LIPA 6th Form

Phase 2 Intrusive Investigation

Curtins Ref: EB1738/GL/4833

Revision: 00

Issue Date: 13 August 2015

Client Name: Kier Construction

Client Address: Kier House, Windward Drive, Estuary Park, Speke, Liverpool, L24 8QR

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Client:	Kier Construction
Project:	LIPA 6th Form
Report Type:	Phase 2 – Intrusive Investigation
Report Reference:	EB1738/GL/4833
Revision:	00
Report Status:	**Issue 01**
Date:	13 August 2015

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For and on behalf of **Curtins**

Executive Summary

Appointment
In May 2015 Curtins were instructed by Kier Construction to undertake a Phase 1 Geo-Environmental Detailed Desk Top Study for the construction of a 2/3 storey extension to the existing site building.

The site was centred on national grid reference 335480, 389590 with an area of 0.29ha. A location plan can be found in Appendix A1.

Development Proposals
We understand that the development involves the construction of a 2/3 storey extension to the existing site building.

Fieldworks
The site work was carried out between 15th and 16th June 2015. The locations of exploratory holes were determined by the Engineer, in general accordance with CLR 4 and the site work carried out on the basis of the practices set out in BS 10175:2011, BS 5930:2010 and ISO 1997:2007.

Site work comprised the following:

- Window Sample Boreholes: WS01 (02A, 04A) to WS06 & 06A
- Hand excavated trial pits: HP01 to HP03

The depths of boreholes, descriptions of strata encountered and comments on groundwater conditions are given in the borehole records in Appendix 3.

Representative disturbed and undisturbed samples were taken at the depths shown on the borehole records and dispatched to the laboratory. Standard penetration tests, were carried out in the boreholes in the various strata to assess the relative density or consistency. The values of penetration resistance are given in the borehole records.

Samples were collected for environmental purposes in amber glass jars and kept in a cool box. Perforated standpipes, surrounded by pea shingle and protected by a stopcock cover were installed in boreholes WS02A, WS04A and WS06A, as detailed in the borehole records.

The ground levels at the borehole locations, reported on the records, were interpolated from spot levels on a survey drawing provided by the Client.

Ground Model
The sequence may be summarised as Topsoil or Made Ground overlying localised sand, which subsequently overlies sandstone bedrock.

Laboratory Testing
Given that the proposed end use of the sites is offices and new classroom facilities, the report compares the chemistry analysis results against a '*Commercial'* end use.

Results are analysed in section 7 of this report.

Quantitative Risk Assessment – Human Health
With reference to the Tier 1 Thresholds for a commercial end use, initial assessment shows that the thresholds have not been exceeded in the site shallow soils across the site.

It is therefore considered that the risk presented to the end user from site soils is considered to be **Low**.

Construction workers are to be provided with appropriate PPE and sanitary facilities.

Quantitative Risk Assessment – Controlled Waters
Groundwater was not recorded in any of the exploratory holes formed during this investigation. Due to limited contamination above relevant Tier 1 thresholds found within the shallow site soils and the absence of shallow groundwater or perched groundwater on site, the risk to the underlying Secondary B Aquifer is therefore considered to be **Low**.

Quantitative Risk Assessment – Ground Gases
An initial programme of six gas monitoring visits over three months was proposed within three borehole locations.

Gas monitoring has been undertaken across the site on two occasions to date and is on-going with a further four visits to be completed. Barometric pressure has been recorded at 998mb to 1013mb during the visits. No flow has been recorded to date. A maximum concentration of 1.2% $^{v}/_{v}$ Carbon Dioxide (CO_2) was recorded in WS06 on the second visit. No Methane (CH_4) has been recorded to date.

With reference to Situation A non-traditional construction as defined by the NHBC and the modified Wilson & Card classification as contained within CIRIA C665, the maximum carbon dioxide concentration indicates a CS1 regime requiring no points of gas protection measures for public buildings.

Upon the completion of the six gas monitoring visits, the results and subsequent recommendations will be issued as an addendum to this report.

Quantitative Risk Assessment – Construction Materials
For design purposes a Design Sulphate Class of DS-2 should be adopted. An ACEC class for the site of AC-2 would be appropriate.

Quantitative Risk Assessment – Water Supply Pipes
With reference to the UKWIR publication 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' document reference 10/WM/03/21 advice is given on the appropriate materials for these ground conditions.

Due to no contamination recorded within the site shallow soils, it is therefore considered that PE and PVC pipes would be suitable materials for the water supply pipes. The exact requirements are to be confirmed with the relevant utility supplier.

Waste Classification
An initial assessment for the waste classification of the shallow soils encountered on site has been carried out using the Waste Soils Characterisation Assessment Tool, Cat-WasteSoil, developed by

McArdle and Atkins. This online tool gives a rapid assessment of contaminated soils and their classification as either hazardous or non-hazardous waste.

The samples collected have been entered into this Cat-WasteSoil tool, resulting in an initial classification of the shallow soil samples as **non-hazardous waste**.

However it should be noted that this information is for guidance only and material identified for disposal will have to be tested and assessed in accordance with WM3 to enable classification during the works.

Once classification is determined and if Hazardous Waste Acceptance Criteria testing will be required to allow appropriate disposal facilities to be identified.

Foundation Design
On the basis of observations made on site together with results of in-situ and laboratory tests, it is recommended that consideration could be given to the adoption of spread foundations to support the proposed structures.

Foundation option would be to excavate to bedrock, encountered at depths of 0.50m to 1.20m and construct spread (pad) foundations within the bedrock. A presumed bearing value not less than 400kPa may be adopted for preliminary design of pad foundations up to 3m wide bearing on extremely weak and weak sandstone.

Foundation excavations should be inspected to ensure that the condition of the bedrock is consistent with design assumptions.

The Proposed Development Plan (Figure A1.4) indicates that in areas of deeper Made Ground, the foundations should be founded on mass concrete fill, which in turn will have been taken into sandstone rock.

Ground Floor Slab Design
On the basis of observation on site together with the results of laboratory tests it is recommended that, consideration is given to constructing the ground bearing floor slabs on formations prepared in the bedrock.

Any loose, soft or deleterious material should be removed and replaced with adequately compacted granular fill.

Excavations
On the basis of observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to less than 1.00m should stand unsupported in the short term.

Side support for safety purposes should of course be provided to all excavations which appear unstable, and those in excess of 1.20m deep, in accordance with Health and Safety Regulations.

Groundwater should not be expected in shallow excavations for foundations or services. However, it is possible that perched groundwater could be present in the Made Ground overlying the sand and or bedrock. It is considered that such water ingress could be dealt with by localised pumping.

Buried Concrete

The site has been classified in accordance with BRE Special Digest 1, as greenfield without the presence of pyrite and laboratory testing undertaken accordingly. It is recommended that the guidelines given in BRE Special Digest 1, be adopted.

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1.0 Introduction

1.1 Project Background

In May 2015 Curtins were instructed by Kier Construction to undertake a Phase 1 Geo-Environmental Detailed Desk Top Study for the construction of a 2/3 storey extension to the existing site building. The site was centred on national grid reference 335480, 389590 with an area of 0.29ha.

A location plan can be found in Appendix A1.

1.2 Scope of Works

A Phase 1 Detailed Desk Top Study was undertaken principally to provide an overview of the geo-environmental setting of the site of interest with a brief assessment of any risks that could be presented to site users and the wider environment.

The Phase 2 Ground Investigation was undertaken in order to provide an assessment of the ground conditions on the subject site with respect to geotechnical properties and any potential contamination in the underlying soils and or groundwater. The ground investigation was undertaken to confirm the geo-environmental conceptual model and associated risk determined in the Detailed Desk Top Study undertaken by Curtins in June 2015.

Specifically the Phase 2 report is intended to determine,

a) If there is a risk of the proposed end user being adversely impacted upon by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use
b) Undertake an initial assessment with respect to the significant risk of pollution to groundwater and or surface water from potential contamination that maybe present on the site due to its known historical use.
c) If there is a risk to the end user from landfill type gases that could potentially accumulate under the proposed buildings.
d) Recommendations for the design of foundations and building ground floor slabs.
e) Recommendations for the specification of sub-structure concrete.

2.0 Summary of Phase 1 Desk Study

This section of the report presents a summary of the Curtins Consulting Phase 1 Detailed Desk Top Study, report no EB1738/GL/4726, dated June 2015.

2.1 Current Setting

The site is located off Upper Duke Street, Liverpool and is currently occupied by The Liverpool Institute of Performing Arts. The site is centred on national grid reference 335480, 389590 with an area of 0.29ha.

A site location plan can be referred to in Appendix A1.

2.2 Site History

The earliest historical map dated 1893 illustrates the site to be occupied by residential housing. By 1927 the residential housing has been demolished and an Art School is now present on site. In 1954 the site now shows the Liverpool College of Art. Up to present day the site remains slightly altered and illustrates LIPA 6th Form College now present on site. The Wapping Tunnel runs across the northern corner of the site.

2.3 Surrounding Land Use

The earliest historical map dated 1893 shows the surrounding area is significantly developed, Residential housing surrounds he site and south is Liverpool Institute and School of Art. Upper Duke Street runs adjacent south of the site boundary. There is a large Cemetery located circa 100m south of the site (St James's Cemetery).

The 1908 map illustrates a Cathedral which is in the course of construction circa 100m south of the sites boundary. The surrounding area remains significantly developed and continues to be redeveloped throughout the historical mapping up to present day with residential areas and commercial buildings.

2.4 Geology

A study of the Envirocheck records and British Geological Survey (BGS) 1:50,000 mapping records (Bedrock and Superficial Editions) for Manchester (Sheet 096) indicates the following geological succession underlying the site.

Rock Name	Rock Type	Geological Age
No Superficial Recorded		
Tarporley Siltstone	Siltstone, Mudstone and Sandstone	Anisian – Olenekian

There are five fault lines within 1000m of the site. The closest running adjacent to the eastern boundary of the site.

The Envirocheck Report confirms that there is a very low risk to no hazard from the following ground stability hazards on and around the site; ground dissolution, collapsible ground, running sands, shrinking or swelling clay and landslides and compressible ground.

Both the Radon Atlas for England and Wales, and the Envirocheck Report confirm that the site is in a lower probability radon area, as less than 1% of homes are above the action level. No radon protective measures are necessary in the construction of new dwellings or extensions.

2.4.1 Mining

There nearest BGS Recorded Mineral Site is located 176m south1000m of the site of interest. The site does not lie within a coal mining referral area, and as such, a Coal Authority Report has not been obtained.

2.5 Hydrogeology

The 1:100,000 Sheet 16 West Cheshire Groundwater Vulnerability Map indicates that the site, corresponding with the underlying solid geology, is underlain by a Secondary B Aquifer.

A Secondary B Aquifer is defined as predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Site soils are classed a Soils of High Leaching Potential.

Soils of High Leaching Potential (U) - Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst case vulnerability classification (H) assumed, until proved otherwise.

The site does not lie within a Source Protection Zone (SPZ).

The nearest surface water feature is an unnamed feature and is located 165m south of the site. The nearest groundwater abstraction is located on Stanhope Street, Liverpool 723m south west. There are no surface water or potable water abstractions located within 1000m of the site. There are no pollution incidents, discharge consents, local authority pollution preventions or control permits arising from the site.

The site does not lie within Flood Zone area.

2.6 Landfill

The Envirocheck report confirms that the nearest BGS Recorded Mineral Site is located 176m south of the site of interest.

There are no recorded registered or historical landfill sites within 1000m of the site.

2.7 Detailed Unexploded Ordnance (UXO) Risk Assessment

The site of interest is located on Upper Duke Street, Liverpool.

The Detailed UXO risk assessment report for the site by 6Alpha has placed the site within a **Low/Medium** risk area.

Recommended Risk Mitigations are:
- Operational UXO Risk Management Plan
- UXO Safety & Awareness Briefings.

2.8 Conceptual Model

Potential Sources

Potential Source (S1): Made-ground Soils On Site
Likely to be present on-site as there is historical evidence of development since 1893 up to present day.

Potential Source (S2): Made-ground Soils Off Site
Off-site soils have been exposed to some patterns of development, therefore there is potential for contamination to be present in made ground around the site. Potential contaminants could arise due to geological origin, construction activities, atmospheric deposition and land management. The nature and type of general contamination may include, amongst others; ash and fill, hydrocarbons (e.g. fuel oils), heavy metals and asbestos.

Potential Source (S3): Natural Soils both On and Off Site
Regionally elevated levels of metals may be present within the shallow soils, however the superficial and bedrock deposits beneath the site and within the immediate surrounding area are not considered to present significant sources of natural contamination.

Potential Source (S4): Ground Gas Generating Sources
Likley, as there may be made ground deposits across the site from historical developments and land use since 1893. There are no records of organic rich drift deposits (e.g. peat) or coal measures.

Potential Source (S5): Geological Deposits with Potential to Generate Radon
Both the Radon Atlas for England and Wales, and the Envirocheck Report confirm that the site is in a lower probability radon area, as less than 1% of homes are above the action level. No radon protective measures are necessary in the construction of new dwellings or extensions.

Potential Source (S6): Unexploded Ordinance
Risk mapping for UXOs has placed the site within a Low / Medium risk area. A Detailed UXO risk assessment report has been obtained for the site.

Potential Source (S7): Mining Workings
There nearest BGS Recorded Mineral Site is located 176m south1000m of the site of interest. The site does not lie within a coal mining referral area, subsequently a coal mining desk study is not necessary for the site and a Coal Authority report has not been obtained.

Potential Pathways

Potential Pathway (P1): Direct Contact, Ingestion and Inhalation (dust and vapours)
May occur where the end user is exposed to; solid, dust or volatile components of made-ground soils on site.
Potential Pathway (P2): Vertical Migration
May occur within the made-ground deposits on-site both upwards, due to processes including; capillary action, burrowing animals inducing soil mixing, and downwards into the natural deposits due to processes including; infiltration and burrowing animals. Includes ground gas migration. Soils of High Leaching Potential (U) are found on site, overlying a Secondary B Aquifer beneath the bedrock.

Potential Pathway (P3): Horizontal Migration
May occur within the made-ground or natural deposits due to processes including; the influence of perched or natural groundwater flow patterns and natural or man-made high permeability zones, e.g. sand lenses or drainage runs or pores/voids within natural and made-ground soils for ground gases.

Potential Pathway (P4): Collapse
Unlikely on this site.

Potential Receptors

Potential Receptor (R1): End Users
Students, visitors, site maintenance staff and the general public.
Potential Receptor (R2): Controlled Waters (Groundwater)
Corresponding with the underlying solid geology, the site is underlain by a Secondary B Aquifer. The nearest groundwater abstraction is located on Stanhope Street, Liverpool 723m south West. There are no potable water abstractions within 1000m of the site. The site is not situated within a Source Protection Zone (SPZ).

Potential Receptor (R3): Controlled Waters (Surface Waters)
The nearest surface water feature is an unnamed feature and is located 165m south of the site. There are no surface water abstractions within 1000m of the site.

Potential Receptor (R4): Construction Workers
Whilst unlikely, during the development of the site, construction workers may come into contact with any contamination that is on site. However, wearing the correct personal protective equipment will reduce the risk.
Potential Receptor (R5): Construction Materials
Buried concrete and water supply pipes.
Potential Receptor (R6): Local Ecology
Protected species and local habitats; e.g. hedgerow, grassland and water.

3.0 Phase 2 Investigation Proposal

3.1 General

The Phase 1 Desk Top Study Conceptual Site Model highlighted that there could be a generally **Negligible** to **Moderate** risk of harm being presented to the proposed end user, construction workers, surface water, groundwater (Secondary B Aquifer), buildings and infrastructure, services, neighbours and the general public.

Review of the Desk Study identified that a site investigation was required to investigate potentially contaminating material, to quantify the site condition prior to the sites development; and to provide foundation design for the proposed extension. A strategy for the Phase 2 intrusive investigation was derived accordingly and comprised the following operations:

- Logging and sampling of representative soils in six no. window sample boreholes to 5m depth below existing ground level across the site.
- Logging in three no. hand excavated trial holes to assess existing foundations.
- Environmental Chemistry testing of eight made-ground samples taken from the exploratory holes for a suite of chemicals reflecting the known industrial/historical use of the site and surrounding area.
- Perforated gas and groundwater monitoring standpipes, surrounded by pea shingle and protected by a stopcock cover with initial monitoring of soil gases on six occasions over three months for methane, carbon dioxide, oxygen, hydrogen sulphide, gas flow in l/hr, weather conditions and barometric pressure (with confirmation if falling, steady or rising).
- Suitable geotechnical testing to allow a satisfactory foundation, roads and hardstanding assessment.

4.0 Fieldwork

4.1 General

The site work was carried out between 15th and 16th June 2015. The locations of exploratory holes were determined by the Engineer, in general accordance with CLR 4 and the site work carried out on the basis of the practices set out in BS 10175:2011, BS 5930:2010 and ISO 1997:2007.

Appropriate chemical and geotechnical testing was undertaken on soils representative of the ground conditions revealed.

Site work comprised the following:

- Window sample boreholes: WS01 (02A, 04A) to WS06 & 06A
- Trial pits excavated by hand: HP01 to HP03

The positions of the exploratory holes are shown in Appendix 2. The depths of boreholes, descriptions of strata encountered and comments on groundwater conditions are given in the borehole records in Appendix 3.

Representative disturbed and undisturbed samples were taken at the depths shown on the borehole records and dispatched to the laboratory. Standard penetration tests, were carried out in the boreholes in the various strata to assess the relative density or consistency. The values of penetration resistance are given in the borehole records.

Samples were collected for environmental purposes in amber glass jars and kept in a cool box. Perforated standpipes, surrounded by pea shingle and protected by a stopcock cover were installed in boreholes WS02A, WS04A and WS06A, as detailed in the borehole records.

5.0 Laboratory Testing

5.1 Environmental Chemistry Testing

A programme of environmental chemistry testing was scheduled reflecting the findings of the desk study and on-site observations.

The sampling positions (boreholes) were generally located in a non-targeted, systematic array to give adequate and representative coverage of the site accounting for the historical site use, proposed end use and the immediate environmental setting.

5.1.1 Soil Analysis

The nature and type of soil contamination potentially present on the site was considered to include, amongst others; organic matter, ash and fill, hydrocarbons (e.g. fuel oils), heavy metals and asbestos the extent of which is captured by the broad environmental testing suite listed in Table 5.1.1 below.

Table 5.1.1 *Environmental Chemistry Analysis Suite: Soils*

Suite Ref	Analysis	LOD	Suite Ref	Analysis	LOD
Suite A	Asbestos Screen		**Suite B**	pH	
	pH			Soil Organic Matter	
	Soil Organic Matter				
	Arsenic	5 mg/kg		Arsenic	5 mg/kg
	Boron (water soluble)	1 mg/kg		Boron (water soluble)	1 mg/kg
	Cadmium	0.5 mg/kg		Cadmium	0.5 mg/kg
	Chromium	5 mg/kg		Chromium	5 mg/kg
	Chromium VI	5 mg/kg		Chromium VI	5 mg/kg
	Copper	5 mg/kg		Copper	5 mg/kg
	Lead	5 mg/kg		Lead	5 mg/kg
	Mercury	0.1 mg/kg		Mercury	0.1 mg/kg
	Nickel	5 mg/kg		Nickel	5 mg/kg
	Selenium	5 mg/kg		Selenium	5 mg/kg
	Zinc	5 mg/kg		Zinc	5 mg/kg
	Cyanide (total)	10 mg/kg		Cyanide (total)	10 mg/kg
	Sulphate (total)	200 mg/kg		Sulphate (total)	200 mg/kg
	Sulphide	2 mg/kg		Sulphide	2 mg/kg
	Sulphur (elemental)	20 mg/kg		Sulphur (elemental)	20 mg/kg
	Phenols (screen)	1 mg/kg		Phenols (screen)	1 mg/kg
	PAH's (USEPA16)	0.1 mg/kg		USEPA16 PAH	0.1 mg/kg
	TPH (CWG Banding - Aro/Ali Split)	0.01 mg/kg to 0.1 mg/kg		TPH (CWG Banding)	0.01 mg/kg to 0.1mg/kg

Eight soil samples taken from across the site were tested for Suite A (shallow samples).

The results of the environmental chemistry analyses can be referred to in Appendix A4 of this report.

5.2 Geotechnical Testing

All soil samples were prepared in accordance with BS1377: Part One: 1990 and representative sub-samples were taken for testing. The following tests were carried out:

- 8 No. Water Soluble Sulphate Summary
- 7 No. PH Summary

The results of the testing are given in Appendix A4.

6.0 Ground Conditions

6.1 Sequence

The sequence may be summarised as Topsoil or Made Ground overlying localised sand, which subsequently overlies sandstone bedrock.

6.2 Made Ground

Made Ground was encountered within all locations with thickness in the range of 0.45m to 1.10m. Surface coverings consisted of a thin (0.15m to 0.20m) veneer of tarmacadam in WS01, WS02, WS02A, WS03, WS06 and WS06A, brick paving blocks with bedding sand (0.18m) in WS04 and WS04A and paving slabs (0.05m) in WS05, HP01, HP02 and HP03.

Beneath the surface coverings, the Made Ground comprised grey slightly silty and sandy gravel of brick, ash, sandstone and limestone. WS05 was terminated at 050m due to encountering a concrete obstruction. The base of the Made Ground was encountered within all location apart from WS05, at depths in the range of 0.45m to 1.10m.

6.3 Sand

Red, gravelly medium and coarse sand was encountered within WS02 and WS02A at depths of 0.50m and 0.60m extending to depths of 1.20m and 1.00m respectively.

This may represent weathered sandstone.

The base of the sand was encountered at depths of 1.20m and 1.00m within WS02 and WS02A.

6.4 Silt

Bedrock of sandstone was encountered within all locations apart from WS05 at depths in the range of 0.45m and 1.20m. Mudstone was encountered at 2.20m within WS04A and a band of mudstone encountered at 2.00m within WS06.

All locations apart from WS04A and WS05 were terminated at depths in the range of 0.45m and 3.98m within sandstone. WS04A was terminated at 2.40m within mudstone.

6.5 Groundwater

Damp conditions were encountered in WS04A at depth 2.20m at the boundary between of sandstone and mudstone and in WS06 within a mudstone band encountered at 2.00m.

Groundwater was not noted in the rest of the exploratory holes.

7.0 Geochemical Ground and Groundwater Assessment

7.1 Overall Assessment

The Phase 1 Desk Study, summarised in Section 2.0, concluded that contamination may be present on site as a result of the site's previous uses as a field and Stable Cottages up until the 1970s and then as the sites current use, as Bridgwater Centre. The site's natural geology (glacial till - predominantly clay with subordinate sand and gravel beds) was also identified as a possible ground gas source albeit with a very low generation potential. It was therefore recommended that as part of the ground investigation additional work was undertaken to further assess the presence of, and potential risk presented by, this material.

A strategy for a Phase 2 Ground Investigation was consequently developed with reference to both the proposed end use of the site and to the conceptual site model and associated qualitative risk assessment contained within the Phase 1 Desk Study.

This section of the report presents an appraisal of the ground investigation findings and an assessment of the potential contamination (solid, liquid and gas) identified on the subject site which may present a risk to the proposed end users (human health), controlled waters and, where relevant, the wider environment.

In guidance published by the Environment Agency, the risk to human health or controlled waters is determined through an assessment of pollutant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013.

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment further detail can be applied to the conceptual site model to provide a detailed interpretation on a site by site basis. As part of the planning process this approach is adopted in order to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required in order for the site to be deemed so.

The sub-sections hereafter therefore incorporate the first tier (Tier 1) of this approach otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment presented in the Phase 1 Desk Study in conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins Consulting's ground investigation.

The following sections present further detail on the risk assessment methodology rationale for the main receptors.

Human Health: In order to assess whether a potential pollutant linkage is significant with respect to human health, in 2002 the Environment Agency and the Department of the Environment, Food and Rural Affairs (DEFRA) published guidance referred to as the Contaminated Land Exposure Assessment Model (CLEA). The software originally developed with this model was withdrawn in October 2006 and subsequently reissued in January 2009 (CLEA v1.04).

Development of the CLEA model ultimately led to the derivation of Soil Guideline Values (SGVs) or generic screening criteria against which chemical testing data could be compared to establish whether a risk was likely to exist. These values have been developed from lengthy research applying

knowledge of the toxicity and carcinogenicity of substances and the mechanism by which each acts in the environment.

To date there are SGV's published for only eleven determinands and consequently Curtins Consulting utilise Generic Assessment Criteria (GAC's) to supplement these in order for a comprehensive list of Tier 1 thresholds (or screening criteria) to be derived, as appended herein. References for the GACs include; the TPH Criteria Working Group series of documents, Atkins AtriskSoil™, the LQM/CIEH Suitable for Use Levels (S4UL) and EIC/AGS/CL:AIRE published thresholds.

More recently, DEFRA commissioned a research project to develop Category 4 Screening Levels (C4SLs) to provide a simplified test for local authorities to aid decision making on when land was definitely not 'contaminated land' as defined by Part IIA of the Environment Protection Act (1990). The output of this research was published by CL:AIRE in December 2013 and comprised C4SLs for six chemical species that again, as per the SGVs, were derived using the CLEA methodology with various modification's to account for the new toxicological profile (Low Level of Toxicological Concern, LLTC) and exposure modelling. Accompanying policy companion documents were published by DEFRA (for England) in March 2014 and the Welsh government in May 2014 confirming their intended use within the planning process acknowledging that planning jurisdiction, and therefore the use of C4SLs, ultimately rested with the local planning authority.

The introduction of the C4SLs into the planning process represented a shift within human health risk assessment, moving from an evaluation of 'minimal' (SGVs), to 'acceptably low' risk.

In the first instance the Generic Quantitative Risk Assessment presented herein evaluates the site from a minimal risk perspective and thereafter, if accepted by the local planning authority, gives due consideration to the C4SLs.

Once contaminants of concern have been identified by the Tier 1 assessment, further qualitative and or quantitative risk assessments may be undertaken to determine whether a viable source-pathway-receptor linkage is present.

The main proposed end use is residential (new residential housing, allotments and associated car parking) is directly accounted for by published UK guidance; the main end uses currently being defined as a) residential with home-grown produce b) allotments and c) commercial (associated car parking).

Considering the main proposed end use is Commercial (new offices and classrooms) Commercial thresholds have been applied to the Tier 1 assessment.

Controlled Waters: A model for assessing the potential for pollution of controlled waters and for deriving a safe concentration in ground and groundwater is the Environment Agency's publication "Remedial Targets Methodology - Hydrogeological Risk Assessment for Land Contamination'.

In relation to the standards for controlled waters, there are currently no generic groundwater standards or surface water standards that are necessarily applicable to all sites.

However, dependant on the receptor identified as being at risk, the Surface Water (Abstraction for Drinking Water) and or the Environment Agency's national Environmental Quality Standards (EQS's) are considered appropriate and are used in this Tier 1 assessment.

In addition, and in particular where the groundwater or surface water could not be found or sampled in sufficient quantity, a soil leaching test (BS EN 12457:2002) can be undertaken to provide a preliminary assessment of the potential for contaminants in the soil to pollute ground or surface water. The results are compared, again dependant on the receptor identified as being at risk, against the EA EQS's and or UK Drinking Water Standards.

At the first stage of assessment, if a risk to controlled waters is suspected, direct comparison of either the groundwater or surface water and the soil leaching results against the Tier 1 thresholds can be made to establish whether additional work or else remedial work is warranted in order for the risk to be brought to within acceptable limits.

Ground Gases: The assessment of risk presented by ground gases is assessed with reference to guidance published by CIRIA (Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665) and other broadly accepted references such as the Ground Gas Handbook (2009).

7.2 Site Soils

As discussed previously, six window sample boreholes were undertaken in total across the development site. Representative samples of the shallow soils encountered were taken from each of the borehole locations.

Given that the proposed end use of the site is new offices and classrooms, the report compares the chemistry analysis results for a conservative assessment against a '*commercial'* end use.

The results of the environmental testing can be referred to in Appendix A4. Copies of the Tier 1 thresholds are contained within Appendix A6.

Soil organic matter (SOM) has a strong bearing on the availability of potential contaminants and therefore influences the Tier 1 thresholds. The average soil organic matter (SOM) values for the shallow site soils across the development site less than 6% and therefore for comparison against Tier 1 thresholds a SOM of 1.0% has been adopted.

With reference to the Tier 1 Thresholds initial assessment shows that the thresholds have not been exceeded in the site shallow soils across the site.

It is therefore considered that the risk presented to the end user from site soils is considered to be **Low**.

Construction workers are to be provided with appropriate PPE and sanitary facilities.

7.2.1 Waste Classification

An initial assessment for the waste classification of the shallow soils encountered on site has been carried out using the Waste Soils Characterisation Assessment Tool, Cat-WasteSoil, developed by McArdle and Atkins. This online tool gives a rapid assessment of contaminated soils and their classification as either hazardous or non-hazardous waste.

The samples collected have been entered into this Cat-WasteSoil tool, resulting in an initial classification of the shallow soil samples as **non-hazardous waste**.

However it should be noted that this information is for guidance only and material identified for disposal will have to be tested and assessed in accordance with WM3 to enable classification during the works.

Once classification is determined and if Hazardous Waste Acceptance Criteria testing will be required to allow appropriate disposal facilities to be identified.

7.2.2 Water Supply Pipes

With reference to the UKWIR publication 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' document reference 10/WM/03/21 advice is given on the appropriate materials for these ground conditions.

Due to no contamination recorded within the site shallow soils, it is therefore considered that PE and PVC pipes would be suitable materials for the water supply pipes. The exact requirements are to be confirmed with the relevant utility supplier.

7.3 Controlled Waters

During drilling, groundwater has not been observed in all six boreholes because of a shallow ground water table.

It is anticipated, that due to the absence of exceedance, limited contamination above relevant Tier 1 thresholds was found within the shallow site soils, so the risk posed to the underlying a Secondary B Aquifer and nearest surface water receptors can be considered to be **Low** to **Negligible** for groundwater and surface water receptors respectively.

7.4 Soil Gases

7.4.1 Asphyxiant, Noxious or Explosive Gases

An initial programme of six gas monitoring visits over three months was proposed within three borehole locations.

Gas monitoring has been undertaken across the site on two occasions to date and is on-going with a further four visits to be completed. Barometric pressure has been recorded at 998mb to 1013mb during the visits. No flow has been recorded to date. A maximum concentration of 1.2% v/v Carbon Dioxide (CO2) was recorded in WS06 on the second visit. No Methane (CH4) has been recorded to date.

With reference to Situation A non-traditional construction as defined by the NHBC and the modified Wilson & Card classification as contained within CIRIA C665, the maximum carbon dioxide concentration indicates a CS1 regime requiring no points of gas protection measures for public buildings.

Upon the completion of the six gas monitoring visits, the results and subsequent recommendations will be issued as an addendum to this report.

The results of the gas monitoring completed to date can be referred to in Appendix A5.

8.0 Geotechnical Assessment

8.1 Existing College Building Foundations

Existing building foundations were encountered in HP01, HP02 and HP03. 6.1.2 The foundation encountered within HP01 comprised concrete post structure founded on concrete foundations at depth of 0.20m. The thickness of the concrete foundation was 0.15m. The foundation step-out was 0.20m.

In HP02 a brick structure founded upon a brick foundation at depth of 0.40m was found with the base of the foundation not encountered within 1.10m depth of excavation.

In HP03, the brick wall continued below ground level. A concrete slab was encountered at 0.23m, with a thickness of 0.20m. The slab was undermined and the wall was observed to continue. No foundation was encountered within 0.73m of excavation.

The base of the foundation was encountered in HP01 at depth of 0.35m and was founded upon sandstone. The base of the foundation was not encountered within HP02 and HP03, these two locations were terminated a 1.10m and 0.73m.

8.2 Proposed Development

It is understood that the proposed development is to comprise the refurbishment of the existing college building and the extension into the existing car park .The extension comprises a two storey structure with a mezzanine floor within the extension.

The proposed foundation design is outlined as the following:

- Masonry retaining wall adjacent to existing building with slab formation located on compacted MOT sub-base.
- New extension - Retaining wall base located upon mass filled concrete taken down to rock.

The comments and recommendations below should be reviewed as development details become available.

8.3 Assessment of Sandstone

The sandstone was generally weathered and encountered at depths between about 0.45m to 3.98m and was generally recovered as red brown sandy fine to coarse gravel.

Eleven SPT ‘N’ values within the sandstone were recorded as N=8 to greater than 50 blows with penetration between 75mm to 300mm.

The lowest six values of N=8 to N=33 represent weathered sandstone with the remaining five values are greater than 50 blows with penetration between 75mm to 300m. The penetration of the SPTs at refusal did generally reduce with depth, thus indicating a slight increase in competence of the sandstone with depth. Extrapolation of these values to a penetration of 300mm results in ‘N’ values between N=50 and N=200.

Consideration of the strength of the bedrock may be approximately based on the following:

- σc > 10N (kN/m2)
- where σc = unconfined compressive strength (UCS) and
- N = SPT 'N' value

This approach is presented in CIRIA Report 143 (1995) and is considered to represent a lower bound value of UCS.

On the basis of this approach, lower bound strengths for UCS of circa 0.4 to 1.6MN/m2 could be assumed for sandstone. These values indicate extremely weak and very weak sandstone in accordance with BS EN ISO 14689

8.4 Foundation Design

On the basis of observations made on site together with results of in-situ and laboratory tests, it is recommended that consideration could be given to the adoption of spread foundations to support the proposed structures.

Foundation option would be to excavate to bedrock, encountered at depths of 0.50m to 1.20m and construct spread (pad) foundations within the bedrock. A presumed bearing value not less than 400kPa may be adopted for preliminary design of pad foundations up to 3m wide bearing on extremely weak and weak sandstone.

Foundation excavations should be inspected to ensure that the condition of the bedrock is consistent with design assumptions.

The Proposed Development Plan indicates that in areas of deeper Made Ground, the foundations should be founded on mass concrete fill, which in turn will have been taken into sandstone rock.

8.5 Ground Floor Slabs

On the basis of observation on site together with the results of laboratory tests it is recommended that, consideration is given to constructing the ground bearing floor slabs on formations prepared in the bedrock.

Any loose, soft or deleterious material should be removed and replaced with adequately compacted granular fill.

8.6 Excavations

On the basis of observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to less than 1.00m should stand unsupported in the short term.

Side support for safety purposes should of course be provided to all excavations which appear unstable, and those in excess of 1.20m deep, in accordance with Health and Safety Regulations.

Groundwater should not be expected in shallow excavations for foundations or services. However, it is possible that perched groundwater could be present in the Made Ground overlying the sand and or bedrock. It is considered that such water ingress could be dealt with by localised pumping.

8.7 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest 1, as Greenfield without the presence of pyrite and laboratory testing undertaken accordingly. It is recommended that the guidelines given in BRE Special Digest 1, be adopted.

Made Ground
The results of chemical tests on three samples of Made Ground indicated sulphate concentrations 34mg/l to 1200mg/l as 2:1 water/soil extract, with pH values in the range 8.4 to 10.8. For classification purposes a characteristic value of 1200mg/l soluble sulphate may be derived.

On the basis of the laboratory test results it is considered that a Design Sulphate Class for the Made Ground may be taken as DS-2. On this basis an ACEC class for the site of AC-2 would be appropriate.

Gravel
The results of chemical tests on seven samples of gravel indicated sulphate concentrations 810mg/l as 2:1 water/soil extract, with pH value of 8.2. On the basis of the laboratory test results it is considered that a Design Sulphate Class for the made ground may be taken as DS-2.

On this basis an ACEC class for the site of AC-2 would be appropriate.

Sandstone
The results of chemical tests on three samples of sandstone indicated sulphate concentrations <10mg/l to 96mg/l as 2:1 water/soil extract, with pH values in the range 8.5 to 8.7. For classification purposes a characteristic value of 96mg/l soluble sulphate may be derived.

On the basis of the laboratory test results it is considered that a Design Sulphate Class for the made ground may be taken as DS-1. On this basis an ACEC class for the site of AC-1 would be appropriate.

Design
For overall design purposes a Design Sulphate Class of DS-2 should be adopted. An ACEC class for the site of AC-2 would be appropriate.

9.0 Pre-Remediation Constraints and Outline Remediation Strategy

This section of the report describes general constraints to development currently thought to exist on the site of interest.

9.1 Invasive Plants

The presence of the invasive plants, Japanese Knotweed and or Giant Hogweed, was not apparent during the fieldwork.

9.2 Services

Public utility information was provided by the client.

All window sample borehole and trial hole locations were positioned clear of all services as shown on service drawings and scanned using CAT service detector before and during hand excavation of a starter pit.

9.3 Land Condition and Outline Remediation

The sequence may be summarised as Topsoil or Made Ground overlying localised sand, which subsequently overlies sandstone bedrock.

Given that the current and proposed end use of the site (Educational) is directly accounted for by published UK guidance the report compares the chemistry analysis results against 'Commercial'.

Soil organic matter (SOM) has a strong bearing on the availability of potential contaminants and therefore influences the Tier 1 thresholds. The average soil organic matter (SOM) values for the shallow site soils across the development site is less than 6.0% one of the broadly modelled SOM percentages, and therefore for comparison against Tier 1 thresholds a conservative SOM of 1.0% has been adopted.

With reference to the Tier 1 Thresholds for a Commercial end use, initial assessment shows that the thresholds have not been exceeded in the site soils across the site.

Construction workers are to be provided with appropriate PPE and sanitary facilities.

An initial assessment for the waste classification of the shallow soils encountered on site has been carried out using the Waste Soils Characterisation Assessment Tool, Cat-WasteSoil, developed by McArdle and Atkins. This online tool gives a rapid assessment of contaminated soils and their classification as either hazardous or non-hazardous waste.

The eight samples collected have been entered into this Cat-WasteSoil tool. Initial classification of these shallow soil samples are classed as non-hazardous waste.

However it should be noted that this information is for guidance only and material identified for disposal will have to be tested and assessed in accordance with WM3 to enable classification during the works.

With reference to the UKWIR publication 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' document reference 10/WM/03/21 advice is given on the appropriate materials for these ground conditions.

Due to no contamination recorded within the site shallow soils, it is therefore considered that PE and PVC pipes would be suitable materials for the water supply pipes. The exact requirements are to be confirmed with the relevant utility supplier.

An initial programme of six gas monitoring visits over three months was proposed within three borehole locations.

Gas monitoring has been undertaken across the site on two occasions to date and is on-going with a further four visits to be completed. Barometric pressure has been recorded at 998mb to 1013mb during the visits. No flow has been recorded to date. A maximum concentration of 1.2% v/v Carbon Dioxide (CO2) was recorded in WS06 on the second visit. No Methane (CH4) has been recorded to date.

With reference to Situation A non-traditional construction as defined by the NHBC and the modified Wilson & Card classification as contained within CIRIA C665, the maximum carbon dioxide concentration indicates a CS1 regime requiring no points of gas protection measures for public buildings.

Upon the completion of the six gas monitoring visits, the results and subsequent recommendations will be issued as an addendum to this report.

The site is in a lower probability radon area, as less than 1% of homes are above the action level. No radon protective measures are necessary in the construction of new dwellings or extensions.

9.4 Conclusions

As can be seen from the revised Conceptual Site Model in Appendix A7, the site investigation has highlighted that the risk posed to construction materials and construction workers remain or have been lowered to **Moderate** to **Low.**

It is considered that the risk presented to the end user from site soils is **Low.**

The risk to controlled waters is now **Low**.

Construction workers are to be provided with appropriate PPE.

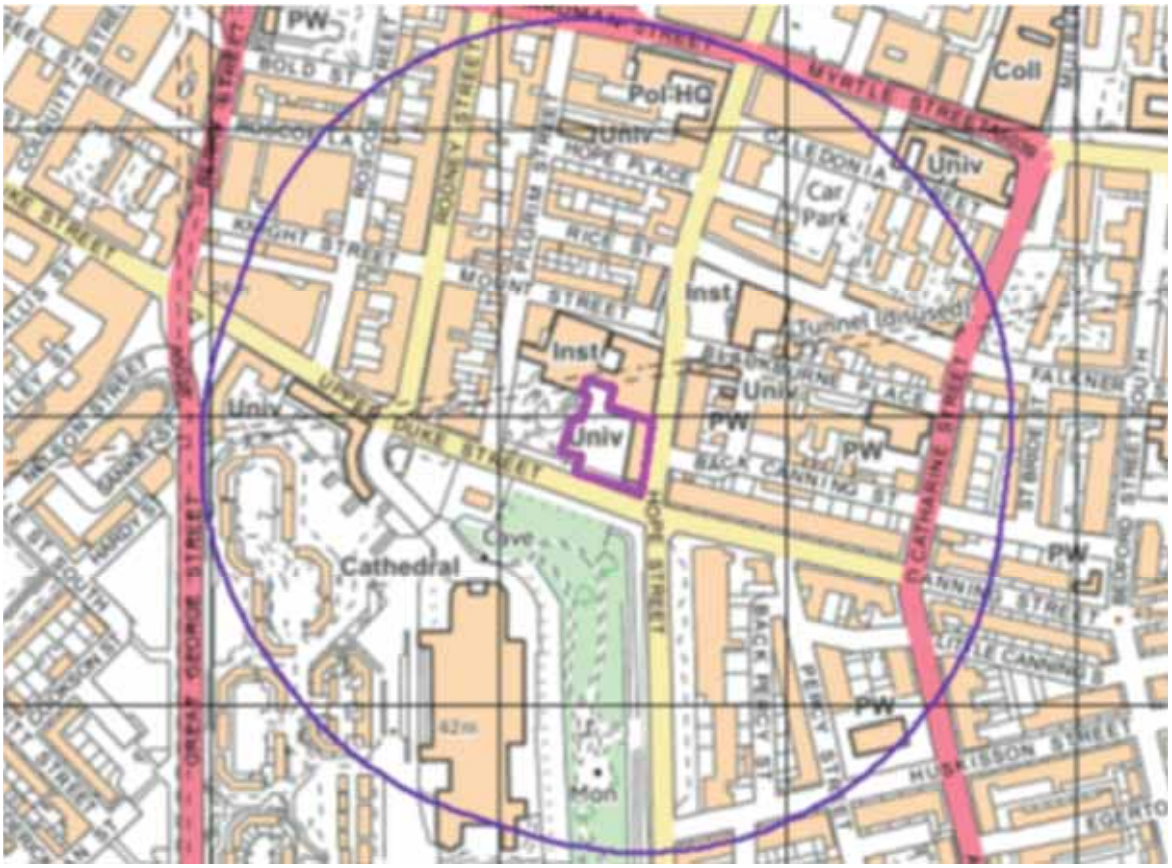
With reference to Situation A non-traditional construction as defined by the NHBC and the modified Wilson & Card classification as contained within CIRIA C665, the maximum carbon dioxide concentration indicates a CS1 regime requiring no points of gas protection measures for public buildings.

While gas monitoring of the site is still ongoing, at this stage it is considered prudent for an allowance to be made for gas protection measures in line with an CS2 gas regime, including a passively ventilated sub floor void with a Visqueen Gas Barrier membrane or equivalent approved by the engineer with all joints and penetrations sealed.

Upon the completion of the six gas monitoring visits, the results and subsequent recommendations will be issued as an addendum to this report.

Appendix A1 – Site Location Plan

Site Location Plan



Key

Approximate development site boundary

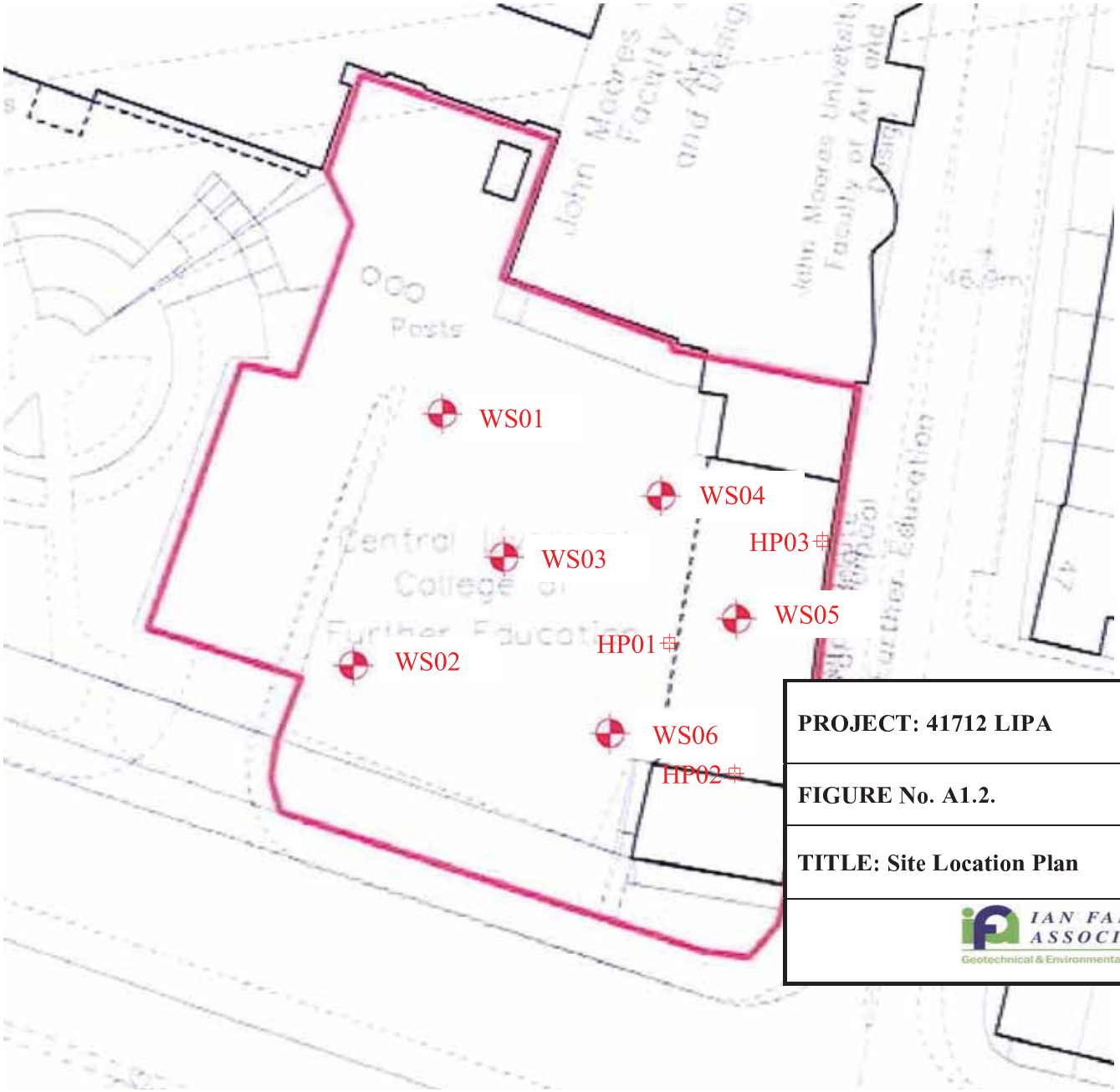
Project	Job Reference	Author
LIPA Sixth Form	EB1738	GL
Drawing Title	**Date**	**Checked**
Site Location Plan	16/06/2014	DM

curtins consulting

Merchant Exchange 17-19 Whitworth Street West , Manchester, M15WG

Tel: 0161 236 2394

Appendix A2 – Exploratory Hole Location Plan


N
WS01
WS04
HP03
WS03
WS05
HP01
WS02
WS06
HP02
PROJECT: 41712 LIPA
FIGURE No. A1.2.
SCALE: As Indicated
TITLE: Site Location Plan
IAN FARMER ASSOCIATES
Geotechnical & Environmental Specialists

Appendix A3 – Exploratory Hole Logs

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 16/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15) 0.15	MADE GROUND: Tarmacadam.		
0.20 0.20	D1 E2				(0.35) 0.50	MADE GROUND: Grey, slightly silty, sandy, angular, fine to coarse GRAVEL including ash and limestone.		
						Red SANDSTONE, recovered as sandy, angular, fine to coarse gravel.		
1.00-1.45	SPT(C) N=50		10,12/13,13,13,11		(0.95) 1.45			
						Complete at 1.45m		

Remarks
Window sample hole remained dry.
Window sample hole backfilled on completion.
Excavating from 0.00m to 1.20m for 0.50 hours.

Scale (approx)	Logged By
1:40	AW

Figure No. 41712.WS01

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS02

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 15/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15) 0.15	MADE GROUND: Tarmacadam.		
					(0.35) 0.50	MADE GROUND: Grey, slightly silty, sandy, angular, fine to coarse GRAVEL including ash and limestone.		
0.40	D1					Red, slightly silty, sandy, angular, fine to coarse GRAVEL of sandstone. (Probable weathered sandstone)		
0.40	E2				(0.70) 1.20			
1.00	D3							
1.20-1.65	SPT(C) N=31		5,5/7,7,8,9			Red, yellow and brown, conglomeratic SANDSTONE, recovered as slightly silty, sand and gravel.		
2.00-2.45	SPT(C) N=33		5,4/5,4,12,12					
2.50	D4				(2.78)			
3.00-3.45	SPT(C) N=22		11,11/11,4,3,4					
3.10	D5							
3.60-3.98	SPT(C) 50/225		15,10/15,18,17		3.98	Complete at 3.98m		

Remarks
Window sample hole remained dry.
Window sample hole backfilled on completion.
Excavating from 0.00m to 1.20m for 0.50 hours.

Scale (approx)	Logged By
1:40	AW

Figure No. 41712.WS02

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS02A

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 15/07/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.40) 0.40	MADE GROUND: Tarmacadam.			
					(0.20) 0.60	MADE GROUND: Grey, sandy GRAVEL. Gravel is subangular to subrounded, fine to coarse including sandstone and limestone.			
0.80	D1				(0.40) 1.00	Brown, very gravelly , medium SAND. Gravel is subangular to subrounded, fine to coarse including sandstone, flint and siltstone.			
1.50	D2				(2.00)	SANDSTONE recovered as medium sand and gravel. Gravel is subrounded, fine to coarse incldiuing sandstone and flint.			
					3.00	Terminated at 3.00m			

Remarks
Between 1.20m and 2.00m: recovery = 100%.
Between 2.00m and 3.00m: recovery = 100%.
Excavating from 0.00m to 1.20m for 1.00 hour.

Scale (approx)	Logged By
1:40	MO

Figure No. 41712.WS02A

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS03

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 15/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.18) 0.18	MADE GROUND: Tarmacadam.		
0.30 0.30	D1 E2				(0.42) 0.60	MADE GROUND: Grey, slightly silty, sandy, angular, fine to coarse GRAVEL including ash and limestone.		
1.00-1.45	SPT N=50		10,10/13,13,13,11		(0.85) 1.45	Red, SANDSTONE, recovered as slightly silty, sandy, angular fine to coarse gravel.		
						Complete at 1.45m		

Remarks
Window sample hole remained dry.
Window sample hole backfilled on completion.
Excavating from 0.00m to 1.20m for 0.50 hours.

Scale (approx)	Logged By
1:40	AW

Figure No. 41712.WS03

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS04

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 15/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.08	MADE GROUND: Brick cobbles.		
					(0.10)			
					0.18	MADE GROUND: Yellow grey, slightly silty SAND.		
0.30	D1				(0.32)			
0.30	E2				0.50	MADE GROUND: Grey, slightly silty, sandy, angular, fine to coarse GRAVEL including ash and limestone.		
0.60	D3					Red, SANDSTONE, recovered as slightly silty, very sandy, angular fine to coarse gravel.		
0.60	E4							
1.20-1.65	SPT(C) N=8		2,2/2,2,2,2					
1.50	D5				(1.95)			
2.00-2.45	SPT(C) N=50		2,2/5,17,20,8					
					2.45	Complete at 2.45m		

Remarks
Window sample hole remained dry.
Window sample hole backfilled on completion.
Excavating from 0.00m to 1.20m for 0.50 hours.

Scale (approx)	Logged By
1:40	AW

Figure No. 41712.WS04

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS04A

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 15/07/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.20) 0.20	COBBLES.			
					(0.10) 0.30	Brown, fine SAND.			
0.50	D1				(0.60)	MADE GROUND: Grey, sandy GRAVEL. Gravel is subangular to subrounded, fine to coarse including brick, limestone and sandstone.			
					0.90				
1.20	D2				(1.30)	Weathered SANDSTONE recovered as reddy, brown, medium SAND and GRAVEL. Gravel is subangular to subrounded, fine to coarse including sandstone.			
2.30	D3		Damp(1) at 2.20m.		2.20 (0.20) 2.40	Grey MUDSTONE.		▽1	
						Terminated at 2.40m			

Remarks
Excavating from 0.00m to 1.20m for 1.00 hour.

Scale (approx)	Logged By
1:40	MO

Figure No. 41712.WS04A

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS05

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 16/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30 0.30	D1 E2				0.05 (0.45) 0.50	MADE GROUND: Paving slab. MADE GROUND: Grey and red brown, slightly silty, sandy, angular, fine to coarse GRAVEL including brick, ash, concrete and limestone. At 0.50m: concrete slab. Terminated at 0.50m		

Remarks
Window sample hole terminated at 0.50m on concrete slab.
Window sample hole remained dry.
Window sample hole backfilled on completion.
Excavating from 0.00m to 0.50m for 0.25 hours.

Scale (approx)	Logged By
1:40	AW

Figure No. 41712.WS05

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS06

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 15/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.19) 0.19	MADE GROUND: Tarmacadam.		
0.30 0.30	D1 E2				(0.31) 0.50	MADE GROUND: Grey, slightly silty, sandy, angular, fine to coarse GRAVEL including ash and limestone.		
1.00-1.45 1.00 1.00	SPT(C) N=14 D3 E4		3,4/4,3,4,4,3		(2.65)	Red, SANDSTONE, recovered as slightly silty, sandy, angular fine to coarse gravel.		▽1
2.00-2.45 2.20	SPT(C) N=8 D5		Damp(1) at 2.00m. 1,1/1,1,3,3			At 2.00m: occasional bands of mudstone.		
3.00-3.15	SPT(C) 25*/75 50/75		25/50		3.15	Terminated at 3.15m		

Remarks
Window sample hole backfilled on completion.
Excavating from 0.00m to 1.20m for 0.50 hours.

Scale (approx)	Logged By
1:40	AW

Figure No. 41712.WS06

IAN FARMER ASSOCIATES

Site	Number
LIPA 6th Form, Liverpool	WS06A

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Curtins Consulting	41712
	Location	**Dates** 15/07/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.40) 0.40	MADE GROUND: Tarmacadam.			
0.40	D1				(0.10) 0.50	MADE GROUND: Grey, sandy GRAVEL. Gravel is subangular to subrounded, fine to coarse including sandstone and limestone.			
0.60	D2				(1.50)	Weathered SANDSTONE recovered as reddy brown, very gravelly SAND. Gravel is subangular to subrounded, fine to coarse including sandstone, flint and siltstone.			
					2.00	Terminated at 2.00m			

Remarks
Excavating from 0.00m to 1.20m for 1.00 hour.

Scale (approx)	Logged By
1:40	MO

Figure No. 41712.WS06A

IAN FARMER ASSOCIATES

Site	Trial Pit Number
LIPA 6th Form, Liverpool	HP01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand excavated	0.77m x 0.30m x 0.45m		Curtins Consulting	41712
	Location	**Dates** 16/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	MADE GROUND: Paving slab.		
0.30	D1				(0.40)	MADE GROUND: Grey, silty silty, sandy, angular, fine to coarse GRAVEL including ash, brick, concrete and clinker.		
					0.45	At 0.45m: sandstone bedrock.		
						Terminated at 0.45m		

Plan

Remarks

Hand pit remained dry and stable during excavation.
Refer to sketch for foundation details.
Hand pit terminated at 0.45m on sandstone bedrock.

Scale (approx)	Logged By	Figure No.
1:40	AW	41712.HP01

IAN FARMER ASSOCIATES

Site	Trial Pit Number
LIPA 6th Form, Liverpool	HP02

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand excavated	0.55m x 0.30m x 1.10m		Curtins Consulting	41712
	Location	**Dates** 16/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	MADE GROUND: Paving slab,		
0.30	D1				(1.05)	MADE GROUND: Grey brown, silty silty, sandy, angular, fine to coarse GRAVEL with low cobble content of brick. Gravel includes brick, concrete, ash and clinker.		
					1.10	Terminated at 1.10m		

Plan

Remarks

Hand pit remained dry and stable during excavation.
Refer to sketch for foundation details.

Scale (approx)	Logged By	Figure No.
1:40	AW	41712.HP02

IAN FARMER ASSOCIATES

Site	Trial Pit Number
LIPA 6th Form, Liverpool	HP03

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand excavated	0.53m x 0.30m x 0.73m		Curtins Consulting	41712
	Location	**Dates** 16/06/2015	**Engineer** Curtins Consulting	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	MADE GROUND: Paving slab.		
0.50	D1				(0.68)	MADE GROUND: Brown, silty silty, sandy, angular, fine to coarse GRAVEL with medium cobble content of brick. Gravel includes clinker, ash, brick and concrete.		
					0.73	Terminated at 0.73m		

Plan

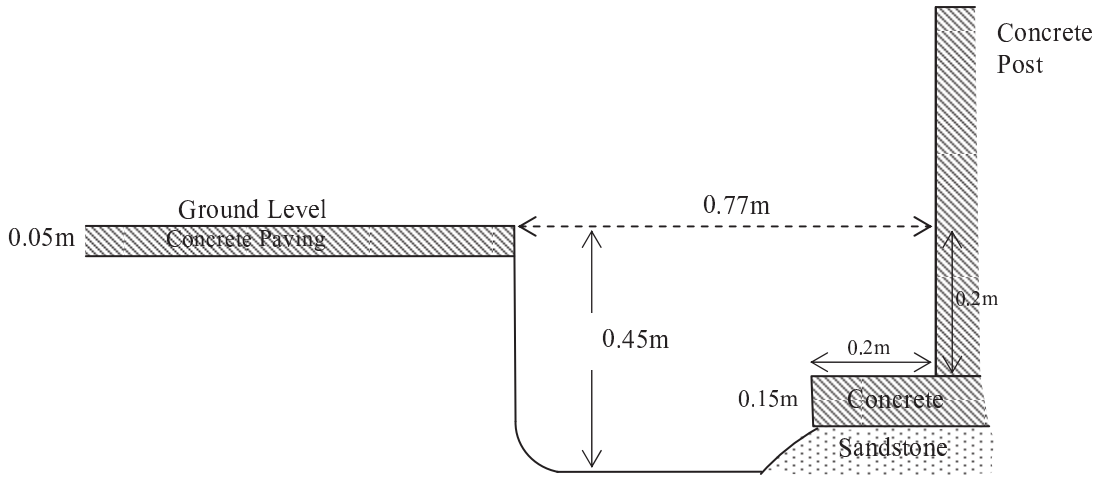
Remarks

Hand pit remained dry and stable during excavation.
Refer to sketch for foundation details.

Scale (approx)	Logged By	Figure No.
1:40	AW	41712.HP03

Hand Pit Drawings & Photographs
HP01

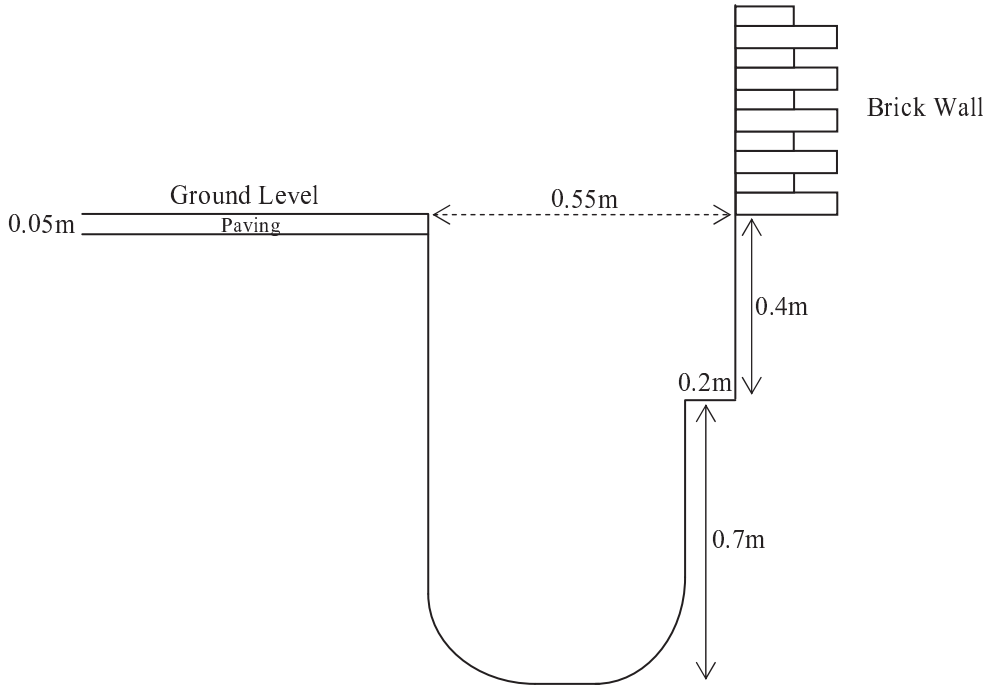
Cross Section



Hand Pit Drawings & Photographs
HP01

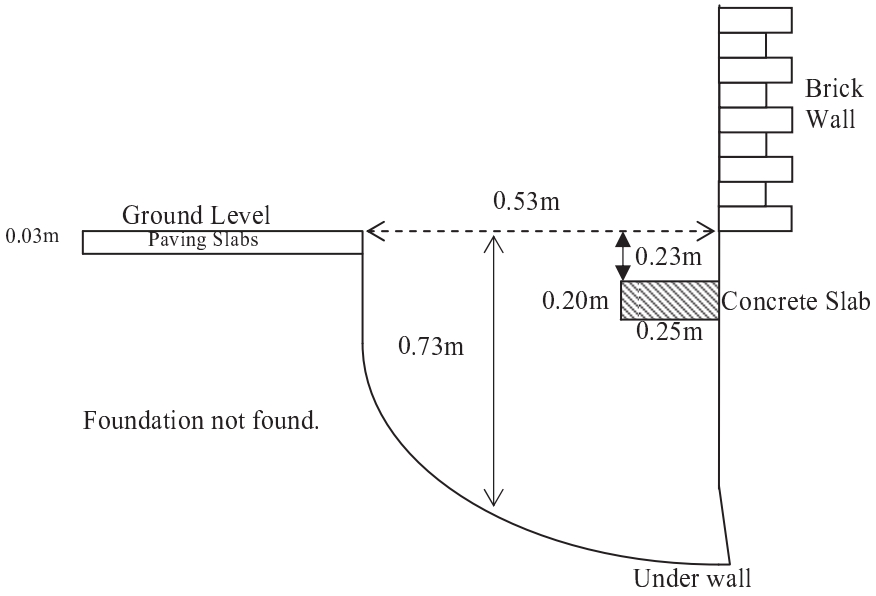
Hand Pit Drawing and Photograph
HP02

Cross Section



Hand Pit Drawing and Photographs
HP03

Cross Section



Hand Pit Drawing and Photographs
HP03

Appendix A4 – Chemical and Geotechnical Laboratory Testing Results

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Report Number: 487560-1

Date of Report: 26-Jun-2015

Customer: Curtins Consulting Ltd.
17-19 Whitworth Street West
Manchester
M1 5WG

Customer Contact: Ms Gemma Lownsbrough

Customer Job Reference: EB1738/GL/4770
Customer Purchase Order: EB1370
Customer Site Reference: LIPA 6th Form College, Liverpool
Date Job Received at SAL: 17-Jun-2015
Date Analysis Started: 23-Jun-2015
Date Analysis Completed: 25-Jun-2015

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with Section 25 of the SAL Quality Manual

UKAS TESTING
1549

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked and authorised by :
Bianca Prince
Project Management

Issued by :
Bianca Prince
Project Management

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
Heavy Metals(9)

				SAL Reference	**487560 001**	**487560 002**	**487560 003**	**487560 004**	**487560 005**
				Customer Sample Reference	**WS01**	**WS02**	**WS03**	**WS04**	**WS04**
				Date Sampled	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
				Depth	**0.20**	**0.40**	**0.30**	**0.30**	**0.60**
				Type	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Arsenic	T6	M40	2	mg/kg	**8**	**6**	**8**	**14**	**3**
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**15**	**13**	**12**	**13**	**6**
Copper	T6	M40	1	mg/kg	**11**	**7**	**8**	**10**	**2**
Lead	T6	M40	1	mg/kg	**35**	**30**	**28**	**49**	**7**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**14**	**11**	**12**	**14**	**7**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**30**	**19**	**28**	**31**	**24**

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
Heavy Metals(9)

				SAL Reference	**487560 006**	**487560 007**	**487560 008**
				Customer Sample Reference	**WS05**	**WS06**	**WS06**
				Date Sampled	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
				Depth	**0.30**	**0.30**	**1.00**
				Type	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Arsenic	T6	M40	2	mg/kg	**15**	**11**	**3**
Cadmium	T6	M40	1	mg/kg	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**24**	**18**	**5**
Copper	T6	M40	1	mg/kg	**47**	**22**	<1
Lead	T6	M40	1	mg/kg	**1700**	**110**	**5**
Mercury	T6	M40	1	mg/kg	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**18**	**18**	**6**
Selenium	T6	M40	3	mg/kg	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**170**	**50**	**21**

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
Curtins Suite A

SAL Reference			**487560 001**	**487560 002**	**487560 003**	**487560 004**	**487560 005**
Customer Sample Reference			**WS01**	**WS02**	**WS03**	**WS04**	**WS04**
Date Sampled			**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
Depth			**0.20**	**0.40**	**0.30**	**0.30**	**0.60**
Type			**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	N.D.	N.D.
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1
pH	T7	AR			**9.6**	**8.5**	**8.6**	**8.6**	**9.4**
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1
Retained on 10mm sieve	T2	AR	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1
Soil Organic Matter	T287	M40	0.1	%	**1.7**	**1.1**	**0.8**	**1.1**	<0.1
SO4(Total)	T6	M40	0.01	%	**0.18**	**0.17**	**0.10**	**0.15**	<0.01
Sulphide	T546	AR	1	mg/kg	<1	<1	<1	<1	<1
Sulphur (total)	T6	M40	0.01	%	**0.30**	**0.23**	**0.19**	**0.30**	**0.01**

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
Curtins Suite A

SAL Reference			**487560 006**	**487560 007**	**487560 008**
Customer Sample Reference			**WS05**	**WS06**	**WS06**
Date Sampled			**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
Depth			**0.30**	**0.30**	**1.00**
Type			**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Asbestos ID	T27	AR			N.D.	N.D.	N.D.
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1
pH	T7	AR			**8.7**	**9.5**	**8.9**
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1
Retained on 10mm sieve	T2	AR	0.1	%	<0.1	<0.1	<0.1
Soil Organic Matter	T287	M40	0.1	%	**2.8**	**1.9**	<0.1
SO4(Total)	T6	M40	0.01	%	**0.10**	**0.13**	<0.01
Sulphide	T546	AR	1	mg/kg	<1	<1	<1
Sulphur (total)	T6	M40	0.01	%	**0.04**	**0.32**	<0.01

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
TPH (CWG)

				SAL Reference	**487560 001**	**487560 002**	**487560 003**	**487560 004**	**487560 005**
				Customer Sample Reference	**WS01**	**WS02**	**WS03**	**WS04**	**WS04**
				Date Sampled	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
				Depth	**0.20**	**0.40**	**0.30**	**0.30**	**0.60**
				Type	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Benzene	T54	AR	1	µg/kg	<1	<1	<1	(100) <2	<1
Toluene	T54	AR	1	µg/kg	**3**	**2**	<1	(100) <2	<1
EthylBenzene	T54	AR	1	µg/kg	<1	<1	<1	(100) <2	<1
M/P Xylene	T54	AR	1	µg/kg	<1	<1	<1	(100) <2	<1
O Xylene	T54	AR	1	µg/kg	<1	<1	**2**	(100) <2	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	<1	<1	(100) <2	<1
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	(100) <0.020	<0.010
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	(100) <0.020	<0.010
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	(100) <0.020	<0.010
TPH (C10-C12 aliphatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	<1	<1	<1
TPH (C12-C16 aliphatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	**3**	<1	<1
TPH (C16-C21 aliphatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	**2**	<1	<1
TPH (C21-C35 aliphatic)	T8	M105	1	mg/kg	**180**	**360**	**64**	<1	<1
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	(100) <0.020	<0.010
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	(100) <0.020	<0.010
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	(100) <0.020	<0.010
TPH (C10-C12 aromatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	**5**	<1	<1
TPH (C12-C16 aromatic)	T8	M105	1	mg/kg	(9) <10	**11**	**6**	**1**	<1
TPH (C16-C21 aromatic)	T8	M105	1	mg/kg	**42**	**11**	**10**	**4**	<1
TPH (C21-C35 aromatic)	T8	M105	1	mg/kg	**54**	(9) <10	<1	**3**	<1

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
TPH (CWG)

				SAL Reference	**487560 006**	**487560 007**	**487560 008**
				Customer Sample Reference	**WS05**	**WS06**	**WS06**
				Date Sampled	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
				Depth	**0.30**	**0.30**	**1.00**
				Type	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Benzene	T54	AR	1	µg/kg	<1	(110) <2	(100) <2
Toluene	T54	AR	1	µg/kg	<1	(110) <2	(100) <2
EthylBenzene	T54	AR	1	µg/kg	<1	(110) <2	(100) <2
M/P Xylene	T54	AR	1	µg/kg	<1	(110) <2	(100) <2
O Xylene	T54	AR	1	µg/kg	<1	(110) <2	(100) <2
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	(110) <2	(100) <2
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(100) <0.020
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(100) <0.020
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(100) <0.020
TPH (C10-C12 aliphatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	<1
TPH (C12-C16 aliphatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	<1
TPH (C16-C21 aliphatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	<1
TPH (C21-C35 aliphatic)	T8	M105	1	mg/kg	**3**	**84**	<1
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(100) <0.020
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(100) <0.020
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(100) <0.020
TPH (C10-C12 aromatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	<1
TPH (C12-C16 aromatic)	T8	M105	1	mg/kg	**1**	(9) <10	<1
TPH (C16-C21 aromatic)	T8	M105	1	mg/kg	**5**	(9) <10	<1
TPH (C21-C35 aromatic)	T8	M105	1	mg/kg	**18**	(9) <10	<1

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
Moistures

				SAL Reference	**487560 001**	**487560 002**	**487560 003**	**487560 004**	**487560 005**
				Customer Sample Reference	**WS01**	**WS02**	**WS03**	**WS04**	**WS04**
				Date Sampled	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
				Depth	**0.20**	**0.40**	**0.30**	**0.30**	**0.60**
				Type	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture @ 105 C	T162	AR	0.1	%	**4.5**	**3.1**	**4.2**	**3.8**	**6.3**

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
Moistures

				SAL Reference	**487560 006**	**487560 007**	**487560 008**
				Customer Sample Reference	**WS05**	**WS06**	**WS06**
				Date Sampled	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
				Depth	**0.30**	**0.30**	**1.00**
				Type	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Moisture @ 105 C	T162	AR	0.1	%	**9.8**	**4.0**	**8.3**

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

				SAL Reference	**487560 001**	**487560 002**	**487560 003**	**487560 004**	**487560 005**
				Customer Sample Reference	**WS01**	**WS02**	**WS03**	**WS04**	**WS04**
				Date Sampled	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
				Depth	**0.20**	**0.40**	**0.30**	**0.30**	**0.60**
				Type	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Naphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	<0.1	**0.1**	<0.1	**0.1**	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	<0.1	**0.1**	<0.1	**0.1**	<0.1

SAL Reference: 487560
Project Site: LIPA 6th Form College, Liverpool
Customer Reference: EB1738/GL/4770

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

SAL Reference	**487560 006**	**487560 007**	**487560 008**
Customer Sample Reference	**WS05**	**WS06**	**WS06**
Date Sampled	**17-JUN-2015**	**17-JUN-2015**	**17-JUN-2015**
Depth	**0.30**	**0.30**	**1.00**
Type	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**

Determinand	Method	Test Sample	LOD	Units			
Naphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	**0.1**	<0.1	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	**0.3**	<0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	**0.3**	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	**0.2**	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	**0.8**	<0.1	<0.1

Index to symbols used in 487560-1

Value	Description
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
AR	As Received
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
N.D.	Not Detected
9	LOD raised due to dilution of sample
110	LOD raised due to low internal standard recovery.
100	LOD determined by sample aliquot used for analysis
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos
Samples submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T27	PLM
T7	Probe
T54	GC/MS (Headspace)
T546	Colorimetry (CF)
T162	Grav (1 Dec) (105 C)
T287	Calc TOC/0.58
T8	GC/FID
T207	GC/MS (MCERTS)
T6	ICP/OES
T2	Grav

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Arsenic	T6	M40	2	mg/kg	M	001-008
Cadmium	T6	M40	1	mg/kg	M	001-008
Chromium	T6	M40	1	mg/kg	M	001-008
Copper	T6	M40	1	mg/kg	M	001-008
Lead	T6	M40	1	mg/kg	M	001-008
Mercury	T6	M40	1	mg/kg	M	001-008
Nickel	T6	M40	1	mg/kg	M	001-008
Selenium	T6	M40	3	mg/kg	M	001-008
Zinc	T6	M40	1	mg/kg	M	001-008
Asbestos ID	T27	AR			SU	001-008
Boron (water-soluble)	T6	AR	1	mg/kg	N	001-008
Chromium VI	T6	AR	1	mg/kg	N	001-008
Cyanide(Total)	T546	AR	1	mg/kg	M	001-008
pH	T7	AR			M	001-008
Phenols(Mono)	T546	AR	1	mg/kg	M	001-008
Retained on 10mm sieve	T2	AR	0.1	%	N	001-008
Soil Organic Matter	T287	M40	0.1	%	N	001-008
SO4(Total)	T6	M40	0.01	%	N	001-008
Sulphide	T546	AR	1	mg/kg	N	001-008
Sulphur (total)	T6	M40	0.01	%	N	001-008
Benzene	T54	AR	1	µg/kg	U	001-008
Toluene	T54	AR	1	µg/kg	U	001-008
EthylBenzene	T54	AR	1	µg/kg	U	001-008
M/P Xylene	T54	AR	1	µg/kg	U	001-008
O Xylene	T54	AR	1	µg/kg	U	001-008
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	U	001-008
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	N	001-008
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	N	001-008
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	N	001-008
TPH (C10-C12 aliphatic)	T8	M105	1	mg/kg	N	001-008
TPH (C12-C16 aliphatic)	T8	M105	1	mg/kg	N	001-008
TPH (C16-C21 aliphatic)	T8	M105	1	mg/kg	N	001-008
TPH (C21-C35 aliphatic)	T8	M105	1	mg/kg	N	001-008
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	N	001-008
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	N	001-008
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	N	001-008
TPH (C10-C12 aromatic)	T8	M105	1	mg/kg	N	001-008
TPH (C12-C16 aromatic)	T8	M105	1	mg/kg	N	001-008
TPH (C16-C21 aromatic)	T8	M105	1	mg/kg	N	001-008
TPH (C21-C35 aromatic)	T8	M105	1	mg/kg	N	001-008
Moisture @ 105 C	T162	AR	0.1	%	N	001-008
Naphthalene	T207	M105	0.1	mg/kg	M	001-008
Acenaphthylene	T207	M105	0.1	mg/kg	U	001-008
Acenaphthene	T207	M105	0.1	mg/kg	M	001-008
Fluorene	T207	M105	0.1	mg/kg	M	001-008
Phenanthrene	T207	M105	0.1	mg/kg	M	001-008
Anthracene	T207	M105	0.1	mg/kg	U	001-008
Fluoranthene	T207	M105	0.1	mg/kg	M	001-008
Pyrene	T207	M105	0.1	mg/kg	M	001-008
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001-008
Chrysene	T207	M105	0.1	mg/kg	M	001-008
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	M	001-008
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001-008
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001-008
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001-008
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001-008
PAH(total)	T207	M105	0.1	mg/kg	U	001-008

Certificate of Analysis

Certificate Number 15-38660

01-Jul-15

Client	Ian Farmer Associates 17 Rivington Court Hardwick Grange Woolston Warrington Cheshire WA1 4RT
Our Reference	15-38660
Client Reference	41712
Contract Title	LIPA
Description	8 Soil samples.
Date Received	25-Jun-15
Date Started	25-Jun-15
Date Completed	01-Jul-15
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 15-38660
Client Ref 41712
Contract Title LIPA

				Lab No	830823	830824	830825	830826	830827	830828	830829	830830
				Sample ID	TP02	WS01	WS02	WS02	WS04	WS05	WS06	WS06
				Depth	0.30	0.20	1.00	2.50	0.60	0.30	1.00	2.20
				Other ID	1	1	3	4	3	1	3	5
				Sample Type	D	D	D	D	D	D	D	D
				Sampling Date	16/06/15	16/06/15	15/06/15	15/06/15	15/06/15	16/06/15	15/06/15	15/06/15
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**									
Inorganics												
pH	DETSC 2008#			10.2	10.8	8.2	8.5	8.5	8.4	8.6	8.7
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	1200	200	810	96	31	34	< 10	12

Key: # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 15-38660
Client Ref 41712
Contract LIPA

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
830823	TP02 0.30 SOIL	16/06/15	PT 1L	pH (7 days)	
830824	WS01 0.20 SOIL	16/06/15	PT 1L	pH (7 days)	
830825	WS02 1.00 SOIL	15/06/15	PT 1L	pH (7 days)	
830826	WS02 2.50 SOIL	15/06/15	PT 1L	pH (7 days)	
830827	WS04 0.60 SOIL	15/06/15	PT 1L	pH (7 days)	
830828	WS05 0.30 SOIL	16/06/15	PT 1L	pH (7 days)	
830829	WS06 1.00 SOIL	15/06/15	PT 1L	pH (7 days)	
830830	WS06 2.20 SOIL	15/06/15	PT 1L	pH (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix A5 – Gas Monitoring Results

Curtins Consulting
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	LIPA	**Date:**	30/07/2015
Job Number:	EB1738	**Visit:**	1
Client:		**Weather:**	Sunny
Barometric State:	Falling	**Ground Conditions:**	Dry

Borehole Reference	Barometric Pressure (mb)	Flow (l/hr)		Methane (%)		Carbon Dioxide (%)		Oxygen (%)	Hydrogen Sulphide (ppm)	Water Level (m bgl)	Note
		Max	SS	Max	SS	Max	SS				
WS02	1013	0.0	0.0	0.0	0.0	0.6	0.6	21.2	0	Dry	
WS04	1013	0.0	0.0	0.0	0.0	0.1	0.1	20.6	0	Dry	
WS06	1012	0.0	0.0	0.0	0.0	0.2	0.2	21.4	0	Dry	

Notes **Logged by**

GL

1% gas volume = 10,000 ppm
Flow rate, methane and cabon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins Consulting
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project: LIPA **Date:** 12/08/2015

Job Number: EB1738 **Visit:** 2

Client: **Weather:** Sunny

Barometric State: Falling **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Water Level m bgl	Note
		Max	SS	Max	SS	Max	SS				
WS02	998	0.0	0.0	0.0	0.0	0.1	0.1	21.5	0	Dry	
WS04	998	0.0	0.0	0.0	0.0	0.5	0.5	20.0	0	Dry	
WS06	999	0.0	0.0	0.0	0.0	1.2	1.2	22.6	0	Dry	

Notes **Logged by**

GL

1% gas volume = 10,000 ppm
Flow rate, methane and cabon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Appendix A6 – Tier 1 Thresholds

- Tier 1 Thresholds *'Commercial'* 1% SOM

Tier 1 Thresholds

Soil Contaminants: Initial Assessment of Risk

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The following tables can be used for the initial assessment with regard to the potential for the identified contaminants within a sandy matrix with an average Soil Organic Matter (SOM) content of 1% to present a risk of significant harm to the **'Commercial'** end user.

The list of determinands is non-industry specific and it should be recognised that additional site specific determinands may need to be accounted for.

Table 1.0 Inorganic Species and Phenols

Contaminants	Threshold Trigger Concentration For Planned End Use	
	Source (ref. 1)	Value (mg/kg)
Antimony	ATRISK^{soil} Soil Screening Value	4830
Arsenic	CLEA SGV for commercial end use published May 09	640
Beryllium	ATRISK^{soil} Soil Screening Value	1010
Boron	Recognised threshold to prevent phytotoxic affects	3
Cadmium	CLEA SGV for commercial end use published July 09	230
Chromium (VI)	ATRISK^{soil} Soil Screening Value	330
Copper	ATRISK^{soil} Soil Screening Value	109000
Cyanide (Free)	ATRISK^{soil} Soil Screening Value	34
Lead	ATRISK^{soil} Soil Screening Value	6490
Mercury	ATRISK^{soil} Soil Screening Value (ref. 2)	4.3 ; 3600 ; 66.4
Nickel	CLEA SGV for commercial end use published May 09	1800
Selenium	CLEA SGV for commercial end use published March 09	13000
Sulphate	Recognised threshold for protection of sub-surface concrete	2400
Sulphur (Free)	Recognised threshold for all end uses	5000
Sulphide	Recognised threshold for all end uses	250
Vanadium	ATRISK^{soil} Soil Screening Value	7530
Zinc	ATRISK^{soil} Soil Screening Value	≤1,000,000
pH	Typical value in uncontaminated soils	6-8
Phenols	Recognised threshold for protection of services (ref. 3)	5

1. The tables are for guidance only and must be read in conjunction with relevant source documentation.
2. Three values correspond to: elemental mercury (Hg); inorganic mercury (Hg^{2+}) and methyl mercury (Hg^{+4}).
3. For human health consider using ATRISK^{soil} Soil Screening Value of 686mg/kg.

Table 1.1 BTEX Species

Contaminants	Threshold Trigger Concentration For Planned End Use	
	Source	Value (mg/kg)
Benzene	ATRISK^{soil} Soil Screening Value	13.1
Toluene	ATRISK^{soil} Soil Screening Value (ref. 4)	414000
Ethylbenzene	ATRISK^{soil} Soil Screening Value (ref. 4)	180000
m-Xylene	ATRISK^{soil} Soil Screening Value (ref. 4)	276000
o-Xylene	ATRISK^{soil} Soil Screening Value (ref. 4)	296000
p-Xylene	ATRISK^{soil} Soil Screening Value (ref. 4)	279000

Tier 1 Thresholds

Soil Contaminants: Initial Assessment of Risk

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Table 1.2 PAH Species

Contaminants	Threshold Trigger Concentration For Planned End Use	
	Source	Value (mg/kg)
Acenaphthene	ATRISK^{soil} Soil Screening Value (ref. 4)	109000
Anthracene	ATRISK^{soil} Soil Screening Value (ref. 4)	536000
Benz(a)anthracene	ATRISK^{soil} Soil Screening Value (ref. 4)	131
Benzo(a)pyrene	ATRISK^{soil} Soil Screening Value (ref. 4)	14.3
Benzo(b)fluoranthene	ATRISK^{soil} Soil Screening Value (ref. 4)	142
Benzo(ghi)perylene	ATRISK^{soil} Soil Screening Value (ref. 4)	1440
Benzo(k)fluoranthene	ATRISK^{soil} Soil Screening Value (ref. 4)	1430
Chrysene	ATRISK^{soil} Soil Screening Value (ref. 4)	14000
Dibenz(ah)anthracene	ATRISK^{soil} Soil Screening Value (ref. 4)	14.3
Fluoranthene	ATRISK^{soil} Soil Screening Value (ref. 4)	72300
Fluorene	ATRISK^{soil} Soil Screening Value (ref. 4)	66800
Indeno(123cd)pyrene	ATRISK^{soil} Soil Screening Value (ref. 4)	142
Naphthalene	ATRISK^{soil} Soil Screening Value (ref. 4)	8180
Pyrene	ATRISK^{soil} Soil Screening Value (ref. 4)	54200

4. Where free product is not observed, otherwise consider revising.

Table 1.3 Total Petroleum Hydrocarbon (TPH) Bandings (All values in mg/kg)

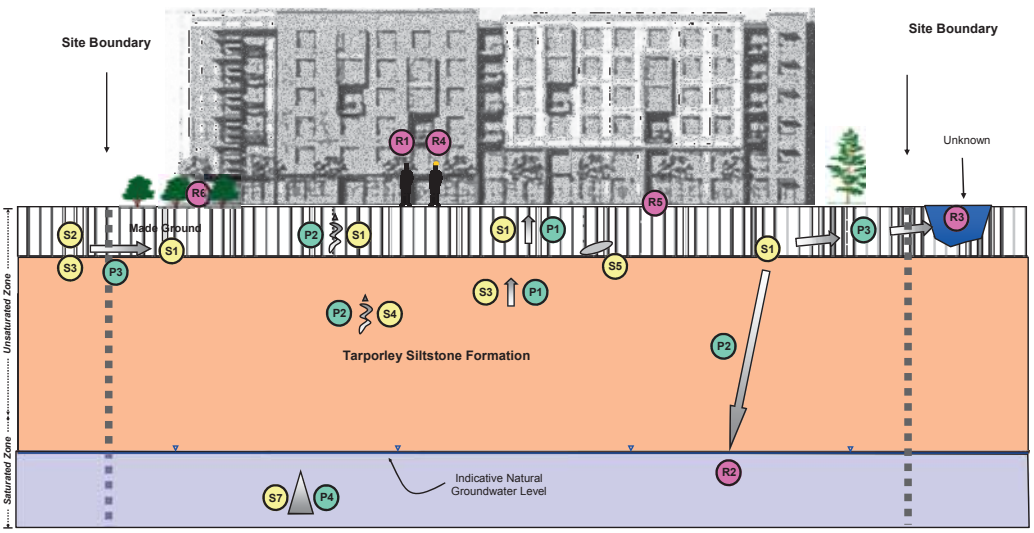
Carbon Range	Threshold Trigger Concentration For Planned End Use		
	Source	Aromatic	Aliphatic
C5 – C6	ATRISK^{soil} Soil Screening Value (ref. 5)	13.1 (C5-C7)	327 (ref. 9)
C6 – C8	ATRISK^{soil} Soil Screening Value (ref. 6)	414000 (C7-C8)	158 (ref. 9)
C8 – C10	ATRISK^{soil} Soil Screening Value (ref. 7)	58600	167000
C10 – C12	ATRISK^{soil} Soil Screening Value (ref. 7)	68300	171000
C12 – C16	ATRISK^{soil} Soil Screening Value (ref. 7)	68400	171000
C16 – C21	ATRISK^{soil} Soil Screening Value	28400	≤1,000,000
C21 – C35	ATRISK^{soil} Soil Screening Value	28400	

5. Based on total benzene concentration in the soil.
6. Based on total toluene concentration in the soil.
8. Aliphatic & Aromatic: where free product is not observed, otherwise consider revising.
9. Modelled threshold <1kg/kg; lowest of either aqueous or vapour saturation limits presented.

ATRISK^{soil} Soil Screening Values are published by Atkins Limited

Appendix A7 – Conceptual Site Model and Risk Assessment

LIPA 6th From



Sources

- S1 Made-ground (On site)
- S2 Made-ground (Off site)
- S3 Natural soils (On & off site)
- S4 Ground gas sources
- S5 Unexploded ordnance
- S6 Radon geology
- S7 Mine workings

Pathways

- P1 Direct contact, ingestion and or inhalation
- P2 Vertical migration
- P3 Horizontal migration
- P4 Collapse

Receptors

- R1 End users
- R2 Groundwater
- R3 Surface water
- R4 Construction workers
- R5 Construction materials
- R6 Local ecology

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Merchant Exchange
17-196 Whitworth Street West ,
Manchester, M1 5WG
Tel: 0161 236 2394

Project	Job Reference	Author	Client
LIPA 6th Form	EB1738	GL	Kier Construction
Drawing Title	**Date**	**Checked**	**Scale**
Diagrammatic Conceptual Model	16.06.2015	DM	Not to scale

Risk Assessment

Table 1.0 presents a site-specific qualitative (Phase 1) risk assessment of environmental harm and Table 2.0 a revision comprising a semi-quantitative risk assessment (Phase 2) based upon the findings of the site investigation; the principle of both being to establish connecting links between a hazardous source to a potential receptor via an exposure pathway, the Conceptual Site Model.

The risk assessments correspond with the **total** site area.

Risk assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the hazardous source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore the presence of hazard on a site does not necessarily mean there is a risk.

By considering where a viable pathway exists which connects a source with a receptor the risk assessment in Table 1.0 and Table 2.0 will identify where pollutant linkage exists. If there is no pollutant linkage there is no risk and only where a pollutant linkage is established does the risk assessment consider the level of risk.

The risk assessments consider the likelihood of a particular event taking place (accounting for the presence of the hazard and receptor and the integrity of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment shown in Table 1.0 and Table 2.0 the consequence of the hazard has been classified as severe or medium or mild or minor. The probability (likelihood) of the circumstances actually occurring has been classified as high likelihood or likely or low likelihood or unlikely.

The above consequences and probabilities have been integrated to give a qualitative (Table 1.0) and semi-quantitative (Table 2.0) estimation of the risk using Department of the Environment risk classifications. The following categorisation has been used for this purpose.

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability (Likelihood)	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Negligible Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Negligible Risk
	Low Likelihood	High/Moderate Risk	Moderate/Low Risk	Low Risk	Negligible Risk
	Unlikely	Moderate/Low Risk	Low Risk	Negligible Risk	Negligible Risk

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem or organisation forming part of such ecosystem.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (exc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

Where risk is evaluated as **moderate** or greater within the Phase 2 Conceptual Site Model (Table 2.0) either; a) remedial action is recommended to address this residual risk (Section 7.2 in the main body of the report) or, b) further investigation is recommended to better inform the risk classification and/or to enable a more detailed, quantitative risk assessment to be undertaken.

Conceptual Site Model (CSM) and Risk Assessment
Table 1.0 (Phase 1)

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Table and Summary of Potential Risks, Sheet 1

Conceptual Site Model			Qualitative Risk Assessment		
Source	Pathway(s)	Receptor(s)	Consequence (Potential Severity)	Likelihood of Occurrence	Risk*
S1: Made ground soils on site	**P2**: Vertical migration	**R2:** Controlled waters (Groundwater)	Medium	Likely	Moderate
	P3: Horizontal migration	**R3:** Controlled waters (Surface Waters)	Mild	Likely	Moderate / Low
	P1: Direct contact, ingestion, inhalation (dust and vapours)	**R1:** End user of site	Medium	Likely	Moderate
	P1: Direct contact, ingestion, inhalation (dust and vapours)	**R4:** Construction workers	Minor	Likely	Negligible
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R5:** Construction materials	Mild	Likely	Negligible
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R6:** Local ecology	Minor	Likely	Negligible
S2: Made ground soils off site	**P3 & P1**: Horizontal migration and direct contact, ingestion, inhalation (dust and vapours)	**R1:** End user of site	Medium	Likely	Moderate
	P3 & P1: Horizontal migration and direct contact, ingestion, inhalation (dust and vapours)	**R4:** Construction workers	Minor	Likely	Negligible

* *Risk refers to the potential risk that the Source, Pathway, Receptor linkage is complete and is used to determine if any further investigation is required. It does not indicate immediate emergency risk to any individual or feature present on the site unless specifically noted.*

Conceptual Site Model (CSM) and Risk Assessment
Table 1.0 (Phase 1)

curtins

Table and Summary of Potential Risks, Sheet 2

Conceptual Site Model			Qualitative Risk Assessment		
Source	Pathway	Receptor	Consequence (Potential Severity)	Likelihood of Occurrence	Risk*
S3: Natural soils on or off site	**P1 & P3**: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R1:** End user of site	Medium	Low likelihood	Moderate/Low
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R4:** Construction workers	Minor	Low Likelihood	Negligible
S4: Ground gases	**P2 & P3**: Vertical and horizontal migration	**R1:** End user of site	Severe	Likely	High
S5: Radon	**P2 & P3**: Vertical and horizontal migration	**R1:** End user of site	Medium	Unlikely	Low
S6: Unexploded ordnance	**P1**: Direct contact	**R1:** End user of site	Severe	Unlikely	Moderate / Low
	P1: Direct contact	**R4:** Construction workers	Severe	Unlikely	Moderate / Low

* *Risk refers to the potential risk that the Source, Pathway, Receptor linkage is complete and is used to determine if any further investigation is required. It does not indicate immediate emergency risk to any individual or feature present on the site unless specifically noted.*

Conceptual Site Model (CSM) and Revised Risk Assessment
Table 2.0 (Phase 2)

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Table and Summary of Potential Risks, Sheet 1

Conceptual Site Model			Qualitative Risk Assessment		
Source	**Pathway(s)**	**Receptor(s)**	**Consequence (Potential Severity)**	**Likelihood of Occurrence**	**Risk***
S1: Made ground soils on site	**P2:** Vertical migration	**R2:** Controlled waters (Groundwater)	Medium	Unlikely	Low
	P3: Horizontal migration	**R3:** Controlled waters (Surface Waters)	Medium	Unlikely	Low
	P1: Direct contact, ingestion, inhalation (dust and vapours)	**R1:** End user of site	Medium	Unlikely	Low
	P1: Direct contact, ingestion, inhalation (dust and vapours)	**R4:** Construction workers	Minor	Low	Negligible
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R4:** Construction materials	Medium	Low	Moderate / Low
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R6:** Local ecology	Medium	Low	Moderate / Low
S2: Made ground soils off site	**P3 & P1:** Horizontal migration and direct contact, ingestion, inhalation (dust and vapours)	**R1:** End user of site	Medium	Unlikely	Low
	P3 & P1: Horizontal migration and direct contact, ingestion, inhalation (dust and vapours)	**R4:** Construction workers	Minor	Unlikely	Negligible

* *Where risk is evaluated as **moderate** or greater) either; a) remedial action is recommended to address this residual risk (Section 7.2 in the main body of the report) or, b) further investigation is recommended to better inform the risk classification and/or to enable a more detailed, quantitative risk assessment to be undertaken.*

Conceptual Site Model (CSM) and Revised Risk Assessment
Table 2.0 (Phase 2)

Table and Summary of Potential Risks, Sheet 2

Conceptual Site Model			Qualitative Risk Assessment		
Source	**Pathway**	**Receptor**	**Consequence (Potential Severity)**	**Likelihood of Occurrence**	**Risk***
S3: Natural soils on or off site	**P1 & P3:** Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R1:** End user of site	Medium	Unlikely	Low
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R4:** Construction workers	Minor	Unlikely	Negligible
S4: Ground gases	**P2 & P3:** Vertical and horizontal migration	**R1:** End user of site	Severe	Low	High / Moderate
S5: Unexploded ordnance	**P1:** Direct contact	**R1:** End user of site	Severe	Unlikley	Moderate / Low
	P1: Direct contact	**R4:** Construction workers	Severe	Unlikley	Moderate / Low
S6: Radon	**P2 & P3:** Vertical and horizontal migration	**R1:** End user of site	Medium	Unlikely	Low

* *Where risk is evaluated as **moderate** or greater) either; a) remedial action is recommended to address this residual risk (Section 7.2 in the main body of the report) or, b) further investigation is recommended to better inform the risk classification and/or to enable a more detailed, quantitative risk assessment to be undertaken.*

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