are included within Appendix VIII.

2.5 Permeability Tests

Three falling head permeability tests were undertaken within environmental monitoring wells (WS101, WS105 and WS111) in order to assess the likely permeability of the underlying strata to determine the potential suitability for soakaway drainage within the proposed development. The results are presented in Table 3.3 and the test certificates are included within Appendix IX.

2.6 Laboratory Analysis

Selected soil samples were submitted for a range of chemical analysis comprising, metals, pH, total sulphate, water soluble sulphate (2:1 extract), sulphide, cyanide, phenols, pesticides, total and speciated poly-aromatic hydrocarbons (PAHs), chlorinated solvents, asbestos and total and speciated petroleum hydrocarbon (TPH).

I2 Analytical undertook the analytical work and the testing results are included in Appendix V and discussed in Section 3.0

Selected samples were submitted to PSL Laboratory where the following geotechnical tests were undertaken:

- Particle Size Distribution

Laboratory analysis sheets are included in Appendix VII.

3. GROUND AND GROUNDWATER CONDITIONS

3.1 Ground and Groundwater Conditions

3.1.1 Summary of Ground Conditions

The Ground Investigation generally confirms the published geology and identifies the strata set out in Table 3.1 below:

Table 3.1 Summary of Strata

HOLE	DEPTH TO STRATUM (mbgl)				
	SAND (TOPSOIL)	MADE GROUND-GRAVEL (TOPSOIL)	SAND	MADE GROUND-GRAVEL	SANDSTONE
TP101		0.00-0.30		0.30-0.40	0.40-1.00
TP102	0.00-0.30	0.00-0.30		0.30-0.60	0.60-1.60
TP103		0.00-0.30		0.30-0.80	0.80-1.70
TP104		0.00-0.30			0.30-1.50
TP105		0.00-0.30		0.30-0.50	0.50-1.10
TP106	0.00-0.30				0.30-1.10
TP107	0.00-0.30				0.30-0.80
TP108		0.00-0.30		0.30-0.40	0.40-1.00
TP109	0.00-0.60				0.60-1.50
TP110	0.00-0.60				0.60-0.50
TP111	0.00-0.20				0.20-0.70
TP112	0.00-0.30				0.30-0.70
TP113	0.00-0.30				0.30-0.70
TP114	0.00-0.30				0.30-0.60
TP115		0.00-0.30		0.30-0.50	0.50-1.00
WS101		0.00-0.20			0.20-2.00
WS102		0.00-0.10		0.10-0.40	0.40-1.00
WS103		0.00-0.10		0.10-0.40	0.40-2.00
WS104	0.00-0.10				0.10-1.00
WS105	0.00-0.30		0.30-0.50		0.50-1.00
WS106		0.00-0.20		0.20-0.90	
WS107	0.00-0.30				0.30-1.00
WS108	0.00-0.20				0.20-0.80
WS109	0.00-0.30				0.30-0.50
WS110		0.00-0.20			0.20-1.00
WS111		0.00-0.30	0.30-0.90		0.90-1.00
WS112	0.00-0.30				0.30-1.00

3.1.2 Made Ground

Made Ground topsoil was identified in the north east, south east, south west and central northern sector of the site in the location of former development. Made Ground topsoil was identified between ground level and 0.30m bgl and comprises brown sandy gravel with frequent cobbles with gravel and cobbles of sandstone and brick.

Deeper Made Ground was also identified in the proximity of the former building in the north east of the site (TP101, TP102, TP103 and WS101) and south east of the site (WS102, WS103 and TP105) between 0.30m and 0.80m bgl. Deeper Made Ground between 0.30m and 0.90m bgl was also noted in the central northern sector of the site (TP108, TP115 and WS106) in proximity of the former car park. This Made Ground comprised red sandy gravel with frequent cobbles with gravel of sandstone, brick and concrete and cobbles of sandstone.

3.1.3 Topsoil

Topsoil was identified throughout the site between ground level and 0.30m bgl. An isolated area of deeper topsoil was identified in the north of the site (TP109 and TP110) near the bordering trees to depths of 0.60m bgl. Topsoil comprised brown slightly clayey fine to medium SAND with frequent rootlets.

3.1.4 Drift Deposits

Drift deposits were only encountered within WS105 in the north east and WS111 in the north west of the site between 0.30m and 0.90m bgl. This deposit comprised brown clayey fine to medium SAND.

3.1.5 Solid Geology

All exploratory hole locations were underlain by weathered sandstone between 0.20m and 2.00m bgl comprising red sandy gravel with frequent cobbles, with gravel and cobbles of sandstone.

3.1.6 Groundwater

There were no groundwater strikes encountered within any of the exploratory hole location holes.

Monitoring was undertaken using an electronic dip meter and interface probe to record the depth to groundwater and the thickness of any free phase hydrocarbon product. However, no hydrocarbon products were identified and all of the monitoring wells and all wells were noted to have been dry.

3.1.7 Visual and Olfactory Evidence of Contamination

There was no visual or olfactory evidence of potential contamination identified during the site investigation.

3.1.8 Side Stability and Ease of Excavation

The sides of the exploratory trial pit excavations appeared to be stable during excavation, with the exception of TP103 in the north east of the site which was noted to have been unstable at 0.30m bgl due to loose Made Ground gravels.

All excavations were noted to have been slow or terminated due to the dense weathered SANDSTONE.

Table 3.2 Standard/Cone Penetration Test Results

BOREHOLES	DEPTH (mbgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE $(N_1)_{60}$	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m^2)
WS101	1	Weathered SANDSTONE	19	19.15	Medium Dense	N/A	N/A	N/A
WS101	2	Weathered SANDSTONE	50	45.68	Dense	N/A	N/A	N/A
WS102	1	Weathered SANDSTONE	50	50.41	Very Dense	N/A	N/A	N/A
WS103	1	Weathered SANDSTONE	25	25.20	Medium Dense	N/A	N/A	N/A
WS104	1.5	Weathered SANDSTONE	50	47.51	Dense	N/A	N/A	N/A
WS105	1	Weathered SANDSTONE	50	50.41	Very Dense	N/A	N/A	N/A
WS106	1	Weathered SANDSTONE	50	50.41	Very Dense	N/A	N/A	N/A
WS107	1	Weathered SANDSTONE	50	50.41	Very Dense	N/A	N/A	N/A
WS108	1	Weathered SANDSTONE	50	50.41	Very Dense	N/A	N/A	N/A
WS109	0.5	Weathered SANDSTONE	50	56.02	Very Dense	N/A	N/A	N/A
WS110	0.4	Weathered SANDSTONE	50	57.95	Very Dense	N/A	N/A	N/A
WS111	0.4	Weathered SANDSTONE	50	57.95	Very Dense	N/A	N/A	N/A
WS112	1	Weathered SANDSTONE	50	50.41	Very Dense	N/A	N/A	N/A

3.1.9 Soil Infiltration

In-situ variable (falling) head permeability tests were undertaken within the monitoring well installations located in three probeholes (WS101, WS105 and WS111). All three of the installations were noted to be dry prior to the test being undertaken, therefore the tests were undertaken in the unsaturated zone.

The results are presented in Table 3.3 below and the test certificates are included within Appendix IX.

Table 3.3 Soil Infiltration Results

LOCATION	DEPTH (m)	MATERIAL	TEST NO.	SOIL INFILTRATION RATE (m/s)
WS101	1.78	GRAVEL (weathered sandstone)	Test No.1	$8.07E^{-7}$
WS105	0.82	GRAVEL (weathered sandstone)	Test No.1	$3.04E^{-6}$
WS111	0.96	GRAVEL (weathered sandstone)	Test No.1	$2.81E^{-5}$

Soil infiltration was taken over the wetted area from between 75% and 25% of the effective depth. The test results were fairly varied as WS101 has poor soakaway potential, WS105 has moderate soakaway potential and WS111 had good soakaway potential.

Therefore, it is considering that soakaway drainage may not be suitable for the proposed development. However, the application of soakaway drainage will ultimately be dependent on the specific requirements of the development. All soakaways should be designed in accordance with BRE Special Digest 365 – *Soakaway Design*.

3.1.10 California Bearing Ratio

The California Bearing Ratio (CBR) for the soils were measured using a plate bearing test. The results are summarised in Table 3.4.

The result sheets are included in Appendix X and the locations are shown on Drawing 12-999-004 (Appendix III).

Table 3.4 Summary of CBR Results

LOCATION	DEPTH (m)	STRATA	IN SITU OR LAB TEST	CBR (%)
DCP101	0.34-0.64	Red Sand/ Bedrock	In-Situ	25%
DCP102	0.24-0.52	Red Sand/ Bedrock	In-Situ	8%
DCP103	0.39-0.49	Red Sand/ Bedrock	In-Situ	7%
DCP104	0.35-0.41	Red Sand/ Bedrock	In-Situ	6%

It should be noted that the CBR's reported herein were obtained from soils in a highly undisturbed state, however if the topsoil and surface cover is removed during periods of wetter climatic condition, the formation will soften reducing the CBR.

3.1.11 pH and Sulphate

Chemical analyses for pH and soluble sulphate content contained in Appendix VII (summarised below in Table 3.10), shows that the soils at the site meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005).

Table 3.5 Summary of pH and Sulphate Data

LOCATION	DEPTH (m)	SO_4 IN 2:1 WATER / SOIL (g/l)	pH VALUE	CLASSIFICATION
WS103	1.2	0.0093	7.9	DS-1/AC-1s
WS107	0.7	0.0046	8.0	DS-1/AC-1s
WS108	0.1	0.0068	7.0	DS-1/AC-1s
TP101	0.5	0.0062	6.9	DS-1/AC-1s
WS107	0.1	0.0062	6.9	DS-1/AC-1s

3.2 Ground Gas

A ground gas assessment has been completed in accordance with guidance provided within CIRIA 665 *Assessing risk posed by hazardous ground gases to buildings*.

3.2.1 Investigation Rationale

The ICSM has identified that the underlying Made Ground and infilled field boundary may represent a potential source of ground gas generation. Based the identification of these sources, E3P has determined that the site represents a low ground gas source generation potential.

Within the context of the proposed commercial end use and ground gas generation potential, the gas assessment requires 6 visits are required over 3 months with at least two sets of readings at low or falling atmospheric pressure as set out within CIRIA 665 Tables 5.5a and 5.5b.

The spacing requirements for monitoring wells are detailed within CIRIA 665 Table 4.2 this indicates that for low gas hazard sites (*Made Ground with limited degradable material, organic clay of limited thickness*) and a high sensitivity development nominal well spacing should be between 25m and 50m.

Table 3.6 Ground Gas Monitoring Location Rationale

LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS101	Former Unspecified Building in the north east (1956-2003)/ natural ground/ groundwater well	0.5-2.0
WS102	Former hardstanding area in the south east (1990-2003)/ natural ground/ groundwater well	0.5-1.0
WS105	Former Car Park in the north east (1999-2003)/ natural ground/ groundwater well	0.5-1.0
WS106	Former Unspecified Building in the north east (1956-2003)/ Deep Made Ground	0.5-1.0
WS107	Natural ground/ groundwater well	0.5-1.0
WS110	Natural ground/ groundwater well	0.5-1.0
WS111	Natural ground/ groundwater well	0.5-1.0
WS112	Natural ground/ groundwater well	0.5-1.0

3.2.2 Monitoring Methodology

Concentrations of methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) were measured using an infra-red gas analyser (GFM435) calibrated to a reference standard (before and after each survey) and gas flow rates were measured using an attached flow pod.

Gas measurements were recorded for a minimum of sixty seconds at each location, at which point the maximum concentration of CH_4 and CO_2 together with the lowest concentration of O_2 were recorded. The results of the ground gas monitoring are presented in Table 3.7 (overleaf).

Table 3.7 Summary of Ground Gas Monitoring Results

WELL	DATE	CH_4 INITIAL %V/V	CH_4 STEADY %V/V	CH_4 GSV l/hr	CO_2 INITIAL %V/V	CO_2 STEADY %V/V	CO_2 GSV l/hr	O_2 %V/V	ATMOS(mB)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE / STRATUM (mbgl)	DEPTH TO BASE (mbgl)	DEPTH TO WATER (mbgl)
WS101	07/1/19	0.1	0.1	0.00026	0.6	0.6	0.00156	19.9	1026	Falling	0.26	0.5-2.0	1.84	Dry
WS105	07/1/19	0.1	0.1	0.00144	1.1	1.1	0.01584	19.3	1026	Falling	1.44	0.5-1.0	0.93	Dry
WS106	07/1/19	0.1	0.1	0.00013	0.6	0.6	0.00078	19.9	1026	Falling	0.13	0.5-1.0	0.92	Dry
WS107	07/1/19	0.1	0.1	0.00026	0.8	0.8	0.00208	19.5	1026	Falling	0.26	0.5-1.0	0.93	Dry
WS110	07/1/19	0.1	0.1	0.00013	0.9	0.9	0.00117	19.5	1026	Falling	0.13	0.5-1.0	0.95	Dry
WS111	07/1/19	0.1	0.1	0.00013	1.6	1.6	0.00208	18.6	1026	Falling	0.13	0.5-1.0	1.09	Dry
WS112	07/1/19	0.1	0.1	0.00026	0.8	0.8	0.00208	20.0	1026	Falling	0.26	0.5-1.0	0.89	Dry

4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 1 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

4.1 Human Health Risk Assessment

At a Tier 1 stage the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM / CIEH S4UL (S4UL3267).

The results of this comparison have been summarised within Table 4.1 (overleaf).

Table 4.1 Summary of Inorganic and Hydrocarbon Toxicity Assessment for a Commercial End Use

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	170	12	15	N/A	1	No Further Action
Cadmium	mg/kg	532	12	<0.2	N/A	1	No Further Action
Chromium (VI)	mg/kg	220	12	<4.0	N/A	1	No Further Action
Lead	mg/kg	200	12	56	N/A	1	No Further Action
Mercury	mg/kg	30	12	<0.3	N/A	3	No Further Action
Nickel	mg/kg	3400	12	14	N/A	1	No Further Action
Selenium	mg/kg	1800	12	1.7	N/A	1	No Further Action
Copper	mg/kg	44000	12	35	N/A	1	No Further Action
Zinc	mg/kg	170000	12	50	N/A	1	No Further Action
Cyanide - Total	mg/kg	791	13	<1.0	N/A	1	No Further Action
Phenols - Total.	mg/kg	210	7	<1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	8	0.029	WS110-0.10m	4	**Further Action**
Naphthalene	mg/kg	1200	12	<0.05	N/A	3	No Further Action
Acenaphthylene	mg/kg	29000	12	<0.05	N/A	2	No Further Action
Acenaphthene	mg/kg	29000	12	<0.05	N/A	1	No Further Action
Fluorene	mg/kg	20000	12	<0.05	N/A	1	No Further Action
Phenanthrene	mg/kg	6200	12	<0.05	N/A	2	No Further Action
Anthracene	mg/kg	150000	12	<0.05	N/A	2	No Further Action
Fluoranthene	mg/kg	6300	12	<0.05	N/A	2	No Further Action
Pyrene	mg/kg	15000	12	<0.05	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	49	12	<0.05	N/A	2	No Further Action
Chrysene	mg/kg	93	12	<0.05	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	13	12	<0.05	N/A	2	No Further Action
Benzo(k)Fluoranthene	mg/kg	370	12	<0.05	N/A	2	No Further Action
Benzo(a)Pyrene**	mg/kg	11	12	<0.05	N/A	2	No Further Action
Indeno(123-cd)Pyrene	mg/kg	150	12	<0.05	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	1.1	12	<0.05	N/A	2	No Further Action
Benzo(ghi)Perylene	mg/kg	1400	12	<0.05	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	95000	13	<1.0	N/A	3	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	150000	13	<0.1	N/A	3	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	14000	13	<0.1	N/A	3	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	9200	13	<2.0	N/A	3	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	10000	13	14	N/A	3	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	7600	13	54	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	7800	13	1000	N/A	1	No Further Action

Notes
Main Exposure Pathways: 1 = Soil Ingestion, 2 = Dermal Contact & Ingestion, 3 = Vapour Inhalation (indoor), 4 = Dust Inhalation. Abbreviations: GAC = General Assessment Criteria, n = number of samples, MC = Maximum Concentration; Loc of Ex = Location of Exceedance; NFD = No Fibres Detected
* The Tier 1 GAC for the hydrocarbon fraction is derived from the CIEH assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. E3P has utilised the Tier 1 values for aliphatic compounds for the volatile and semi volatile fractions (C_5-C_{12}) and the Tier 1 values for aromatic compound for the non-volatile fractions (C_{12}-C_{35}). The comparison of a total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.

Referring to Table 4.1, the results of this direct comparison indicates that asbestos was the only contaminant of concern. All other contaminants did not exceed the screening criteria for commercial end use without plant uptake.

Asbestos in the form of loose chrysotile fibres have been identified in the Made Ground topsoil (0.10m bgl) in WS110 at a concentration of at 0.029%.

No significant concentrations of elevated VOC's were identified in the soils submitted for chemical analysis.

In relation to this exceedance the main exposure pathway based on the Tier I exceedances is fibre dust inhalation.

Risk Assessment and Mitigation

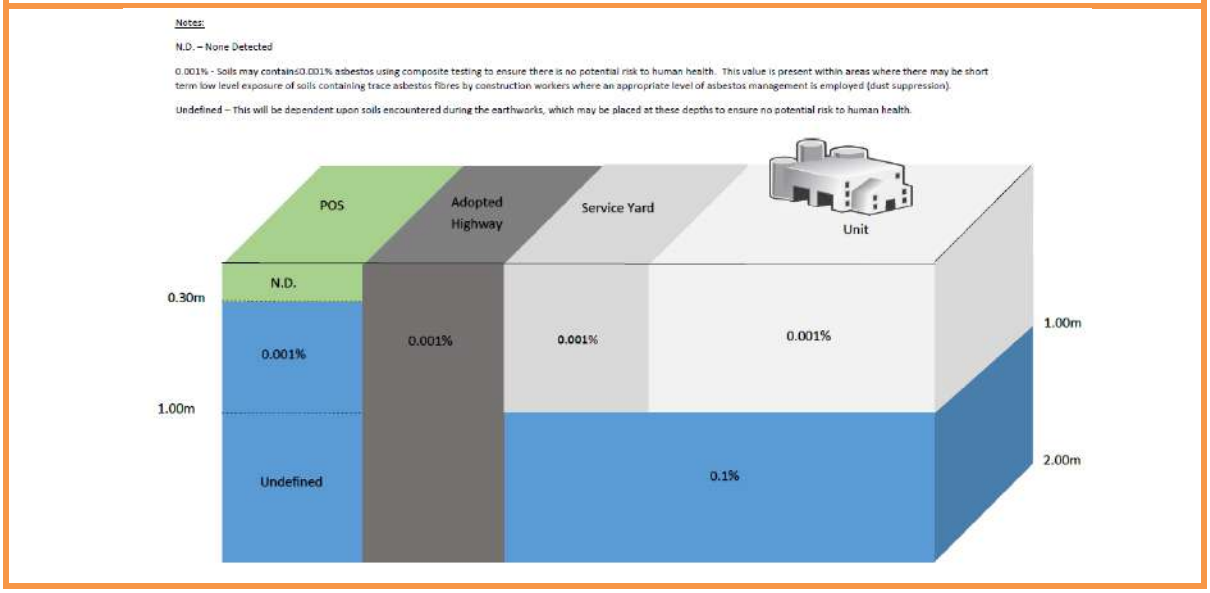
The identified elevated concentration of asbestos has a primary exposure pathway related to the fibre dust inhalation. The risk to chronic human health associated with the elevated concentration of loose chrysotile fibres can be mitigated through the installation of a suitable cover system in all proposed landscaping and hardstanding to remove any potential for direct exposure to impacted soils.

The specific design and installation process for the appropriate cover systems will be clearly defined within the Site remediation & Enabling Works Strategy, however industry best practice (as outlined within BRE 465) will require the following minimum depths of certified clean cover:

- Landscaped areas – 300mm
- Public Open Space – 300mm

A hotspot excavation will be required in the proximity of WS110 to remove the impacted topsoil with placement >1.00m beneath an area of low sensitivity such as public open space or the proposed car park to ensure the contaminant pose no unacceptable risk to the future site users (Figure 4.1). Site specific control procedures and appropriate validation monitoring will be required to demonstrate the absence of any unacceptable risk to construction workers.

Figure 4.1 Asbestos Risk Mitigation Conceptual Site Model



4.2 Controlled Waters Risk Assessment

The site sensitivity with respect to controlled waters is summarised within Table 4.2

Table 4.2 Controlled Waters Sensitivity Profile

RISK PROFILE	DISCUSSION	SENSITIVITY RATING
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not located in a Groundwater Source Protection Zone or Drinking Water Safeguard Zone	**LOW**
Distance to the closest groundwater abstraction point.	There are 22 groundwater abstraction points situated within 1km of the subject site. The closest five of which are located within 366m of the site, operated by Bromborough Business Park Ltd and utilised for industrial, commercial and public services. The remaining groundwater abstraction points are operated by the following: CSM, Bakemark UK Ltd, Arkady Craigmillar, UML Ltd, Pochin (Bromborough) Limited, Bromborough Business Park Ltd, Unilever Research, UML Ltd, J P Whitter (Waterwell Engineers) Ltd. The water abstracted is generally utilised for food and drink, cooling, manufacturing and construction.	**HIGH**
Aquifer Classification in Superficial Drift Deposits.	The site is not underlain by Superficial Drift Deposits.	**N/A**
Aquifer classification in Bedrock.	Chester Formation – Sandstone (Principal Aquifer)	**HIGH**
Viability for Anthropogenic soil in direct contact with aquifer (drift or bedrock).	Variable Made Ground has been identified between ground level and 0.90m bgl in the location of the former building and adjacent car park. However, the chemical analysis results of these deposits did not exceed screening criteria for any of the contaminants of concern.	**MODERATE**
Is the site located within 50m of a surface watercourse?	The risk to a surface water is negligible given the absence of a viable receptor within influencing distance of the site.	**LOW**
Summary The ICSM developed within the context of the site setting has identified viable pollutant risks which would be the downward migration of potentially mobile phase soluble contaminants towards the underlying Principle Aquifer. There are also 22 groundwater abstraction points situated within 1km of the site utilised for food and drink, cooling, manufacturing and construction.		

To further refine the ICSM, E3P has undertaken an initial qualitative assessment of the soil data analysis to assess the potential for a source of separate phase or dissolved phase contamination originating from either a defined on-site source or from impacted soils. This assessment is summarised in Table 4.3.

Table 4.3 Qualitative Risk to Controlled Waters from Soil Analytical Results

BTEX - >1mg/kg **Total VOC - > 1mg/kg**	The soil data analysis has not identified any levels of VOCs above the LOD or detectable concentrations of TPH C5 to C6 that might otherwise be indicative of VOC impact.
Total SVOC - > 1 mg/kg	PAH analysis recorded concentrations to be below the laboratory LOD.
C5-C10 - > 5mg/kg	All concentrations are below the laboratory LOD.
C10-C12 - > 10mg/kg	All concentrations are below the laboratory LOD.
C12-C16 - > 50mg/kg	All concentrations are below 50mg/kg.
Phenols – > 2mg/kg	All concentrations are below the laboratory LOD.
Naphthalene - > 2mg/kg	Naphthalene has been not identified at concentrations greater than 2mg/kg.
Total PAH - > 10mg/kg	All concentrations are below the laboratory LOD
PCB - > 1mg/kg	An electric substation is located in the north east of the site dated circa 1956. This substation may be a potential source of PCB, however E3P were unable to investigate this area due to live electrical services. It is recommended that further assessment should be undertaken during the remediation.
Heavy metals - > 500mg/kg	Concentrations of heavy metals are all below 500mg/kg.

The ICSM which has identified a potential pollutant linkage associated with the migration towards the underlying Principal Aquifer. There are also 22 groundwater abstraction points situated within 1km of the site utilised for food and drink, cooling, manufacturing and construction. E3P has undertaken a Tier I controlled waters risk assessment. The Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground to Drinking Water Standards in the first instance and where absent Environmental Quality Standards (EQS). Groundwater samples were not chemically assessed for the subject site due to the insufficient volumes of water within the monitoring wells.

These are presented in Table 4.4 (overleaf).

Table 4.4 Comparison of Groundwater Analysis with Tier 1 Screening Levels

DETERMINAND	UNITS	EQS SCREENING VALUE [1, 2, 3]		DWS [3,4,5]	N (L-Leachate, GW –Groundwater)	MC	LOC OF EX	ASSESSMENT
		AA	MAC					
Arsenic	µg/l	50	-	10	2 L	<1.0	N/A	No Further Action
Cadmium	µg/l	0.08	0.45	5	2 L	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	-	-	2 L	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	-	50	2 L	<1.7	N/A	No Further Action
Copper (hardness)	µg/l	1-28		2000	2 L	17	N/A	No Further Action
Total Cyanide	µg/l	1	-	50	2 L	<1.0	N/A	No Further Action
Lead	µg/l	1.2	14	10	2 L	1.7	N/A	No Further Action
Mercury	µg/l	-	0.07	1.0	2 L	<0.5	N/A	No Further Action
Nickel	µg/l	4	34	20	2 L	0.4	N/A	No Further Action
Selenium	µg/l		-	10	2 L	<4.0	N/A	No Further Action
Zinc(hardness)	µg/l	8-125	-	-	2 L	8.7	N/A	No Further Action
pH	6-9				2 L	6.9-8.2	N/A	No Further Action
PAH								
Naphthalene	µg/l	2	130	10*	2 L	<0.01	N/A	No Further Action
Anthracene	µg/l	0.1	0.1		2 L	<0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	1.7^{-4}	0.017		2 L	<0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	1.7^{-4}	0.017		2 L	<0.01	N/A	No Further Action
Benzo(a)pyrene	µg/l	1.7^{-4}	0.27		2 L	<0.01	N/A	No Further Action
Flouranthene	µg/l	0.0063	0.12		2 L	<0.01	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7^{-4}	8.2^{-3}		2 L	<0.01	N/A	No Further Action
TPH-Aromatic								
TPH C5-C6 (benzene)	µg/l	10	50	1	2 L	<1.0	N/A	No Further Action
TPH C6-C8 (toluene)	µg/l	50	-	700	2 L	<1.0	N/A	No Further Action
TPH C8-C10 (ethyl Benzene)	µg/l	20	-	300	2 L	<1.0	N/A	No Further Action
TPH C10-C12 (xylene)	µg/l	30	-	500	2 L	<10	N/A	No Further Action
TPH C12-C16	µg/l	2	130	90[5]	2 L	<10	N/A	No Further Action
TPH C16-C35	µg/l	50#	50#	90[5]	2 L	<10	N/A	No Further Action
TPH Aliphatic [5]								
TPH C5-C6	µg/l	-	-	15000	2 L	<1.0	N/A	No Further Action
TPH C6-C8	µg/l	-	-	15000	2 L	<1.0	N/A	No Further Action
TPH C8-C10	µg/l	-	-	300	2 L	<1.0	N/A	No Further Action
TPH C10-C12	µg/l	-	-	300	2 L	<1.0	N/A	No Further Action
TPH C12-C16	µg/l	-	-	300	2 L	<10	N/A	No Further Action
TPH C16 – C21	µg/l	-	-	300**	2 L	<10	N/A	No Further Action
TPH C21-C35	µg/l	-	-	300**	2 L	<10	N/A	No Further Action
VOC								
Tetrachloroethylene	µg/l	0.4	-	10	2 L	N/A	N/A	No Further Action
Trichloroethylene	µg/l	10	-	10	2 L	N/A	N/A	No Further Action
Trichlorobenzene	µg/l	0.4	-	-	2 L	N/A	N/A	No Further Action
Trichloromethane	µg/l	2.5	-	-	2 L	N/A	N/A	No Further Action
Dichloromethane	µg/l	20	-	200	2 L	N/A	N/A	No Further Action
Carbon Tetrachloride	µg/l	12	-	3	2 L	N/A	N/A	No Further Action
Vinyl Chloride	µg/l	-	-	0.3	2 L	N/A	N/A	No Further Action

Notes
Solubility <0.01µg/l
AA – Annual Average
MAC- Maximum Admissible Concentration

* Sum of The specified compounds are benzo[b]fluoranthene (CAS 205-99-2), benzo[k]fluoranthene (CAS 207-08-9), benzo[g,h,i]perylene (CAS 191-24-2) and indeno[1,2,3-c,d]pyrene (CAS 193-39-5)

1. The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations (2015)
2. Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) - List II substances
3. Council Directive on the quality of water intended for human consumption (Drinking Water Directive)
4. WHO Guidelines for Drinking Water Quality. Third edition (2004)

For the purposes of the Tier 1 assessment E3P has compared the laboratory test data directly to the DWS values for the protection of drinking water and where absent DWS values, which are for the protection of surface water quality.

Referring to Table 4.4, the results of this direct comparison indicates that the data does not exceed the screening criteria for any of the contaminants of concern.

4.3 Ground Gas

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 (*Assessing risks posed by hazardous ground gases to buildings*, 2007). However, it is recommended that the full ground gas assessment and recommended protection measures are agreed with the local authority prior to their adoption on-site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

CIRIA C665 provide assessments for carbon dioxide and methane based upon Gas Screening Values (GSVs) utilising flow rates and concentrations. The site based GSVs for steady state methane and carbon dioxide are based upon the following equation:

$$GSV = \frac{concentration\ (by\ vol)}{100} \times flowrate\ (1/hr)$$

The GSVs within CIRA C665 are based upon all buildings other than standard residential houses.

The thresholds for GSVs based upon CIRIA guidance are provided within Table 4.5 (below)

Table 4.5 Commercial Thresholds for Gas Screening Values (GSV) in accordance with CIRIA C665– Commercial End Use

CIRIA – NO SUB-FLOOR VOID	
CLASSIFICATION	**GSV (METHANE AND CARBON DIOXIDE)**
CS1	<0.07
CS2	<0.70
CS3	<3.5
CS4	<15
CS5	<70
CS6	>70

4.4 Sources of Ground Gas

The Phase I report and subsequent Ground Investigation has identified the following potential sources of ground gas:

- Made Ground deposits
- Infilled field boundary

4.4.1 Groundwater

All wells were noted to have been dry during the first monitoring visit.

4.4.2 Gas Flow

During the monitoring a positive flow was noted in all monitoring wells. Positive flow is considered to be due to low levels of gas production.

4.4.3 Gas Concentrations

No methane was recorded within any of the monitoring wells above the limit of detection (0.1%) during the first monitoring visit. However, low levels of Carbon Dioxide were identified within all monitoring wells as concentrations ranged from 0.6% v/v (LOD) and 1.1% v/v. The maximum Carbon Dioxide concentrations were also associated with low oxygen concentrations and appear to be associated with the natural strata within WS105 (1.1% v/v).

4.4.4 Gas Assessment

In accordance with the methodology outlined with the CIRIA publication C665, E3P have utilised the results of the ground gas monitoring surveys to calculate a tentative Gas Screening Value (GSV). The GSVs for the monitoring positions are summarised in Table 4.6.

Table 4.6 Gas Risk Profile & Location

LOCATION	MAX CO_2	GSV	MAX CH_4	GSV	CLASSIFICATION
WS101	0.6	0.00156	0.1	0.00026	CS1
WS105	1.1	0.01584	0.1	0.00144	CS1
WS106	0.6	0.00078	0.1	0.00013	CS1
WS107	0.8	0.00208	0.1	0.00026	CS1
WS110	0.9	0.00117	0.1	0.00013	CS1
WS111	1.6	0.00208	0.1	0.00013	CS1
WS112	0.8	0.00208	0.1	0.00026	CS1

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

Preliminary ground gas monitoring suggests that the site can be classified as CS1 and it is considered that gas protection measures will not be required.

4.5 Conceptual Site Model

Following the completion of the intrusive site investigation, chemical analysis and risk assessment the conceptual model shown in Table 4.7 has been prepared for the site.

Table 4.7 Conceptual Model

POLLUTANT LINKAGE	PATHWAY	RECEPTOR	CONTAMINANT (SOURCE)	PROBABILITY	RISK	ASSESSMENT AND RECOMMENDATIONS	RESIDUAL RISK AFTER MITIGATION
PL2	Inhalation of dust	Future site users. Offsite receptors	ACM identified in Made Ground	Likely	Moderate	**Assessment:** Asbestos in the form of loose chrysotile fibres has been identified in the Made Ground topsoil (0.10m bgl) in WS110 at a concentration of at 0.029%. **Recommendation:** Localised impacted soils will be either placed at depth or removed from site during a carefully managed and regulatory authority approved phase of enabling works, under strict construction phase health and safety controls. Upon placement of asbestos impacted soils at depth beneath hardstanding or public open space, no unacceptable risk to the future site users will remain.	**LOW**

5. GEOTECHNICAL ASSESSMENT

5.1 Proposed Development

Redsun Developments are considering the proposed acquisition and future development of the land at Croft Business Park, Brombrough for mixed use commercial and retail buildings with associated roads and utility infrastructure. Drawing 12-999-002 (Appendix III) identifies the proposed development layout.

5.2 Summary of Ground Conditions

Made Ground

Made Ground topsoil was identified in the north east, south east, south west and central northern sector of the site in the location of former development. Made Ground topsoil was identified between ground level and 0.30m bgl and comprises brown sandy gravel with frequent cobbles with gravel and cobbles of sandstone and brick.

Deeper Made Ground was also identified in the proximity of the former building in the north east of the site (TP101, TP102, TP103 and WS101) and south east of the site (WS102, WS103 and TP105) between 0.30m and 0.80m bgl. Deeper Made Ground between 0.30m and 0.90m bgl was also noted in the central northern sector of the site (TP108, TP115 and WS106) in proximity of the former car park. This Made Ground comprised red sandy gravel with frequent cobbles with gravel of sandstone, brick and concrete and cobbles of sandstone.

Topsoil

Topsoil was identified throughout the site between ground level and 0.30m bgl. An isolated area of deeper topsoil was identified in the north of the site (TP109 and TP110) near the bordering trees to depths of 0.60m bgl. Topsoil comprised brown slightly clayey fine to medium SAND with frequent rootlets.

Drift

Drift deposits were only encountered within WS105 in the north east and WS111 in the north west of the site between 0.30m and 0.90m bgl. This deposit comprised brown clayey fine to medium SAND.

Solid

All exploratory hole locations were underlain by weathered sandstone between 0.20m and 2.00m bgl comprising red sandy gravel with frequent cobbles, with gravel and cobbles of sandstone.

5.3 Site Preparation

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the Specification for Highway Works. This should include:

- Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill;
- Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill; and,

- Removal of Made Ground and buried structures (concrete). These should be excavated.

5.4 Foundation Conditions & Assessment of Potential Bearing Capacities

In due consideration of the identified ground conditions, in-situ and laboratory geotechnical testing, E3P has undertaken an assessment of the net safe Allowable Bearing Pressure (ABP) within the underlying natural stratum to assist in the detailed design of foundations and infrastructure and determine the target founding stratum. The assessment of ABP is summarised in Table 5.1.

Table 5.1 Summary of ABP Assessment

GRANULAR SOILS			
Description	**Depth (range bgl)**	**Relative Density**	**Allowable Bearing Pressure (kN/m²)**
Weathered SANDSTONE	0.40-0.95	Very Dense	*560*
Weathered SANDSTONE	1.00-1.45	Medium Dense	*192-504*
Weathered SANDSTONE	1.50-1.95	Dense	*475*
Weathered SANDSTONE	2.00-2.45	Dense	*457*

Based on the assessment of the net ABP, the suitable target founding stratum has been identified as the underlying medium dense to very dense weathered sandstone.

The underlying weathered sandstone has been identified as being medium dense to very dense with an ABP ranging from 192kN/m² to 560kN/m² between 0.40m and 2.45m bgl.

All window sample probeholes were terminated due to refusals on very dense weathered sandstone between 0.5m and 2.0m bg.

At this time it is not possible to accurately define the foundation types due to the absence of a final development levels, however based on our experience of similar sites we would anticipate that the final foundation solution would be a combination of the following:

- Shallow strip foundations bearing on medium dense to dense gravel (weathered sandstone);
- Trench fill to support re-enforced strip foundations in areas of variable ground.

The anticipated foundation options are summarised in Table 5.2.

Table 5.2 Anticipated Foundations

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH	GROUND WATER	FOUNDATION TYPE	TYPE OF CONCRETE	REMARKS
TP101	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	N/A
TP102	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP103	1.15	N/A	TRAD. STRIP	DS-1 AC-1S	
TP104	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP105	0.85	N/A	TRAD. STRIP	DS-1 AC-1S	
TP106	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP107	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP108	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP109	0.95	N/A	TRAD. STRIP	DS-1 AC-1S	
TP110	0.95	N/A	TRAD. STRIP	DS-1 AC-1S	
TP111	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP112	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP113	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP114	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
TP115	0.85	N/A	TRAD. STRIP	DS-1 AC-1S	
WS101	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
WS102	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
WS103	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
WS104	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
WS105	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
WS106	1.25	N/A	TRAD. STRIP	DS-1 AC-1S	
WS107	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
WS108	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
WS109	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
BH101	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	
BH102	0.75	N/A	TRAD. STRIP	DS-1 AC-1S	

In addition to the above the, E3P has also undertaken an assessment of the site investigation findings in order to confirm if the ground conditions are suitable to facilitate ground improvement.

Table 5.3 Ground Improvement Design Risk Matrix

RISK ITEM	COMMENT	PASS / FAIL
Soft clays with an undrained shear strength less than 30kN/m^2	Not identified.	PASS
Ground with peat layers close to foundation level or the base of the stone column, or where intermediate layers of peat are thicker than 200mm either as a single layer or the sum of the thicknesses of individual layers throughout the length of the stone column.	Not identified.	PASS
Voided filled ground, eg old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	Not identified.	PASS

RISK ITEM	COMMENT	PASS / FAIL
Loose or non-engineered fill not previously subject to rising or fluctuating water levels saturation	None identified	PASS
Filled ground still settling or expected to settle under its own weight or due to the effects of surcharging/up-filling where there is a high organic content or where decay is continuing.	Not identified.	PASS
Fill, containing degradable material where organic material forms more than 15% of fill by volume	None Identified	PASS
Clays with a plasticity index greater than 40%	None Identified	PASS
Highly sensitive soils liable to collapse or remoulding	None Identified	PASS
Cohesive soils with trees in influencing distance.	Not identified.	PASS
Overall Risk Rating & Suitability for Vibratory Ground Improvement		PASS

A Concept Foundation Zoning Plan is included as Drawing 12-999-010 in Appendix III.

5.5 Ground Floor Slabs

Current building control regulations require that where infilled ground is present to depths in excess of 600mm or where the sub-stratum is variable in terms of the structure and settlement potential or where clay soils are present within the influence of existing or proposed trees, a suspended floor slab is required.

In this instance it is considered that, the underlying stratum would have in-excess of 600mm of infill and as such a suspended floor slab will be required.

5.6 Heave Precautions

Due to the presence of granular strata across the entire site, heave precautions will not be required during the construction of the proposed dwellings.

5.7 Pavement Construction

A programme of remediation and enabling works will be required to remediate the proposed road sub-grade in accordance with the requirements of the highways design manual (series 600) for a Method Compaction.

It is considered that the material can be re-engineered to a method to achieve a CBR in excess of 5% if works are completed in favourable climatic conditions.

5.8 Drainage

The underlying weathered sandstone was granular. Three falling head permeability tests were conducted which displayed varied results. WS101 has poor soakaway potential, WS105 had moderate soakaway potential and WS111 had good soakaway potential.

Therefore, it is considering that soakaway drainage may not be suitable for the proposed development. However, the application of soakaway drainage will ultimately be dependent on the specific requirements of the development. All soakaways should be designed in accordance with BRE Special Digest 365 – Soakaway Design

5.9 Concrete Durability

Based upon the results of the chemical analyses summarised in it is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE Special Digest 1 (2005).

5.10 Excavations

The sides of the exploratory trial pit excavations appeared to be stable during excavation, with the exception of TP103 in the north east of the site which was noted to have been unstable at 0.30m bgl due to loose Made Ground gravels.

All excavations were noted to have been slow or prematurely terminated due to the dense weathered sandstone.

If local pumping of groundwater is required during the advancement of excavations for the proposed foundations. Consideration should be given for the potential for dewatering gravels in the surrounding areas to the subject site that may cause structural damage to buildings sub-structures in close proximity to the site.

Table 5.4 Civil Engineering Excavation Risk Matrix

Risk Item	Present	Comment
Running Sands	No	Running sands were not identified during the site investigation.
Minor Water ingress	No	There was no groundwater identified during borehole and Trial Pit excavations.
Shallow Bedrock	Yes	Shallow Bedrock has been identified throughout the site at depths less than 0.5m below current ground levels. The presence of bedrock will impede excavation for drainage infrastructure using traditional excavation plant and equipment.

5.11 Slope Stability

The site is predominantly flat but embankments are present in the southern and eastern boundaries which are circa 2m higher than the remainder of the site.

As and when detailed topographic information is available and in due consideration of the proposed development design, structural and infrastructure loading, a detailed slope stability model may be required. This model will seek to determine the potential for newly imposed loadings to generate a risk of instability or failure within the off-site embankment and the need for any mitigation measures such as piled foundation to transfer loadings below the base of the slope.

5.12 Coal Mining

The site is not located in a coal mining affected area.

5.13 Further Works

Based on the findings of the intrusive site investigation, the following additional works are recommended to be completed in due course:

- Plot Specific Foundation Schedule (upon receipt of the final development levels);
- Materials Management Plan;
- Geotechnical Earthworks Strategy (Infrastructure).
- Remediation & Enabling Works strategy; and
- Full three dimensional earthworks Cut / Fill Model.

5.14 Construction Activity and Inspection

The following activities and inspections should be incorporated in to the site works:

- Excavations where access is required should be subject to a risk assessment from a competent person and where appropriate mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 utilised;
- It is considered that de-watering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond;
- Where access to confined spaces is required appropriate mitigation measures should be addressed within the Construction Stage Health and Safety Plan. Particular account should be taken of the gas results; and,
- The presence of potential contamination and mitigation measures should be addressed as part of the Construction Stage Health and Safety Plan and should include measures to design out the risks, reduce their impact and finally the use of Personnel Protective Equipment (PPE).

6. CONCLUSIONS AND RECOMMENDATIONS

Contaminated Land	
Human Health	A Tier I Human Health Risk Assessment has been undertaken using the chemical analysis results of the soils and comparing to the relevant Tier I criteria. This assessment has identified the presence of asbestos. Asbestos in the form of loose chrysotile fibres have been identified in the Made Ground topsoil (0.10m bgl) in WS110 at a concentration of at 0.029%. A hotspot excavation will be required in the proximity of WS110 to remove the impacted topsoil with placement >1.00m beneath an area of low sensitivity such as public open space or the proposed car park to ensure the contaminant pose no unacceptable risk to the future site users. Site specific control procedures and appropriate validation monitoring will be required to demonstrate the absence of any unacceptable risk to construction workers.
Controlled Waters	A Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground to Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) which did not identify any elevated levels of contaminants. There is considered to be a low risk to controlled waters and the wider environment.
Ground Gas	Ground gas monitoring thus far has indicated the site would be classed as Characteristic Situation 1, suggesting no gas protection measures will be required. However, the final ground gas regime will be confirmed following the completion of the ground gas monitoring programme.
Potable Water	This will need to be confirmed following the completion of a UKWIR Risk Assessment. Post remediation and enabling works ground conditions may be different from those identified during this site investigation.

Geotechnical Issues

The site is predominantly flat in topography; however embankments are present in the southern and eastern boundaries which are circa 2m higher than the remainder of the site, a phase of cut and fill enabling works may be required in order to create a proposed development platform suitable for a commercial development and adjacent car parks. This will generally comprise decreasing levels on south and western side.

During a phase of cut fill enabling works to create a developable platform, all below ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of the proposed development.

Based on the assessment of the net Allowable Bearing Pressure, the suitable target founding stratum has been identified as the underlying medium dense to very dense weathered SANDSTONE.

The underlying weathered SANDSTONE has been identified as being medium dense to very dense with an ABP ranging from 192kN/m² to 560kN/m² between 0.40m and 2.45m bgl.

All window sample probeholes were terminated due to refusals on shallow sandstone bedrock between 0.5m and 2.0m bgl. The presence of bedrock will impede excavation for drainage infrastructure using traditional excavation plant and equipment.

At this time it is not possible to accurately define the foundation types due to the absence of a final development levels, however based on our extensive experience of similar sites we would anticipate that the final foundation solution would be a combination of shallow strip foundations bearing on medium dense to dense gravel (weathered SANDSTONE) or trench fill to support re-enforced strip foundations in areas of variable ground

END OF REPORT

APPENDIX I
LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the Client as indicated in Section 1.2.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not be made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.

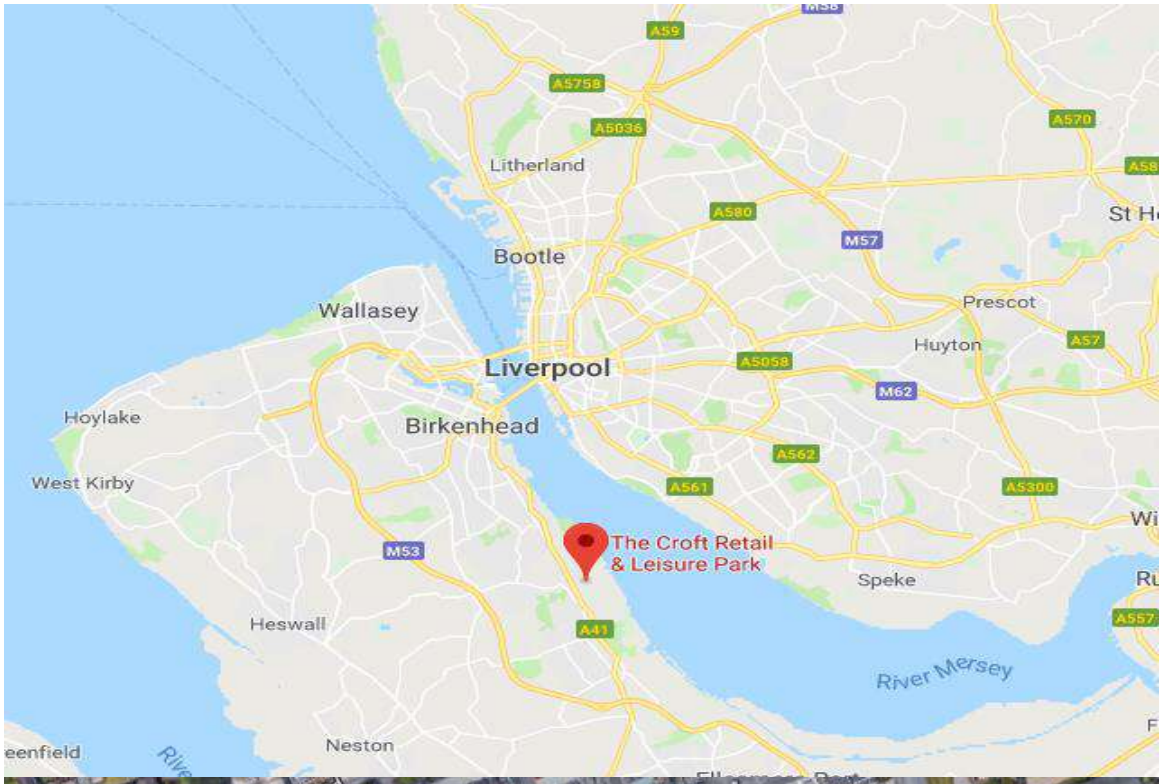
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

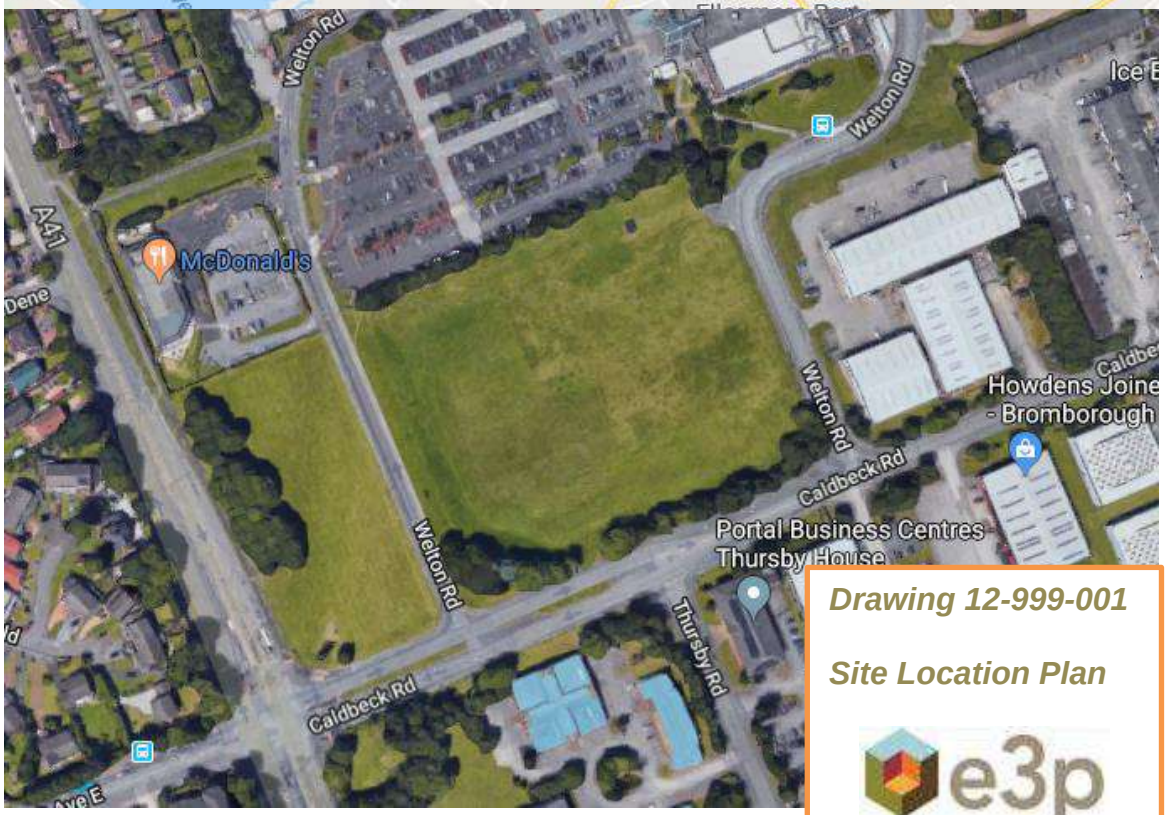
APPENDIX II
GLOSSARY

TERMS

AST	Above Ground Storage Tank	**SGV**	Soil Guideline Value
BGS	British Geological Survey	**SPH**	Separate Phase Hydrocarbon
BSI	British Standards Institute	**TPH CWG**	Total Petroleum Hydrocarbon (Criteria Working Group)
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes	**SPT**	Standard Penetration Test
CIEH	Chartered Institute of Environmental Health	**SVOC**	Semi Volatile Organic Compound
CIRIA	Construction Industry Research Association	**UST**	Underground Storage Tank
CLEA	Contaminated Land Exposure Assessment	**VCCs**	Vibro Concrete Columns
CSM	Conceptual Site Model	**VOC**	Volatile Organic Compound
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)	**WTE**	Water Table Elevation
DWS	Drinking Water Standard	**m**	Metres
EA	Environment Agency	**km**	Kilometres
EQS	Environmental Quality Standard	**%**	Percent
GAC	General Assessment Criteria	**%v/v**	Percent volume in air
GL	Ground Level	**mb**	Milli Bars (atmospheric pressure)
GSV	Gas Screening Value	**l/hr**	Litres per hour
HCV	Health Criteria Value	**µg/l**	Micrograms per Litre (parts per billion)
ICSM	Initial Conceptual Site Model	**ppb**	Parts Per Billion
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene)	**mg/kg**	Milligrams per kilogram (parts per million)
ND	Not Detected	**ppm**	Parts Per Million
LMRL	Lower Method Reporting Limit	**mg/m^3**	Milligram per metre cubed
NR	Not Recorded	**m bgl**	Metres Below Ground Level
PAH	Polycyclic Aromatic Hydrocarbon	**m bcl**	Metre Below Cover Level
PCB	Poly-Chlorinated Biphenyl	**mAOD**	Metres Above Ordnance Datum (sea level)
PID	Photo Ionisation Detector	**kN/m^2**	Kilo Newtons per metre squared
QA	Quality Assurance	**µm**	Micro metre
SGV	Soil Guideline Value		

APPENDIX III
DRAWINGS





Drawing 12-999-001

Site Location Plan

Key:

Notes:

P1	-	30.01.2019	DRAFT	HM	EM
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Croft Business Park, Bromborough	Job No: 12-999	Date: 30.01.2019
	Drawing No: 002	Scale: NTS @ A3
Job Title: Redsun Developments	Drawing Title: Proposed Development Plan	

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Key:

Historical Features

- Former Field Boundary (Pre 1876 - Pre 1899)
- Former Building (Pre 1956 - Pre 2003)
- Site Contour (Pre 1950 - Present)
- Site Contour (Pre 1980 - Present)
- Former Carpark (Pre 1990 - Pre 2006)
- Former Hardstanding (Pre 1999 - Pre 2003)

Notes:

P1	-	30.01.2019	DRAFT	HM	EM
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Croft Business Park, Bromborough

Job No: 12-999

Date: 30.01.2019

Drawing No: 003

Scale: NTS @ A3

Job Title: Redsun Developments

Drawing Title: Historical Features Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Key:

Location Symbols

- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- CBR101 — Approximate California Bearing Ratio Test Location
- Historical Features Outline

Notes:

P1 P1	R1 -	09-01-2019 15-11-2018	REVISION DRAFT	CB CB	RH RH
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Croft Business Park, Bromborough

Job No: 12-999

Date: 09-01-2019

Drawing No: 004

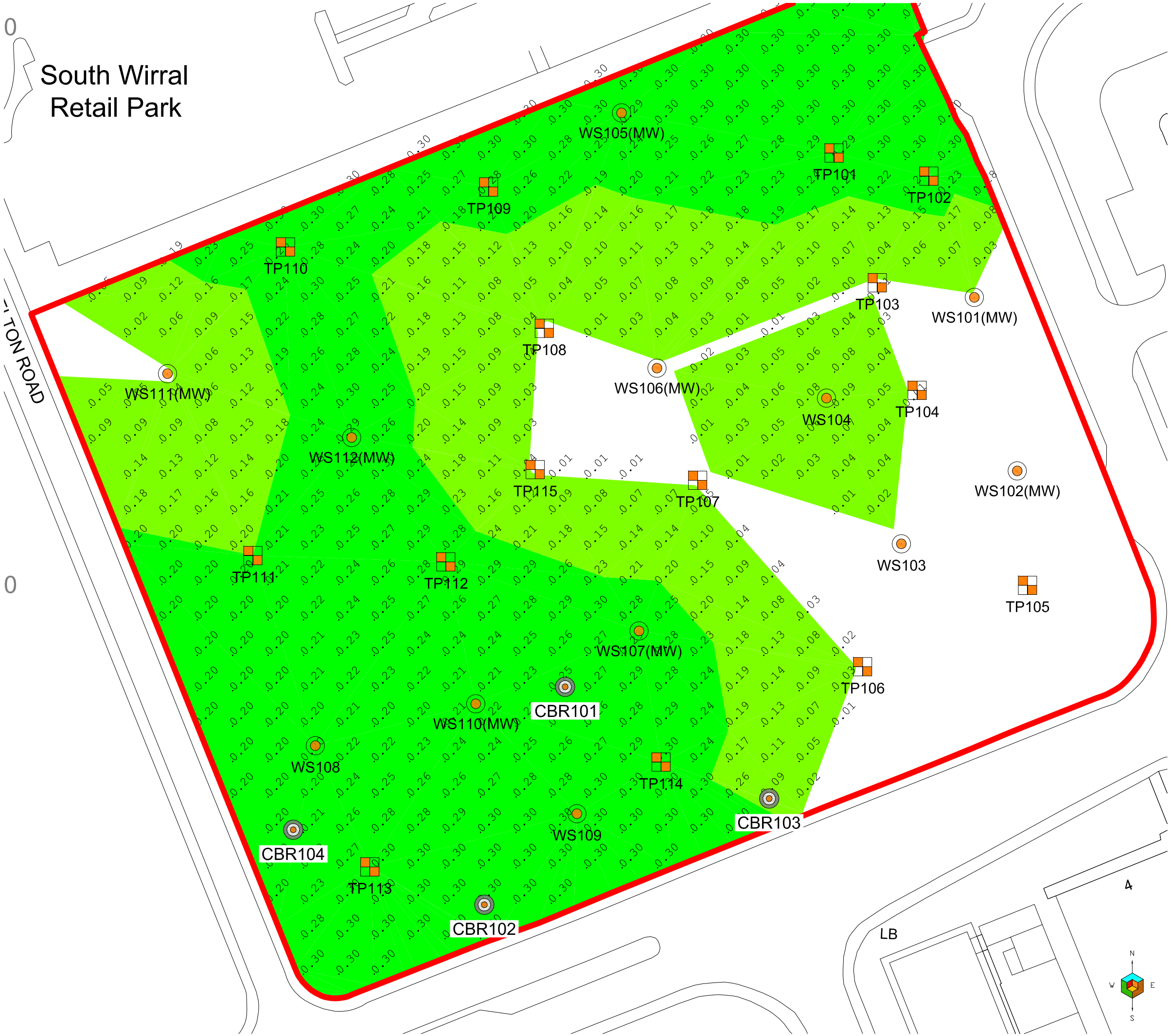
Scale: NTS @ A3

Job Title: Redsun Developments

Drawing Title: Exploratory Hole Location Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

South Wirral Retail Park



Key:

Location Symbols

- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- CBR101 — Approximate California Bearing Ratio Test Location

Topsoil *Depth (m)*

- Depth of Topsoil in Excess of 2.00m
- Depth of Topsoil Between 1.80 - 1.99m
- Depth of Topsoil Between 1.60 - 1.79m
- Depth of Topsoil Between 1.40 - 1.59m
- Depth of Topsoil Between 1.20 - 1.39m
- Depth of Topsoil Between 1.00 - 1.19m
- Depth of Topsoil Between 0.80 - 0.99m
- Depth of Topsoil Between 0.60 - 0.79m
- Depth of Topsoil Between 0.40 - 0.59m
- Depth of Topsoil Between 0.20 - 0.39m
- Depth of Topsoil Between 0.00 - 0.19m
- Topsoil Not Identified

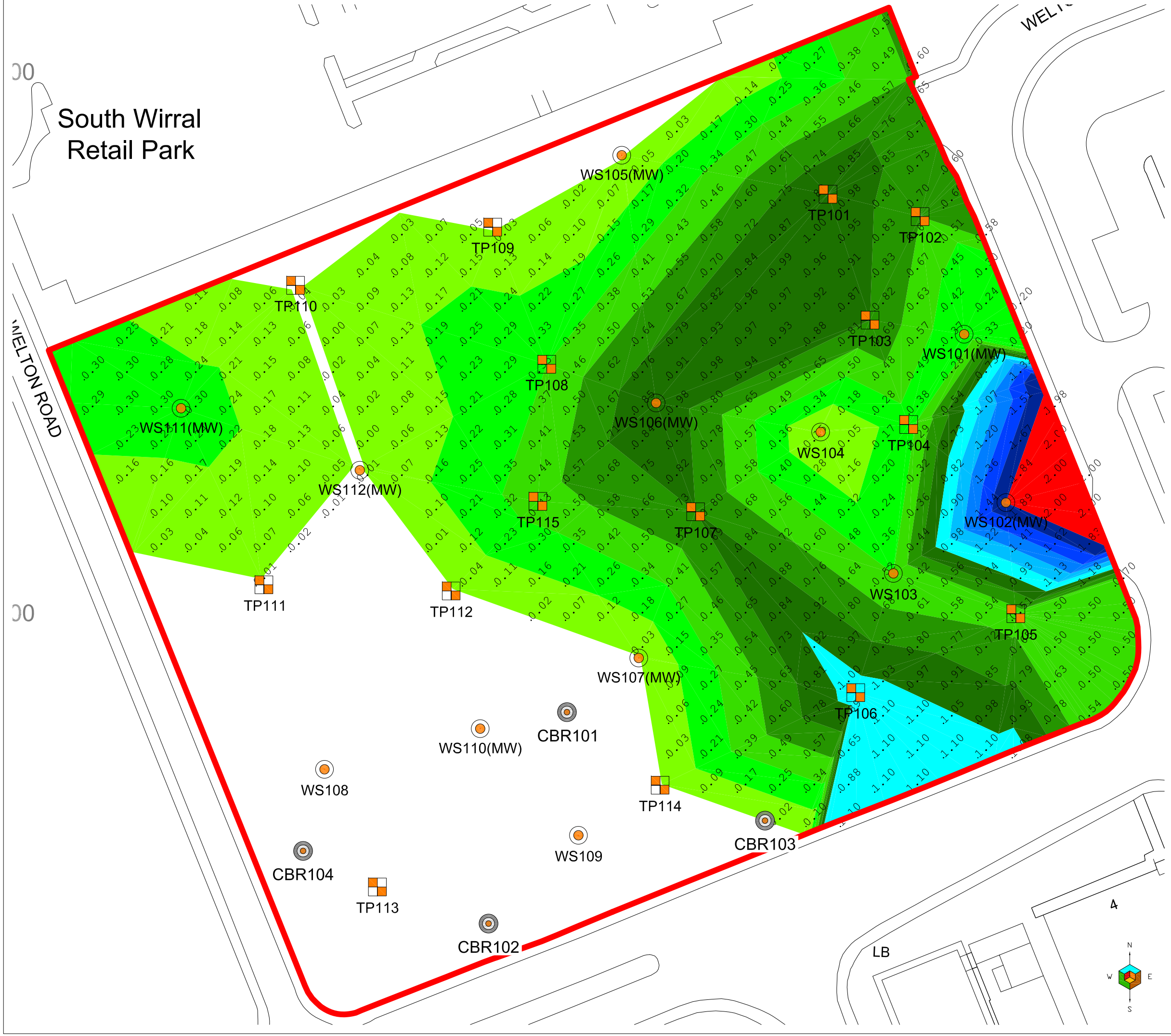
Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

P1	-	30.01.2019	DRAFT	HM	RH
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Croft Business Park, Bromborough	Job No: 12-999	Date: 30.01.2019
	Drawing No: 005	Scale: NTS
Job Title: Redsun Developments	Drawing Title: Depth of Topsoil Plan	

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk



Key:

Location Symbols

WS101(MW) — Approximate Window Sample Probehole Location with Install

TP101 — Approximate Trial Pit Location

CBR101 — Approximate California Bearing Ratio Test Location

Topsoil *Depth (m)*

- Depth of Made Ground in Excess of 2.00m
- Depth of Made Ground Between 1.80 - 1.99m
- Depth of Made Ground Between 1.60 - 1.79m
- Depth of Made Ground Between 1.40 - 1.59m
- Depth of Made Ground Between 1.20 - 1.39m
- Depth of Made Ground Between 1.00 - 1.19m
- Depth of Made Ground Between 0.80 - 0.99m
- Depth of Made Ground Between 0.60 - 0.79m
- Depth of Made Ground Between 0.40 - 0.59m
- Depth of Made Ground Between 0.20 - 0.39m
- Depth of Made Ground Between 0.00 - 0.19m
- Made Ground Not Identified

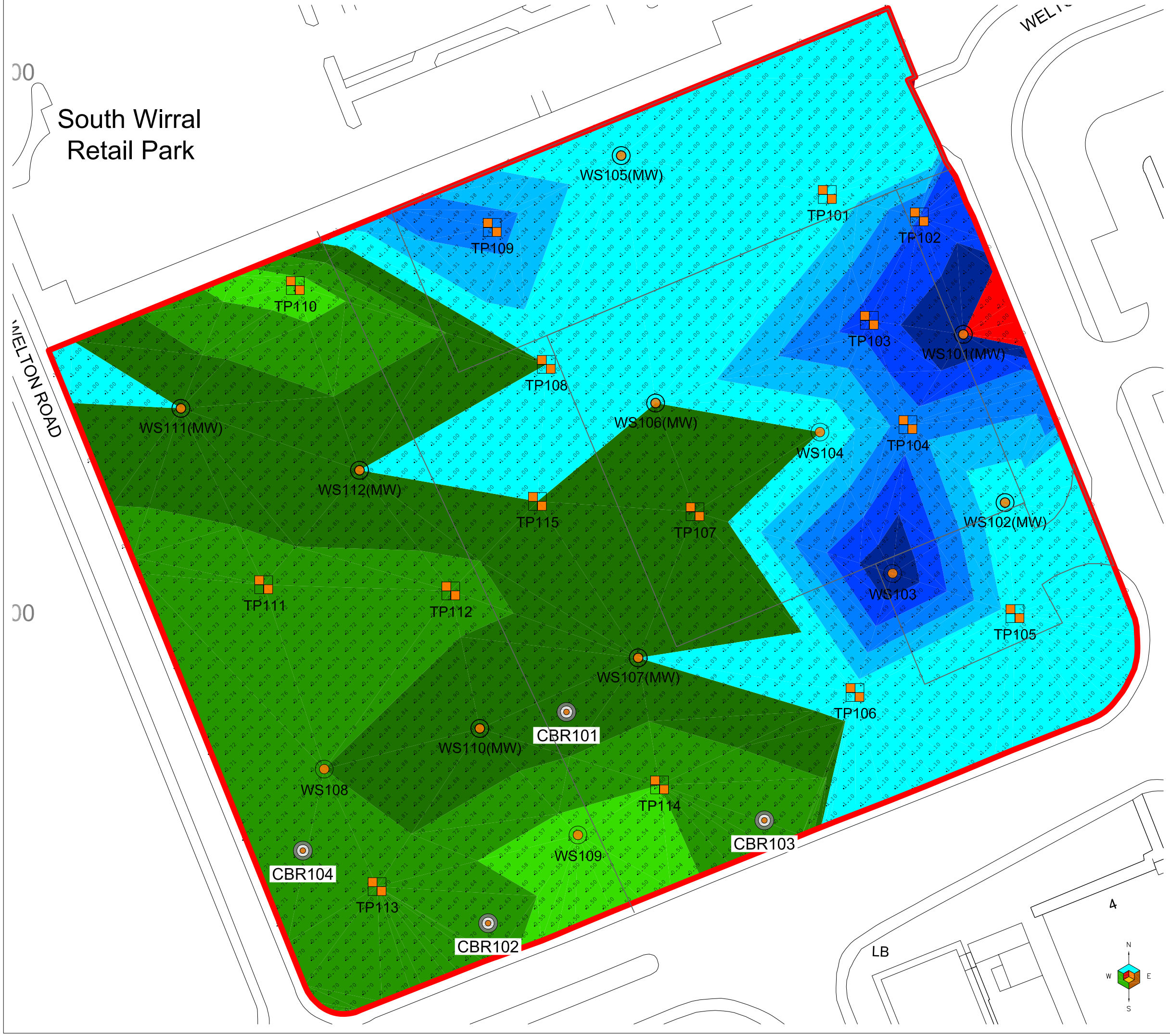
Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	30.01.2019	DRAFT	HM	RH

Client: Croft Business Park, Bromborough	Job No: 12-999
	Date: 30.01.2019
	Drawing No: 006
	Scale: NTS
Job Title: Redsun Developments	Drawing Title: Depth of Made Ground Plan

e3p
Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk



Key:

Location Symbols

WS101(MW) — Approximate Window Sample Probehole Location with Install

TP101 — Approximate Trial Pit Location

CBR101 — Approximate California Bearing Ratio Test Location

Topsoil *Depth (m)*

- Depth To Bedrock in Excess of 2.00m
- Depth To Bedrock Between 1.80 - 1.99m
- Depth To Bedrock Between 1.60 - 1.79m
- Depth To Bedrock Between 1.40 - 1.59m
- Depth To Bedrock Between 1.20 - 1.39m
- Depth To Bedrock Between 1.00 - 1.19m
- Depth To Bedrock Between 0.80 - 0.99m
- Depth To Bedrock Between 0.60 - 0.79m
- Depth To Bedrock Between 0.40 - 0.59m
- Depth To Bedrock Between 0.20 - 0.39m
- Depth To Bedrock Between 0.00 - 0.19m

Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

Phase	Revision	Date	Issue	Drawn	Authorised
P1	R1	08.02.2019	REVISION	HM	RH
P1	-	30.01.2019	DRAFT	HM	RH

Client: Croft Business Park, Bromborough

Job No: 12-999

Date: 08.02.2019

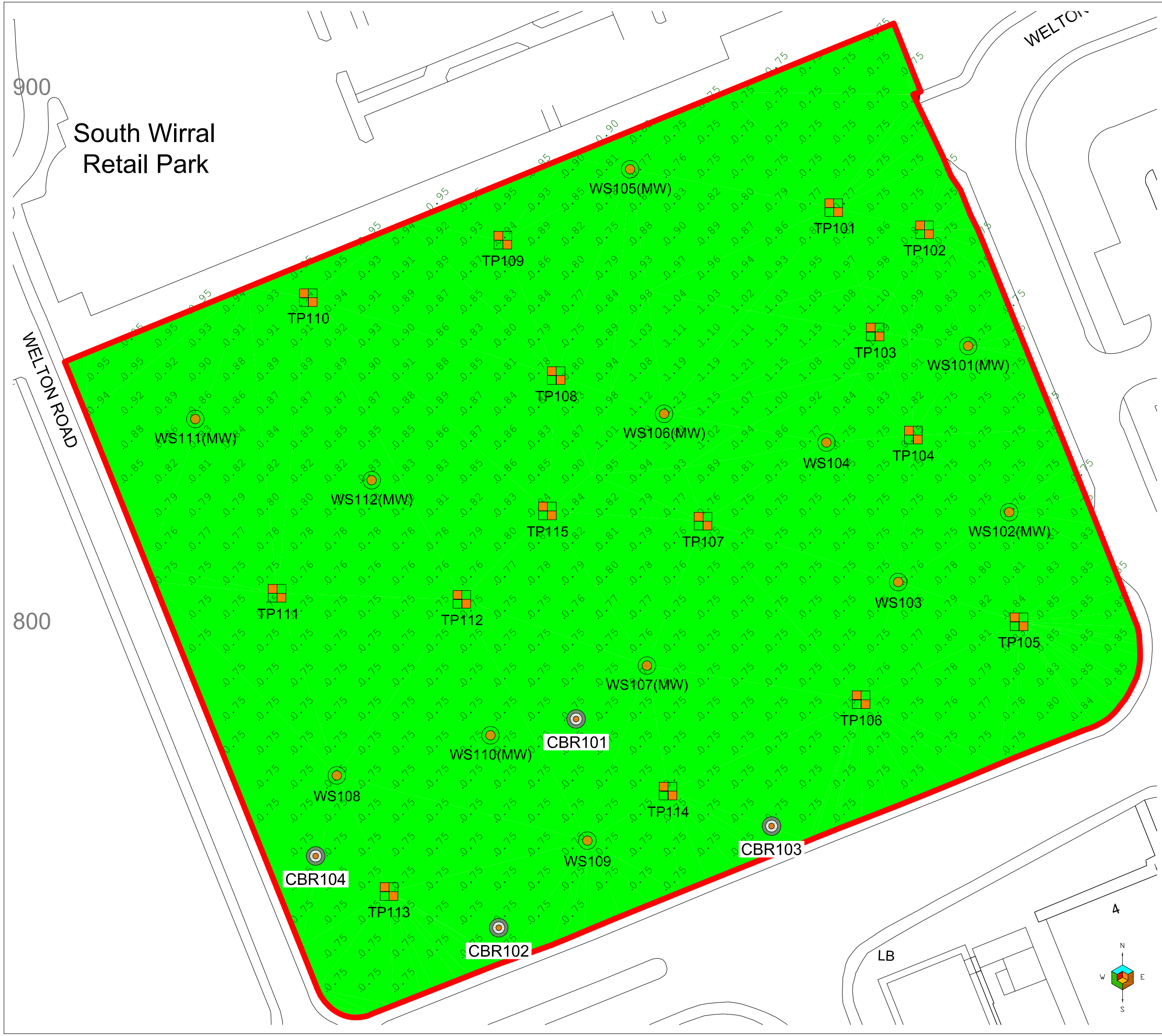
Drawing No: 007

Scale: NTS

Job Title: Redsun Developments

Drawing Title: Depth To Bedrock Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk



Key:

Location Symbols

WS101(MW) Approximate Window Sample Probehole Location with Install

TP101 Approximate Trial Pit Location

CBR101 Approximate California Bearing Ratio Test Location

Shallow Spread Footings

Depth to Founding Strata 0.00 - 1.24m

Depth to Founding Strata 1.25 - 1.49m

Mass Trench Fill Footings

Depth to Founding Strata 1.50 - 1.74m

Depth to Founding Strata 1.75 - 1.99m

Depth to Founding Strata 2.00 - 2.24m

Engineered Footings

Depth to Founding Strata 2.25 - 2.49m

Depth to Founding Strata >2.50m

Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	30.01.2019	DRAFT	HM	RH

Client: Croft Business Park, Bromborough

Job No: 12-999

Date: 30.01.2019

Drawing No: 008

Scale: NTS

Job Title: Redsun Developments

Drawing Title: Depth to Founding Strata Plan

e3p

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Key:

Location Symbols

WS101(MW) Approximate Window Sample Probehole Location with Install

CS1

Notes:

WELL	DATE	CH_4 INITIAL %V/V	CH_4 STEADY %V/V	CH_4 GSV l/hr	CO_2 INITIAL %V/V	CO_2 STEADY %V/V	CO_2 GSV l/hr	O_2 %V/V	ATMOS(mB)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE / STRATUM (mbgl)	DEPTH TO BASE (mbgl)	DEPTH TO WATER (mbgl)
WS101	07/01/2019	0.1	0.1	0.00026	0.6	0.6	0.00156	19.9	1026	Falling	0.26	0.5-2.0	1.84	Dry
WS105	07/01/2019	0.1	0.1	0.00144	1.1	1.1	0.01584	19.3	1026	Falling	1.44	0.5-1.0	0.93	Dry
WS106	07/01/2019	0.1	0.1	0.00013	0.6	0.6	0.00078	19.9	1026	Falling	0.13	0.5-1.0	0.92	Dry
WS107	07/01/2019	0.1	0.1	0.00026	0.8	0.8	0.00208	19.5	1026	Falling	0.26	0.5-1.0	0.93	Dry
WS110	07/01/2019	0.1	0.1	0.00013	0.9	0.9	0.00117	19.5	1026	Falling	0.13	0.5-1.0	0.95	Dry
WS111	07/01/2019	0.1	0.1	0.00013	1.6	1.6	0.00208	18.6	1026	Falling	0.13	0.5-1.0	1.09	Dry
WS112	07/01/2019	0.1	0.1	0.00026	0.8	0.8	0.00208	20	1026	Falling	0.26	0.5-1.0	0.89	Dry

Phase	Revision	Date	Issue	Drawn	Authorised
P1	R1	08-02-2019	REVISION	HM	RH
P1	-	31-01-2019	DRAFT	RW	EM

Client: Croft Business Park, Bromborough

Job No: 12-999

Date: 08-02-2019

Drawing No: 009

Scale: NTS @ A3

Job Title: Redsun Developments

Drawing Title: Gas Assessment Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Minimum Width of Strip Footings

Type of Ground (Including Engineered Fill)	Condition of Ground	Total Load of Load-Bearing Walling more than (kN/linear metre)					
		20	30	40	50	60	70
		Minimum Width of Strip Foundation (mm)					
Gravel Sand	Medium Dense to Dense	250	300	400	500	600	650
Clay Sandy Clay	Stiff	250	300	400	500	600	650
Clay Sandy Clay	Firm	300	350	450	600	750	850

Summary of Heave Precaution Requirements

Volume Change Potential	Required Foundation Depth (m)	Minimum Void Dimensions for Foundations, Ground Beams & Suspended In-Situ Concrete Ground Floors		Minimum Void Dimensions Under Pre-Cast Concrete & Suspended Timber Floors
		Thickness of Void Former Against Side of Foundation of Ground Beam (mm)	Thickness of Void Former on Underside of Edge Beam & Floor Slab (mm)	Void Dimension (mm)
Low Volume Change Potential (<20%)	>2.00	No Special Precautions		200
	2.00-2.50	-	50	
Medium Volume Change Potential (20-40%)	1.50-2.00	25	50	250
	2.00-2.50	25	100	
	>2.50	Engineer Design		Engineer Design
High Volume Change Potential (>40%)	1.50-2.00	25	75	300
	2.00-2.50	35	150	
	>2.50	Engineer Design		Engineer Design

Key:

Anticipated Foundation Types

Colours indicate depth to anticipated founding stratum with letters indicating potential footing types.

- TS — Traditional Strip Foundations. Minimum depth 900mm below proposed Final Finished Level, Maximum safe bearing pressure limited to 100kN/m2.
- MT — Mass Trench Fill Foundations. Minimum depth 1250mm below proposed Final Finished Level, Maximum safe bearing pressure limited to 100kN/m2.
- V — Vibro Stone Ground Compaction. In accordance with NHBC Chapter 4.2
- P — Piled Foundations. Where the maximum foundation depth exceeds 2.50m a piled foundation option rather than a trench fill / deep reinforced strip foundations may be adopted, Column or line loads supported by ground beams.
- R — Raft Foundations. Maximum safe bearing pressure limited to 50kN/m2 on approved engineered granular fill, Raft foundations to be designed by a structural engineer in accordance with Chapter 4.3 of NHBC 2013, Raft foundations are considered suitable to mitigate against potential influence of clay heave / desiccation in accordance with Section 4.2, sub-section D70.
- S/TB — Traditional Strip / Trench Block Foundations. Traditional strip founded at 450mm below current level with build up in Trench Block and subsequent backfill to development level.

Depth to Target Founding Strata

- Footings 0.75 - 0.90m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 0.90 - 1.25m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 1.25 - 1.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2

→ Viable for Shallow Strip Foundations

- Footings 1.50 - 1.75m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 1.75 - 2.00m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 2.00 - 2.25m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 2.25 - 2.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2

→ Viable for Trench Fill Foundations

Engineered Foundation Solutions (Piled or Ground Improvement)

- Footings >2.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Where orange circle is shown, ground conditions would allow for improvement by the construction of Vibratory Replacement Stone Columns (VRSC) to ensure a new Allowable Bearing Pressure of 125kN/m2 is achieved at 600mm below piling platform, However; where plots are underlain by cohesive soils, the reinforced strip (bearing on the VRSC) will need to be deepened in accordance with the associated tree influences identified on the drawing.

Requirement for Mitigation of Volumetric Instability in Clay

- Where pale blue circle is shown, Plots may require deepening of foundations to mitigate volumetric instability within clay soil and heave precautions.
- Low volume change potential clay. Heave precautions required to underside of cast in-situ floor slab (with no sub-floor void) within corjected zone of tree influence, Heave precautions not required to foundation.

Items Considered

Bearing Capacity	TBC
Trees	TBC
Historical	TBC
Groundwater Table	TBC
FFL	TBC
Contamination	TBC
Remediation	TBC
Volume Change Potential	TBC
Root Protection Areas	TBC

E3P Designers Residual Risk Assessment

Designers Statement of declaration

E3P realises its obligations as a design organisation to avoid forseeable risks to those constructing our designs. In accordance with our statutory duties under CDM 2015, E3P has taken all reasonably practicable steps to eliminate hazards, taking into account other design considerations, from out designs.
E3P utilise a number of processes and documents to decide on the final design. This design risk assessment profile forms part of the overall E3P design process.

Where hazards remain, then details have been provided below on the significant residual risks from those hazards. To assist other project team members our designer has provided information needed to identify and manage remaining significant risks for this project, along with justification for the final design choice.

Additional Information:

Underground Services

No allowance has been made in the foundation design to accommodate the presence or installation of underground services except where specifically noted, It is assumed that the design for the installation of underground services has or will take into account the house/retaining wall foundations as detailed on this plan and in accompanying schedule. Foundation depths should comply with BS813-1:1995.

Deep Excavations

Deep excavations will be necessary on this site. A full risk assessment and agreed method statement must be produced prior to the construction phase.

Trench Stability

The contractor should be aware that due to the nature of the ground conditions, it is likely that there is the potential for unstable trenches. The contractor should allow within their tender for temporary means of support and safe methods of working. Particular reference is made to excavations immediately adjacent to existing road/footway/verge/boundary features & structures.

Construction Issues

The contractor is deemed to have considered all construction issues identified in E3P drawings and should have priced for the work accordingly.

CDM Regulations

Preparatory works such as reducing ground levels and deep excavations should be carefully considered and carried out in such a manner as to comply with the current CDM (2015) regulations, particularly for excavations close to the site boundary, existing structures & roads.

Construction of foundations

It has been assumed at the design stage that foundations will be constructed prior to the construction of roads and the installation of drainage and services. If roads, footways or verges exist on the site prior to foundation construction, temporary support is required during excavation.

Insitu Suspended Slabs

Where the depth of unsuitable material exceeds 600mm, suspended ground floor slabs are required. Reinforced insitu suspended concrete slabs may be used, unless influenced by vegetation (e.g Heave Zone).

New Planting

No allowance has been made for deepening of foundations due to new planting, Planting proposals to be submitted to E3P for consideration.

Saplings

Unless stated otherwise all saplings within the site and its boundary are to be removed prior to construction. For advice seek appropriate tree care specialist. Permission may be required prior to removal. Should any saplings remain then E3P should be informed prior to excavating foundations.

Geology

Ground below foundations to have a net allowable bearing pressure of circa 75kN/m² at 1.00m bgl in natural sandy CLAY and SAND deposits. Foundations may require deepening due to varying bearing strata. Foundations must not be found in different materials as this may result in differential settlement. Foundations must not be founded in Made Ground. E3P to be informed if ground conditions differ from that anticipated. If in any doubt contact E3P.

Foundation Concrete

Concrete to trench fill or traditional strip footings to be GEN1 to BS 8500, compacted by vibration. Reinforced concrete to be RC35, compacted by vibration. Top of concrete foundations to suit construction Health & Safety requirements.

Gas/Radon Precautions

Gas precautions to be confirmed. Radon protection is not required.

Foundation Schedule

Numbers at corners of plots to be used when
referring to foundation schedule. (Pending Revised Layout & Levels)

Heave Precaution

Heave precautions should be used where;

- The clay is moderate or high plasticity;
- Where the foundation is within the zone of influence of trees; and,
- Where the foundation depth determined in accordance with NHBC 2013 Clause D6 is greater than 1.50m based on the appropriate tree height.

Heave precautions are required within the proposed development.

N.B: This Foundation Zoning Plan is subject to change pending completion of the site wide earthworks programme.

Foundation Options

Due to the variable ground conditions across the site, this would suggest that the proposed development may be constructed on a combination of traditional strip foundations and mass trench fill with the majority of proposed dwellings to require vibro ground improvement to support a shallow reinforced strip footing.

The use of Vibro Stone Columns, which would bear on the underlying firm to stiff clays and medium dense sands at circa 3.0-4.0m bgl, would allow the construction of shallow reinforced strip foundations to be cast 600mm below formation level. The suitability of VSC would depend on the presence of organic materials / peat, which have until this point, not been identified on the site. In the event that peat is identified at a thickness of >200mm, driven pile foundations may be required.

Local deepening of foundations will be required with tree influences as indicated. For a deep strip / mass trench fill, the structural design would need to account for differential settlement of foundations bearig on cohesive and granular soils. This is an indicative plan and will be amended upon receipt of the final development layout.

Trees

Due to the absence of an Arboricultural survey for the site, an assumption has been made of moderate water demand 20m mature height for each tree as an indication for tree influence within the proposed development. These influences are subject to change pending receipt of the tree survey.

Residual Risks

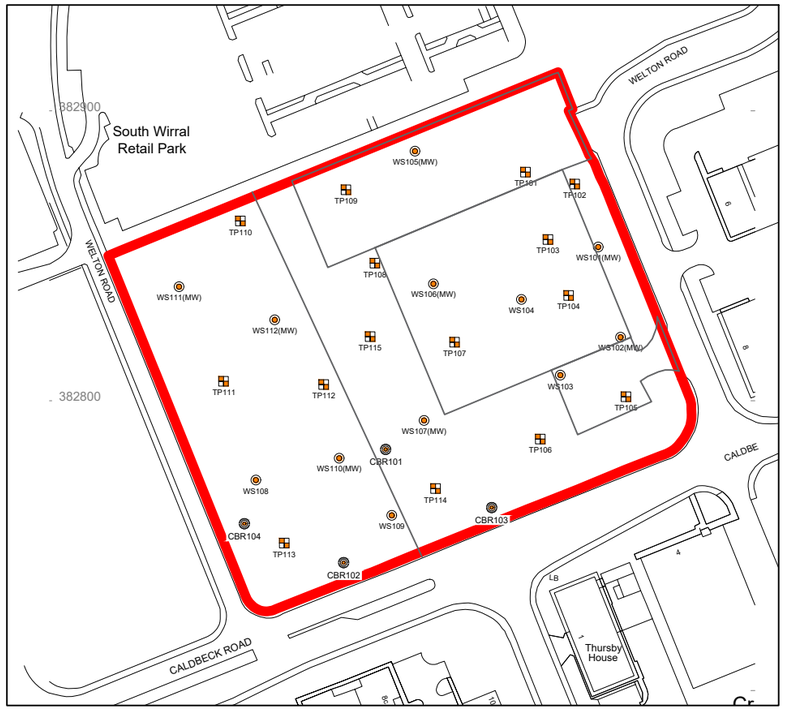
Foreseeable Risks That Cannot be Avoided	Applicable (Y/N)	Action to Reduce Risk	Justification for Design Decision
Deep Excavations	Y	Identify locations on drawing and depths on schedule	Lesser risk than other alternatives
Trench Collapse	Y	Risk highlighted on drawing	Lesser risk than other alternatives
Use of Working Platform for Pile/Vibro Operations	Y	Compliance with working platform directive required	Pile/Vibro foundation less risky than other alternatives

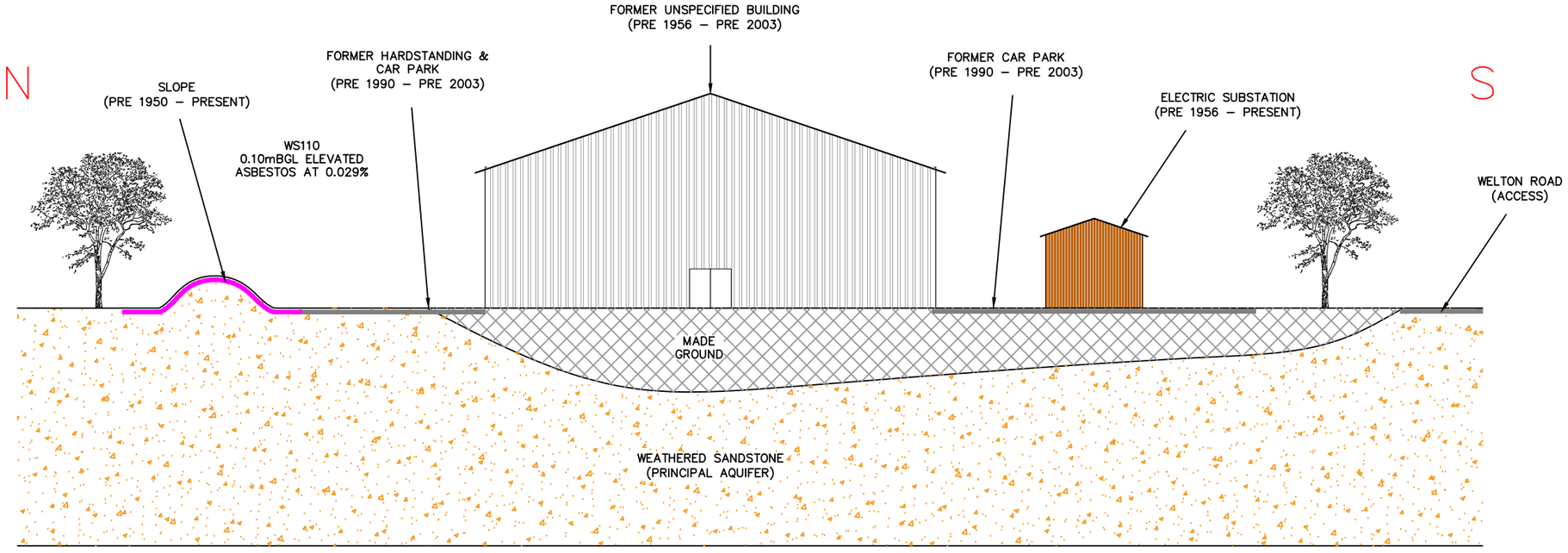
Phase	Revision	Date	Issue	Drawn	Authorised
P1	R1	08.02.2019	REVISION	HM	RH
P1	-	30.01.2019	DRAFT	HM	RH

Client: Croft Business Park, Bromborough	*Job No:* 12-999	*Date:* 08.02.2019	
	Drawing No: 010	*Scale:* NTS	
Job Title: Redsun Developments	*Drawing Title:* Conceptual Foundation Zoning Plan		

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

POLLUTANT LINKAGE	PATHWAY	RECEPTOR	CONTAMINANT (SOURCE)
PL1	Dermal contact. Inhalation of soil, fibres and dust. Ingestion of soils, dust, vegetables, soil attached to vegetables. Windblown dust.	Future site users. Offsite receptors.	ACM (former buildings, potentially in Made Ground, brake pad linings)
PL2	Soil ingestion, dermal contact and ingestions. Consumption of homegrown vegetables.	Construction works and residential end users.	Heavy metals within Made Ground, Topsoil , Natural drift deposits.
PL3	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Offsite receptors.	Volatile contaminants such as hydrocarbons, solvents, chlorinated hydrocarbons, naphthalene (Made Ground)
PL4	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Offsite land users.	Methane, carbon dioxide. (Made Ground and infilled features on and within 250m of the site)
PL5	Surface run off. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Secondary A Aquifer)	Mobile contaminants such as hydrocarbons, volatile compounds (Made Ground)
PL6	Sulphate attack on concrete.	Building Structure.	Sulphate (Potential ash within Made Ground)
PL7	Ingestion of tainted water supply.	Future site users. Water pipes.	Organic contaminants such as hydrocarbons, solvents (Made Ground, scrap yard, mills, works)
PL8	Direct Contact (Plant uptake)	Flora.	Phytotoxic Contaminants (Made Ground)





Key:

Legend

MADE GROUND

WEATHERED SANDSTONE

Notes:

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	31-01-2019	DRAFT	RW	EM

Client: Croft Business Park, Bromborough

Job No: 12-999

Date: 31-01-2019

Drawing No: 011

Scale: N.T.S

Job Title: Redsun Developments

Drawing Title: Conceptual Site Model

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

APPENDIX IV
E3P EXPLORATORY HOLE LOGS

Trial Pit Log

TrialPit No: TP101
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): Depth 1.00 (2.00 × 1.00)	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES					MADE GROUND: Brown slightly clayey gravelly fine to medium sand with frequent rootlets (topsoil). Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick.
				0.30			
				0.40			MADE GROUND: Grey gravel. Gravel is fine to coarse sub-angular to sub-rounded of mudstone and concrete and brick.
							Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
				1.00			End of Pit at 1.00m

Remarks: 1.Terminated at 1m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP102
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 1.60	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
	0.50	ES		0.60			MADE GROUND: Red sandy gravel with frequent cobbles. Gravel is fine to coarse sub-angular to subrounded of sandstone, brick and concrete. Cobbles are sub-angular to subrounded of sandstone.
				1.60			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 1.60m

1
2
3
4
5

Remarks: 1.Excavation slow due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP103
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 1.70	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
	0.60	ES		0.80			MADE GROUND: Red sandy gravel with frequent cobbles and occasional boulders. Gravel is fine to coarse sub-angular to subrounded of sandstone, brick and concrete. Cobbles and boulders are sub-angular to subrounded of sandstone, concrete and brick.
				1.70			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 1.70m

Remarks: 1.Unstable Made Ground at 0.3m bgl. 2.Excavation slow due to weathered sandstone.

Stability: Unstable.

Trial Pit Log

TrialPit No: TP104
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 1.50	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.30			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
	1.20	ES		1.50			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 1.50m

Remarks: 1.Excavation slow due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP105
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): Depth 1.10 — 2.00 × 1.00	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.40	ES		0.30			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
				0.50			MADE GROUND: Grey gravel with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone and concrete. Cobbles are sub-anglar of concrete.
				1.10			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 1.10m

Remarks: 1.Excavation moved west due to suspected service.

Stability: Stable.

Trial Pit Log

TrialPit No: TP106
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 1.10	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
	1.00	ES		1.10			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 1.10m

Remarks: 1.Terminated at 1.1m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP107
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 0.80	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
				0.80			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 0.80m

Remarks: 1.Terminated at 0.8m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP108
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 1.00	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
				0.40			MADE GROUND: Grey gravel with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone and concrete. Cobbles are sub-anglar of concrete.
							Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
				1.00			End of Pit at 1.00m

Remarks: 1.Terminated at 1m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP109
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 1.50	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
				0.60			
	1.00	ES					Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
	1.20	B					
				1.50			End of Pit at 1.50m

Remarks: 1.Terminated at 1.5m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP110
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 0.50	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.10			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
				0.50			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 0.50m

Remarks: 1.Excavation slow due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP111
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 0.70	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
	0.50	ES		0.70			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 0.70m

Remarks: 1.Terminated at 0.7m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP112
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 0.70	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
	0.50	ES		0.70			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 0.70m

Remarks: 1.Terminated at 0.7m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP113
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 0.70	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
				0.70			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 0.70m

Remarks: 1.Terminated at 0.7m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP114
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): 2.00 x 1.00 Depth 0.60	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
				0.60			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 0.60m

Remarks: 1.Terminated at 0.6m bgl due to dense weathered sandstone.

Stability: Stable.

Trial Pit Log

TrialPit No: TP115
Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords: - Level:	Date 13/12/2018
Location: Bromborough		Dimensions (m): Depth 1.00 (1.00 × 2.00)	Scale 1:24
Client: Redsun Developments			Logged E.Moss

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
				0.50			MADE GROUND: Grey gravel with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone and concrete. Cobbles are sub-anglar of concrete.
	0.70	ES		1.00			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
							End of Pit at 1.00m

Remarks: 1.Terminated at 1.5m bgl due to dense weathered sandstone.

Stability: Stable.

Borehole Log

Borehole No. **WS101**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND: Brown sandy gravel with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
		1.00	SPT	N=19 (3,3/4,4,5,6)				Dense red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
		2.00	SPT	50 (7,8/50 for 152mm)	2.00			End of Borehole at 2.00m

Remarks

1.Terminated at 2.0m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

Borehole Log

Borehole No. **WS102**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.10			MADE GROUND: Brown sandy gravel with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
					0.40			MADE GROUND: Black gravel with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone, mudstone, concrete, brick and asphalt.
		1.00	SPT	50 (12,13/50 for 140mm)	1.00			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
								End of Borehole at 1.00m

Remarks

1.Terminated at 1.0m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

Borehole Log

Borehole No. **WS103**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
					0.40			MADE GROUND: Red sandy gravel with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone, brick and concrete. Cobbles are sub-angular to subrounded of sandstone, concrete and brick.
		1.00	SPT	N=25 (5,5/5,6,6,8)				
		1.20	ES					
		1.50	SPT	50 (18,7/50 for 20mm)				Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
					2.00			End of Borehole at 2.00m

Remarks

1.Terminated at 2.0m bgl due to refusal on weathered sandstone.

Borehole Log

Borehole No. **WS104**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
		1.00	SPT	50 (6,6/50 for 210mm)	1.00			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
								End of Borehole at 1.00m

Remarks

1.Terminated at 1.0m bgl due to refusal on weathered sandstone.

Borehole Log

Borehole No. **WS105**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
					0.50			Brown clayey fine to medium SAND.
		1.00 1.00	ES SPT	50 (25 for 80mm/50 for 25mm)	1.00			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone). End of Borehole at 1.00m

Remarks

1.Terminated at 1.0m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

Borehole Log

Borehole No. **WS106**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
		0.70	ES		0.60			MADE GROUND: Red sandy gravel with frequent cobbles. Gravel is fine to coarse sub-angular to subrounded of sandstone, brick and concrete. Cobbles are sub-angular to subrounded of sandstone, concrete and brick.
		1.00	SPT	50 (25 for 10mm/50 for 15mm)	0.90 1.00			MADE GROUND: Brown sandy gravel with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick.
								Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
								End of Borehole at 1.00m

Remarks

1.Terminated at 1.0m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

Borehole Log

Borehole No. **WS107**

Sheet 1 of 1

Project Name:	The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location:	Bromborough		Level:	Scale 1:50
Client:	Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
		0.70	ES					Red weathered sandstone.
		1.00	SPT	50 (70 for 55mm/50 for 4mm)	1.00			End of Borehole at 1.00m

Remarks

1.Terminated at 1.0m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

Borehole Log

Borehole No. **WS108**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
		0.50	SPT	0 (75 for 80mm/0 for 0mm)	0.80			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
								End of Borehole at 0.80m

Remarks

1.Terminated at 0.8m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

Borehole Log

Borehole No. **WS109**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
		0.40	SPT	0 (75 for 90mm/0 for 0mm)	0.50			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
								End of Borehole at 0.50m

Remarks

1.Terminated at 0.5m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

Borehole Log

Borehole No. **WS110**

Sheet 1 of 1

Project Name:	The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location:	Bromborough		Level:	Scale 1:50
Client:	Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
		0.40	SPT	50 (6,8/50 for 230mm)				Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
		0.80	ES		1.00			End of Borehole at 1.00m

Remarks

1.Terminated at 1.0m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

Borehole Log

Borehole No. **WS111**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30			MADE GROUND: Brown sandy gravel (Topsoil) with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and brick. Cobbles are sub-angular to sub-rounded of sandstone and brick. Orange fine to medium SAND.
		1.00	SPT	50 (3,4/50 for 237mm)	0.90 1.00			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
								End of Borehole at 1.00m

Remarks

1.Terminated at 1.0m bgl due to refusal on weathered sandstone.

Borehole Log

Borehole No. **WS112**

Sheet 1 of 1

Project Name: The Croft	Project No. 12999	Co-ords:	Hole Type WS
Location: Bromborough		Level:	Scale 1:50
Client: Redsun Developments		Dates: 13/12/2018	Logged By E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.30			Brown slightly clayey fine to medium SAND with frequent rootlets (topsoil).
		0.90	SPT	50 (25 for 5mm/50 for 20mm)	1.00			Red sandy GRAVEL with frequent cobbles. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Cobbles are sub-rounded of sandstone (Weathered sandstone).
								End of Borehole at 1.00m

Remarks

1.Terminated at 1.0m bgl due to refusal on weathered sandstone. 2.Monitroing well installed.

APPENDIX V
CHEMICAL TESTING RESULTS

Ella Moss
e3p
Office 4
Heliport Business Park
Eccles
Liverpool Road
Manchester
M30 7RU

t: 0161 707 9612

e: EMoss@e3p.co.uk

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 : 18-22972

Project / Site name:	Croft Liverpool	**Samples received on:**	19/12/2018
Your job number:	12999	**Samples instructed on:**	19/12/2018
Your order number:	31042	**Analysis completed by:**	02/01/2019
Report Issue Number:	1	**Report issued on:**	02/01/2019
Samples Analysed:	7 soil samples		

Signed:

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

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

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

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

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

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

Analytical Report Number: 18-22972

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1118914	1118915	1118916	1118917	1118918
Sample Reference				MG TP101	MGWS103	NAT TP108	NAT WS108	TS WS107
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.30	1.00	0.80	0.10
Date Sampled				13/12/2018	13/12/2018	13/12/2018	13/12/2018	13/12/2018
Time Taken				None Supplied	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	24	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	9.6	4.5	4.5	11	14
Total mass of sample received	kg	0.001	NONE	0.43	0.46	0.42	0.41	1.1
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	-	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	6.9	-	-	-	6.9
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	190	-	-	-	390
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	12	-	-	-	12
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0062	-	-	-	0.0062
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	6.2	-	-	-	6.2
Sulphide	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Total Sulphur	mg/kg	50	MCERTS	71	-	-	-	200
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	< 0.80	< 0.80	< 0.80	< 0.80

Analytical Report Number: 18-22972

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1118914	1118915	1118916	1118917	1118918
Sample Reference				MG TP101	MGWS103	NAT TP108	NAT WS108	TS WS107
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.30	1.00	0.80	0.10
Date Sampled				13/12/2018	13/12/2018	13/12/2018	13/12/2018	13/12/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	2.7	6.9	3.6	7.0	4.5
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	27	270	34	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.19	0.99	0.32	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	9.2	-	-	-	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	4.4	6.7	13	2.4	10
Lead (aqua regia extractable)	mg/kg	1	MCERTS	6.9	11	38	6.2	41
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	5.7	6.9	6.2	6.0	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	1.0	1.2	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	12	7.6	12	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	15	12	32	13	36
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	4.3	14	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	35	54	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	1000	280	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	850	180	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	1900	530	< 10	< 10

Analytical Report Number: 18-22972

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1118914	1118915	1118916	1118917	1118918
Sample Reference				MG TP101	MGWS103	NAT TP108	NAT WS108	TS WS107
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.30	1.00	0.80	0.10
Date Sampled				13/12/2018	13/12/2018	13/12/2018	13/12/2018	13/12/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
Chloroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Bromomethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Trichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-	-
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Trichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Dibromomethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Styrene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Tribromomethane	µg/kg	1	NONE	< 1.0	-	-	-	-
o-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Bromobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	-

Analytical Report Number: 18-22972

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1118914	1118915	1118916	1118917	1118918
Sample Reference				MG TP101	MGWS103	NAT TP108	NAT WS108	TS WS107
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.30	1.00	0.80	0.10
Date Sampled				13/12/2018	13/12/2018	13/12/2018	13/12/2018	13/12/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	< 0.1	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	< 0.2	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Hexachloroethane	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
2-Nitrophenol	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	-	-	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	< 0.1	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	< 0.3	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
4-Nitroaniline	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Azobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
Anthraquinone	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	< 0.3	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-

Analytical Report Number: 18-22972

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1118919	1118920			
Sample Reference				TSTP111	TP112			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				13/12/2018	13/12/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	16	< 0.1			
Moisture Content	%	N/A	NONE	12	8.3			
Total mass of sample received	kg	0.001	NONE	1.1	0.42			
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-			
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-			
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1			
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-			
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-			
Sulphide	mg/kg	1	MCERTS	-	-			
Total Sulphur	mg/kg	50	MCERTS	-	-			
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-			
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80			

Analytical Report Number: 18-22972

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1118919	1118920			
Sample Reference				TSTP111	TP112			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				13/12/2018	13/12/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.1	4.2			
Barium (aqua regia extractable)	mg/kg	1	MCERTS	55	37			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.43	0.33			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	12	4.7			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	38	16			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	8.3			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.7			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	19	15			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	40	24			

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0			
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0			
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0			
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	< 1.0			
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	< 1.0			
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10			
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	< 10			

Analytical Report Number: 18-22972

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1118919	1118920			
Sample Reference				TSTP111	TP112			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				13/12/2018	13/12/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	-			
Chloroethane	µg/kg	1	NONE	-	-			
Bromomethane	µg/kg	1	ISO 17025	-	-			
Vinyl Chloride	µg/kg	1	NONE	-	-			
Trichlorofluoromethane	µg/kg	1	NONE	-	-			
1,1-Dichloroethene	µg/kg	1	NONE	-	-			
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-			
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-			
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-			
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-			
Trichloromethane	µg/kg	1	MCERTS	-	-			
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-			
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-			
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-			
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-			
Benzene	µg/kg	1	MCERTS	-	-			
Tetrachloromethane	µg/kg	1	MCERTS	-	-			
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-			
Trichloroethene	µg/kg	1	MCERTS	-	-			
Dibromomethane	µg/kg	1	MCERTS	-	-			
Bromodichloromethane	µg/kg	1	MCERTS	-	-			
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-			
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-			
Toluene	µg/kg	1	MCERTS	-	-			
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-			
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-			
Dibromochloromethane	µg/kg	1	ISO 17025	-	-			
Tetrachloroethene	µg/kg	1	NONE	-	-			
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-			
Chlorobenzene	µg/kg	1	MCERTS	-	-			
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-			
Ethylbenzene	µg/kg	1	MCERTS	-	-			
p & m-Xylene	µg/kg	1	MCERTS	-	-			
Styrene	µg/kg	1	MCERTS	-	-			
Tribromomethane	µg/kg	1	NONE	-	-			
o-Xylene	µg/kg	1	MCERTS	-	-			
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-			
Isopropylbenzene	µg/kg	1	MCERTS	-	-			
Bromobenzene	µg/kg	1	MCERTS	-	-			
n-Propylbenzene	µg/kg	1	ISO 17025	-	-			
2-Chlorotoluene	µg/kg	1	MCERTS	-	-			
4-Chlorotoluene	µg/kg	1	MCERTS	-	-			
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-			
tert-Butylbenzene	µg/kg	1	MCERTS	-	-			
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-			
sec-Butylbenzene	µg/kg	1	MCERTS	-	-			
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-			
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-			
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-			
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-			
Butylbenzene	µg/kg	1	MCERTS	-	-			
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-			
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-			
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-			
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-			

Analytical Report Number: 18-22972

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1118919	1118920			
Sample Reference				TSTP111	TP112			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				13/12/2018	13/12/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	-			
Phenol	mg/kg	0.2	ISO 17025	-	-			
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-			
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-			
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-			
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-			
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-			
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-			
2-Methylphenol	mg/kg	0.3	MCERTS	-	-			
Hexachloroethane	mg/kg	0.05	MCERTS	-	-			
Nitrobenzene	mg/kg	0.3	MCERTS	-	-			
4-Methylphenol	mg/kg	0.2	NONE	-	-			
Isophorone	mg/kg	0.2	MCERTS	-	-			
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-			
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-			
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-			
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-			
Naphthalene	mg/kg	0.05	MCERTS	-	-			
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-			
4-Chloroaniline	mg/kg	0.1	NONE	-	-			
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-			
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-			
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-			
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-			
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-			
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-			
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-			
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-			
Acenaphthylene	mg/kg	0.05	MCERTS	-	-			
Acenaphthene	mg/kg	0.05	MCERTS	-	-			
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-			
Dibenzofuran	mg/kg	0.2	MCERTS	-	-			
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-			
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-			
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-			
Fluorene	mg/kg	0.05	MCERTS	-	-			
Azobenzene	mg/kg	0.3	MCERTS	-	-			
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-			
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-			
Phenanthrene	mg/kg	0.05	MCERTS	-	-			
Anthracene	mg/kg	0.05	MCERTS	-	-			
Carbazole	mg/kg	0.3	MCERTS	-	-			
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-			
Anthraquinone	mg/kg	0.3	MCERTS	-	-			
Fluoranthene	mg/kg	0.05	MCERTS	-	-			
Pyrene	mg/kg	0.05	MCERTS	-	-			
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-			
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-			
Chrysene	mg/kg	0.05	MCERTS	-	-			
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-			

Analytical Report Number : 18-22972

Project / Site name: Croft Liverpool

* 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 *
1118914	MG TP101	None Supplied	0.50	Brown loam and sand with gravel.
1118915	MGWS103	None Supplied	0.30	Brown loam and sand with gravel and rubble.
1118916	NAT TP108	None Supplied	1.00	Brown loam and sand with gravel and stones.
1118917	NAT WS108	None Supplied	0.80	Brown loam and sand with vegetation and gravel.
1118918	TS WS107	None Supplied	0.10	Brown loam and sand with vegetation and gravel.
1118919	TSTP111	None Supplied	0.10	Brown loam and sand with vegetation and stones.
1118920	TP112	None Supplied	0.50	Brown loam and sand with vegetation and gravel.

Analytical Report Number : 18-22972

Project / Site name: Croft Liverpool

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
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 : 18-22972

Project / Site name: Croft Liverpool

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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 sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-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.

Ella Moss
e3p
Office 4
Heliport Business Park
Eccles
Liverpool Road
Manchester
M30 7RU

t: 0161 707 9612

e: EMoss@e3p.co.uk

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 : 18-22830

Project / Site name:	Croft Liverpool	**Samples received on:**	14/12/2018
Your job number:	12999	**Samples instructed on:**	17/12/2018
Your order number:	31042	**Analysis completed by:**	28/12/2018
Report Issue Number:	1	**Report issued on:**	28/12/2018
Samples Analysed:	2 leachate samples - 6 soil samples		

Signed:

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

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

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

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

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

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

Analytical Report Number: 18-22830

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1117983	1117984	1117985	1117986	1117987
Sample Reference				TS/TP101	NAT/WS103	NAT/TP109	WS107	WS108
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	1.20	1.00	0.70	0.10
Date Sampled				13/12/2018	13/12/2018	13/12/2018	13/12/2018	13/12/2018
Time Taken				None Supplied	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	28	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	31	10	7.5	8.1	13
Total mass of sample received	kg	0.001	NONE	0.46	0.43	0.41	1.6	0.42
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	7.9	-	8.0	7.0
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	120	-	99	350
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-	0.0093	-	0.0046	0.0068
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-	19	-	9.1	14
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-	9.3	-	4.6	6.8
Sulphide	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	< 1.0
Total Sulphur	mg/kg	50	MCERTS	-	< 50	-	< 50	160
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80

Analytical Report Number: 18-22830

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1117983	1117984	1117985	1117986	1117987
Sample Reference				TS/TP101	NAT/WS103	NAT/TP109	WS107	WS108
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	1.20	1.00	0.70	0.10
Date Sampled				13/12/2018	13/12/2018	13/12/2018	13/12/2018	13/12/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.5	7.1	9.5	6.8	15
Barium (aqua regia extractable)	mg/kg	1	MCERTS	86	-	41	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.56	-	0.37	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	11	-	12	12
Copper (aqua regia extractable)	mg/kg	1	MCERTS	35	4.3	11	3.6	15
Lead (aqua regia extractable)	mg/kg	1	MCERTS	56	7.8	23	5.6	32
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	14	7.6	9.1	7.3	13
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	20	-	19	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	50	15	25	11	37
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	46	< 1.0	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	65	< 1.0	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	110	< 10	< 10	< 10

Analytical Report Number: 18-22830

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1117988				
Sample Reference				WS110				
Sample Number				None Supplied				
Depth (m)				0.10				
Date Sampled				13/12/2018				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	14				
Total mass of sample received	kg	0.001	NONE	1.6				
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile				
Asbestos in Soil	Type	N/A	ISO 17025	Detected				
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	0.029				
Asbestos Quantification Total	%	0.001	ISO 17025	0.029				
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-				
Total Cyanide	mg/kg	1	MCERTS	< 1				
Total Sulphate as SO_4	mg/kg	50	MCERTS	-				
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-				
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-				
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-				
Sulphide	mg/kg	1	MCERTS	-				
Total Sulphur	mg/kg	50	MCERTS	-				
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-				
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05				
Fluorene	mg/kg	0.05	MCERTS	< 0.05				
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05				
Anthracene	mg/kg	0.05	MCERTS	< 0.05				
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Pyrene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05				
Chrysene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05				
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80				

Analytical Report Number: 18-22830

Project / Site name: Croft Liverpool
Your Order No: 31042

Lab Sample Number				1117988				
Sample Reference				WS110				
Sample Number				None Supplied				
Depth (m)				0.10				
Date Sampled				13/12/2018				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14				
Barium (aqua regia extractable)	mg/kg	1	MCERTS	88				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.57				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	26				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	68				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	21				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	67				

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0				
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1				
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1				
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0				
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0				
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0				
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0				
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10				
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10				

Analytical Report Number: 18-22830
Project / Site name: Croft Liverpool
Your Order No: 31042

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
1117988	WS110	0.10	150	Rope	**Chrysotile**	0.029	**0.029**

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number: 18-22830

Project / Site name: Croft Liverpool

Your Order No: 31042

Lab Sample Number				1117989	1117990			
Sample Reference				MG/TP102	MG/WS106			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.50	0.70			
Date Sampled				13/12/2018	13/12/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH	pH Units	N/A	ISO 17025	6.9	8.2			
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0			
Total Phenols								
Total Phenols (monohydric)	µg/l	1	ISO 17025	3.0	2.0			
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01			
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01			
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01			
Total PAH								
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2			
Heavy Metals / Metalloids								
Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1	< 1.1			
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08			
Chromium (hexavalent)	µg/l	5	NONE	< 5.0	< 5.0			
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.1	1.7			
Copper (dissolved)	µg/l	0.7	ISO 17025	12	17			
Lead (dissolved)	µg/l	1	ISO 17025	1.7	< 1.0			
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5			
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.4	0.3			
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0			
Zinc (dissolved)	µg/l	0.4	ISO 17025	8.7	1.9			

Analytical Report Number: 18-22830

Project / Site name: Croft Liverpool

Your Order No: 31042

Lab Sample Number				1117989	1117990			
Sample Reference				MG/TP102	MG/WS106			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.50	0.70			
Date Sampled				13/12/2018	13/12/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0			
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0			
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0			
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0			
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0			
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 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			
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10			

Analytical Report Number : 18-22830

Project / Site name: Croft Liverpool

* 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 *
1117983	TS/TP101	None Supplied	0.10	Brown loam and sand with vegetation and gravel.
1117984	NAT/WS103	None Supplied	1.20	Brown clay and sand with vegetation and gravel
1117985	NAT/TP109	None Supplied	1.00	Brown loam and sand with vegetation and stones.
1117986	WS107	None Supplied	0.70	Brown clay and sand with gravel.
1117987	WS108	None Supplied	0.10	Brown loam and clay with vegetation and gravel
1117988	WS110	None Supplied	0.10	Brown loam and sand with vegetation and gravel.

Analytical Report Number : 18-22830

Project / Site name: Croft Liverpool

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
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
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	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
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
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
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

Analytical Report Number : 18-22830

Project / Site name: Croft Liverpool

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038-PL	D	MCERTS
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
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	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 sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX VI
ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA

Constituent	Origin of Risk Assessment Value
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs - methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide - Total	2014 LQM/CIEH S4ULs
Phenols - Total.	2014 LQM/CIEH S4ULs
Naphthalene	General Assessment Criteria (GAC) developed by CIEH / LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene[	
Chrysene	
Benzo(b/k)Fluoranthene [iii]	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C_5-C_6 (aliphatic)	
TPH C_6-C_8 (aliphatic)	
TPH C_8-C_{10} (aliphatic)	
TPH C_{10}-C_{12} (aliphatic)	
TPH C_{12}-C_{16} (aromatic)	
TPH C_{16}-C_{21} (aromatic)	
TPH C_{21}-C_{35} (aromatic)	

APPENDIX VII
GEOTECHNICAL TESTING RESULTS

LABORATORY REPORT

4043

Contract Number: PSL19/0203

Report Date: 17 January 2019

Client's Reference: 12999

Client Name: E3P
Heliport Business Park
Liverpool Road
Eccles
Manchester
M30 7RU

For the attention of: Ella Moss

Contract Title: The Croft

Date Received: 3/1/2019
Date Commenced: 3/1/2019
Date Completed: 17/1/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
S Royle (Laboratory Manager)	S Eyre (Senior Technician)	L Knight (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP104		BB	1.00		Reddish brown silty SAND & GRAVEL.
TP109		BB	1.30		Reddish brown very sandy very silty GRAVEL.

UKAS TESTING 4043	PSL Professional Soils Laboratory	The Croft	Contract No: PSL19/0203 Client Ref: 12999

PARTICLE SIZE DISTRIBUTION TEST

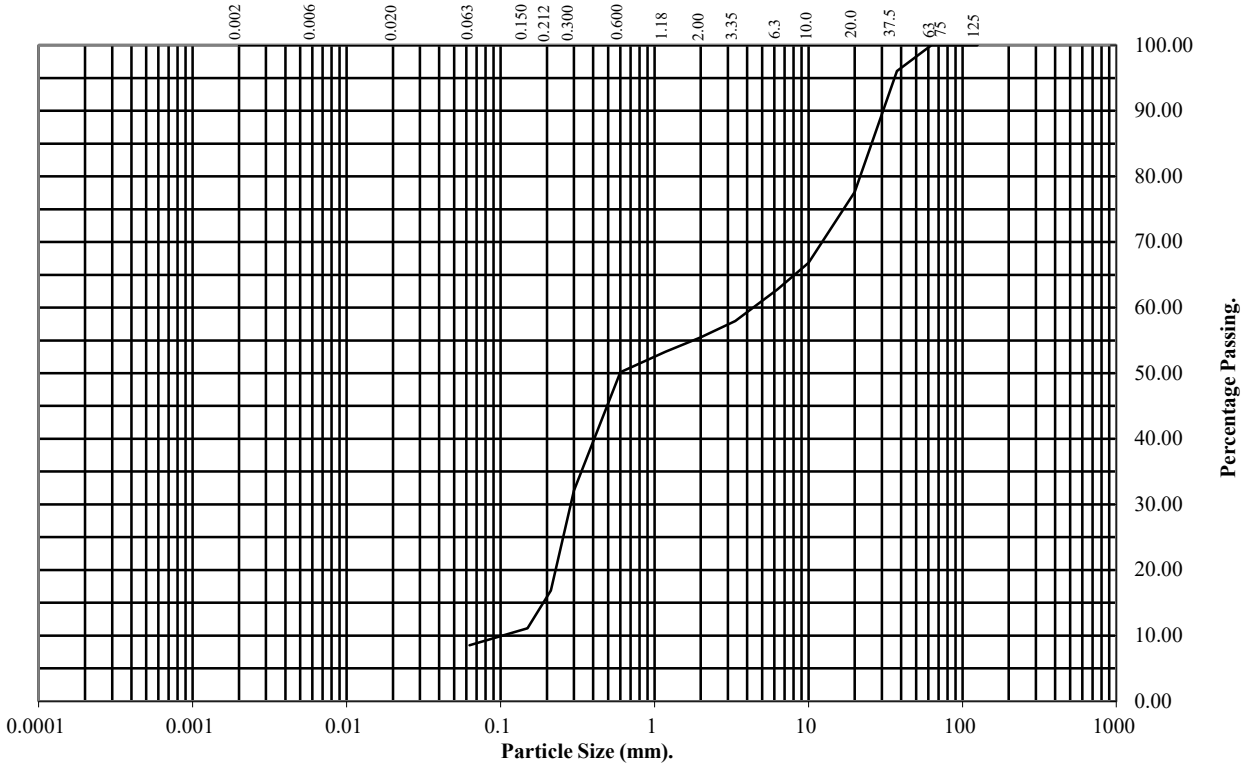
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP104 **Top Depth (m):** 1.00

Sample Number: **Base Depth(m):**

Sample Type: BB



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	96
20	78
10	67
6.3	63
3.35	58
2	55
1.18	53
0.6	50
0.3	32
0.212	17
0.15	11
0.063	9

Soil Fraction	Total Percentage
Cobbles	0
Gravel	45
Sand	46
Silt/Clay	9

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

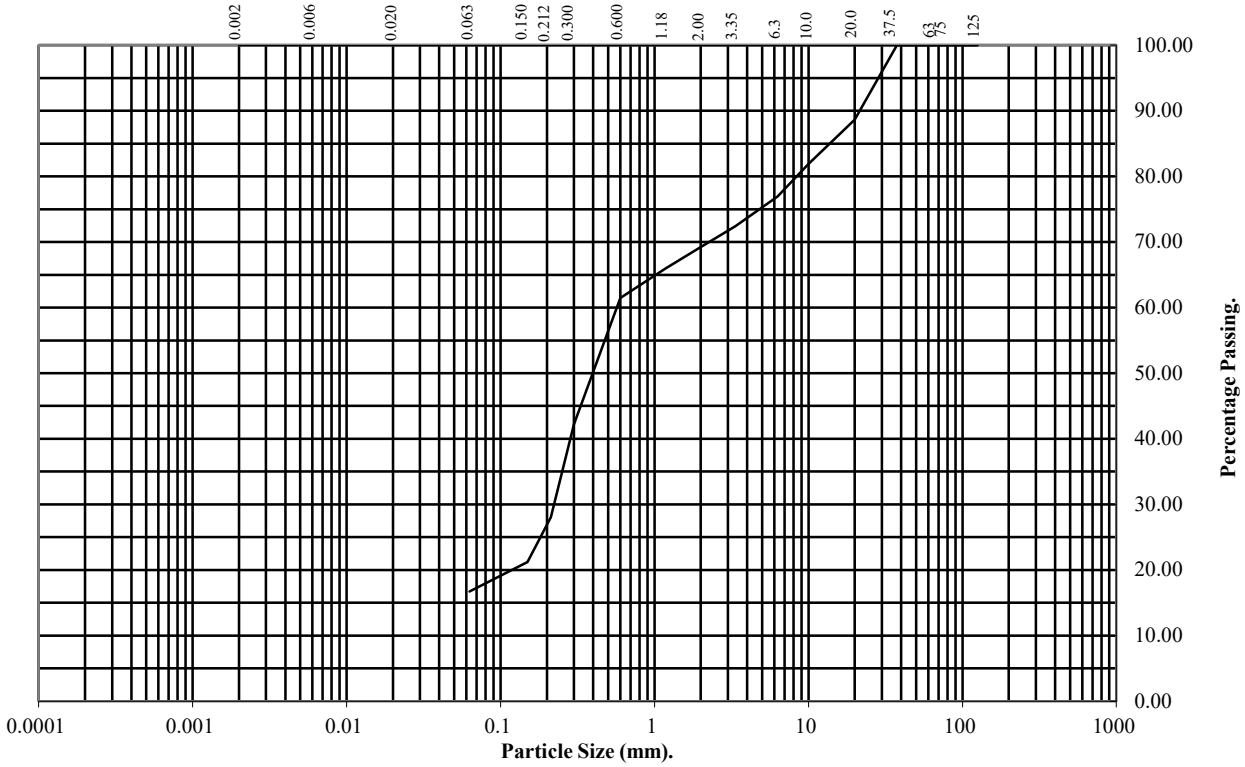
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP109 **Top Depth (m):** 1.30

Sample Number: **Base Depth(m):**

Sample Type: BB



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	89
10	82
6.3	77
3.35	72
2	69
1.18	66
0.6	61
0.3	42
0.212	28
0.15	21
0.063	17

Soil Fraction	Total Percentage
Cobbles	0
Gravel	31
Sand	52
Silt/Clay	17

Remarks:

See Summary of Soil Descriptions

APPENDIX VIII
CBR
TEST CERTIFICATES

Vertical Deformation Test-Equivalent CBR Value

In Accordance with BS1377: Part 9:1990

Site Name:	**The Croft Business Park**	**Test Date:**	13/12/2019
Site Ref:	12-999	**Type of Kentledge:**	6 Tonne Excavator
Test No.:	CBR101	**Test Depth (m bgl):**	GL
Plate Diameter (mm)	450	**Easting:**	N/A
Maximum Applied Pressure (kN/m2):	215.88	**Northing:**	N/A
Maximum Deformation (mm):	-1.84	**Weather:**	Dry
Strata Description:	Red Sand/Bedrock		

Equivalent CBR Value of 25%

Comments

Site Engineer:	Checked By:	Date:	Approved By:	Date:
J. James	R. Horseman	13/12/2018	M. Dyer	13/12/2018

Vertical Deformation Test-Equivalent CBR Value

In Accordance with BS1377: Part 9:1990

Site Name:	**The Croft Business Park**	**Test Date:**	13/12/2019
Site Ref:	12-999	**Type of Kentledge:**	6 Tonne Excavator
Test No.:	CBR102	**Test Depth (m bgl):**	GL
Plate Diameter (mm)	450	**Easting:**	N/A
Maximum Applied Pressure (kN/m2):	215.88	**Northing:**	N/A
Maximum Deformation (mm):	-2.73	**Weather:**	Dry
Strata Description:	Red Sand/Bedrock		

Equivalent CBR Value of 8%

Comments

Site Engineer:	Checked By:	Date:	Approved By:	Date:
J. James	R. Horseman	13/12/2018	M. Dyer	13/12/2018

Vertical Deformation Test-Equivalent CBR Value

In Accordance with BS1377: Part 9:1990

Site Name:	**The Croft Business Park**	**Test Date:**	13/12/2019
Site Ref:	12-999	**Type of Kentledge:**	6 Tonne Excavator
Test No.:	CBR103	**Test Depth (m bgl):**	GL
Plate Diameter (mm)	450	**Easting:**	N/A
Maximum Applied Pressure (kN/m2):	215.88	**Northing:**	N/A
Maximum Deformation (mm):	-4.50	**Weather:**	Dry
Strata Description:	Red Sand/Bedrock		

Equivalent CBR Value of 7%

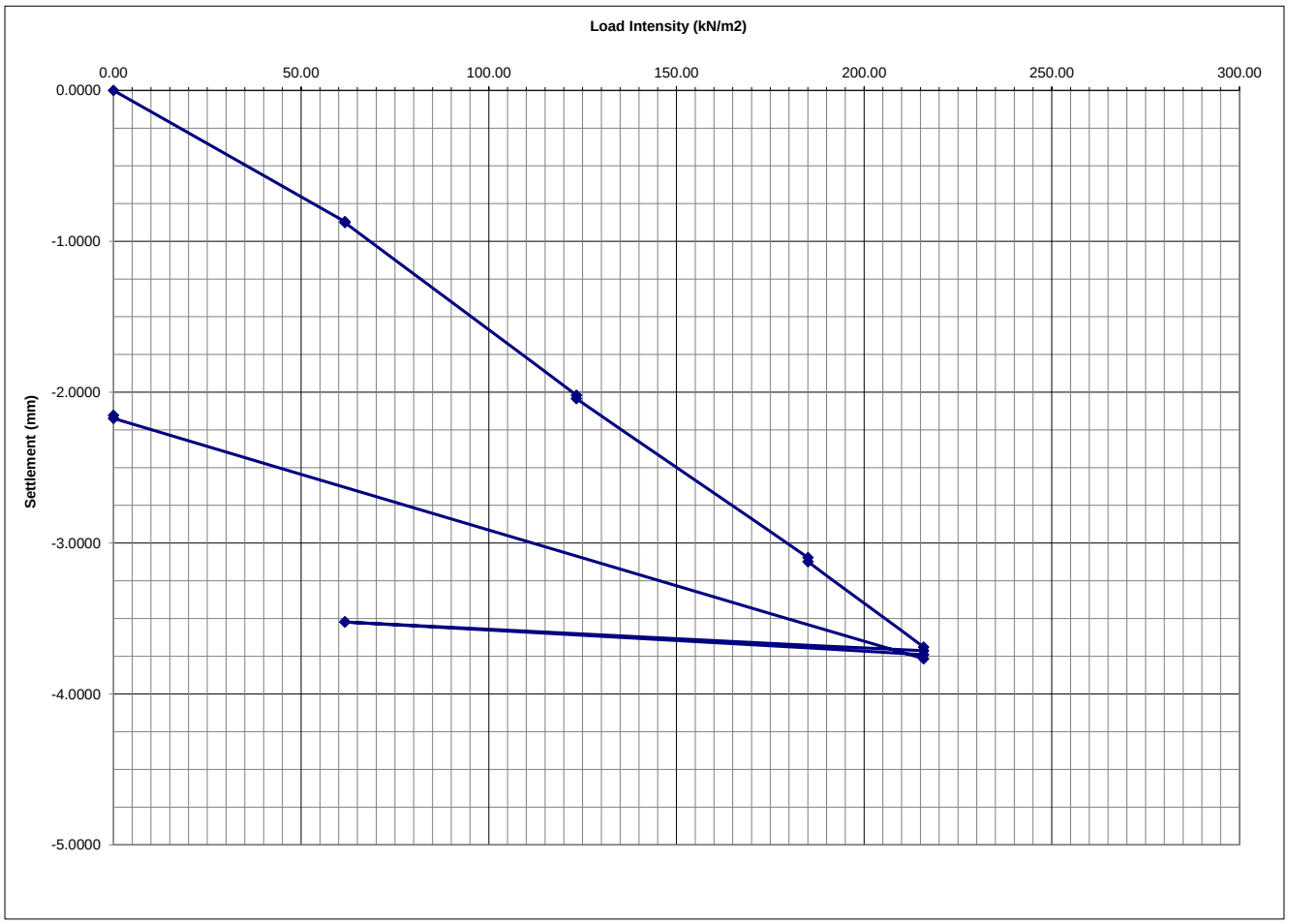
Comments

Site Engineer:	Checked By:	Date:	Approved By:	Date:
J. James	R. Horseman	13/12/2018	M. Dyer	13/12/2018

Vertical Deformation Test-Equivalent CBR Value

In Accordance with BS1377: Part 9:1990

Site Name:	**The Croft Business Park**	**Test Date:**	13/12/2019
Site Ref:	12-999	**Type of Kentledge:**	6 Tonne Excavator
Test No.:	CBR104	**Test Depth (m bgl):**	GL
Plate Diameter (mm)	450	**Easting:**	N/A
Maximum Applied Pressure (kN/m2):	215.88	**Northing:**	N/A
Maximum Deformation (mm):	-3.77	**Weather:**	Dry
Strata Description:	Red Sand/Bedrock		



Equivalent CBR Value of 6%

Comments

Site Engineer:	Checked By:	Date:	Approved By:	Date:
J. James	R. Horseman	13/12/2018	M. Dyer	13/12/2018

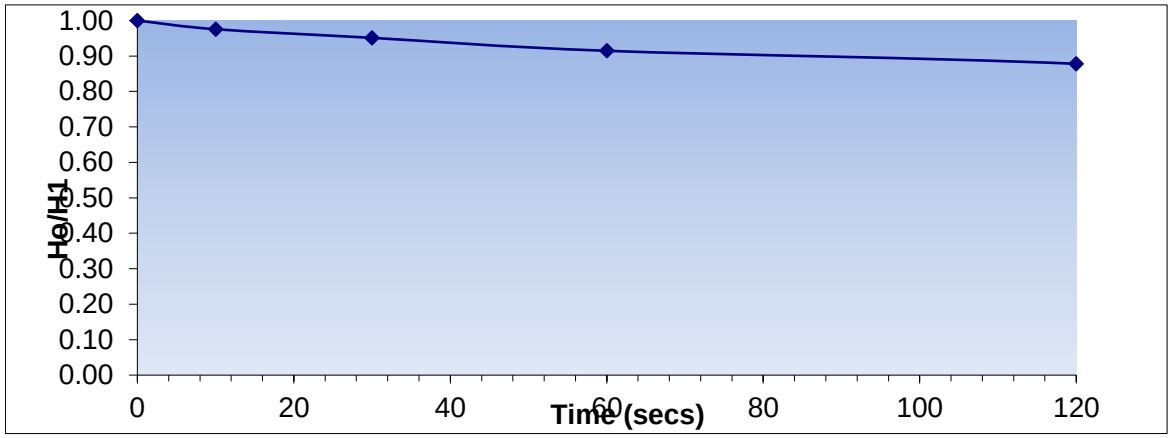
APPENDIX IX
FALLING HEAD PERMEABILITY TEST CERTIFICATES

Falling Head Test

Borehole: WS105 **Test No: 3**

Contract No:	12999	Casing Diameter: (m)	0.05
Contract Title:	The Croft	Height of Casing:	0
Date of Test:	31.12.18	Depth of Borehole: (m)	0.82

Recorded Time			Total Time			H/Ho
Hours	Minutes	Seconds	(secs)	Depth (m)		
		0	0	0	0	1.0000
		10	10	0.02	10	0.9756
		30	30	0.04	30	0.9512
		50	60	0.07	60	0.9146
		120	120	0.1	120	0.8780
		180	180	0.16	180	0.8049
		300	300	0.24	300	0.7073
	10	600	600	0.44	600	0.4634
	13	780	780	0.52	780	0.3659
	20	1200	1200	0.74	1200	0.0976
	32	1920	1920	0.82	1920	0.0000



General Approach

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

k = permeability of soil

F = Intake Factor (figures 6 &7, BS5930:1999)

H_1 = variable head measured at time t_1 after commencement of test

H_2 = variable head measured at time t_2 after commencement of test

A = Cross sectional area of borehole casing or standpipe as appropiate.

H_1 =	0.9756	t_1 =	10
H_2 =	0.976	t_2 =	1200
		F=	1.4757

A = 0.00196349 m^2

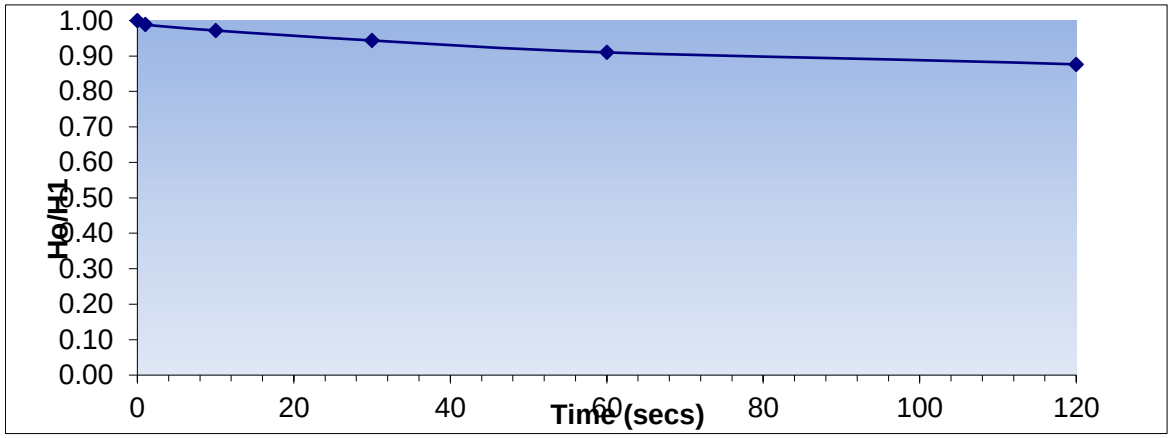
Coefficient of Permeability, k = **3.04E-06** m/s

Falling Head Test

Borehole: WS101 **Test No: 3**

Contract No:	12999	Casing Diameter: (m)	0.05
Contract Title:	The Croft	Height of Casing:	0
Date of Test:	31.12.18	Depth of Borehole: (m)	1.78

Recorded Time			Total Time			H/Ho
Hours	Minutes	Seconds	(secs)	Depth (m)		
		0	0	0	0	1.0000
		1	1	0.02	1	0.9888
		10	10	0.05	10	0.9719
		30	30	0.1	30	0.9438
		60	60	0.16	60	0.9101
		120	120	0.22	120	0.8764
		180	180	0.31	180	0.8258
	5	300	300	0.34	300	0.8090
	8	480	480	0.43	480	0.7584
	12	720	720	0.5	720	0.7191
	25	1500	1500	0.69	1500	0.6124
	44	2640	2640	0.91	2640	0.4888
	65	3900	3900	0.94	3900	0.4719
	92	5520	5520	1.01	5520	0.4326
	121	7260	7260	1.12	7260	0.3708
	157	9420	9420	1.24	9420	0.3034
	185	11100	11100	1.38	11100	0.2247
	217	13020	13020	1.44	13020	0.1910



General Approach

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

k = permeability of soil

F = Intake Factor (figures 6 &7, BS5930:1999)

H_1 = variable head measured at time t_1 after commencement of test

H_2 = variable head measured at time t_2 after commencement of test

A = Cross sectional area of borehole casing or standpipe as appropiate.

H_1 =	0.9888	t_1 =	1
H_2 =	0.2247	t_2 =	11100
		F=	2.621866594

A = 0.00196349 m^2

Coefficient of Permeability, k = **8.07E-07** m/s