

# St Julies Catholic High School, High Street, Woolton

## Phase 2 Intrusive Investigation

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Client Name: KIER Construction-Northern

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**Project:** St Julies Catholic High School, High Street, Woolton  
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For and on behalf of **Curtins**

## Executive Summary

### Appointment

In June 2014 Curtins were instructed by KIER Construction- Northern to undertake a Phase 1 Geo-Environmental Detailed Desk Top Study and a Phase 2 Intrusive Site Investigation of a site located at St Julies Catholic High School, High Street, Woolton, Liverpool.

The site is centred on national grid reference 342390, 386530 with an area of 4.48ha. A location plan can be found in Appendix A1.

### Development Proposals

It is understood that the proposed development is to comprise of new school buildings, refurbishment of existing buildings and construction of sports pitches.

### Fieldworks

The site work was carried out between 27th and 29th October 2014. 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.

The locations of the exploratory holes were restricted by existing buildings and services. Site work comprised of three Cable percussion boreholes designated BH01 to BH03, fourteen Window Sample Boreholes designated WS01 to WS14 and fourteen hand excavated trial pits designated HP01 to HP14. The positions of all locations are shown on the site plan in Appendix 2.

The depths of boreholes and trial pits, descriptions of strata encountered and comments on groundwater conditions are given in the borehole and trial pit records, Appendix 3. 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 WS03, WS07, WS09 and WS11, as detailed in the borehole records.

Falling head tests were carried out in BH02 and BH03 in accordance with BS5930:2010 Test records are presented in Appendix 2. The ground levels at the borehole and trial pit locations were not determined.

### Ground Model

The sequence of the strata encountered during the investigation generally confirms the anticipated geology as interpreted from the geological map. The sequence may be summarised as made ground, locally overlying sand that in turn overlies sandstone bedrock.

Boreholes were located around the existing school. Hand dug trial pits were located on the tree covered area to the southwest.

Made ground was encountered at all borehole locations to depths in the overall range 0.20 to 1.50m. The greatest thickness of made ground was encountered in WS07 and WS08, 1.50 and 1.20m respectively. The base of the made ground at the rest of the positions ranged from 0.20 to 0.80m. Made ground generally comprised surface coverings, predominantly turf and sandy topsoil.

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Asphalt was encountered at surface in WS05. The localised thicker made ground comprised gravelly sand including ash and brick.

Natural strata comprised sand and sandstone. Sand was locally encountered to depths up to 1.60m (WS06). This material was generally described as brown, slightly gravelly fine to coarse sand.

Groundwater was not encountered in any of the exploratory holes.

### Laboratory Testing

Forty six soil samples taken from within the Made Ground and natural material across the site and a programme of environmental chemistry testing was scheduled reflecting the findings of the desk study and on-site observations.

With reference to the Tier 1 Thresholds initial assessment shows that the thresholds have been exceeded in the Topsoil/Made Ground with respect to the proposed end use (School buildings).

It is considered that the levels of sulphate encountered within the Made Ground will not present a risk to the proposed end user. However consideration should be made with respect to buried concrete requirements as specified in BRE Special Digest 1: 2005.

### Quantitative Risk Assessment – Human Health

Elevations of PAH's were encountered on site above the relevant tier 1 thresholds.

The observed concentrations of PAH's could present a risk of harm to the proposed end user by risk of direct contact and ingestion. Various PAH's were recorded at elevated concentrations in BH02 at 0.30m bgl, BH03 at 0.30m and 0.50m bgl, and WS04 at 0.30m and 0.50m bgl.

Due to the relatively widespread occurrences of PAH's it is recommended that 300mm of 'clean and inert cover' is provided to soft landscaped areas to break the source-pathway-receptor linkage. Building construction and hard standing / car parking will be sufficient to break pathways.

The majority of the significantly elevated samples are located around the existing school buildings. This is likely to be associated with tarmac and ash in this area.

Asbestos (Chrysotile) was encountered at detectable limits within the shallow made ground soils at a number location across the holes, located in BH01 0.3m bgl, BH02 0.30m bgl, BH03 0.30m bgl and WS05 0.30m bgl. In two locations within the woods Asbestos (Chrysotile and Amosite) was encountered at detectable limits within the shallow made ground soils in (Chrysotile HP02 0.3m and Amosite HP14 0.10m bgl). These are considered to be localised hotspots and not considered to be a widespread issue.

This asbestos contamination was delineated to further assess the risk to end users.

It is recommended that any impacted material should be either encapsulated on site by building construction or hard standing, or removed from site to a suitably licensed disposal facility. Depending on the outcome of the delineation exercise a limited picking operation may be undertaken to remove the risk.



Quantification of the asbestos has been undertaken and the analysis results will be concluded in an addendum to this report.

Although there would not appear to be a significant risk to future development there is nevertheless asbestos fibres in certain locations. These will need to be adequately managed during construction and the presence recorded in the development Health and Safety File.

#### **Quantitative Risk Assessment – Controlled Waters**

Groundwater was not recorded in any of the exploratory holes formed during this investigation.

The majority of the natural material is clean; however contamination is evident in WS04 at 0.50m bgl. The contamination present in this location is possibly a result of tarmac and ash found in the borehole logs or oil leak from parked vehicles in the area. We would recommend that this area is delineated and further testing undertaken to accurately assess the risk to groundwater.

#### **Quantitative Risk Assessment – Ground Gases**

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

Standpipe installations were incorporated in WS03, WS07, WS09 and WS11 as detailed in the borehole records.

Gas monitoring has been undertaken across the site on two occasions. Barometric pressure has been recorded at between 1003mb and 1010mb during the visits.

No flow has been recorded to date, a maximum of 6.9% CO<sub>2</sub> was recorded in WS03. No methane CH<sub>4</sub> 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 CS2 regime requiring 3 points of gas protection measures for public buildings.

#### **Quantitative Risk Assessment – Construction Materials**

It is considered that the levels of sulphate encountered within the Topsoil/Made Ground will not present a risk to the proposed end user. However consideration should be made with respect to buried concrete requirements as specified in BRE Special Digest 1: 2005.

#### **Quantitative Risk Assessment – Water Supply Pipes**

Elevated concentrations of PAH contamination with respect to the protection of water supply pipes were determined within the Topsoil/Made Ground. Therefore, it is recommended that appropriate materials for water supply pipes would comprise Barrier Pipes (PE/AL/PE). 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 seventy eight samples collected have been entered into this Cat-WasteSoil tool. Initial classification of these shallow soil samples are classed as non-hazardous waste.

Further WAC environmental analysis of the shallow soils encountered during the redevelopment of the site will need to be carried out to classify the material as clean and inert or hazardous if the material is to be taken off site.

### **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 localised seepages may be encountered. It is considered that these could be dealt with by localised pumping from sumps.

Excavations may extend into competent sandstone. Hydraulic breakers may be required to advance excavations in these materials.

### **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.

The materials encountered are considered to be non-plastic and will therefore not be subject to significant volume change due to changes in moisture content. It is recommended that foundation excavations are advanced through any made ground and very loose sand to the underlying sandstone in order to provide consistent bearing characteristics. On this basis it is anticipated that foundation excavations may locally have to be extended to depths about 2.00m.

Strip foundations of widths about 1.00m bearing on sandstone may be designed to an allowable bearing capacity of not less than 250kN/m<sup>2</sup>. Square pad foundations of width about 1.00m may be designed to an allowable bearing capacity of not less than 500kN/m<sup>2</sup>. Foundation excavations should be inspected in order to confirm the competence and suitability of the bearing strata.

The allowable bearing capacities indicated above would provide an adequate factor of safety against shear failure and limit settlements to the order of a few millimetres.

### **Chemical Attack on Buried Concrete**

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

The results of chemical tests indicate sulphate concentrations in the soil between <10mg/l and 180mg/l as 2:1 water/soil extract, with pH values in the range 4.7 to 11.1.

It is recommended that for conventional shallow foundations the groundwater should be regarded as mobile. On the basis of the laboratory test results it is considered that a Design Sulphate Class

for this material may be taken as DS-1. The site conditions would suggest that an ACEC class for the site of AC-2z would be appropriate.

**Permeability**

Falling head permeability tests were carried out in BH02 and BH03. These tests recorded permeability of the sandstone of  $1.6 \times 10^{-6}$  and  $1.0 \times 10^{-6}$  m/s.

These indicate the material to be of poor drainage characteristics.

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**Appendix A3 – Exploratory Hole Logs**

**Appendix A4 – Chemical and Geotechnical Laboratory Test Results**

**Appendix A5 – Gas Monitoring Results**

**Appendix A6 – Tier 1 Thresholds**

**Appendix A7 – Conceptual Site Model and Risk Assessment**

**Appendix A8 – Detailed UXO Survey**

## 1.0 Introduction

### 1.1 Project Background

In June 2014 Curtins were instructed by the clients to undertake a Phase 1 Geo-Environmental Detailed Desk Top Study of a site located off High Street, Woolton, Liverpool.

The site is centred on national grid reference 342390, 386530 with an area of 4.48ha. A location plan can be found in Appendix A1.

The proposed development is to comprise of new school buildings, refurbishment of existing buildings and construction of sports pitches.

### 1.2 Scope of Works

A Phase 1 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 February 2014.

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 Curtins Phase 1 Detailed Desk Top Study of the site, document reference no. EB1441/AW/3853, dated 16<sup>th</sup> July 2014.

### 2.1 Current Setting

The site is centred on national grid reference 342390, 342390 with an area of 4.48ha. A location plan can be found in Appendix A1.

The site is currently occupied by St Julies Catholic High School and associated car parking.

### 2.2 Site History

The earliest historical map dated 1849 shows the site to be occupied by open farmland with a pathway running through the site by the late 1800's. The first signs of development occurred in the late 1950's where an over sixties club was constructed in the north east corner of the site. The south of the site is developed around the 1970s, where a school now exists which extends south of the site also. This remains on site to present day, however the smaller building in the north east corner of the site is no longer illustrated by around the 21st century.

### 2.3 Surrounding Land Use

The earliest historical map dated 1849 shows the south of the site up to around 350m is Woolton Woods with Woolton Hall around 100m south east. Woolton Sandstone Quarry is located around 500m north-west, which is no longer illustrated around the mid 1900's. The majority of the surrounding area is occupied by fields separated by hedge rows, with the main residential and industrial developments to the north after around 280m. Cheshire lines railway runs 1000m north east of the site.

Over the late 1800s and throughout the 1900s the area slowly expands, seeing the growth of the towns mainly in the north (Woolton) west and south. Amongst the residential development are several works, including gas works and water works in the west. Ruins are also illustrated post WWII, with the closest being located around 80m north of the sites boundary. Urban expansion continues to present day, and the south west and west remains less developed and occupied by fields separated by connecting roads and hedgerows.

### 2.4 Geology

A study of the Envirocheck records and British Geological Survey (BGS) 1:50,000 mapping records (Bedrock and Superficial Editions) for Runcorn (Sheet 097) indicates the following geological succession underlying the site.

Rock Name	Rock Type	Geological Age
Chester Pebble Beds Formation	Pebbly (Gravelly) Sandstone	Early Triassic



Due to historical evidence of some small development and redevelopment in and around the site area, it is expected that there will be some variable deposits of made ground across the site. There are no fault lines within 1000m 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; running sands, shrinking or swelling clay, ground dissolution, collapsible ground, compressible ground and landslides.

## **2.5 Hydrogeology**

The 1:100,000 Sheet 16 West Cheshire Vulnerability Map indicates that the site, corresponding with the underlying solid geology, the bedrock geology is a Principal Aquifer. There are no superficial deposits recorded on the site. A Principal Aquifer comprises of layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

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 is not within a Source Protection Zone (SPZ).

The nearest surface water feature is a surface drain 489m west of the site.

There are no groundwater, surface water or potable water abstractions located within 1000m of the site.

There are no Pollution incidents, Discharge Consents, Local Authority Pollution Prevention and Controls permits arising from the site.

The site lies in Flood Zone 1 and is therefore at no risk from flooding from rivers or sea without defences.

## **2.6 Landfills**

The Envirocheck report confirms that there are no BGS Recorded Landfill sites within 1000m of the site.

There are two historical landfill sites located within 1000m of the site. The landfill is located 248m north west of the site, and is operated by Woolton Quarry South, and waste deposited includes inert waste.

There is one recorded Registered Landfill site located within 1000m of the site. This is located 484m north-west of the site, the license holder is Ian Glen Ltd, however license is now lapsed.

## **2.7 Mining and Radon**

There are eight BGS Recorded Mineral Sites located within 1000m of the site, all of which operations have now ceased. The closest, now inactive site, was located 296m north west of site. This site was an opencast site, mined for the commodity of sandstone.

The site does not lie within a coal mining referral area, and as such, a Coal Authority report has not been obtained. The site lies outside the Cheshire Brine Compensation District.

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.

## **2.8 Unexploded Ordnance**

The site of interest is located near Liverpool city centre. Risk mapping for UXOs has placed the site within a high risk area. Areas designated as high risk are those that show a high density of bombing hits (50+ bombs per 1000 acres) and abundant potential WWII targets. In high-risk regions, further action to mitigate UXB risk is considered essential.

Historical maps for the site and surrounding area show evidence of bomb damage post WWII. Several ruins are located within 250m of the sites boundary. The site has a limited development history, with only one development in the north east corner which is later demolished, and the school towards the south.

A detailed UXO report has been obtained for the site, this gives a risk level of **Medium/high** and highlights a number of mitigation measures, which should be followed during intrusive works. This can be found in Appendix A8

## **2.9 Public Utility Information**

Public utility information have been obtained as a part of this report.

## **2.10 Existing Reports**

No previous reports have been made available for review at the time of writing this report.

## **2.11 Other Significant Features Potentially Affecting Re-Development**

No other significant features are noted that could potentially affect re-development.

## **2.12 Conceptual Model**

The following sub-sections present a non-exhaustive list of the possible sources, pathways and receptors that exist within the site conceptual model.

Potential source-pathway-receptor linkages that may arise are discussed in the following section, the Qualitative Risk Assessment.

A Diagrammatic Conceptual Model is provided in Appendix A3.

### 2.12.1 Potential Sources

#### Potential Source (S1): Made-ground Soils On Site

Likely to be present on-site due to historical evidence of development in the north east and southern areas of the site. It should be noted that poorly managed demolition can result in material such as asbestos or heating oils being present in the sub-soils.

The nature and type of contamination may include, amongst others; ash and fill, hydrocarbons (e.g. fuel oils), heavy metals, herbicides / pesticides and asbestos.

#### Potential Source (S2): Made-ground Soils Off Site

As with on-site made-ground soils, off-site soils have been exposed to similar patterns of development and demolition so 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

May be present due to made ground deposits across the site from historical developments and land use. There are two historical landfill sites located within 1000m of the site. The landfill is located 248m north west of the site, and is operated by Woolton Quarry South, and waste deposited includes inert waste. 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 Ordnance

The site of interest is located near Liverpool city centre.

Risk mapping for UXOs has placed the site within a high risk area.

Areas designated as high risk are those that show a high density of bombing hits (50+ bombs per 1000 acres) and abundant potential WWII targets. In high-risk regions, further action to mitigate UXB risk is considered essential.

Historical maps for the site and surrounding area show evidence of bomb damage post WWII. Several ruins are located within 250m of the sites boundary. The site has a limited development history, with only one development in the north east corner which is later demolished, and the school towards the south.

In light of these findings and in accordance with CIRIA's publication on managing UXO risks, it is recommended that a preliminary UXO report is obtained for the site.

**Potential Source (S7): Mining Workings**

There are eight BGS Recorded Mineral Sites located within 1000m of the site, all of which operations have now ceased. The closest, now inactive site, was located 296m north west of site. This site was an opencast site, mined for the commodity of sandstone.

The site does not lie within a coal mining referral area, and as such, a Coal Authority report has not been obtained. The property lies outside the Cheshire Brine Compensation District.

**2.12.2 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 negligible leaching potential are found onsite. Overlying a principle aquifer within the bedrock.

**Potential Pathway (P3): Horizontal 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 Principal Aquifer within the bedrock.

**Potential Pathway (P4): Collapse**

Unlikely on this site.

**2.12.3 Potential Receptors****Potential Receptor (R1): End Users**

Students, employees, 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 Principal Aquifer within the bedrock, no superficial deposits have been recorded on site.

There are no groundwater abstractions located within 1000m of the site.

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)**

There are no surface water abstractions within 1000m of the site.

The nearest surface water feature is pond in Calderstones Park located 379m south west 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 (Principal Aquifer), buildings and infrastructure, services, neighbours and the general public.

It is understood that the aim of this site investigation is to investigate and characterise areas of land around the existing St Julies Building which are intended to be occupied by a number of new school buildings, refurbishment of existing buildings and construction of sports pitches.

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 redevelopment; and to provide foundation design for the proposed accommodation. A strategy for the Phase 2 intrusive investigation was derived accordingly and comprised the following operations:

- Logging and sampling of representative soils in fourteen no. window sample boreholes to 5m depth below existing ground level.
- Logging and sampling of representative soils in three no. Light Cable Percussive boreholes to 15m depth below existing ground level
- Logging of representative soils in fourteen hand dug trial pits for environmental analysis.
- Environmental Chemistry testing of thirty 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.
- Environmental Chemistry testing of sixteen natural 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.
- 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 27th and 29th October 2014. 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.

The locations of the exploratory holes were restricted by existing buildings and services. Site work comprised of three Cable percussion boreholes designated BH01 to BH03, fourteen Window Sample Boreholes designated WS01 to WS14 and fourteen Hand excavated trial pits designated HP01 to HP14. The positions of all locations are shown on the site plan in Appendix 2.

The depths of boreholes and trial pits, descriptions of strata encountered and comments on groundwater conditions are given in the borehole and trial pit records, Appendix 3. 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 WS03, WS07, WS09 and WS11, as detailed in the borehole records.

Falling head tests were carried out in BH02 and BH03 in accordance with BS5930:2010 Test records are presented in Appendix 2. The ground levels at the borehole and trial pit locations were not determined.

The ground level and co-ordinates at the borehole and trial pit locations were not determined.

Groundwater and gas monitoring visits have been undertaken on two occasions. The results are presented in Appendix A5.

The locations of the exploratory holes, a copy of which is contained within Appendix A2.

### 4.2 Light Cable Percussive Borehole Investigation

Three boreholes, designated BH01 to BH03 were undertaken by Light Cable Percussive technique. The depths of boreholes, descriptions of strata encountered and comments on groundwater conditions are given in the borehole record sheets.

Samples were collected for environmental purposes in amber glass jars and kept in a cool box. The ground levels at the borehole were not determined.

The depths of the samples recovered are shown on the relevant exploratory hole log presented in Appendix A3 of this report

### 4.3 Window Sampling Borehole Investigation

Fourteen boreholes, designated WS01 to WS14 undertaken by drive-in window sampler technique, five of the boreholes where not undertaken due to access on the site. The depths of boreholes,

descriptions of strata encountered and comments on groundwater conditions are given in the borehole record sheets.

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 as detailed in the borehole records. The ground levels at the borehole were not determined.

The depths of the samples recovered are shown on the relevant exploratory hole log presented in Appendix A3 of this report.

#### **4.4 Trial Pits**

Fourteen trial pits were dug by hand at the positions shown on the site plan. The depths of trial pits, descriptions of strata encountered and comments on groundwater conditions are given in the trial pit records, Appendix A3.



## 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
	USEPA16 PAH	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 0.1 mg/kg

Thirty soil samples taken from across the site were tested for Suite A (shallow samples) and sixteen tested for Suite B.

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

### **5.1.2 Groundwater Analysis**

Groundwater was not recorded in any of the exploratory holes formed during this investigation.

## **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:

- 15 No. pH value
- 15 No. Soluble sulphate Content

## 6.0 Ground Conditions

The sequence of the strata encountered during the investigation generally confirms the anticipated geology as interpreted from the geological map.

The sequence of the strata encountered during the investigation generally confirms the anticipated geology as interpreted from the geological map. The sequence may be summarised as made ground, locally overlying sand that in turn overlies sandstone bedrock.

The sequence and indicative thicknesses of strata are provided below.

### 6.1 Made Ground / Topsoil

Made ground was encountered at all borehole locations to depths in the overall range 0.20 to 1.50m. The greatest thickness of made ground was encountered in WS07 and WS08, 1.50 and 1.20m respectively. The base of the made ground at the rest of the positions ranged from 0.20 to 0.80m.

Made ground generally comprised surface coverings, predominantly turf and sandy topsoil. Asphalt was encountered at surface in WS05. The localised thicker made ground comprised gravelly sand including ash and brick. WS13 was terminated in made ground, on an obstruction of concrete, at a depth of 0.85m.

Made ground was encountered in HP04, HP05, HP12 and HP13 to depths of 0.30m (HP04, HP12 & HP13) and 0.50m (HP05). Made ground variably comprised sand or clay with included fragments of brick, plastic and glass. HP05 was terminated within made ground at a depth of 0.50m. One SPT 'N' value of 8 was recorded within made ground indicating loose material.

### 6.2 Natural Strata

Natural strata comprised sand and sandstone. Sand was locally encountered to depths up to 1.60m (WS06). This material was generally described as brown, slightly gravelly fine to coarse sand HP01 to HP14 encountered sand, locally overlain by made ground, to depths up to 0.80m. HP13 and HP14 were terminated in sand at depths of 0.70 and 0.50m respectively.

The sand is likely to be locally derived from the underlying sandstone. The sand may either represent residual soil derived from the sandstone or locally re-deposited material. Weathered sandstone was encountered across the site, generally at shallow depths. Weathered sandstone was encountered beneath made ground or, locally, beneath sand at depths in the range 0.30 to 1.60m.

This material was generally recovered as red brown sandy gravel or gravelly sand. Sandstone generally increased in competence with depth. Boreholes were terminated in sandstone at depths in the range 0.50 to 2.30m. HP01 to HP12 were terminated when sandstone was reached at depths in the range 0.30 to 0.80m. Boreholes were terminated in sandstone when further progress could not be made.

The depth to sandstone, and depth to competent rock based on termination of boreholes, does not appear to vary systematically across the site.

The boundary between sand, where encountered, and sandstone may locally be gradational, representing decrease in weathering with depth. One SPT 'N' value of 2 was recorded in sand indicating very loose material. Four SPT 'N' values were obtained in sandstone. Full penetration was not achieved on these tests after 50 blows.

### **6.3 Groundwater**

Groundwater was not recorded in any of the exploratory holes formed during this investigation.

## 7.0 Geochemical Ground and Groundwater Assessment

### 7.1 Overall Assessment

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 (Principal aquifer beneath the solid geology), buildings and infrastructure, services, neighbours and the general public.

A strategy for a Phase 2 ground investigation was consequently developed with reference to this information, the initial conceptual site model and the proposed development use as School Buildings.

This section of the report includes the assessment of the potential contamination, solid, liquid and gas, identified on the subject site which may present a risk to the proposed end users, associated utilities and the wider environment.

Curtins use a tiered approach in assessing the risk from potential contamination, such assessment being based on the known history of the site as determined by the desk study in conjunction with observations made during the ground investigation. This assessment is based solely on the results of the chemical and other testing data obtained as part of Curtins Consulting's investigation.

Under the Contaminated Land (England) Regulations 2000 a Local Authority has from time to time to survey the land within its boundaries to identify "Contaminated Land". This is land "in such condition, by reason of substances in, on, or under the land, that: significant harm is being caused, or pollution of controlled waters is being or likely to be caused".

In guidance published by the Environment Agency, the risk to end users or controlled waters is determined through an assessment of pollutant linkages between a source of contamination and a sensitive receptor such as house occupants, plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship.

With respect to this investigation the source is taken as being a point or area of contamination within the ground. The pathway is a mechanism by which the contamination could reach the receptor.

For instance this could be through eating contaminated soil or plants contaminated through taking up contamination in the soil through their roots, inhaling contaminated dust or drinking contaminated water. Other pathways include directly causing degradation of buried building materials such as plastic or concrete. Further indirect pathways include groundwater transporting contamination to a groundwater abstraction point or to a river or stream and thus causing it to become polluted.

In order to assess whether a potential pollutant linkage is significant with respect to human health, the Environment Agency and the Department of the Environment, Food and Rural Affairs (DEFRA), published in 2002 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).

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'.

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 model to provide a detailed interpretation on a site by site basis. This is to determine whether the criteria are being met to prevent contamination of controlled waters and to protect human health and the environment.

This assessment is the first tier in the process. It is a comparison between various sets of generic criteria and the result of testing from the investigation. Where available these criteria are drawn from the CLEA guidance itself in the form of Soil Guideline Values (SGV's).

These values have been derived 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 for the Tier 1 assessment as shown in Appendix A6 of this report.

Currently, within the UK, there are no Tier 1 assessment values published by regulatory bodies for a wide range of organic compounds, petroleum hydrocarbons, volatile and semi-volatile compounds. Therefore other guidance maybe referred to, for example the TPH Criteria Working Group series of documents, the LQM/CIEH and EIC/AGS/CL:AIRE published thresholds.

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 considered acceptable to the Regulators) 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.

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

In the case of this site the proposed end use the site is defined as 'Residential without the Consumption of Produce'.

## 7.2 Site Soils

As discussed previously, fourteen window samples boreholes, three cable percussive boreholes and fourteen had pits were undertaken in total across the development site. Representative samples of the site soils were taken from each of the borehole locations.

Given that the proposed end use of the site is a school with attached wooded area, the report compares the chemistry analysis results for a conservative assessment against '*Residential without plant uptake*' 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 is more than 6%, and therefore for comparison against Tier 1 thresholds a conservative SOM of 6.0% has been adopted.

The locations where 'Residential without Consumption of Produce' Tier 1 thresholds have been exceeded are shown in Table 7.2 below.

**Table 7.2** Location of exceeded Tier 1 Thresholds for 'Residential without Consumption of Produce'

Location	Depth (m)	Strata	Contaminant	Concentration (mg/kg)	Tier 1 (mg/kg)
BH01	0.30	Made Ground	Chrysotile	Detected	-
BH02	0.30	Made Ground	Benzo(a)pyrene	5.70	1.04
			Benzo(b/k)fluoranthene	11	10.30
			Chrysotile	Detected	-
BH03	0.30	Made Ground	Benzo(a)pyrene	20	1.04
			Benzo(a)anthracene	22	9.04
			Benzo(b/k)fluoranthene	37	10.30
			Dibenzo(ah)anthracene	2.10	1.03
			Chrysotile	Detected	-
BH03	0.50	Made Ground	Benzo(a)pyrene	1.40	1.04
WS04	0.30	Made Ground	Benzo(a)pyrene	1.10	1.04
WS04	0.50	Natural	Benzo(b/k)fluoranthene	16	10.30
			Benzo(a)pyrene	7.40	1.04
			Dibenzo(ah)anthracene	1.20	1.03
			Benzo(a)anthracene	11	9.04
WS05	0.30	Made Ground	Chrysotile	Detected	-
HP02	0.30	Made Ground	Chrysotile	Detected	-
HP14	0.10	Made Ground	Amosite	Detected	-

### 7.2.1 Organics

- Poly Aromatic Hydrocarbons (PAH's)

A number of Poly Aromatic Hydrocarbons (PAH's) were observed above Tier 1 'Residential without plant uptake' thresholds at concentrations which could present a risk of to the proposed end user at five locations across the site.

The observed concentrations of PAH's could present a risk of harm to the proposed end user by risk of direct contact and ingestion.

Benzo[a]pyrene was observed above Tier 1 thresholds at a concentration which could present a risk of to the proposed end user in a number of locations within the site soils, with a maximum recorded concentration of 20mg/kg in BH03 at a depth of 0.30m bgl.

Benzo[a]anthracene was observed above Tier 1 thresholds at a concentration which could present a risk of to the proposed end user in a number of locations within the made ground, with a maximum recorded concentration of 22mg/kg in BH03 at a depth of 0.30m bgl.

Benzo(b/k)fluoranthene was observed above Tier 1 thresholds at a concentration which could present a risk of to the proposed end user in several locations within the made ground, with a maximum recorded concentration of 37mg/kg in BH03 at a depth of 0.30m bgl.

Dibenzo[ah]anthracene was observed above Tier 1 thresholds at a concentration which could present a risk of to the proposed end user in four locations within the made ground, with a recorded maximum concentration of 2.10mg/kg BH03 at a depth of 0.30m bgl.

Due to the relatively widespread occurrences of PAH's it is recommended that 300mm of 'clean and inert cover' is provided to soft landscaped areas to break the source-pathway-receptor linkage. Building structure and hard standing / car parking will also be sufficient to break pathways.

The majority of the significantly elevated samples are located around the existing school buildings. This is likely to be associated with tarmac and ash in this area.

- Asbestos

Asbestos (Chrysotile) was encountered at detectable limits within the shallow made ground soils at a number location across the holes, located in BH01 0.3m bgl, BH02 0.30m bgl, BH03 0.30m bgl and WS05 0.30m bgl. In two locations within the woods Asbestos (Chrysotile and Amosite) was encountered at detectable limits within the shallow made ground soils in (Chrysotile HP02 0.3m and Amosite HP14 0.10m bgl). These are considered to be localised hotspots and not considered to be a site wide issue.

A 'detection' of asbestos indicates a potential risk to ground workers and end users. Further investigation, delineation and quantification will be required to accurately assess the risk presented to site end users and ground workers at these locations.

It is recommended that any impacted material should be either encapsulated on site by building construction or hard standing, or removed from site to a suitably licensed disposal facility. Depending on the outcome of the delineation exercise a limited picking operation may be undertaken to remove the risk.



Quantification of the asbestos has been undertaken and the analysis results will be concluded in an addendum to this report.

Although there would not appear to be a significant risk to future development there is nevertheless asbestos fibres in certain locations. These will need to be adequately managed during construction and the presence recorded in the development Health and Safety File.

Following further delineation and quantification of asbestos across the site, it is recommended that any impacted material should be either encapsulated on site by building construction or hard standing, or removed from site to a suitably licensed disposal facility.

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

Further WAC environmental analysis of the shallow soils encountered during the redevelopment of the site will need to be carried out to classify the material as clean and inert or hazardous if the material is to be taken off site.

### **7.2.3 Mining and Radon**

There are eight BGS Recorded Mineral Sites located within 1000m of the site, all of which operations have now ceased. The closest, now inactive site, was located 296m north west of site. This site was an opencast site, mined for the commodity of sandstone.

The site does not lie within a coal mining referral area, and as such, a Coal Authority report has not been obtained. The site lies outside the Cheshire Brine Compensation District.

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.

### **7.2.4 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.

Elevated concentrations of PAH's contamination with respect to the protection of water supply pipes were determined within the Topsoil/Made Ground. Therefore, it is recommended that appropriate materials for water supply pipes would comprise Barrier Pipes (PE/AL/PE). The exact requirements are to be confirmed with the relevant utility supplier.

### **7.3 Controlled Waters**

Groundwater was not recorded in any of the exploratory holes formed during this investigation.

The majority of the natural material is clean, however contamination is evident in WS04 at 0.50m bgl. The contamination present in this location is possibly a result of tarmac and ash found in the borehole logs or oil leak from parked vehicles in the area. We would recommend that this area is delineated and further testing undertaken to accurately assess the risk to groundwater.

The results will be issued as an addendum to this report.

### **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 twenty five borehole locations.

Standpipe installations were incorporated in WS03, WS07, WS09 and WS11 as detailed in the borehole records.

Gas monitoring has been undertaken across the site on two occasions. Barometric pressure has been recorded at between 1003mb and 1010mb during the visits.

No flow has been recorded to date, a maximum of 6.9% CO<sub>2</sub> was recorded in WS03. No methane CH<sub>4</sub> 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 CS2 regime requiring 3 points of gas protection measures for public buildings.

## 8.0 Geotechnical Assessment

### 8.1 Structural Design

It is understood that the proposed development comprises new school buildings, refurbishment of existing buildings and construction of sports pitches.

Accordingly the comments and recommendations below should be reviewed as design details become available.

### 8.2 Assessment of Strata Conditions

#### **Made Ground/Topsoil**

Made ground was encountered at all borehole locations to depths in the overall range 0.20 to 1.50m. The greatest thickness of made ground was encountered in WS07 and WS08, 1.50 and 1.20m respectively. The base of the made ground at the rest of the positions ranged from 0.20 to 0.80m.

Made ground generally comprised surface coverings, predominantly turf and sandy topsoil. Asphalt was encountered at surface in WS05. The localised thicker made ground comprised gravelly sand including ash and brick. WS13 was terminated in made ground, on an obstruction of concrete, at a depth of 0.85m.

Made ground was encountered in HP04, HP05, HP12 and HP13 to depths of 0.30m (HP04, HP12 & HP13) and 0.50m (HP05). Made ground variably comprised sand or clay with included fragments of brick, plastic and glass. HP05 was terminated within made ground at a depth of 0.50m. One SPT 'N' value of 8 was recorded within made ground indicating loose material.

#### **Natural Strata**

Natural strata comprised sand and sandstone. Sand was locally encountered to depths up to 1.60m (WS06). This material was generally described as brown, slightly gravelly fine to coarse sand HP01 to HP14 encountered sand, locally overlain by made ground, to depths up to 0.80m. HP13 and HP14 were terminated in sand at depths of 0.70 and 0.50m respectively.

The sand is likely to be locally derived from the underlying sandstone. The sand may either represent residual soil derived from the sandstone or locally re-deposited material. Weathered sandstone was encountered across the site, generally at shallow depths. Weathered sandstone was encountered beneath made ground or, locally, beneath sand at depths in the range 0.30 to 1.60m.

This material was generally recovered as red brown sandy gravel or gravelly sand. Sandstone generally increased in competence with depth. Boreholes were terminated in sandstone at depths in the range 0.50 to 2.30m. HP01 to HP12 were terminated when sandstone was reached at depths in the range 0.30 to 0.80m. Boreholes were terminated in sandstone when further progress could not be made.

The depth to sandstone, and depth to competent rock based on termination of boreholes, does not appear to vary systematically across the site.

The boundary between sand, where encountered, and sandstone may locally be gradational, representing decrease in weathering with depth. One SPT 'N' value of 2 was recorded in sand indicating very loose material. Four SPT 'N' values were obtained in sandstone. Full penetration was not achieved on these tests after 50 blows

### **8.3 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.

The materials encountered are considered to be non-plastic and will therefore not be subject to significant volume change due to changes in moisture content. It is recommended that foundation excavations are advanced through any made ground and very loose sand to the underlying sandstone in order to provide consistent bearing characteristics. On this basis it is anticipated that foundation excavations may locally have to be extended to depths about 2.00m.

Strip foundations of widths about 1.00m bearing on sandstone may be designed to an allowable bearing capacity of not less than 250kN/m<sup>2</sup>. Square pad foundations of width about 1.00m may be designed to an allowable bearing capacity of not less than 500kN/m<sup>2</sup>. Foundation excavations should be inspected in order to confirm the competence and suitability of the bearing strata.

The allowable bearing capacities indicated above would provide an adequate factor of safety against shear failure and limit settlements to the order of a few millimetres.

### **8.4 Ground Floor Slab Design**

On the basis of observation on site consideration may be given to constructing the ground floor slab on formation prepared in natural strata. Formations should be inspected and any loose or deleterious material should be removed and replaced with properly compacted granular fill.

### **8.5 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 localised seepages may be encountered. It is considered that these could be dealt with by localised pumping from sumps.

Excavations may extend into competent sandstone. Hydraulic breakers may be required to advance excavations in these materials.

## **8.6 Chemical Attack on Buried Concrete**

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

The results of chemical tests indicate sulphate concentrations in the soil between <10mg/l and 180mg/l as 2:1 water/soil extract, with pH values in the range 4.7 to 11.1.

It is recommended that for conventional shallow foundations the groundwater should be regarded as mobile. On the basis of the laboratory test results it is considered that a Design Sulphate Class for this material may be taken as DS-1. The site conditions would suggest that an ACEC class for the site of AC-2z would be appropriate.

## **8.7 Permeability**

Falling head permeability tests were carried out in BH02 and BH03. These tests recorded permeability of the sandstone of  $1.6 \times 10^{-6}$  and  $1.0 \times 10^{-6}$  m/s.

These indicate the material to be of poor drainage characteristics.

## 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 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.

### 9.4 Land Condition and Outline Remediation

The sequence of the strata encountered during the investigation generally confirms the anticipated geology as interpreted from the geological map.

Given that the current and proposed end use of the site (School Building) is directly accounted for by published UK guidance the report compares the chemistry analysis results against 'Residential without the Consumption of Produce'.

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 more than 6%, one of the broadly modelled SOM percentages, and therefore for comparison against Tier 1 thresholds a conservative SOM of 6.0% has been adopted.

It is considered that the levels of sulphate encountered within the Made Ground will not present a risk to the proposed end user. However consideration should be made with respect to buried concrete requirements as specified in BRE Special Digest 1: 2005 LCP01 is located within an area of soft landscaping which is to be converted to a car park during development of the site.

Elevations of PAH's were encountered on site above the relevant tier 1 thresholds.

The observed concentrations of PAH's could present a risk of harm to the proposed end user by risk of direct contact and ingestion. Various PAH's were recorded at elevated concentrations in BH02 at 0.30m bgl, BH03 at 0.30m and 0.50m bgl, and WS04 at 0.30m and 0.50m bgl.

Due to the relatively widespread occurrences of PAH's it is recommended that 300mm of 'clean and inert cover' is provided to soft landscaped areas to break the source-pathway-receptor linkage. Building construction and hard standing / car parking will be sufficient to break pathways.

The majority of the significantly elevated samples are located around the existing school buildings. This is likely to be associated with tarmac and ash in this area.

Asbestos (Chrysotile) was encountered at detectable limits within the shallow made ground soils at a number location across the holes, located in BH01 0.3m bgl, BH02 0.30m bgl, BH03 0.30m bgl and WS05 0.30m bgl. In two locations within the woods Asbestos (Chrysotile and Amosite) was encountered at detectable limits within the shallow made ground soils in (Chrysotile HP02 0.3m and Amosite HP14 0.10m bgl). These are considered to be localised hotspots and not considered to be a site wide issue.

This asbestos contamination was delineated to further assess the risk to end users.

It is recommended that any impacted material should be either encapsulated on site by building construction or hard standing, or removed from site to a suitably licensed disposal facility. Depending on the outcome of the delineation exercise a limited picking operation may be undertaken to remove the risk.

Quantification of the asbestos has been undertaken and the analysis results will be concluded in an addendum to this report.

Although there would not appear to be a significant risk to future development there is nevertheless asbestos fibres in certain locations. These will need to be adequately managed during construction and the presence recorded in the development Health and Safety File.

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

Further WAC environmental analysis of the shallow soils encountered during the redevelopment of the site will need to be carried out to classify the material as clean and inert or hazardous if the material is to be taken off site.

Groundwater was not recorded in any of the exploratory holes formed during this investigation.

The majority of the natural material is clean, however contamination is evident in WS04 at 0.50m bgl. The contamination present in this location is possibly a result of tarmac and ash found in the borehole logs or oil leak from parked vehicles in the area. We would recommend that this area is delineated and further testing undertaken to accurately assess the risk to groundwater.

The results will be issued as an addendum to this report.

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

Standpipe installations were incorporated in WS03, WS07, WS09 and WS11 as detailed in the borehole records.



Gas monitoring has been undertaken across the site on two occasions. Barometric pressure has been recorded at between 1003mb and 1010mb during the visits.

No flow has been recorded to date, a maximum of 6.9% CO<sub>2</sub> was recorded in WS03. No methane CH<sub>4</sub> 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 CS2 regime requiring 3 points of gas protection measures for public buildings.

Elevated concentrations of PAH contamination with respect to the protection of water supply pipes were determined within the Topsoil/Made Ground. Therefore, it is recommended that appropriate materials for water supply pipes would comprise Barrier Pipes (PE/AL/PE). The exact requirements are to be confirmed with the relevant utility supplier.

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.

## 9.5 Conclusions

As can be seen from the revised Conceptual Site Model in Appendix A7, the site investigation has highlighted that the risk posed to controlled waters is **Moderate** for groundwater, however the surface water has been reduced to **Moderate / Low**.

The risk to site users is still classed as **Moderate** but this can be mitigated by the measures presented within this report. These should be expanded upon within a site specific Remediation Strategy following the recommended delineation works.

Gas monitoring completed to date shows the risk posed to the site end user from ground gases is **High**. This will be reassessed following the completion of the gas monitoring regime.

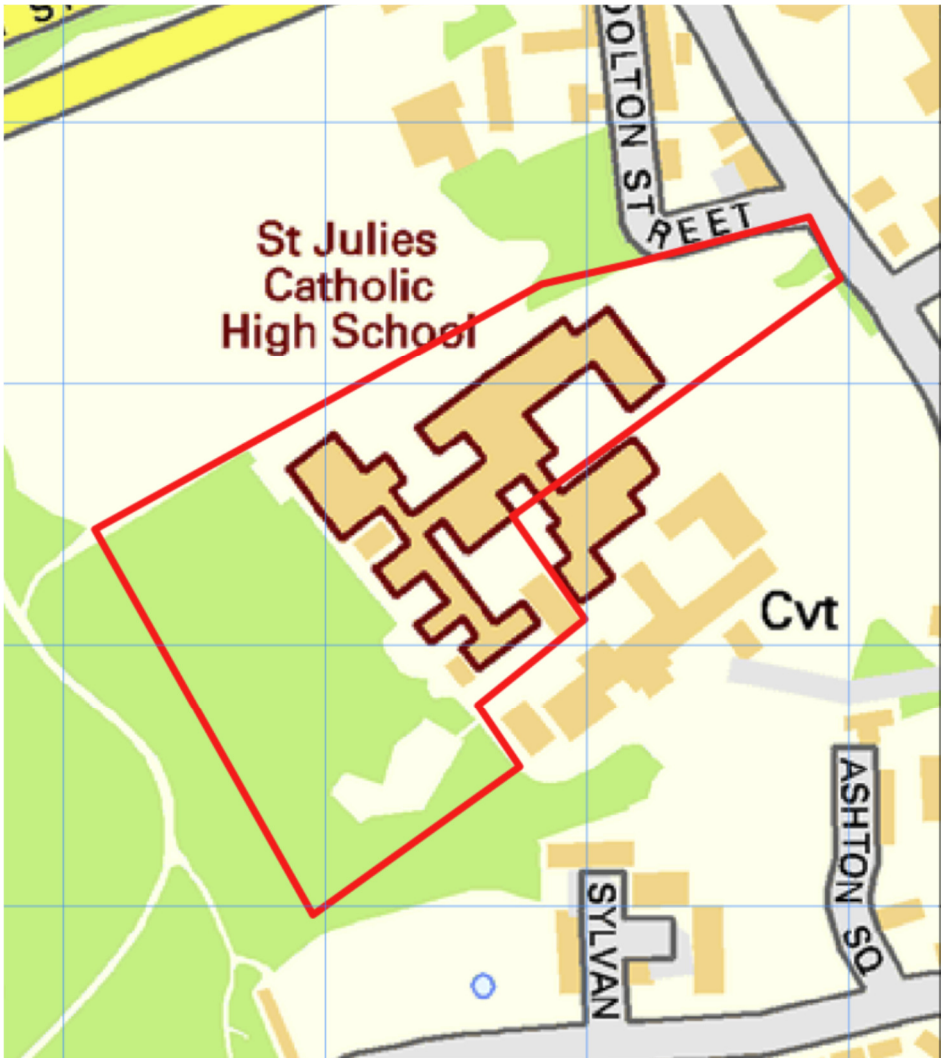
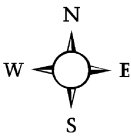
It should be noted that due to the risk for UXO's all intrusive should be undertaken with necessary precautions.

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




## **Appendix A1- Site Plans**

Site Location Plan



Crown copyright. Licence Number 100020245

Key

 Approximate site boundary

<b>Project</b>
St Julies Catholic High School, Woolton
<b>Drawing Title</b>
Site Location Plan

<b>Job Reference</b>
EB1441A
<b>Date</b>
18.12.2014

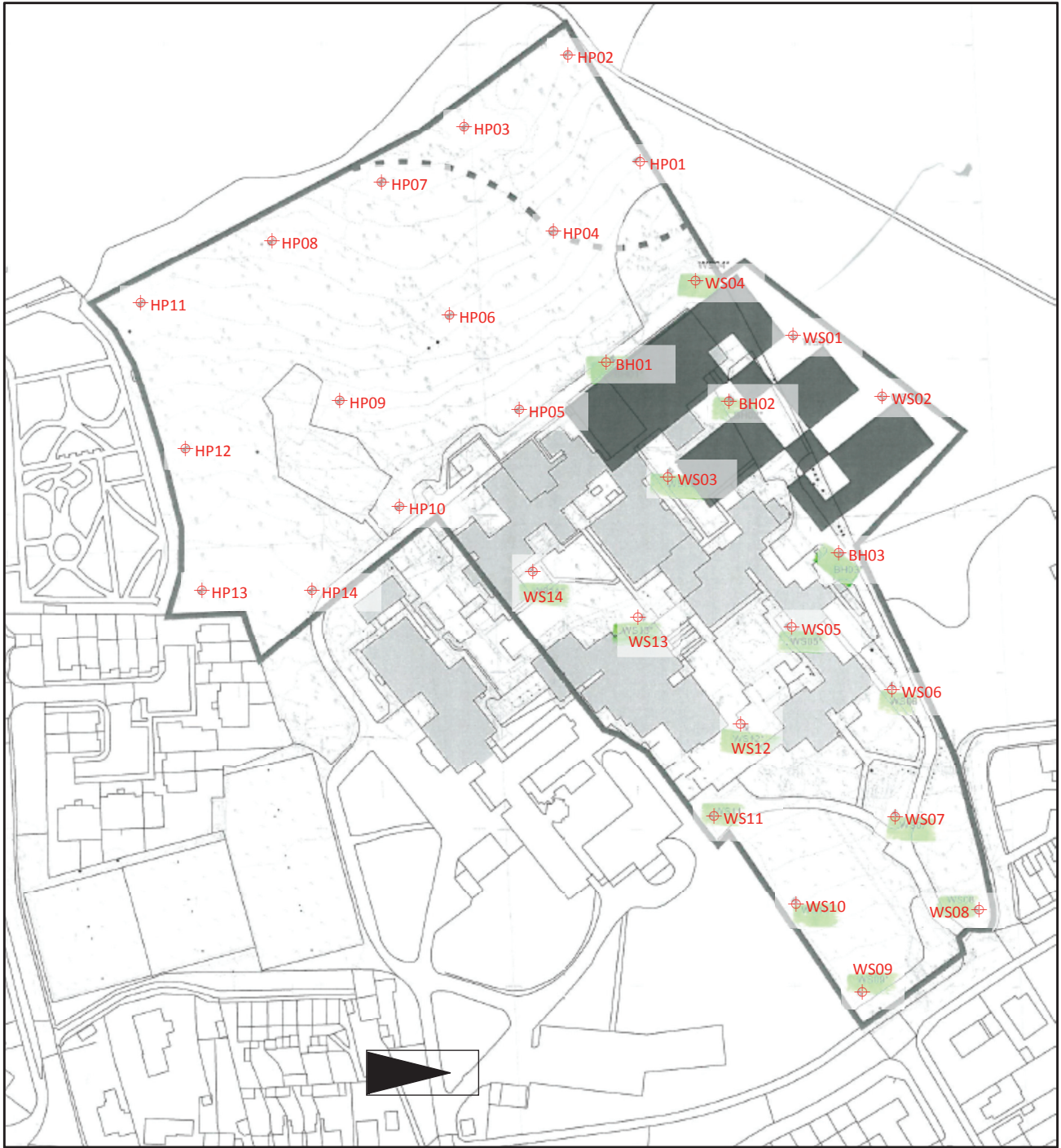
<b>Author</b>
GL
<b>Checked</b>
DM




Merchant Exchange,  
17-19 Merchant Exchange  
Manchester  
M15WG

Tel: 0161 236 2394

## **Appendix A2 – Exploratory Hole Location Plan**



PROJECT: 41558 St Julies School	
FIGURE No. A1.2.	SCALE: Not to scale
TITLE: Exploratory Hole Location Plan	
 <b>IAN FARMER ASSOCIATES</b> <small>Geotechnical &amp; Environmental Specialists</small>	

## **Appendix A3 – Exploratory Hole Logs**



**IAN FARMER  
ASSOCIATES**

**Site**

St. Julies School. Liverpool

**Borehole  
Number**

**BH01**

**Boring Method**

Cable Percussion

**Casing Diameter**

**Ground Level (mOD)**

**Client**

Curtins Consulting

**Job  
Number**

41558

**Location**

**Dates**

29/10/2014

**Engineer**

Curtins Consulting

**Sheet**

1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	B5					(0.10) (0.10) (0.20) 0.30	MADE GROUND: TARAMCADAM. MADE GROUND: Grey, SAND and GRAVEL. At 0.30m: Sandstone. Complete at 0.30m		
0.20	D1								
0.30	D2								
0.30	D4								
0.30	J3								

**Remarks**

Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
End of hole at 0.30m: Refusal on sandstone.  
Excavating from 0.00m to 1.20m for 1.00 hour.

**Scale  
(approx)**

1:40

**Logged  
By**

JC

**Figure No.**

41558.BH01



**IAN FARMER  
ASSOCIATES**

**Site**

St. Julies School. Liverpool

**Borehole  
Number  
BH02**

**Boring Method**

Cable Percussion

**Casing Diameter**

**Ground Level (mOD)**

**Client**

Curtins Consulting

**Job  
Number  
41558**

**Location**

**Dates**

29/10/2014

**Engineer**

Curtins Consulting

**Sheet  
1/1**

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	B4					(0.10)	MADE GROUND: TARMACADAM.		
0.20	D1					(0.30)	MADE GROUND: Grey, SAND and GRAVEL. Coarse		
0.30	D2					(0.40)	SAND. Gravel is angular to subrounded, fine to coarse		
0.30	J3					(0.50)	including sandstone.		
0.40	D5					(0.38)	Weathered sandstone recovered as very, sandy, slightly		
0.50	D6					0.88	gravelly CLAY. Gravel is angular to subrounded, fine to		
0.50	J7						coarse including sandstone.		
0.70	D8						SANDSTONE recovered as sandy gravel. Gravel is		
							angular, fine to coarse of sandstone.		
							Complete at 0.88m		

**Remarks**

Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
Falling heal test.  
Excavating from 0.00m to 1.20m for 0.00 hours.

**Scale  
(approx)**

1:40

**Logged  
By**

JC

**Figure No.**

41558.BH02



**IAN FARMER  
ASSOCIATES**

**Site**

St. Julies School. Liverpool

**Borehole  
Number**

**BH03**

**Boring Method**

Cable Percussion

**Casing Diameter**

**Ground Level (mOD)**

**Client**

Curtins Consulting

**Job  
Number**

41558

**Location**

**Dates**





29/10/2014

**Engineer**

Curtins Consulting

**Sheet**

1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D1					(0.10)	MADE GROUND: TARMACADAM.		
0.30	D2					(0.25)	MADE GROUND: Grey, SAND and GRAVEL. Sand is coarse. Gravel is angular to subrounded, fine to coarse including concrete.		
0.30	J3					(0.35)			
0.40	D4					(0.15)			
0.50	D5					0.50	Red brown, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.		
0.50	J6					(0.25)			
0.60	D7					0.75	SANDSTONE recovered as red brown, slightly sandy gravel. Gravel is angular, fine to coarse including sandstone.		
							Complete at 0.75m		

**Remarks**

Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
Falling heal test.  
Excavating from 0.00m to 1.20m for 1.00 hour.

**Scale  
(approx)**

1:40

**Logged  
By**

JC

**Figure No.**

41558.BH03





Site	Number
St. Julies School. Liverpool	WS01

Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client	Job Number
	Location	Dates 27/10/2014	Engineer	Sheet
			Curtins Consulting	41558
			Curtins Consulting	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B6					Grass over, brown, clayey, sandy, slightly gravelly TOPSOIL. Gravel is angular and rounded, fine and coarse including sandstone.		
0.20	D1				(0.50)			
0.30	D2							
0.30	D4				0.50			
0.30	J3							
0.30	J5				(0.40)	Light brown, clayey, slightly gravelly SAND. Gravel is angular to rounded, fine to coarse including sandstone and mudstone. (Weathered sandstone)		
0.50	D7							
0.50	D9				0.90			
0.50	J10							
0.50	J8							
0.50-1.20	B16					Red brown, slightly clayey, gravelly, coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone. (Weathered sandstone)		
0.80	D11							
1.00	D12							
1.00	D14				(1.40)			
1.00	J13							
1.00	J15							
1.20-1.65	D17							
1.30	D18							
1.80	D19							
2.20-3.00	D20				2.30	At 2.30m: Refusal on sandstone.		
						Complete at 2.30m		

Remarks Samples marked as D & J comprise of 1 x amber jar and 1 x vial. Excavating from 0.00m to 1.20m for 1.0 hour.	Scale (approx)	Logged By
	1:40	JC
	Figure No. 41558.WS01	



<b>Excavation Method</b> Drive-in Window Sampler	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Curtins Consulting	<b>Job Number</b> 41558
	<b>Location</b>	<b>Dates</b> 27/10/2014	<b>Engineer</b> Curtins Consulting	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B6					Grass over, brown, clayey, sandy, slightly gravelly, TOPSOIL. Gravel is angular to rounded, fine to coarse including sandstone.		
0.20	D1				(0.50)			
0.30	D2							
0.30	D4				0.50			
0.30	J3							
0.30	J5				(0.40)	Light brown, clayey, slightly gravelly SAND. Gravel is angular to rounded, fine to coarse including sandstone.		
0.50	D7							
0.50	D9				0.90			
0.50	J10							
0.50	J8							
0.50-1.00	D15				(0.80)	Red brown, slightly clayey, gravelly, coarse SAND. Gravel is angular and subrounded, fine and coarse including sandstone. (Weathered sandstone)		
0.80	D11							
1.00	D12							
1.00	D14							
1.00	J13							
1.20-1.65	D16				1.70			
1.30	D17							
1.50	D18					At 1.70m: Refusal on sandstone.		
1.60-1.70	D19					Complete at 1.70m		

<b>Remarks</b> Excavating from 0.00m to 1.20m for 1.00 hour.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	JC
	<b>Figure No.</b> 41558.WS02	



<b>Site</b> St. Julies School. Liverpool						<b>Number</b> <b>WS03</b>			
<b>Excavation Method</b> Drive-in Window Sampler		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> Curtins Consulting		<b>Job Number</b> 41558	
		<b>Location</b>		<b>Dates</b> 27/10/2014		<b>Engineer</b> Curtins Consulting		<b>Sheet</b> 1/1	
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Water Depth (m)</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>	<b>Legend</b>	<b>Water</b>	
0.00-0.80	B9				(0.20)	MADE GROUND: Grass over black, slightly clayey, sandy, slightly gravelly TOPSOIL with rootlets. Gravel is angular to subrounded, fine to coarse including ash, brick, wood and plastic.			
0.20	D1				0.20				
0.30	D2								
0.30	J3				(0.60)	MADE GROUND: Black, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular, fine to coarse.			
0.50	D4								
0.50	J5								
0.80	D6				0.80	Light brown, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular to rounded, fine to coarse including sandstone.			
1.00	D7								
1.00	J8				(0.70)				
1.20-1.65	D10								
1.30	D11								
1.50	D12				1.50	Red brown, gravelly, coarse SAND. Gravel is angular, fine to coarse of sandstone (Weathered sandstone)			
1.50	J13				(0.30)				
1.70-1.80	D14				1.80	Complete at 1.80m			
<b>Remarks</b> Excavating from 0.00m to 1.20m for 1.00 hour.						<b>Scale (approx)</b> 1:40		<b>Logged By</b> JC	
						<b>Figure No.</b> 41558.WS03			



**IAN FARMER  
ASSOCIATES**

**Site**

St. Julies School. Liverpool

**Number  
WS04**

**Excavation Method**

JCB 3CX

**Dimensions**

**Ground Level (mOD)**

**Client**

Curtins Consulting

**Job  
Number  
41558**

**Location**



**Dates**

27/10/2014

**Engineer**

Curtins Consulting

**Sheet  
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20 0.30 0.30 0.30 0.50 0.50 0.50	D1 D2 D4 J3 D5 D7 J6				(0.35) 0.35 (0.15) 0.50	MADE GROUND: Black, slightly clayey, gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including brick, concrete and ash.  Red brown, slightly gravelly, coarse SAND. Gravel is angular, fine to coarse including red sandstone (Weathered sandstone).  Complete at 0.50m	 	

**Remarks**

**Scale  
(approx)**

1:40

**Logged  
By**

JC

**Figure No.**

41558.WS04



Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client Curtins Consulting	Job Number 41558
	Location	Dates 28/10/2014	Engineer Curtins Consulting	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20 0.30 0.30 0.40 0.50 0.50	D1 D2 J3 D4 D5 J6				(0.10) (0.10) (0.20) (0.30) (0.20) 0.50	MADE GROUND: TARMACADAM.  MADE GROUND: Dark brown, clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including brick and sandstone.  Red brown, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular, fine to coarse including sandstone.  Complete at 0.50m	  	

<b>Remarks</b> Samples marked as D & J comprise of 1 x amber jar and 1 x vial. At 0.5m: End of hole. Excavating from 0.00m to 1.20m for 1.00 hour.	Scale (approx)	Logged By
	1:40	JC
	Figure No. 41558.WS05	



**IAN FARMER  
ASSOCIATES**

**Site**

St. Julies School. Liverpool

**Number  
WS06**

**Excavation Method**

JCB 3CX

**Dimensions**

**Ground Level (mOD)**

**Client**

Curtins Consulting

**Job  
Number  
41558**

**Location**

**Dates**

28/10/2014

**Engineer**

Curtins Consulting

**Sheet  
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.10	B9				(0.20)	MADE GROUND: Grass over brown, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine and coarse including brick, sandstone with roots and rootlets.		
0.20	D1				0.20			
0.30	D2							
0.30	J3							
0.50	D4							
0.50	J5							
0.80	D6				(1.40)			
1.00	D7							
1.00	J8							
1.20-1.65	D10							
1.30	D11							
1.50	D12				1.60			
1.50	J13					Red brown, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular, fine and coarse including sandstone. (Weathered sandstone)		
1.80	D14				(0.70)			
2.00-2.30	D15				2.30			
						At 2.30m: Refusal on sandstone		
						Complete at 2.30m		

**Remarks**

Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
Excavating from 0.00m to 1.20m for 1.00 hour.

**Scale  
(approx)**

1:40

**Logged  
By**

JC

**Figure No.**

41558.WS06



**IAN FARMER  
ASSOCIATES**

**Site**

St. Julies School. Liverpool

**Number  
WS07**

**Excavation Method**

Drive-in Window Sampler

**Dimensions**

**Ground Level (mOD)**

**Client**

Curtins Consulting

**Job  
Number  
41558**

**Location**

**Dates**

29/10/2014

**Engineer**

Curtins Consulting

**Sheet  
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D1				(0.30)	MADE GROUND: Black, slightly clayey, sandy, slightly gravelly TOPSOIL. Gravel is angular o subrounded, fine to coarse including brick and sandstone.		
0.30	D2				0.30			
0.30	J3							
0.30-1.20	B9					MADE GROUND: Brown, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and birch.		
0.50	D4				(1.20)			
0.50	J5							
0.80	D6							
1.00	D7							
1.00	J8							
1.20-1.65	SPT N=8		1,2/2,2,2,2		1.50	Red brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.		
1.30	D10				(0.50)			
1.80	D11				2.00	Complete at 2.30m		
2.00-2.33	SPT 52/177		2,2/2,2,21,27					

**Remarks**

Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
At 2.30m: End of hole.  
Excavating from 0.00m to 1.20m for 1.00 hour.

**Scale  
(approx)**

1:50

**Logged  
By**

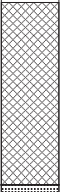
JC

**Figure No.**

41558.WS07



Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client Curtins Consulting	Job Number 41558
	Location	Dates 28/10/2014	Engineer Curtins Consulting	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.20	B9					MADE GROUND: Light brown, slightly clayey, slightly gravelly SAND. Gravel is angular to subrounded, fine to coarse including sandstone and brick.		
0.20 0.30 0.30 0.50 0.50 0.80 1.00 1.00 1.20-1.25	D1 D2 J3 D4 J5 D6 D7 J8 D10				(1.20)  1.20 1.25	SANDSTONE recovered as red brown, sandy, gravel. Gravel is angular, fine to coarse, of sandstone.  Complete at 1.25m		

Remarks	Scale (approx)	Logged By
	1:50	JC
	Figure No. 41558.WS08	









**IAN FARMER  
ASSOCIATES**

<b>Site</b> St. Julies School. Liverpool	<b>Number</b> <b>WS09</b>
<b>Excavation Method</b> Drive-in Window Sampler	<b>Client</b> Curtins Consulting
<b>Dimensions</b>	<b>Job Number</b> 41558
<b>Location</b>	<b>Engineer</b> Curtins Consulting
<b>Dates</b> 29/10/2014	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20 0.30 0.30 0.50 0.50	D1 D2 J3 D4 J5				(0.30) 0.30	MADE GROUND: Grass over, black, slightly clayey, sandy, slightly gravelly TOPSOIL. Gravel is angular to subrounded, fine to coarse including brick and rootlets.		
0.80	D6				(1.20)	Light, brown and orange, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone,		
1.00 1.00 1.20-1.56	D7 J8 SPT 50/205		1,1/2,21,27		1.50	1.50m: Refusal on sandstone Complete at 1.50m		

<b>Remarks</b> Samples marked as D & J comprise of 1 x amber jar and 1 x vial. At 1.50m: Refusal on sandstone.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	JC
	<b>Figure No.</b> 41558.WS09	

 <b>IAN FARMER ASSOCIATES</b>						<b>Site</b> St. Julies School. Liverpool		<b>Number</b> <b>WS10</b>	
<b>Excavation Method</b> Drive-in Window Sampler		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> Curtins Consulting		<b>Job Number</b> 41558	
		<b>Location</b>		<b>Dates</b> 29/10/2014		<b>Engineer</b> Curtins Consulting		<b>Sheet</b> 1/1	
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Water Depth (m)</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>		<b>Legend</b>	<b>Water</b>
0.20 0.30 0.30 0.50 0.50 0.50-1.20 0.80  1.00 1.00 1.20-1.44	D1 D2 J3 D4 J5 B9 D6  D7 J8 SPT 25*/125 50/115		8,17/24,26		(0.50)  0.50  (0.70)  1.20	MADE GROUND: Grass over, black, slightly clayey, sandy, slightly gravelly TOPSOIL. Gravel is angular to subrounded, fine to coarse including brick.  Red brown, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.  At 1.20m: Refusal on sandstone  Complete at 1.20m		  	
<b>Remarks</b> Samples marked as D & J comprise of 1 x amber jar and 1 x vial. Excavating from 0.00m to 1.20m for 1.00 hour.						<b>Scale (approx)</b> 1:40		<b>Logged By</b> JC	
						<b>Figure No.</b> 41558.WS10			



**IAN FARMER  
ASSOCIATES**

<b>Site</b> St. Julies School. Liverpool	<b>Number</b> <b>WS11</b>
<b>Excavation Method</b> JCB 3CX	<b>Client</b> Curtins Consulting
<b>Dimensions</b>	<b>Job Number</b> 41558
<b>Location</b>	<b>Engineer</b> Curtins Consulting
<b>Dates</b> 29/10/2014	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D1				(0.30)	MADE GROUND: Grass over black, slightly clayey, sandy, slightly gravelly TOPSOIL. Gravel is dense, angular to subrounded, fine to coarse including brick and rootlets.		
0.30	D2				0.30			
0.30	J3				(0.20)	MADE GROUND: Grey SAND and GRAVEL. Sand is coarse. Gravel is angular to subrounded, fine to coarse including concrete and ash.		
0.40	D4				0.50			
0.50	D5							
0.50	J6							
0.80	D7							
1.00	D8							
1.00	J9				(1.30)	Red brown, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.		
1.20-1.65	SPT N=2		1,0/0,1,0,1					
1.30	D10							
1.50	D11							
1.50	J12							
1.80-1.85	SPT 25*/20				1.80	At 1.80m: Refusal on sandstone		
1.80	50/25		25/50			Complete at 1.80m		
	D13							

#### Remarks

Samples marked as D & J comprise of 1 x anber jar and 1 x vial.

**Scale (approx)**  
1:40

**Logged By**  
JC

**Figure No.**  
41558.WS11



**IAN FARMER  
ASSOCIATES**

<b>Site</b> St. Julies School. Liverpool	<b>Number</b> <b>WS12</b>
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<b>Excavation Method</b> Drive-in Window Sampler	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Curtins Consulting	<b>Job Number</b> 41558
	<b>Location</b>	<b>Dates</b> 28/10/2014	<b>Engineer</b> Curtins Consulting	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	B4					MADE GROUND: Black, slightly clayey, gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including brick, concrete, ash.		
0.20	D1				(0.60)			
0.30	D2							
0.30	J3							
0.60-1.20	B8				0.60	Red brown, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular, fine to coarse including sandstone.		
0.80	D5				(0.75)			
1.00	D6							
1.00	J7							
1.20-1.65	D9				1.35	Yellow brown, clayey, slightly gravelly, coarse SAND. Gravel is angular, fine to coarse including sandstone.		
1.30	D10				(0.40)			
1.50	D11				1.75	SANDSTONE recovered as red brown, sandy gravel. Gravel is angular, fine to coarse of sandstone.		
1.50	J12				(0.45)			
1.80	D13							
2.00-2.20	D14				2.20	At 2.20m: Refusal on sandstone		
						Complete at 2.20m		

<b>Remarks</b> Samples marked as D & J comprise of 1 x amber jar and 1 x vial.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	JC
	<b>Figure No.</b> 41558.WS12	



St. Julies School, Liverpool

Number  
**WS13**

### Drive-in Window Sampler

### Dimensions

<b>Dates</b>	27/10/2014
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Curtins Consulting

**Job  
Number**  
41558

Curtins Consulting

Sheet  
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.85	B7				(0.10)	TARMACADAM over red, brown SAND.		
0.20	D1					MADE GROUND: Light brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including ash, brick, concrete with cobbles and boulders of concrete.		
0.30	D2							
0.30	J3				(0.75)			
0.50	D4							
0.50	J5							
0.80	D6				0.85	At 0.85: Refusal on concrete.		
						Complete at 0.85m		

**Remarks**  
Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
Spoke to Dan Mason, possibly relocate later in the week.

1:40

JC

41558.WS13



<b>Excavation Method</b> Drive-in Window Sampler	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Curtins Consulting	<b>Job Number</b> 41558
	<b>Location</b>	<b>Dates</b> 28/10/2014	<b>Engineer</b> Curtins Consulting	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20 0.30 0.40-1.20 0.50 0.50	D1 D2 B8 D3 J4				(0.40) 0.40	Grass over brown, clayey, sandy, slightly gravelly TOPSOIL. Gravel is angular to subrounded, fine to coarse including birch and sandstone.		
0.80 1.00 1.00 1.20-1.30	D5 D6 J7 D9				(0.90) 1.30	Red brown slightly clayey, slightly gravelly, coarse SAND. Gravel is angular, fine to coarse of sandstone.		
						At 1.30m: Refusal on sandstone.		
						Complete at 1.30m		

<b>Remarks</b> Excavating from 0.00m to 1.20m for 1.00 hour.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	JC
	<b>Figure No.</b> 41558.WS14	



**IAN FARMER  
ASSOCIATES**

**Site**

St. Julies School. Liverpool

**Trial Pit  
Number**

**HP01**

**Excavation Method**

Hand excavated

**Dimensions**

**Ground Level (mOD)**

**Client**

Curtins Consulting

**Job  
Number**

41558

**Location**

**Dates**


29/10/2014

**Engineer**

Curtins Consulting

**Sheet**

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20 0.30 0.30	D1 D2 J3				(0.50)  0.50	Brown, slightly clayey, slightly gravelly, fine to coarse SAND and rootlets. Gravel is angular to subrounded, fine to coarse including sandstone.  Complete at 0.50m		

**Plan**

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**Remarks**

At 0.50m: Refusal on sandstone.

**Scale (approx)**

1:40

**Logged By**

JC

**Figure No.**

41558.HP01



St. Julies School, Liverpool

**Trial Pit  
Number  
HP02**

Hand excavated.

Location

## Dates

29/10/2014

Curtins Consulting

Curtins Consulting

**Job  
Number**  
41558

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  
J2

(0.50)

0.50

Brown, slightly clayey, slightly gravelly, fine to coarse SAND and rootlets. Gravel is angular to subrounded, fine to coarse including sandstone.

Complete at 0.50m

### Plan

Remarks

Excavating from 0.00m to 1.20m for 1.00 hour.  
Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
At 0.5m: Refusal on sandstone.

Scale (approx)

1:40

Logged By

JC

Figure No.

41558.HP02





**IAN FARMER  
ASSOCIATES**

**Site**

St. Julies School. Liverpool

**Trial Pit  
Number**

**HP03**

**Excavation Method**

Hand excavation.

**Dimensions**

**Ground Level (mOD)**

**Client**

Curtins Consulting

**Job  
Number**

41558

**Location**

**Dates**


29/10/2014-  
29/11/2014

**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 J2				(0.40) 0.40	Brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone and quartz.  Complete at 0.40m		

**Plan**

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**Remarks**

At 0.40m: Refusal on sandstone.

**Scale (approx)**




1:40

**Logged By**

JC


**Figure No.**

41558.HP03



 <b>IAN FARMER ASSOCIATES</b>						<b>Site</b> St. Julies School. Liverpool		<b>Trial Pit Number</b> <b>HP04</b>																																																													
<b>Excavation Method</b> Hand excavated.		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> Curtins Consulting		<b>Job Number</b> 41558																																																													
		<b>Location</b>		<b>Dates</b> 29/10/2014		<b>Engineer</b> Curtins Consulting		<b>Sheet</b> 1/1																																																													
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Water Depth (m)</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>		<b>Legend</b>	<b>Water</b>																																																												
0.30 0.30 0.50 0.50	D1 J2 D3 J4				(0.30) 0.30 (0.30) 0.60	MADE GROUND: Brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone and brick. Light brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone. Complete at 0.60m		 																																																													
<b>Plan</b> <table border="1"> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> </table>						.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	<b>Remarks</b> Samples marked as D & J comprise of 1 x amber jar and 1 x vial. At 0.60m: Refusal on sandstone.			
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						<b>Scale (approx)</b> 1:40		<b>Logged By</b> JC	<b>Figure No.</b> 41558.HP04																																																												




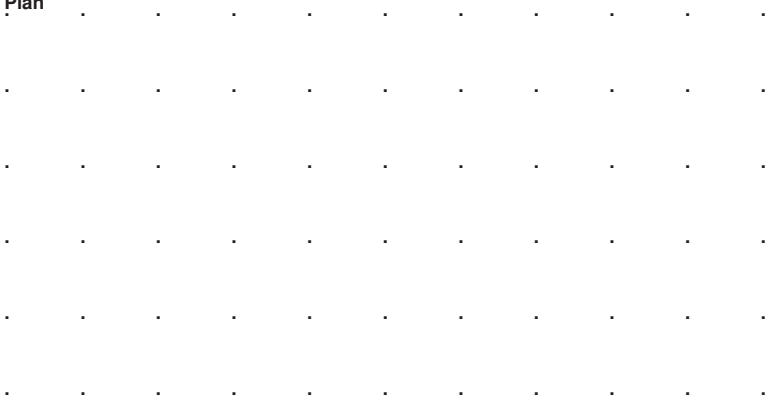





Excavation Method Hand excavation.	Dimensions		Ground Level (mOD)	Client Curtins Consulting	Job Number 41558
	Location		Dates 30/10/2014	Engineer Curtins Consulting	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30 0.30	D1 J2				(0.50) 0.50	MADE GROUND: Firm and stiff, brown, sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, glass and plastic.  Complete at 0.50m		

Plan . . . . . .	Remarks  Samples marked as D & J comprise of 1 x amber jar and 1 x vial. At 0.50m: Refusal on sandstone.									
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Scale (approx) 1:40							Logged By JC	Figure No. 41558.HP05		

 <b>IAN FARMER ASSOCIATES</b>						<b>Site</b> St. Julies School. Liverpool		<b>Trial Pit Number</b> <b>HP06</b>																																																													
<b>Excavation Method</b> Hand excavation.		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> Curtins Consulting		<b>Job Number</b> 41558																																																													
		<b>Location</b>		<b>Dates</b> 30/10/2014		<b>Engineer</b> Curtins Consulting		<b>Sheet</b> 1/1																																																													
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Water Depth (m)</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>		<b>Legend</b>	<b>Water</b>																																																												
0.30 0.30	D1 J2				<div style="display: flex; align-items: center;"> <div style="width: 100px; border-left: 1px solid black; margin-right: 5px;"></div> <div style="text-align: right;">(0.40) 0.40</div> </div>	Brown, slightly clayey, slightly gravelly, fine to coarse SAND with rootlets. Gravel is angular to subrounded, fine to coarse including sandstone.																																																															
						Complete at 0.40m																																																															
<b>Plan</b> <table border="1" style="width: 100%; height: 150px;"> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> </table>						.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	<b>Remarks</b> Excavating from 0.00m to 1.20m for 1.00 hour. samples marked as D & J .comprise of 1 x amber jar and 1 x vial. At 0.40m: Refusal on sandstone.			
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<b>Scale (approx)</b> 1:40		<b>Logged By</b> JC		<b>Figure No.</b> 41558.HP06																																																																	

 <b>IAN FARMER ASSOCIATES</b>						<b>Site</b> St. Julies School. Liverpool		<b>Trial Pit Number</b> <b>HP07</b>	
<b>Excavation Method</b> Hand excavation.		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> Curtins Consulting		<b>Job Number</b> 41558	
		<b>Location</b>		<b>Dates</b> 30/10/2014		<b>Engineer</b> Curtins Consulting		<b>Sheet</b> 1/1	
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Water Depth (m)</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>		<b>Legend</b>	<b>Water</b>
0.20 0.20	D1 J2				(0.30) 0.30 	Brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone and rootlets. Complete at 0.30m			
<b>Plan</b> 						<b>Remarks</b> Excavating from 0.00m to 1.20m for 1.00 hour. Samples marked as D & J comprise of 1 x amber jar and 1 x vial. At 0.30m: Refusal on sandstone.			
						<b>Scale (approx)</b> 1:40		<b>Logged By</b> JC	

 <b>IAN FARMER ASSOCIATES</b>						<b>Site</b> St. Julies School. Liverpool		<b>Trial Pit Number</b> <b>HP08</b>																																																													
<b>Excavation Method</b> Hnad excavated.		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> Curtins Consulting		<b>Job Number</b> 41558																																																													
		<b>Location</b>		<b>Dates</b> 30/10/2014		<b>Engineer</b> Curtins Consulting		<b>Sheet</b> 1/1																																																													
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Water Depth (m)</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>	<b>Legend</b>	<b>Water</b>																																																													
0.20 0.20 0.40 0.40	D1 J2 D3 J4				(0.30) 0.30 (0.20) 0.50	Dark brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone with rootlets. Orange/light brown, slightly clayey, slightly gravelly, fine to coarse SAND with rootlets. Gravel is angular to subrounded, fine to coarse including sandstone. Complete at 0.50m	 																																																														
<b>Plan</b> <table border="1"> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> <tr><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td><td>.</td></tr> </table>						.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	<b>Remarks</b> Excavating from 0.00m to 1.20m for 1.00 hour. Samples marked as D & J comprise of 1 x amber jar and 1 a vial. At 0.50m Refusal on sandstone.			
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						<b>Scale (approx)</b> 1:40	<b>Logged By</b> JC	<b>Figure No.</b> 41558.HP08																																																													



St. Julies School, Liverpool

**Trial Pit Number**  
**HP09**

Hand excavated.

Location

## Dates

30/10/2014

Curtins Consulting

Curtins Consulting

**Job Number**  
41558

Sheet  
1/1

Depth  
(m)

### Sample / Tests

Water  
Depth  
(m)

## Field Records

Level  
(mOD)Depth  
(m)  
(Thickness)

### Description

### Legend

Water

0.20
0.20
0.50

D1  
J2  
D3

(0.20)  
0.20  
(0.60)  
0.80

Dark brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.

Light brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.

Complete at 0.80m

## Plan

Remarks

Excavating from 0.00m to 1.20m for 1.00 hour.  
Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
At 0.80m: Refusal on sandstone.

Scale (approx)


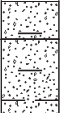
1:40

Logged By

JC

Figure No.

41558.HP09

 <b>IAN FARMER ASSOCIATES</b>						<b>Site</b> St. Julies School. Liverpool		<b>Trial Pit Number</b> <b>HP10</b>	
<b>Excavation Method</b> Hand excavation		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> Curtins Consulting		<b>Job Number</b> 41558	
		<b>Location</b>		<b>Dates</b> 30/10/2014		<b>Engineer</b> Curtins Consulting		<b>Sheet</b> 1/1	
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Water Depth (m)</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>	<b>Legend</b>	<b>Water</b>	
0.10 0.10	D1 J2				<div style="display: flex; align-items: center;"> <div style="width: 10px; height: 10px; border: 1px solid black; margin-right: 5px;"></div> <div>           (0.20) 0.20  (0.40) 0.60         </div> </div>	Brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.  Orange, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular to angular.  Complete at 0.60m			
<b>Plan</b> <div style="display: grid; grid-template-columns: repeat(10, 1fr); gap: 5px;"> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> <div><div></div></div> </div>						<b>Remarks</b>  Samples marked as D & J comprise of 1 x amber jar and 1 x vial. At 0.60m: Refusal on sandstone.			
						<b>Scale (approx)</b> 1:40	<b>Logged By</b> JC	<b>Figure No.</b> 41558.HP10	





St. Julies School, Liverpool

**Trial Pit  
Number**  
**HP11**

Hand excavation.

Location

## Dates

30/10/2014

Curtins Consulting

Curtins Consulting

**Job Number**  
41558

1/1

Depth  
(m)

### Sample / Tests

Water  
Depth  
(m)

## Field Records

Level  
(mOD)Depth  
(m)  
(Thickness)

### Description

### Legend

Water

Light brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.

Complete at 0.40m

(0.40)

0.40

## Plan

Remarks

Excavating from 0.00m to 1.20m for 1.00 hour.  
Samples marked as D & J comprise of 1 x amber jar and 1 x vial.  
At 0.40m: Refusal on sandstone.

Scale (approx)



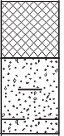
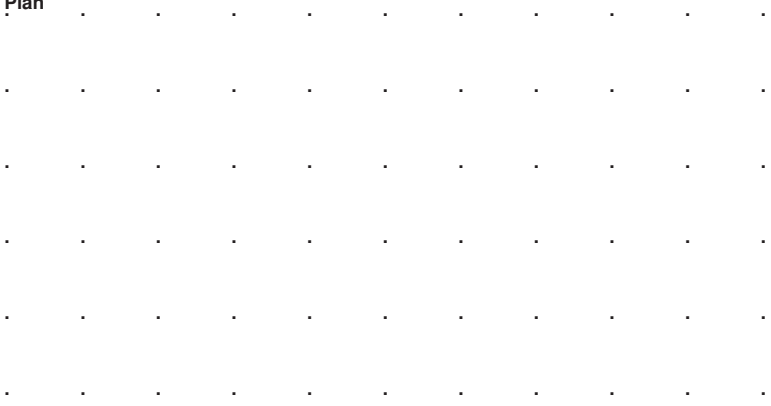
1:40

Logged By

JC



Figure No.

41558.HP11

 <b>IAN FARMER ASSOCIATES</b>						<b>Site</b> St. Julies School. Liverpool		<b>Trial Pit Number</b> <b>HP12</b>	
<b>Excavation Method</b> Hand excavation.		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> Curtins Consulting		<b>Job Number</b> 41558	
		<b>Location</b>		<b>Dates</b> 30/10/2014		<b>Engineer</b> Curtins Consulting		<b>Sheet</b> 1/1	
<b>Depth (m)</b>	<b>Sample / Tests</b>	<b>Water Depth (m)</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>		<b>Legend</b>	<b>Water</b>
0.20 0.20 0.50 0.50	D1 J2 D3 J4					MADE GROUND: Brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone, brick and charcoal. Red, slightly clayey, slightly gravelly, coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone. Complete at 0.70m			
<b>Plan</b> 						<b>Remarks</b> Samples marked as D & J comprise of 1 x amber jar and 1 x vial. At 0.70m: Refusal on sandstone.			
						<b>Scale (approx)</b> 1:40		<b>Logged By</b> JC	
						<b>Figure No.</b> 41558.HP12			



Excavation Method Hand excavation.	Dimensions	Ground Level (mOD)	Client Curtins Consulting	Job Number 41558
	Location	Dates 30/10/2014	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 0.50 0.50	D1 J2 D3 J4				(0.30) 0.30 (0.40) 0.70	MADE GROUND: Brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including brick, sandstone, ceramic, slate and brick cobbles.  Orange, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse of sandstone.  Complete at 0.70m	 	

Plan . . . . . .	Remarks Samples marked as D & J comprise of 1 x amber jar and 1 x vial.									
	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.
Scale (approx) 1:40							Logged By JC	Figure No. 41558.HP13		



St. Julies School, Liverpool

**Trial Pit  
Number**  
**HP14**

Hand excavation.

Location

## Dates

30/10/2014

Curtins Consulting

Curtins Consulting

**Job Number**  
41558

Sheet  
1/1

Depth  
(m)

### Sample / Tests

Water  
Depth  
(m)

## Field Records

Level  
(mOD)Depth  
(m)  
(Thickness)

### Description

### Legend

## Water

0.10	0.10
0.40	0.40

D1  
J2

D3  
J4

(0.20)  
0.20  
(0.30)  
0.50

Brown, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone and rootlets.

Light, brown/orange, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel is angular to subrounded, fine to coarse including sandstone.

Complete at 0.50m

### Plan

Remarks

Samples marked as D & J comprise of 1 x amber jar and 1 x vial.

Scale (approx)

1:40

Logged By

JC

Figure No.

41558.HP14

## **Appendix A4 – Chemical and Geotechnical Laboratory Testing Results**

# Scientific Analysis Laboratories Ltd

## Certificate of Analysis

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

Scientific Analysis Laboratories is a  
limited company registered in England and  
Wales (No 2514788) whose address is at  
Hadfield House, Hadfield Street, Manchester M16 9FE

**Report Number:** 435648-1

**Date of Report:** 21-Nov-2014

**Customer:** Curtins Consulting Ltd.  
10 Oxford Court  
Bishopsgate  
Manchester  
M2 3WQ

**Customer Contact:** Ms Gemma Lownsbrough

**Customer Job Reference:** EB1441/GL/4140

**Customer Purchase Order:** EB1008

**Customer Site Reference:** St Julies, Liverpool

**Date Job Received at SAL:** 31-Oct-2014

**Date Analysis Started:** 12-Nov-2014

**Date Analysis Completed:** 21-Nov-2014

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 QP22



Report checked  
and authorised by :  
Mr Ross Walker  
Customer Services Manager  
(Land)

Issued by :  
Mr Ross Walker  
Customer Services Manager  
(Land)



<b>SAL Reference:</b> 435648 <b>Project Site:</b> St Julies, Liverpool <b>Customer Reference:</b> EB1441/GL/4140	
<b>Soil</b>	Analysed as Soil
<b>MCERTS Preparation</b>	

SAL Reference					435648 001	435648 002	435648 003	435648 004	435648 005	435648 006	435648 007	435648 008	435648 009	435648 010
Customer Sample Reference					BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02	WS02	WS03
Date Sampled					29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	27-OCT- 2014
Depth					0.30	0.30	0.50	0.30	0.50	0.30	0.50	0.30	0.50	0.30
Type					Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Sandy Soil	Topsoil	Topsoil	Sandy Soil

Determinand	Method	Test Sample	LOD	Units										
Moisture @ 105 C	T162	AR	0.1	%	2.8	7.2	12	3.9	8.9	14	14	18	14	18

<b>SAL Reference:</b> 435648 <b>Project Site:</b> St Julies, Liverpool <b>Customer Reference:</b> EB1441/GL/4140	
<b>Soil</b>	Analysed as Soil
<b>MCERTS Preparation</b>	

SAL Reference					435648 011	435648 012	435648 013	435648 014	435648 015	435648 016	435648 017	435648 018	435648 019	435648 020
Customer Sample Reference					WS03	WS04	WS04	WS05	WS05	WS06	WS06	WS07	WS07	WS08
Date Sampled					27-OCT- 2014	27-OCT- 2014	27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	28-OCT- 2014
Depth					1.00	0.30	0.50	0.30	0.50	0.30	1.00	0.30	1.00	0.30
Type					Topsoil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
Moisture @ 105 C	T162	AR	0.1	%	14	5.4	12	11	9.1	12	8.8	13	9.8	9.0

<b>SAL Reference:</b> 435648 <b>Project Site:</b> St Julies, Liverpool <b>Customer Reference:</b> EB1441/GL/4140	
<b>Soil</b>	Analysed as Soil
<b>MCERTS Preparation</b>	

SAL Reference					435648 021	435648 022	435648 023	435648 024	435648 025	435648 026	435648 027	435648 028	435648 029	435648 030
Customer Sample Reference					WS08	WS09	WS09	WS10	WS10	WS11	WS11	WS12	WS12	WS13
Date Sampled					28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	28-OCT- 2014	28-OCT- 2014	27-OCT- 2014
Depth					1.00	0.30	1.00	0.30	1.00	0.30	1.00	0.30	1.00	0.30
Type					Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil	Sandy Soil	Topsoil	Sandy Soil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units										
Moisture @ 105 C	T162	AR	0.1	%	9.0	17	10	13	6.3	20	18	9.0	10	13

<b>SAL Reference:</b> 435648 <b>Project Site:</b> St Julies, Liverpool <b>Customer Reference:</b> EB1441/GL/4140	
<b>Soil</b>	Analysed as Soil
<b>MCERTS Preparation</b>	

SAL Reference					435648 031	435648 032	435648 033	435648 034	435648 035	435648 036	435648 037	435648 038	435648 039	435648 040
Customer Sample Reference					WS13	WS14	WS14	HP01	HP02	HP03	HP04	HP05	HP06	HP07
Date Sampled					27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014
Depth					0.50	0.50	1.00	0.30	0.30	0.30	0.30	0.30	0.30	0.20
Type					Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
Moisture @ 105 C	T162	AR	0.1	%	14	13	12	7.9	14	8.3	17	23	26	13

<b>SAL Reference:</b> 435648 <b>Project Site:</b> St Julies, Liverpool <b>Customer Reference:</b> EB1441/GL/4140										
<b>Soil</b> Analysed as Soil <b>MCERTS Preparation</b>										
SAL Reference					435648 041	435648 042	435648 043	435648 044	435648 045	435648 046
Customer Sample Reference					HP08	HP09	HP10	HP12	HP13	HP14
Date Sampled					29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014
Depth					0.20	0.20	0.10	0.20	0.30	0.10
Type					Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units						
Moisture @ 105 C	T162	AR	0.1	%	16	16	25	13	21	16

SAL Reference: 435648 Project Site: St Julies, Liverpool Customer Reference: EB1441/GL/4140														
Soil Metals		Analysed as Soil												
SAL Reference					435648 001	435648 002	435648 003	435648 004	435648 005	435648 006	435648 007	435648 008	435648 009	435648 010
Customer Sample Reference					BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02	WS02	WS03
Date Sampled					29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	27-OCT- 2014
Depth					0.30	0.30	0.50	0.30	0.50	0.30	0.50	0.30	0.50	0.30
Type					Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Sandy Soil	Topsoil	Topsoil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units										
Arsenic	T6	M40	2	mg/kg	7	6	6	4	5	12	5	10	4	8
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	11	13	23	9	15	21	22	18	15	15
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	29	16	14	12	10	32	12	25	10	25
Lead	T6	M40	1	mg/kg	160	110	25	270	66	86	13	80	18	62
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	14	14	20	8	20	23	16	18	10	13
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	95	42	35	47	31	64	34	56	25	55

SAL Reference: 435648 Project Site: St Julies, Liverpool Customer Reference: EB1441/GL/4140														
Soil Metals		Analysed as Soil												
SAL Reference					435648 011	435648 012	435648 013	435648 014	435648 015	435648 016	435648 017	435648 018	435648 019	435648 020
Customer Sample Reference					WS03	WS04	WS04	WS05	WS05	WS06	WS06	WS07	WS07	WS08
Date Sampled					27-OCT- 2014	27-OCT- 2014	27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	28-OCT- 2014
Depth					1.00	0.30	0.50	0.30	0.50	0.30	1.00	0.30	1.00	0.30
Type					Topsoil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
Arsenic	T6	M40	2	mg/kg	6	8	6	9	4	18	6	16	7	5
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	13	13	11	17	11	19	15	18	13	16
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	15	28	13	24	5	80	19	64	28	29
Lead	T6	M40	1	mg/kg	44	50	25	68	12	290	82	140	90	53
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	9	14	11	16	8	21	13	33	17	10
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	28	71	34	48	18	130	32	130	64	36



Analysed as Soil

Determinand	Method	Test Sample	LOD	Units										
Arsenic	T6	M40	2	mg/kg	4	19	5	13	4	11	5	9	4	6
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	12	17	16	16	13	13	12	16	12	14
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	21	71	18	35	9	32	13	32	13	19
Lead	T6	M40	1	mg/kg	47	170	57	120	27	92	56	150	87	43
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	8	22	13	17	10	14	11	15	9	13
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	29	50	38	100	25	60	31	85	37	49

Analysed as Soil

Determinand	Method	Test Sample	LOD	Units										
Arsenic	T6	M40	2	mg/kg	5	5	3	6	8	5	23	11	14	9
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	11	18	13	16	15	8	17	18	16	15
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	9	13	7	14	18	11	52	31	40	26
Lead	T6	M40	1	mg/kg	47	21	13	37	81	27	120	78	100	160
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	9	11	8	9	10	4	11	12	12	9
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Zinc	T6	M40	1	ma/ka	32	28	19	27	25	10	51	44	34	24

<div>SAL Reference: 435648</div> <div>Project Site: St Julies, Liverpool</div> <div>Customer Reference: EB1441/GL/4140</div>										
Soil		Analysed as Soil								
Metals										
SAL Reference					435648 041	435648 042	435648 043	435648 044	435648 045	435648 046
Customer Sample Reference					HP08	HP09	HP10	HP12	HP13	HP14
Date Sampled					29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014
Depth					0.20	0.20	0.10	0.20	0.30	0.10
Type					Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units						
Arsenic	T6	M40	2	mg/kg	11	19	15	22	14	31
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	14	15	14	23	13	19
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	21	26	57	68	83	120
Lead	T6	M40	1	mg/kg	50	73	160	260	410	300
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	7	6	10	19	18	12
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3
Zinc	T6	M40	1	ma/ka	25	19	56	100	230	53

SAL Reference: 435648 Project Site: St Julies, Liverpool Customer Reference: EB1441/GL/4140														
Soil		Analysed as Soil												
Curtins Suite A														
SAL Reference		435648 001	435648 002	435648 003	435648 004	435648 005	435648 006	435648 007	435648 008	435648 009	435648 010			
Customer Sample Reference		BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02	WS02	WS03			
Date Sampled		29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014	29-OCT-2014	27-OCT-2014			
Depth		0.30	0.30	0.50	0.30	0.50	0.30	0.50	0.30	0.50	0.30			
Type		Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Sandy Soil	Topsoil	Topsoil	Sandy Soil			
Determinand	Method	Test Sample	LOD	Units										
Asbestos ID	T27	AR			Chrysotile Detected	Chrysotile Detected	-	Chrysotile Detected	-	N.D.	-	N.D.	-	N.D.
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH	T7	AR			8.7	8.7	8.2	8.5	8.6	5.9	6.5	5.9	6.1	7.2
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Soil Organic Matter	T287	M40	0.1	%	8.4	2.4	1.5	2.2	1.4	4.0	1.2	3.6	1.2	3.0
SO4(Total)	T6	M40	0.01	%	0.08	0.03	0.02	0.03	0.02	0.06	0.02	0.06	0.02	0.07
Sulphide	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphur (total)	T6	M40	0.01	%	0.06	0.03	<0.01	0.02	<0.01	0.03	<0.01	0.02	<0.01	0.03

SAL Reference					435648 011	435648 012	435648 013	435648 014	435648 015	435648 016	435648 017	435648 018	435648 019	435648 020
Customer Sample Reference					WS03	WS04	WS04	WS05	WS05	WS06	WS06	WS07	WS07	WS08
Date Sampled					27-OCT- 2014	27-OCT- 2014	27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	28-OCT- 2014
Depth					1.00	0.30	0.50	0.30	0.50	0.30	1.00	0.30	1.00	0.30
Type					Topsoil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
Asbestos ID	T27	AR			-	N.D.	-	Chrysotile Detected	-	N.D.	-	N.D.	-	N.D.
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH	T7	AR			5.6	8.6	8.4	8.3	7.6	7.6	7.9	7.2	6.5	4.6
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Soil Organic Matter	T287	M40	0.1	%	1.8	4.2	1.8	2.6	0.4	4.4	1.7	6.7	3.1	3.7
SO4(Total)	T6	M40	0.01	%	0.04	0.16	0.05	0.03	<0.01	0.09	0.03	0.08	0.03	0.06
Sulphide	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphur (total)	T6	M40	0.01	%	0.02	0.08	0.03	0.02	<0.01	0.04	0.01	0.05	0.02	0.03

SAL Reference					435648 021	435648 022	435648 023	435648 024	435648 025	435648 026	435648 027	435648 028	435648 029	435648 030
Customer Sample Reference					WS08	WS09	WS09	WS10	WS10	WS11	WS11	WS12	WS12	WS13
Date Sampled					28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	28-OCT- 2014	28-OCT- 2014	27-OCT- 2014
Depth					1.00	0.30	1.00	0.30	1.00	0.30	1.00	0.30	1.00	0.30
Type					Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil	Sandy Soil	Topsoil	Sandy Soil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units										
Asbestos ID	T27	AR			-	N.D.	-	N.D.	-	N.D.	-	N.D.	-	N.D.
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH	T7	AR			4.4	4.9	5.0	6.6	7.1	7.2	7.7	7.6	8.1	8.9
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Soil Organic Matter	T287	M40	0.1	%	3.3	5.4	1.4	2.9	0.7	3.7	1.4	2.9	0.7	1.1
SO4(Total)	T6	M40	0.01	%	0.05	0.09	0.03	0.06	0.01	0.06	0.01	0.06	0.02	0.04
Sulphide	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphur (total)	T6	M40	0.01	%	0.02	0.04	0.01	0.03	<0.01	0.03	<0.01	0.03	<0.01	0.03

**SAL Reference:** 435648  
**Project Site:** St Julies, Liverpool  
**Customer Reference:** EB1441/GL/4140

**Soil** Analysed as Soil  
**Curtins Suite A**

SAL Reference					435648 031	435648 032	435648 033	435648 034	435648 035	435648 036	435648 037	435648 038	435648 039	435648 040
Customer Sample Reference					WS13	WS14	WS14	HP01	HP02	HP03	HP04	HP05	HP06	HP07
Date Sampled					27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014
Depth					0.50	0.50	1.00	0.30	0.30	0.30	0.30	0.30	0.30	0.20
Type					Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
Asbestos ID	T27	AR			-	N.D.	-	N.D.	Chrysotile Detected	N.D.	N.D.	N.D.	N.D.	N.D.
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH	T7	AR			8.8	7.8	7.7	4.0	6.6	4.2	3.8	7.0	3.7	4.1
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Soil Organic Matter	T287	M40	0.1	%	0.9	0.8	0.6	3.3	3.8	12	4.8	3.6	8.1	5.3
SO4(Total)	T6	M40	0.01	%	0.05	0.01	0.01	0.08	0.06	0.05	0.12	0.06	0.10	0.07
Sulphide	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphur (total)	T6	M40	0.01	%	0.02	<0.01	<0.01	0.03	0.03	0.03	0.06	0.03	0.05	0.04

**SAL Reference:** 435648  
**Project Site:** St Julies, Liverpool  
**Customer Reference:** EB1441/GL/4140

**Soil** Analysed as Soil  
**Curtins Suite A**

SAL Reference					435648 041	435648 042	435648 043	435648 044	435648 045	435648 046
Customer Sample Reference					HP08	HP09	HP10	HP12	HP13	HP14
Date Sampled					29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014
Depth					0.20	0.20	0.10	0.20	0.30	0.10
Type					Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units						
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	N.D.	N.D.	Amosite Detected
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
pH	T7	AR			4.5	4.1	6.1	5.6	6.8	3.8
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
Soil Organic Matter	T287	M40	0.1	%	3.1	3.2	14	5.2	16	13
SO4(Total)	T6	M40	0.01	%	0.05	0.06	0.17	0.08	0.20	0.21
Sulphide	T546	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
Sulphur (total)	T6	M40	0.01	%	0.02	0.03	0.10	0.04	0.10	0.10

**Customer Reference:** EB1441/GL/4140

SAL Reference					435648 001	435648 002	435648 003	435648 004	435648 005	435648 006	435648 007	435648 008	435648 009	435648 010
Customer Sample Reference					BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02	WS02	WS03
Date Sampled					29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	27-OCT- 2014
Depth					0.30	0.30	0.50	0.30	0.50	0.30	0.50	0.30	0.50	0.30
Type					Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Sandy Soil	Topsoil	Topsoil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units										
Naphthalene	T207	M105	0.1	mg/kg	<0.1	0.2	<0.1	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	2.9	<0.1	5.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	1.9	<0.1	5.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	0.4	14	0.5	45	0.6	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	T207	M105	0.1	mg/kg	0.2	5.7	0.2	17	0.3	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	1.2	23	1.1	51	2.1	0.1	<0.1	0.3	<0.1	0.2
Pyrene	T207	M105	0.1	mg/kg	1.2	17	0.8	37	2.0	0.1	<0.1	0.3	<0.1	0.2
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	0.9	7.4	0.4	22	0.9	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	0.6	5.8	0.3	16	0.8	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	1.3	11	0.5	37	2.3	0.1	<0.1	0.2	<0.1	0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	0.7	5.7	0.3	20	1.4	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	0.3	2.6	0.1	8.7	0.7	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	0.1	0.6	<0.1	2.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	0.5	3.1	0.2	9.7	0.8	<0.1	<0.1	<0.1	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	7.4	100	4.4	280	12	0.3	<0.1	0.8	<0.1	0.5

Customer Reference: EB1441/GL/4140

SAL Reference					435648 011	435648 012	435648 013	435648 014	435648 015	435648 016	435648 017	435648 018	435648 019	435648 020
Customer Sample Reference					WS03	WS04	WS04	WS05	WS05	WS06	WS06	WS07	WS07	WS08
Date Sampled					27-OCT- 2014	27-OCT- 2014	27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	28-OCT- 2014
Depth					1.00	0.30	0.50	0.30	0.50	0.30	1.00	0.30	1.00	0.30
Type					Topsoil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
Naphthalene	T207	M105	0.1	mg/kg	<0.1	0.3	0.4	<0.1	<0.1	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	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	0.1	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	<0.1	0.9	9.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1	0.4	2.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	<0.1	2.4	20	<0.1	<0.1	0.8	<0.1	0.2	<0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	<0.1	2.3	16	<0.1	<0.1	0.7	<0.1	0.2	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1	1.2	11	<0.1	<0.1	0.3	<0.1	0.1	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	<0.1	1.0	7.8	<0.1	<0.1	0.4	<0.1	0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	<0.1	2.3	16	<0.1	<0.1	0.7	<0.1	0.2	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1	1.1	7.4	<0.1	<0.1	0.4	<0.1	0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1	0.7	3.8	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	0.3	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1	0.9	4.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	<0.1	14	100	<0.1	<0.1	4.5	<0.1	0.9	<0.1	<0.1

**Customer Reference:** EB1441/GL/4140

**Total and Speciated USEPA16 PAH**

SAL Reference					435648 021	435648 022	435648 023	435648 024	435648 025	435648 026	435648 027	435648 028	435648 029	435648 030
Customer Sample Reference					WS08	WS09	WS09	WS10	WS10	WS11	WS11	WS12	WS12	WS13
Date Sampled					28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	28-OCT- 2014	28-OCT- 2014	27-OCT- 2014
Depth					1.00	0.30	1.00	0.30	1.00	0.30	1.00	0.30	1.00	0.30
Type					Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil	Sandy Soil	Topsoil	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	<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	<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	<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	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1	0.2	0.1	0.2	<0.1	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	<0.1	0.4	<0.1	0.1	<0.1	0.4	0.4	0.3	0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	<0.1	0.4	<0.1	0.1	<0.1	0.3	0.3	0.3	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1	0.2	<0.1	0.2	<0.1	<0.1
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	<0.1	0.4	<0.1	0.2	<0.1	0.3	0.2	0.3	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1	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	<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	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	<0.1	2.3	<0.1	0.4	<0.1	1.7	1.2	1.5	0.1	<0.1

Customer Reference: EB1441/GL/4140

Total and Speciated USEPA16 PAH

SAL Reference					435648 031	435648 032	435648 033	435648 034	435648 035	435648 036	435648 037	435648 038	435648 039	435648 040
Customer Sample Reference					WS13	WS14	WS14	HP01	HP02	HP03	HP04	HP05	HP06	HP07
Date Sampled					27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014
Depth					0.50	0.50	1.00	0.30	0.30	0.30	0.30	0.30	0.30	0.20
Type					Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Topsoil	Topsoil	Sandy Soil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
Naphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<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	<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	<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	<0.1	0.3	<0.1	0.3	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<0.1	0.6	<0.1	0.4	<0.1
Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	0.4	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.2	<0.1
Chrysene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.2	<0.1
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	<0.1	0.1	<0.1	<0.1	0.1	<0.1	0.6	<0.1	0.4	0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.2	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<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	<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	<0.1	0.2	<0.1	0.2	<0.1
PAH(total)	T207	M105	0.1	mg/kg	<0.1	0.1	<0.1	<0.1	0.1	<0.1	3.3	<0.1	2.3	0.1

<b>SAL Reference:</b> 435648 <b>Project Site:</b> St Julies, Liverpool <b>Customer Reference:</b> EB1441/GL/4140	
<b>Soil</b>	Analysed as Soil
<b>Total and Speciated USEPA16 PAH</b>	

SAL Reference					435648 041	435648 042	435648 043	435648 044	435648 045	435648 046
Customer Sample Reference					HP08	HP09	HP10	HP12	HP13	HP14
Date Sampled					29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014
Depth					0.20	0.20	0.10	0.20	0.30	0.10
Type					Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	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	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<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	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.7	0.5	0.1	0.7
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.3	0.1	<0.1	0.1
Fluoranthene	T207	M105	0.1	mg/kg	0.2	<0.1	1.5	0.9	0.2	1.3
Pyrene	T207	M105	0.1	mg/kg	0.2	<0.1	1.4	0.8	0.2	1.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.9	0.5	0.1	0.7
Chrysene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.8	0.4	0.2	0.8
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	0.2	<0.1	1.8	0.8	0.4	1.5
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.8	0.4	0.1	0.6
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.5	0.3	<0.1	0.4
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1	0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1	<0.1	0.7	0.3	0.1	0.5
PAH(total)	T207	M105	0.1	mg/kq	0.6	<0.1	9.6	5.0	1.4	7.8

<b>SAL Reference:</b> 435648 <b>Project Site:</b> St Julies, Liverpool <b>Customer Reference:</b> EB1441/GL/4140	
<b>Soil</b> <b>TPH (CWG)</b>	Analysed as Soil

SAL Reference					435648 001	435648 002	435648 004	435648 006	435648 008	435648 010	435648 012	435648 014	435648 016	435648 018
Customer Sample Reference					BH01	BH02	BH03	WS01	WS02	WS03	WS04	WS05	WS06	WS07
Date Sampled					29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	27-OCT- 2014	27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014
Depth					0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Type					Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
Benzene	T54	AR	1	µg/kg	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
Toluene	T54	AR	1	µg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EthylBenzene	T54	AR	1	µg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
M/P Xylene	T54	AR	1	µg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
O Xylene	T54	AR	1	µg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C10-C12 aliphatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	(9) <10	<1	<1	<1	(9) <10	(9) <10	<1	<1
TPH (C12-C16 aliphatic)	T8	M105	1	mg/kg	15	(9) <10	(9) <10	<1	<1	<1	(9) <10	(9) <10	<1	<1
TPH (C16-C21 aliphatic)	T8	M105	1	mg/kg	(9) <10	36	11	<1	<1	1	(9) <10	(9) <10	<1	<1
TPH (C21-C35 aliphatic)	T8	M105	1	mg/kg	(9) <10	110	54	<1	<1	1	(9) <10	95	1	2
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C10-C12 aromatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	(9) <10	<1	<1	<1	(9) <10	(9) <10	<1	<1
TPH (C12-C16 aromatic)	T8	M105	1	mg/kg	(9) <10	57	43	<1	<1	<1	(9) <10	(9) <10	1	1
TPH (C16-C21 aromatic)	T8	M105	1	mg/kg	19	360	370	<1	2	2	38	(9) <10	4	3
TPH (C21-C35 aromatic)	T8	M105	1	mg/kg	(9) <10	580	720	1	4	2	95	(9) <10	13	11





**Customer Reference:** EB1441/GL/4140

Analysed as Soil

SAL Reference: 435648 Project Site: St Julies, Liverpool Customer Reference: EB1441/GL/4140														
Soil					Analysed as Soil									
TPH														
SAL Reference					435648 003	435648 005	435648 007	435648 009	435648 011	435648 013	435648 015	435648 017	435648 019	435648 021
Customer Sample Reference					BH02	BH03	WS01	WS02	WS03	WS04	WS05	WS06	WS07	WS08
Date Sampled					29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	29-OCT- 2014	27-OCT- 2014	27-OCT- 2014	28-OCT- 2014	28-OCT- 2014	29-OCT- 2014	28-OCT- 2014
Depth					0.50	0.50	0.50	0.50	1.00	0.50	0.50	1.00	1.00	1.00
Type					Sandy Soil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Sandy Soil	Sandy Soil	Topsoil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units										
TPH (C8-C10)	T8	M105	1	mg/kg	<1	<1	<1	<1	(35) <15	(9) <10	<1	<1	<1	(9) <50
TPH (C10-C12)	T206	M105	1	mg/kg	<1	<1	<1	<1	(35) <15	(9) <10	<1	<1	<1	(9) <50
TPH (C12-C16)	T206	M105	1	mg/kg	<1	<1	<1	<1	(35) <15	(9) <10	<1	<1	3	(9) <50
TPH (C16-C21)	T206	M105	1	mg/kg	<1	4	<1	<1	(35) <15	28	7	1	6	(9) <50
TPH (C21-C35)	T206	M105	1	mg/kg	<1	23	<1	<1	(35) <15	240	120	20	24	(9) <50

Soil	Analysed as Soil
TPH	

Determinand	Method	Test Sample	LOD	Units						
TPH (C8-C10)	T8	M105	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C10-C12)	T206	M105	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C12-C16)	T206	M105	1	mg/kg	1	<1	<1	<1	<1	<1
TPH (C16-C21)	T206	M105	1	mg/kg	2	<1	4	<1	6	<1
TPH (C21-C35)	T206	M105	1	mg/kg	13	<1	30	<1	79	<1

## Index to symbols used in 435648-1

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
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
AR	As Received
N.D.	Not Detected
13	Results have been blank corrected.
35	LOD raised due to interference from non-hydrocarbon compounds.
9	LOD raised due to dilution of sample
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

## Method Index

Value	Description
T8	GC/FID
T287	Calc TOC/0.58
T6	ICP/OES
T27	PLM
T7	Probe
T54	GC/MS (Headspace)
T206	GC/FID (MCERTS)
T546	Colorimetry (CF)
T207	GC/MS (MCERTS)
T162	Grav (1 Dec) (105 C)

## Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Asbestos ID	T27	AR			SU	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
Cyanide(Total)	T546	AR	1	mg/kg	M	001-046
pH	T7	AR			M	001-046
Phenols(Mono)	T546	AR	1	mg/kg	M	001-046
Soil Organic Matter	T287	M40	0.1	%	N	001-046
SO4(Total)	T6	M40	0.01	%	N	001-046
Sulphide	T546	AR	1	mg/kg	N	001-046
Sulphur (total)	T6	M40	0.01	%	N	001-046

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Arsenic	T6	M40	2	mg/kg	M	001-046
Boron (water-soluble)	T6	AR	1	mg/kg	N	001-046
Cadmium	T6	M40	1	mg/kg	M	001-046
Chromium	T6	M40	1	mg/kg	M	001-046
Chromium VI	T6	AR	1	mg/kg	N	001-046
Copper	T6	M40	1	mg/kg	M	001-046
Lead	T6	M40	1	mg/kg	M	001-046
Mercury	T6	M40	1	mg/kg	M	001-046
Nickel	T6	M40	1	mg/kg	M	001-046
Selenium	T6	M40	3	mg/kg	M	001-046
Zinc	T6	M40	1	mg/kg	M	001-046
Naphthalene	T207	M105	0.1	mg/kg	M	001-046
Acenaphthylene	T207	M105	0.1	mg/kg	U	001-046
Acenaphthene	T207	M105	0.1	mg/kg	M	001-046
Fluorene	T207	M105	0.1	mg/kg	M	001-046
Phenanthrene	T207	M105	0.1	mg/kg	M	001-046
Anthracene	T207	M105	0.1	mg/kg	U	001-046
Fluoranthene	T207	M105	0.1	mg/kg	M	001-046
Pyrene	T207	M105	0.1	mg/kg	M	001-046
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001-046
Chrysene	T207	M105	0.1	mg/kg	M	001-046
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	M	001-046
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001-046
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001-046
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001-046
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001-046
PAH(total)	T207	M105	0.1	mg/kg	U	001-046
Benzene	T54	AR	1	µg/kg	U	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
Toluene	T54	AR	1	µg/kg	U	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
EthylBenzene	T54	AR	1	µg/kg	U	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
m/P Xylene	T54	AR	1	µg/kg	U	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
O Xylene	T54	AR	1	µg/kg	U	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	U	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C10-C12 aliphatic)	T8	M105	1	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C12-C16 aliphatic)	T8	M105	1	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C16-C21 aliphatic)	T8	M105	1	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C21-C35 aliphatic)	T8	M105	1	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C10-C12 aromatic)	T8	M105	1	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C12-C16 aromatic)	T8	M105	1	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C16-C21 aromatic)	T8	M105	1	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
TPH (C21-C35 aromatic)	T8	M105	1	mg/kg	N	001-002,004,006,008,010,012,014,016,018,020,022,024,026,028,030,032,034-046
Moisture @ 105 C	T162	AR	0.1	%	N	001-046
TPH (C8-C10)	T8	M105	1	mg/kg	U	003,005,007,009,011,013,015,017,019,021,023,025,027,029,031,033
TPH (C10-C12)	T206	M105	1	mg/kg	M	003,005,007,009,011,013,015,017,019,021,023,025,027,029,031,033
TPH (C12-C16)	T206	M105	1	mg/kg	M	003,005,007,009,011,013,015,017,019,021,023,025,027,029,031,033
TPH (C16-C21)	T206	M105	1	mg/kg	M	003,005,007,009,011,013,015,017,019,021,023,025,027,029,031,033
TPH (C21-C35)	T206	M105	1	mg/kg	M	003,005,007,009,011,013,015,017,019,021,023,025,027,029,031,033



## Certificate of Analysis

Certificate Number 14-20684

19-Nov-14

*Client* Ian Farmer Associates  
17 Rivington Court  
Hardwick Grange  
Woolston  
Warrington  
Cheshire  
WA1 4RT

*Our Reference* 14-20684

*Client Reference* 41558

*Contract Title* St Julies School, Liverpool

*Description* 15 Soil samples.

*Date Received* 13-Nov-14

*Date Started* 13-Nov-14

*Date Completed* 19-Nov-14

*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*

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown  
Business Manager



# Summary of Chemical Analysis Soil Samples

Our Ref 14-20684

Client Ref 41558

Contract Title St Julies School, Liverpool

Lab No	730151	730152	730153	730154	730155	730156	730157	730158	730159	730160	730161	730162
Sample ID	BH02	BH03	WS01	WS02	WS03	WS05	WS06	WS07	WS08	WS09	WS10	WS11
Depth	0.40	0.20	0.80	0.50	0.20	0.20	0.80	0.80	0.20	0.80	0.20	0.40
Other ID	5	1	11	7	1	1	6	6	1	6	1	4
Sample Type	D	D	D	D	D	D	D	D	D	D	D	D
Sampling Date	29/10/14	29/10/14	27/10/14	27/10/14	27/10/14	28/10/14	28/10/14	29/10/14	28/10/14	29/10/14	29/10/14	29/10/14
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units
<b>Inorganics</b>			
pH	DETSC 2008#		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l
		9.1	8.5
		69	22
		7.1	13
		6.3	10
		9.1	120
		7.7	20
		7.5	51
		6.8	24
		4.7	23
		5.4	15
		6.7	14
		7.9	26

# Summary of Chemical Analysis Soil Samples

Our Ref 14-20684

Client Ref 41558

Contract Title St Julies School, Liverpool

Lab No	730163	730164	730165
Sample ID	WS12	WS13	WS14
Depth	0.80	0.80	0.80
Other ID	5	6	5
Sample Type	D	D	D
Sampling Date	28/10/14	27/10/14	28/10/14
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units
Inorganics			
pH	DETSC 2008#	8.0	11.1 8.2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10 mg/l	< 10 180 22

## Information in Support of the Analytical Results

Our Ref 14-20684  
 Client Ref 41558  
 Contract St Julies School, Liverpool

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
730151	BH02 0.40 SOIL	29/10/14	PT 500ml	pH (7 days)	
730152	BH03 0.20 SOIL	29/10/14	PT 500ml	pH (7 days)	
730153	WS01 0.80 SOIL	27/10/14	PT 500ml	pH (7 days)	
730154	WS02 0.50 SOIL	27/10/14	PT 500ml	pH (7 days)	
730155	WS03 0.20 SOIL	27/10/14	PT 500ml	pH (7 days)	
730156	WS05 0.20 SOIL	28/10/14	PT 500ml	pH (7 days)	
730157	WS06 0.80 SOIL	28/10/14	PT 500ml	pH (7 days)	
730158	WS07 0.80 SOIL	29/10/14	PT 500ml	pH (7 days)	
730159	WS08 0.20 SOIL	28/10/14	PT 500ml	pH (7 days)	
730160	WS09 0.80 SOIL	29/10/14	PT 500ml	pH (7 days)	
730161	WS10 0.20 SOIL	29/10/14	PT 500ml	pH (7 days)	
730162	WS11 0.40 SOIL	29/10/14	PT 500ml	pH (7 days)	
730163	WS12 0.80 SOIL	28/10/14	PT 500ml	pH (7 days)	
730164	WS13 0.80 SOIL	27/10/14	PT 500ml	pH (7 days)	
730165	WS14 0.80 SOIL	28/10/14	PT 500ml	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

**VARIABLE HEAD PERMEABILITY TEST**
**41558 Variable Head (Falling) Permeability Test in BH02**
**SITE St Julies School, Liverpool**
**CONTRACT 41558**
**BH02**
**DEPTH: 1.16mbgl**
**INITIAL CONDITIONS**

Base of Response Zone	1.16	mBGL	Operator	JC
Top of Reponse Zone	1.00	mBGL	Date	29/10/2014
Diameter of casing	150.00	mm	Time	
Height of casing	0.12	mAGL	Weather	
Elevation of Borehole		mAOD	Calculated	
Groundwater Level	1.16	mBGL*	0.16	m

**TEST CALCULATION**

				Elapsed (minutes)	Total seconds	Water Depth (m)	Head (metres)	H/Ho
<u>Intake Factor, F</u>  $F = \frac{1.08}{d} \quad (i)$ Borehole Case d BS 5930: 1999 Figure 6				0.0	0	0.340	0.940	1.000
				0.5	30	0.340	0.940	1.000
				1.0	60	0.340	0.940	1.000
				1.5	90	0.340	0.940	1.000
				2.0	120	0.340	0.940	1.000
				2.5	150	0.340	0.940	1.000
				3.0	180	0.340	0.940	1.000
				3.5	210	0.340	0.940	1.000
				4.0	240	0.350	0.930	0.989
				4.5	270	0.350	0.930	0.989
<u>Permeability, K</u>  $K = \frac{A}{F \cdot (t_2 - t_1)} \cdot \ln(H_1/H_2) \quad (ii)$ or $K = \frac{A}{F \cdot T} \quad (iii)$ Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37				5.0	300	0.350	0.930	0.989
				6.0	360	0.350	0.930	0.989
				7.0	420	0.360	0.920	0.979
				8.0	480	0.360	0.920	0.979
				9.0	540	0.370	0.910	0.968
				10.0	600	0.370	0.910	0.968
				15.0	900	0.400	0.880	0.936
				20.0	1200	0.420	0.860	0.915
				25.0	1500	0.440	0.840	0.894
				30.0	1800	0.470	0.810	0.862
L= 0.16 m D= 0.150 m L/D= 1.06666667  t1= 600 s t2= 3600 s H1= 0.97 m H2= 0.71 m  A= 0.01768 m <sup>2</sup> F= 1.0841 From (i) T= s <b>K= 1.6643E-06 m/s</b> From (ii) K= #DIV/0! m/s From (iii)				35.0	2100	0.500	0.780	0.830
				40.0	2400	0.520	0.760	0.809
				45.0	2700	0.540	0.740	0.787
				50.0	3000	0.570	0.710	0.755
				55.0	3300	0.590	0.690	0.734
				60	3600	0.610	0.670	0.713
Remarks								
*Standing water level asumed to be at base of borehole for calculation								



**VARIABLE HEAD PERMEABILITY TEST**
**41558 Variable Head (Falling) Permeability Test in BH03**
**SITE St Julies School, Liverpool**
**CONTRACT 41558**
**BH03**
**DEPTH: 0.75mbgl**
**INITIAL CONDITIONS**

Base of Response Zone	0.75	mBGL	Operator	JC
Top of Reponse Zone	0.75	mBGL	Date	29/10/2014
Diameter of casing	150.00	mm	Time	
Height of casing	0.33	mAGL	Weather	
Elevation of Borehole		mAOD	Calculated	
Groundwater Level	0.75	mBGL*	0.00	m

**TEST CALCULATION**

				Elapsed (minutes)	Total seconds	Water Depth (m)	Head (metres)	H/Ho
<u>Intake Factor, F</u>				0.0	0	0.340	0.740	1.000
				0.5	30	0.340	0.740	1.000
				1.0	60	0.340	0.740	1.000
F= 0.41 (i)				1.5	90	0.340	0.740	1.000
				2.0	120	0.340	0.740	1.000
Borehole Case b				2.5	150	0.340	0.740	1.000
BS 5930: 1999 Figure 6				3.0	180	0.340	0.740	1.000
				3.5	210	0.340	0.740	1.000
				4.0	240	0.340	0.740	1.000
				4.5	270	0.340	0.740	1.000
				5.0	300	0.340	0.740	1.000
<u>Permeability, K</u>				6.0	360	0.340	0.740	1.000
K= $\frac{A}{F \cdot (t_2 - t_1)} \cdot \ln(H_1/H_2)$ (ii)				7.0	420	0.340	0.740	1.000
				8.0	480	0.350	0.730	0.986
or				9.0	540	0.350	0.730	0.986
K= $\frac{A}{F \cdot T}$ (iii)				10.0	600	0.350	0.730	0.986
				15.0	900	0.350	0.730	0.986
				20.0	1200	0.360	0.720	0.973
				25.0	1500	0.360	0.720	0.973
				30.0	1800	0.360	0.720	0.973
				35.0	2100	0.370	0.710	0.959
				40.0	2400	0.370	0.710	0.959
Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37				45.0	2700	0.380	0.700	0.946
				50.0	3000	0.380	0.700	0.946
				55.0	3300	0.390	0.690	0.932
				60	3600	0.390	0.690	0.932
L= 0.00 m								
D= 0.150 m								
L/D= 0								
t1= 420 s								
t2= 3300 s								
H1= 1.00 m								
H2= 0.93 m								
A= 0.01768 m <sup>2</sup>								
F= 0.4125 From (i)								
T= s								
K= 1.0411E-06 m/s From (ii)								
K= #DIV/0! m/s From (iii)								
Remarks								
*Standing water level asumed to be at base of borehole for calculation								

## **Appendix A5 – Gas Monitoring Results**

**Curtins Consulting**

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG

Tel: 0161 236 2394

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<b>GAS MONITORING LOG SHEET</b>
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**Project:** St Julies**Date:** 18/11/2014**Job Number:** EB1441**Visit:** 1**Client:****Weather:** Overcast**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				
WS03	1003	0.0	0.0	0.0	0.0	6.9	6.9	12.6	2	Dry	
WS07	1003	0.0	0.0	0.0	0.0	0.2	0.2	20.4	1	Dry	
WS09	1004	0.0	0.0	0.0	0.0	0.7	0.7	20.0	3	Dry	
WS11	1004	0.0	0.0	0.0	0.0	0.5	0.5	19.6	1	Dry	

**Notes****Logged by**

GL

1% gas volume = 10,000 ppm

Flow rate, methane and carbon 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

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<b>GAS MONITORING LOG SHEET</b>
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**Project:** St Julies**Date:** 05/12/2014**Job Number:** EB1441**Visit:** 2**Client:****Weather:****Barometric State:****Ground Conditions:**

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				
WS03	1010	0.0	0.0	0.0	0.0	4.6	4.6	19.8	1	Dry	
WS07	1010	0.0	0.0	0.0	0.0	0.4	0.4	20.5	0	Dry	
WS09	1009	0.0	0.0	0.0	0.0	0.8	0.8	19.6	0	Dry	
WS11	1010	0.0	0.0	0.0	0.0	0.6	0.6	21.2	0	Dry	

**Notes****Logged by**

GL

*1% gas volume = 10,000 ppm**Flow rate, methane and carbon 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 '*Residential without plant uptake*' 6% SOM

# Tier 1 Thresholds



## Soil Contaminants: Initial Assessment of Risk

The following tables can be used for the initial assessment with regard to the potential for the identified contaminants within a sand matrix with an average Soil Organic Matter (SOM) content of 6% to present a risk of significant harm to the '**Residential without the Consumption of Produce**' 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 <sup>soil</sup> Soil Screening Value	394
Arsenic	ATRISK <sup>soil</sup> Soil Screening Value	35
Beryllium	ATRISK <sup>soil</sup> Soil Screening Value	94.7
Boron	Recognised threshold to prevent phytotoxic affects	3
Cadmium	ATRISK <sup>soil</sup> Soil Screening Value	83.6
Chromium (VI)	ATRISK <sup>soil</sup> Soil Screening Value	38.2
Copper	ATRISK <sup>soil</sup> Soil Screening Value	8370
Cyanide (Free)	ATRISK <sup>soil</sup> Soil Screening Value	34
Lead	Currently accepted threshold	450
Mercury	ATRISK <sup>soil</sup> Soil Screening Value	1.02 ; 238 ; 14.1
Nickel	CLEA SGV for residential end use published May 09	130
Selenium	ATRISK <sup>soil</sup> Soil Screening Value	595
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 <sup>soil</sup> Soil Screening Value	353
Zinc	ATRISK <sup>soil</sup> Soil Screening Value	46800
pH	Typical value in uncontaminated soils	6-8
Phenol	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<sup>2+</sup>) and methyl mercury (Hg<sup>+4</sup>).
3. For human health consider using ATRISK<sup>soil</sup> Soil Screening Value of 519mg/kg.

**Table 1.1 BTEX Species**

Contaminants	Threshold Trigger Concentration For Planned End Use	
	Source	Value (mg/kg)
Benzene	ATRISK <sup>soil</sup> Soil Screening Value	0.998
Toluene	ATRISK <sup>soil</sup> Soil Screening Value	2710
Ethylbenzene	ATRISK <sup>soil</sup> Soil Screening Value	843
m-Xylene	ATRISK <sup>soil</sup> Soil Screening Value	302
o-Xylene	ATRISK <sup>soil</sup> Soil Screening Value	321
p-Xylene	ATRISK <sup>soil</sup> Soil Screening Value	288

# Tier 1 Thresholds



## Soil Contaminants: Initial Assessment of Risk

**Table 1.2 PAH Species**

Contaminants	Threshold Trigger Concentration For Planned End Use	
	Source	Value (mg/kg)
Acenaphthene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	4770
Anthracene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	24000
Benz(a)anthracene	ATRISK <sup>soil</sup> Soil Screening Value	9.04
Benzo(a)pyrene	ATRISK <sup>soil</sup> Soil Screening Value	1.04
Benzo(b)fluoranthene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	10.3
Benzo(ghi)perylene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	104
Benzo(k)fluoranthene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	104
Chrysene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	1010
Dibenz(ah)anthracene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	1.03
Fluoranthene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	3210
Fluorene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	3100
Indeno(123cd)pyrene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	10.3
Naphthalene	ATRISK <sup>soil</sup> Soil Screening Value	9.22
Pyrene	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	2400

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 <sup>soil</sup> Soil Screening Value (ref. 5)	0.998 (C5-C7)	261
C6 – C8	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4 & 6)	2710 (C7-C8)	49400
C8 – C10	ATRISK <sup>soil</sup> Soil Screening Value	233	144
C10 – C12	ATRISK <sup>soil</sup> Soil Screening Value	1080	4340 (ref. 4)
C12 – C16	ATRISK <sup>soil</sup> Soil Screening Value (ref. 4)	2040	5310
C16 – C21	ATRISK <sup>soil</sup> Soil Screening Value	1330	146000
C21 – C35	ATRISK <sup>soil</sup> Soil Screening Value	1330	

5. Based on total benzene concentration in the soil.

6. Based on total toluene concentration in the soil.

ATRISK<sup>soil</sup> Soil Screening Values are published by Atkins Limited

## **Appendix A7 – Conceptual Site Model and 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)

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)	Medium	Likely	Moderate
	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	R4: Construction materials	Mild	Likely	Moderate / Low
	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)

### Table and Summary of Potential Risks, Sheet 2

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

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)	Medium	Low Likelihood	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	R4: Construction materials	Mild	Likely	Moderate / Low
	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	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*
<b>S3:</b> Natural soils on or off site	<b>P1 &amp; P3:</b> Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	<b>R1:</b> End user of site	Medium	Unlikely	Low
	<b>P1 &amp; P3:</b> Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	<b>R4:</b> Construction workers	Minor	Unlikely	Negligible
<b>S4:</b> Ground gases	<b>P2 &amp; P3:</b> Vertical and horizontal migration	<b>R1:</b> End user of site	Severe	Likely	High
<b>S5:</b> Unexploded ordnance	<b>P1:</b> Direct contact	<b>R1:</b> End user of site	Severe	Likely	High
	<b>P1:</b> Direct contact	<b>R4:</b> Construction workers	Severe	Likely	High
<b>S6:</b> Radon	<b>P2 &amp; P3:</b> Vertical and horizontal migration	<b>R1:</b> 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.

## **Appendix A8 – Detailed UXO Survey**

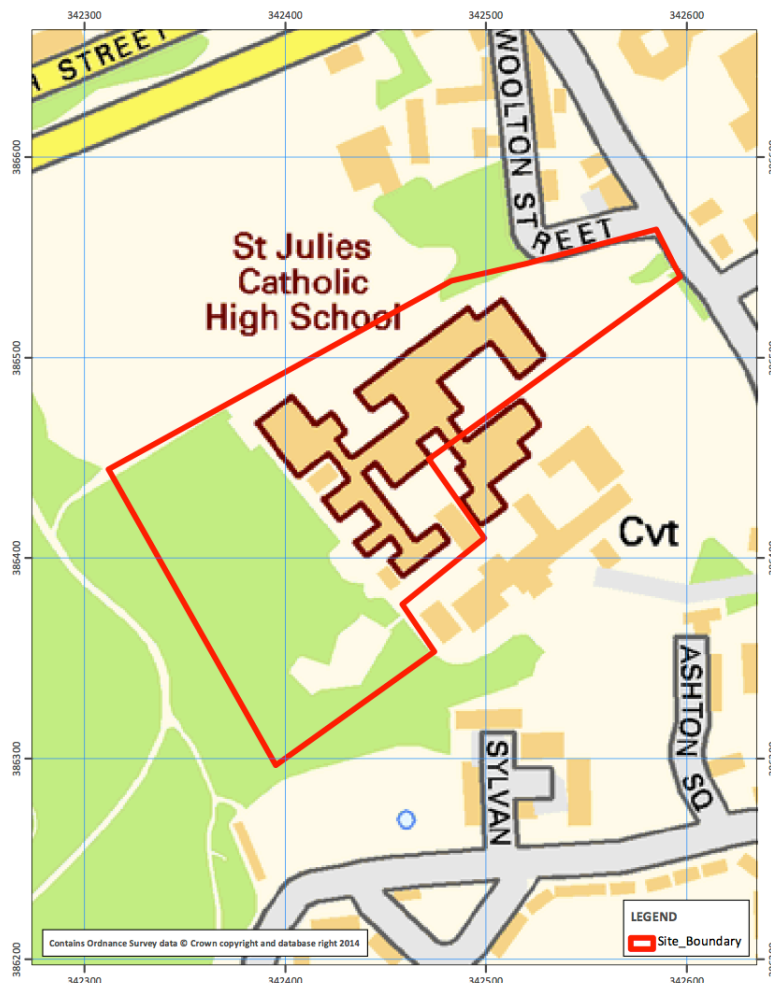
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# Detailed Unexploded Ordnance (UXO) Risk Assessment

Meeting the requirements of CIRIA C681 "Unexploded Ordnance (UXO) – A guide for the Construction Industry" Risk Management Framework



**6 Alpha Project Number:** P4123

**Landmark Order Number:** 61156284\_1

**Client Reference:** EB1441

**Site:** High Street, Woolton, Liverpool, L25 7TE

**Originator:** Gary Hubbard (16<sup>th</sup> October 2014)

**Technical Review:** Robin Rickard (20<sup>th</sup> October 2014)

**Released By:** Lisa Askham (22<sup>nd</sup> October 2014)

Delivered by





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## EXECUTIVE SUMMARY

Study Site	The Client has described the Study Site as “High Street, Woolton, Liverpool, L25 7TE”. The Site is located at National Grid Reference (NGR) 342440, 386440.
Key Findings	<p>During <i>World War Two</i> (WWII) the Study Site was located within the <i>Liverpool County Borough</i>, which recorded 79 HE bombs per 1,000 acres, a low to moderate level of bombing.</p> <p>The Study Site was located within the grounds of <i>Woolton Hall</i>, which was located approximately 9,000m to the southeast of <i>Liverpool</i> city center and comprised dense woodland.</p> <p>Prior to, and during WWII the <i>Luftwaffe</i> had conducted numerous sorties over <i>Britain</i> photographing facilities that were considered vital in supporting <i>Britain’s</i> war effort; These facilities included military establishments, airfields, docks, public services and factories. <i>Luftwaffe</i> reconnaissance photography covering the Study Site has not been located, although <i>Luftwaffe</i> reconnaissance photographs <i>GB 74 59b</i> and <i>GB74 25b</i> have designated <i>Garston Docks</i> (located 3,100m to the southwest), <i>Speke Airfield</i> and <i>Rootes Aircraft Factory</i> (located 2,700m to the south) were designated as primary bombing targets. Additionally, a number of factories, a quarry and a coal and coke yard located within close proximity may have been considered secondary bombing targets.</p> <p><i>Air Raid Precaution</i> (ARP) HE bomb strike records associated with the Site have identified three locations within 130m of the Study Site where HE bombs impacted. These locations are 100m to the north, 130m to the east-northeast and 100m to the east, although information to identify whether these were single or multiple strikes are not recorded.</p> <p>In the absence of official bomb damage mapping, a comparison between pre and post-WWII mapping and ARP bomb strike mapping has identified areas where potential bomb damage was sustained. Three buildings that were located within proximity of the Site are identified as ruins (1952 mapping) and correlate with the locations of bomb strikes recorded by the ARP. Additionally, one building adjoining <i>Woolton Hall</i> (located 60m to the southeast) was identified as a ruin; according to anecdotal evidence this was the result of bomb damage, although no bomb strikes were recorded at this location. Further ruins are located to the south of the Site (located to the west of <i>Ashton Square</i>), which may also be the result of unrecorded bomb strikes.</p> <p>Post-WWII development within the Site was conducted between 1967 and 1974, comprising a large complex of buildings (identified as <i>Notre Dame (Woolton) High School For Girls</i>). Whilst the full scope of this development is unknown, it is considered likely that during the construction of this building and its associated car parks, any buried UXO contamination (which may have been present) would have been encountered, albeit contained within the depth and scale of its footprint.</p> <p>Given that the Study Site comprised dense woodland and access /use of the Site was limited throughout WWII. The potential for an unexploded bomb to enter the Site unnoticed or unrecorded is high. Whilst post WWII development may potentially mitigate the threat of UXO, this will only be to the scale and depth of the groundworks that were employed. Therefore any areas that have not been subjected to “reasonable” post WWII development presents a significant threat to intrusive Site activities.</p>

## EXECUTIVE SUMMARY (...continued)

Potential Threat Source	The most probable UXO threat items at this Site are <i>German</i> HE bombs, whilst IBs and <i>British</i> Anti-Aircraft Artillery (AAA) projectiles pose a residual threat. The consequences of initiating <i>German</i> HE bombs are more severe than initiating IBs or AAA projectiles, and thus they pose the greatest prospective risk to intrusive works.
Risk Pathway	Given the types of UXO that might be present on Site, all types of aggressive intrusive engineering activities may generate a significant risk pathway.
Risk Level	<b>MEDIUM/HIGH</b>
Recommended Risk Mitigation	<p><b>All ground works in all Areas:</b></p> <p><b>1. Operational UXO Risk Management Plan;</b> appropriate Site management documentation should be held on Site to plan for and guide upon the actions to be undertaken in the event of a suspected or real UXO discovery, (6 Alpha can supply this plan);</p> <p><b>2. UXO Safety &amp; Awareness Briefings;</b> the briefings are essential when there is a possibility of explosive ordnance encounter and are a vital part of the general safety requirement. All personnel working on the Site should receive a general briefing concerning the identification of an Unexploded Bomb (UXB), what actions they should take to keep people and equipment away from such a hazard and to alert Site management. Posters and information concerning the general nature of the UXB threat should be held in the Site office and displayed for general information on notice boards, both for reference and as a reminder for ground workers. The safety and awareness briefing is an essential part of the Health and Safety Plan for the Site and helps to evidence conformity with the principles laid down in the CDM regulations 2007, (6 Alpha can supply this brief).</p> <p><b>In addition to the mitigation measures stated above. All Boreholes and Window Sampling in Area B (see <i>Figure 9</i> for Area designation):</b></p> <p><b>3. Intrusive Magnetometer Survey;</b> an intrusive survey (employing down-hole magnetometer or MagCone techniques) should be conducted ahead of/during all window sampling and boreholes within Area B. This survey should extend to the calculated bomb penetration depth or to the maximum depth of the investigative activities, whichever is encountered first, (6 Alpha can provide this service).</p>

## ASSESSMENT METHODOLOGY

<p><b>Approach</b></p>	<p>6 Alpha Associates is an independent, specialist risk management consultancy practice, which has assessed the risk of encountering UXO (as well as buried bulk high explosives) at this site, by employing a process advocated for this purpose by the Construction Industry Research &amp; Information Association (CIRIA). The CIRIA guide for managing UXO risks (C681) not only represents best practice but has also been endorsed by the Health and Safety Executive (HSE). Therefore, any risk levels identified in this assessment are considered objective and quantifiable. Any risk mitigation solution is recommended <i>only</i> because it delivers the Client a risk reduced to ALARP.</p> <p>Potential UXO hazards have been identified through investigation of Local and National archives associated with the Site, <i>Ministry of Defence</i> (MoD) archives, local historical sources, historical mapping as well as contemporaneous aerial photography (where available). Potential hazards have only been recorded if there is specific information that could reasonably place them within the boundaries of the Site. Key source material is referenced within this document, whilst data of lesser relevance (which may have been properly considered and discounted by 6 Alpha), may be made available upon request. The assessment of UXO risk is a measure of <b><i>probability of encounter</i></b> and <b><i>consequence of encounter</i></b>; the former being a function of the identified hazard and proposed development methodology; the latter being a function of the type of hazard and the proximity of personnel (and/or other sensitive receptors), to the hazard at the moment of encounter.</p> <p>If UXO risks are identified, the methods of mitigation we have recommended are considered reasonably and sufficiently robust to reduce them to ALARP. We advocate the adoption of the legal ALARP principal because it is a key factor in efficiently and effectively ameliorating UXO risks. It also provides a ready means for assessing the Client's tolerability of UXO risk. In essence the principle states that if the cost of reducing a risk significantly outweighs the benefit, then the risk may be considered tolerable. Clearly this does not mean that there is never a requirement for UXO risk mitigation, but that any mitigation must demonstrate that it is beneficial. Any additional mitigation that delivers diminishing benefits and that consumes disproportionate time, money and effort are considered <i>de minimis</i> and thus unnecessary. Because of this principle, Unexploded Bomb (UXB) and UXO risks will rarely be reduced to zero (nor need they be).</p>
<p><b>Important Notes</b></p>	<p>Although this report is up to date and accurate, our databases are continually being populated, as and when additional information becomes available. Nonetheless, 6 Alpha have exercised all reasonable care, skill and diligence in providing this service and producing this report.</p> <p>The assessment levels are based upon our professional opinion and have been supported by our interpretation of historical records and by third party data sources. Wherever possible, 6 Alpha has sought to corroborate and to verify the accuracy of all of the data we have employed, but we are not accountable for any inherent errors that may be contained in third party data sets (e.g. National Archive or other library sources), and over which 6 Alpha cannot reasonably exercise control.</p>

## STAGE ONE – SITE LOCATION AND DESCRIPTION

<b>Study Site</b>	The Client has described the Study Site as “High Street, Woolton, Liverpool, L25 7TE”. The Site is located at NGR 342440, 386440. The Site location and Site boundary are presented at <i>Figures 1</i> and <i>2</i> respectively.
<b>Location Description</b>	<p>The Study Site is situated within <i>Woolton</i>, a suburb of <i>Liverpool</i> located approximately 9,000m to southeast of the city centre. The Study Site is located 1,300m to the north-northwest of <i>Hunt’s Cross Railway Station</i> and 2,575m to the east of <i>West Allerton Railway Station</i>.</p> <p>The Study Site covers an area of approximately 2.98 hectares (Ha) and is roughly triangular in shape bounded by:</p> <ul style="list-style-type: none"> <li>• North: Recreation ground located south of <i>High Street</i>;</li> <li>• East: <i>Speke Road</i>;</li> <li>• South: <i>Woolton Hall</i> and <i>Ashton Square</i>;</li> <li>• West: <i>Woolton Wood</i>;</li> </ul> <p>The Study Site comprises of three separate areas; the north eastern sector provides access to the Site from <i>Speke Road</i>, the central sector is extensively developed comprising a large school complex named <i>St. Julie’s Catholic High School</i>, the south western sector is undeveloped and is covered in dense woodland. Aerial photography of the Study Site is presented at <i>Figure 3</i>.</p>
<b>Proposed Works</b>	<p>The Client has stated that the proposed works will comprise of:</p> <ul style="list-style-type: none"> <li>• <i>Light cable percussive Boreholes to around 15m depth</i>;</li> <li>• <i>Window sample holes to around 5m depth</i>;</li> <li>• <i>CBR testing to facilitate hardstanding design</i>.</li> </ul> <p>(CBR testing – Californian Bearing Ratio).</p> <p>See <i>Figure 4</i> for proposed borehole locations.</p>
<b>Ground Conditions</b>	<p>The Client has specified the ground conditions within the Study Site as; ‘<i>Chester Pebble Beds Formation-Sandstone, Pebbly (Gravelly) according to the BGS website.</i>’</p> <p>In addition to the ground conditions provided by the Client, 6 Alpha has located a previously conducted borehole log, which was undertaken 340m to the south of the Site; <i>SJ48NW18 – Speke Reservoir</i>, located at NGR 342444, 385942 to a depth of 99.04m below ground level (bgl). A summary of this log is presented below;</p> <ul style="list-style-type: none"> <li>• Ground Level to 0.70m bgl – Topsoil.</li> <li>• 0.7 to 67.20m bgl – Sherwood Sandstone (Chiltern Pebble Beds).</li> <li>• 67.20 to 77.40m bgl – Bold Formation.</li> <li>• 77.40 to 99.04m bgl – Collyhurst Sandstone.</li> </ul> <p>If the Site investigations and/or civil engineering methodologies change, and/or if a different methodology is to be employed, and/or if the scope of work is focused upon a specific part of the Site, then 6 Alpha are to be informed so that the prospective UXO risks and the associated risk mitigation methodology might be re-assessed. Certain ground conditions may also constrain certain types of risk mitigative works (e.g. magnetometer survey is degraded by the presence of ferrous scrap metals and mineralised ground).</p>

## STAGE TWO – REVIEW OF HISTORICAL DATASETS

Sources of Information Consulted	<p>The following primary information sources have been used in order to establish the background UXO threat:</p> <ol style="list-style-type: none"> <li>1. Home Office WWII Bomb Census Maps;</li> <li>2. WWII &amp; post-WWII Aerial Photography;</li> <li>3. Official Abandoned Bomb Register;</li> <li>4. 6 Alpha Database;</li> <li>5. City Of Liverpool Bomb Strike Map;</li> <li>6. National Archives at Kew;</li> <li>7. Historic UXO information provided by 33 Engineer Regiment (Explosive Ordnance Disposal) at Carver Barracks, Wimbish;</li> </ol>
Site History	<p>From an analysis of the published <i>County Series</i> (CS) and <i>Ordnance Survey</i> (OS) historical mapping associated with the Site, the following Site history can be deduced:</p> <p><b>1908 CS map</b> – The Site comprised of a large area of woodland (<i>Woolton Wood</i>) located to the north and west of <i>Woolton Hall</i> and was bisected by a number of tracks. No development was evident within the Site.</p> <p><b>1927 CS map</b> – Changes were not recorded within the Study Site;</p> <p><b>1936 OS map</b> – Changes were not recorded within the Study Site;</p> <p><b>1952 OS map</b> – Numerous trees were removed from the northeastern sector of the Site. A large Territorial Army (TA) Camp was shown 300m to the south (presently identified as <i>Camp Road</i>);</p> <p><b>1958 to 1978 OS map</b> – A large building complex was constructed within the central area, identified as <i>Notre Dame (Woolton) High School for Girls</i>;</p> <p><b>1967 OS map</b> – <i>Notre Dame (Woolton) High School for Girls</i> was not depicted on Site;</p> <p><b>1974 OS map</b> – A large building complex was constructed within the central area, identified as a school;</p> <p><b>1982 OS map</b> – Changes were not recorded within the Study Site;</p> <p><b>1999 OS map</b> – Changes were not recorded within the Study Site;</p> <p><b>2006 OS map</b> – Changes were not recorded within the Study Site;</p> <p><b>2014 OS map</b> – There have been two noticeable extensions to the principle building, which has been extended on its northern and southern aspect.</p>
Site History Summary	<p>Prior to 1938, the Study Site had been located within the grounds of <i>Woolton Hall</i> (located approximately 50m to the southeast), comprising dense woodland bisected by a number of tracks. The Site appears to have remained unchanged until the 1970s, when the construction of a school complex was undertaken within the central sector of the Site. The school complex remains on Site, although there have been at least two phases of expansion in recent years.</p>



## STAGE TWO – REVIEW OF HISTORICAL DATASETS (...continued)

<b>WWII Bombing of Liverpool</b>	<p>During WWII, <i>Liverpool</i> sustained some of the most prolific bombing raids outside of <i>London</i>. <i>Liverpool</i> was a strategic bombing target for the <i>Luftwaffe</i> due to its port facilities and industry. It is estimated that approximately ninety percent of all war materials brought to <i>Great Britain</i> passed through the <i>Mersey Docks</i>.</p> <p>The first major air raid occurred on the 28<sup>th</sup> August 1940 involving 160 <i>Luftwaffe</i> aircraft. During the following three months <i>Liverpool</i> sustained 50 raids, these ranged from small-scale assaults lasting short periods of time, to formations of 300 aircraft lasting up to 10 hours.</p> <p><i>Liverpool</i> and the surrounding area continued to be subjected to numerous further bombing raids throughout 1940 (The Christmas Blitz) and 1941, with the peak of the bombing occurring from 1<sup>st</sup> to the 7<sup>th</sup> May 1941 (The May Blitz). These raids involved 681 <i>Luftwaffe</i> bombers, which delivered 2,315 HE bombs as well as other ordnance.</p> <p>The last recorded <i>Luftwaffe</i> air raid occurred on 10<sup>th</sup> January 1942.</p>
<b>WWII Site Use</b>	<p>CS mapping prior to WWII (1936) shows no evidence of development within the Site, which comprises of a large area of woodland located within the grounds of <i>Woolton Hall</i> (located approximately 50m to the southeast).</p>
<b>WWII Luftwaffe Bombing Targets (Figure 5)</b>	<p>Prior to WWII, the <i>Luftwaffe</i> conducted numerous aerial photographic reconnaissance missions over <i>Britain</i>, recording key military, industrial and commercial targets for attack, in the event of war. <i>Luftwaffe</i> aerial reconnaissance photography associated with the Study Site has not been located. The closest primary bombing targets identified by the <i>Luftwaffe</i> are <i>GB 74 59b – Garston Docks</i> (located 3,100m to the southwest) and <i>GB74 25b – Speke Airfield</i> and <i>Rootes Aircraft Factory</i> (located 2,700m to the south). Nonetheless, a number of facilities located within the vicinity of the Study Site may have been considered secondary bombing targets, including the <i>Eclipse Factory</i> (located 220m to the north), <i>Hosiery Factory</i> (located 290m to the northwest), a <i>Coal and Coke Yard</i> (located 390m to the northwest and a quarry (located 530m to the northwest).</p>
<b>WWII Defensive Features</b>	<p>Throughout <i>Britain</i> numerous defenses features were constructed in preparation for a <i>German</i> attacks, which included decoy sites, AAA gun sites, pillboxes and barrage balloon site. However, no defensive features have been identified within the Study Site, or within 1,000m of its boundary.</p> <p>Defensive features that have been identified within the local area include a pillbox (located 1,220m to the southwest) and an Observation Post (located 1,500m to the southeast). The closest AAA gun site was located 3,000m to the north, which is identified as <i>D/H9 - Childwall</i>.</p>
<b>WWII HE Bomb Strikes (Figure 6)</b>	<p>During WWII the local authorities ARP wardens compiled detailed records of bomb strikes across their respective districts. The <i>Liverpool</i> bomb strike map (compiled from <i>Air Raid Precaution</i> (ARP) reports), depict the locations where both serious HE bomb damage and serious fire damage was sustained. Whilst it does not appear to present the locations of individual bomb strikes, it is evident that serious bomb damage was sustained in proximity to the Study Site, although not within it. There are three locations in close proximity to the Site where evidence of HE bomb strikes was recorded, 100m to the north, 130m to the east-northeast and 100m to the east.</p>

## STAGE TWO – REVIEW OF HISTORICAL DATASETS (...continued)

<b>WWII Bomb Damage</b> <i>(Figure 7)</i>	<p>There has been no official bomb damage mapping located for this area. However, a comparison of pre and post WWII mapping (1936 and 1952) has identified a number of ruins that are likely to be the result of HE bomb strikes;</p> <ul style="list-style-type: none"> <li>• Number <i>40 Woolton Street</i> is identified as a ruin, which correlates with the HE bomb strike(s) recorded 100m to the north;</li> <li>• Two unidentified structures associated with <i>The Priory off Watergate Lane</i> (one located to the north and one located to the south) were identified as ruins, which correlates with the bomb strikes recorded 130m to the east-northeast and 100m to the east;</li> </ul> <p>In addition to the ruins that relate to HE bomb strike locations, further buildings within proximity of the Site have been identified as ruins including;</p> <ul style="list-style-type: none"> <li>• The rear of number <i>22 High Street</i> (located 200m to the north);</li> <li>• A single building associated with and located immediately south of <i>Woolton Hall</i> (located 60m to the southeast). Anecdotal evidence states that this building was subjected to bomb damage, although no bomb strikes were officially recorded at this location;</li> <li>• Two buildings to the west off <i>Ashton Square</i> (located approximately 60m to the southeast).</li> </ul> <p>It is considered plausible that these ruins were the result of other types of explosive ordnance, or that the bomb strikes causing this damage was not recorded at the time.</p>
<b>WWII HE Bomb Density</b> <i>(Figure 7)</i>	<p>The Study Site was located within the <i>Liverpool County Borough</i>, which recorded 79 HE bombs per 1,000 acres.</p>
<b>Abandoned Bombs</b>	<p>An examination of the official abandoned bomb records has not identified any abandoned bombs located within 1,000m of the Study Site.</p>
<b>Bomb Disposal Operations (BDO) Tasks</b>	<p>There have been no records located describing BDO tasks within the vicinity of the Study Site.</p>



## STAGE THREE – DATA ANALYSIS

Was the ground undeveloped during WWII?	Yes; CS mapping prior to WWII (1936) indicates that the Site comprised predominantly of dense woodland situated within the grounds of <i>Woolton Hall</i> (located 60m to the southeast).
Is there a reason to suspect that the immediate area was a bombing target during WWII?	<p>No; although <i>Luftwaffe</i> aerial reconnaissance photography associated with this region did not designate any facility within proximity of the Site as a primary bombing target, a number of facilities located within the area may have been considered secondary targets. Primary bombing targets located in the general vicinity have been identified as; <i>Garston Docks</i> (located 3,100m to the southwest), <i>Speke Airfield</i> and <i>Rootes Aircraft Factory</i> (located 2,700m to the south.)</p> <p>Furthermore, as WWII progressed major towns and cities were considered bombing targets in their own right. The <i>Luftwaffe</i> switched from specifically targeting individual military and industrial facilities to a more general method of bombing ('carpet-bombing'), and as a result, suburban and residential areas were bombed (particularly in major cities throughout <i>Britain</i>).</p>
Is there firm evidence that ordnance landed on Site?	No; ARP bomb strike mapping associated with the Site has not identified any HE bomb strikes or IBs impacting within the Study Site. The closest HE bomb strikes depicted on <i>Liverpool</i> ARP bomb strike map were located approximately 100m to the north and east.
Is there firm evidence of bomb damage being sustained on Site?	No; there has been no evidence located to suggest that bomb damage was sustained within the Study Site. However, the Study Site comprised predominantly of woodland, as such, it is highly unlikely damage to woodland would have been recorded by the local authorities. There is evidence of damage within the surrounding area, which has been identified from a comparison between bomb strike mapping, pre (CS) and post (OS) WWII mapping. The post WWII mapping (1952) clearly shows ruins at bomb strike locations recorded by the ARP. However, there are further buildings located within 100m of the Site that are also shown as ruins, although no cause for this damage has been established.
Would a UXB entry hole have been observed and reported during WWII?	Unlikely; the Study Site comprised a dense woodland during WWII. Whilst there were a number of tracks bisecting the Site during this time, it is highly unlikely that a UXB entry hole would have been witnessed or identified due to the limited use and dense vegetation that would have covered the Site.
Is there any reason to suspect that Live Firing or military training may have occurred at this location?	No; there is no record of any military training and/or live firing on, or in, the immediate vicinity of the Study Site. Whilst it is likely that military training may have been conducted at the TA camp located 300m to the south, there has been no evidence located to suggest that activities associated with this facility impacted upon the Study Site.
What is the expected UXO contamination?	The most likely source of UXO contamination is from <i>German</i> aerially delivered ordnance, which ranges from small IBs through to large HE bombs; of which the latter forms the principal threat. Additional residual contamination may be present from <i>British</i> AAA projectiles, which were used to defend against <i>German</i> bombing raids.

## STAGE THREE – DATA ANALYSIS (...continued)

<p>Would previous earthwork have removed the potential for UXO to be present?</p>	<p>Possibly, although limited; the Study Site appears to have been developed between 1967 and 1974, comprising a large complex of buildings (identified as <i>Notre Dame (Woolton) High School For Girls</i>) located within the central sector of the Site. It is possible, given the scale of this development, that UXO, if present, may have been encountered during its construction. The southwestern sector of the Site has remained relatively unchanged since 1908, comprising dense woodland. The northeastern sector has been subjected to limited development, which comprise access roads and car parking.</p> <p>It is possible that the development of the structures located within the central sector may have removed items of UXO within their 'footprints', although this is dependant upon scale and depth of ground works. Additionally, although significantly reduced, UXO may have been encountered during the construction of access roads located within the northeast.</p>
<p>Does the probability of a UXO discovery vary across the Site? (Figure 9)</p>	<p>Yes, the probability for encountering UXO within this Site is variable, due to a number of key factors;</p> <ul style="list-style-type: none"> <li>• Site use and development during WWII;</li> <li>• Proximity of local bombing activities;</li> <li>• Post WWII development (scale and depth);</li> <li>• Likely Bomb Penetration Depth.</li> </ul> <p>The Site comprised of dense woodland during WWII, which was bisected by a number of tracks, suggesting the level of footfall within the Site was low and limited, which indicates the potential for identifying UXB entry holes within the Site as being low.</p> <p>The information assessed within this report identifies both HE bomb strikes and bomb damage was sustained within close proximity to the Site, increasing the potential for aerial delivered ordnance to have impacted within the Site.</p> <p>The depth and scale of previous post WWII development may reduce the probability for encountering UXO during subsequent intrusive works. The greater the extent of previous works, the more likely UXO was encountered. Given that the southwestern sector of the Site has remained unchanged (comprising dense woodland) since WWII, this would present the most likely area to encounter UXO, whilst the more extensive ground works employed during the construction of school buildings may have mitigated the Site, although this would depend on the BPD and depth of those works.</p> <p>The Study Site has been divided into two areas (Areas A and B);</p> <p>Area A has been subjected to extensive post WWII development, which has potentially reduced the probability for UXO contamination.</p> <p>Area B has not been subjected to any development, or indeed any limited post WWII development (such as road construction), therefore a residual potential for UXO encounter remains.</p>

## STAGE FOUR – RISK ASSESSMENT

<b>Threat Items</b>	The threat is posed predominately by WWII <i>German</i> HE bombs, whilst IBs and <i>British</i> AAA projectiles pose a residual threat (the latter were used to defend against <i>German</i> bombing raids).
<b>Maximum Penetration</b>	The average Bomb Penetration Depth (BPD) for a 250kg bomb in sandstone is assessed to be 4.63m below ground level (bgl) with a maximum BPD of 10.36m bgl. This figure assumes that ground conditions are homogenous throughout the Site and does not take into account the presence of made ground and/or structures on Site during WWII, which could significantly retard a UXBs penetration capability. Whilst the <i>Luftwaffe</i> employed larger bombs their deployment was both target-specific and infrequent, and to use such larger (or the largest) bombs for the BPD calculations are not justifiable on either technical or risk management grounds.
<b>Risk Pathway</b>	Given the types of UXO that might be present on Site, all types of aggressive intrusive engineering activities (i.e. ground works) may generate a significant risk pathway. Whilst not all munitions encountered aggressively will initiate upon contact, such a discovery could lead to serious impact on the project especially in terms of critical injuries and project delay.
<b>Consequence</b>	<p>Consequences of UXO initiation include:</p> <ol style="list-style-type: none"> <li>1. Kill and/or critically injure personnel;</li> <li>2. Severe damage to plant and equipment;</li> <li>3. Deliver blast and fragmentation damage to nearby buildings;</li> <li>4. Rupture and damage underground utilities/services.</li> </ol> <p>Consequences of UXO discovery include:</p> <ol style="list-style-type: none"> <li>1. Delay to the project and blight;</li> <li>2. Disruption to local community/infrastructure;</li> <li>3. The expenditure of additional risk mitigation resources and Explosive Ordnance Disposal (EOD) clearance;</li> <li>4. Incurring additional time and cost.</li> </ol>

## UXO RISK CALCULATION

<b>Site Activities</b>	Although there is some variation in the probability of encountering and initiating items of UXO when conducting different types of intrusive activities, several intrusive methodologies have been described for analysis at this Site. The consequences of initiating UXO vary greatly, depending upon, <i>inter alia</i> the mass of HE in the UXO and how aggressively it might be encountered. For this reason, 6 Alpha has conducted separate risk rating calculations for each construction methodology that might be employed.
<b>Threat Items</b>	The most probable UXO threat items at this Site are <i>German</i> HE bombs, whilst IBs and <i>British</i> AAA pose a residual threat. The consequences of initiating <i>German</i> HE bombs are more severe than initiating IBs or AAA projectiles, and thus they pose the greatest prospective risk to intrusive works.
<b>Risk Rating Calculation</b>	6 Alpha's Semi-Quantitative Risk Assessment assesses and rates the risks posed by the most probable threat items when conducting a number of different activities on the Site. Risk Rating is determined by calculating the probability of encountering UXO and the consequences of initiating it.

## STAGE FOUR - RISK ASSESSMENT (...continued)

### UXO RISK CALCULATION TABLE – AREA A

Activity	Threat Item	Probability (SHxEM=P)	Consequence (DxPSR=C)	Risk Rating (Px C=RR)
CBR Testing	HE Bombs	1x1=1	1x2=2	1x2=2
	IBs	1x1=1	2x1=2	1x2=2
	AAA Projectiles	1x1=1	1x2=2	1x2=2
Window Sampling ( < 5m bgl)	HE Bombs	1x2=2	2x2=4	2x4=8
	IBs	1x2=2	2x1=2	2x2=4
	AAA Projectiles	1x2=2	2x2=4	2x4=8
Boreholes ( <15m bgl)	HE Bombs	1x2=2	2x2=4	2x4=8
	IBs	1x2=2	2x1=2	2x2=4
	AAA Projectiles	1x2=2	2x2=4	2x4=8

### UXO RISK CALCULATION TABLE – AREA B

Activity	Threat Item	Probability (SHxEM=P)	Consequence (DxPSR=C)	Risk Rating (Px C=RR)
CBR Testing	HE Bombs	2x1=2	1x2=2	2x2=4
	IBs	2x1=2	2x1=2	2x2=4
	AAA Projectiles	2x1=2	1x2=2	2x2=4
Window Sampling ( < 5m bgl)	HE Bombs	2x2=4	2x2=4	4x4=16
	IBs	2x2=4	2x1=2	4x2=8
	AAA Projectiles	2x2=4	2x2=4	4x4=16
Boreholes ( < 15m bgl)	HE Bombs	2x2=4	2x2=4	4x4=16
	IBs	2x2=4	2x1=2	4x2=8
	AAA Projectiles	2x2=4	2x2=4	4x4=16

Abbreviations – Site History (SH), Engineering Methodology (EM), Probability (P), Depth (D), Consequence (C), Proximity to Sensitive Receptors (PSR) and Risk Rating (RR).

## STAGE FIVE – RECOMMENDED RISK MITIGATION MEASURES WITH RESULTING RISK RATING

If a geophysical survey is required are the ground conditions an issue?	<p><b>Non-Intrusive Methods of Mitigation</b> – This type of survey may be effective across the Site, although magnetometer results are highly likely to be affected by ferro-magnetic contamination due to previous construction activities/made ground.</p> <p><b>Intrusive Methods of Mitigation</b> – Intrusive magnetometry may be effective on this Site, prior to/ or during window sampling and bore holing. However, any ferrous scrap metal/red brick contamination in the old foundations/imported fill is highly likely to adversely affect the detection capability of the UXB survey equipment, as it passes through the contaminated layer especially. Nonetheless, below any contaminated strata, an intrusive survey should prove effective.</p>
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### MITIGATION MEASURES TO REDUCE RISK TO ‘ALARP’

Activity/Area	Risk Mitigation Measures	Final Risk Rating
All Activities in All Areas	<p><b>1. Operational UXO Risk Management Plan;</b> appropriate Site management documentation should be held on Site to plan for and guide upon the actions to be undertaken in the event of a suspected or real UXO discovery, (6 Alpha can supply this plan);</p> <p><b>2. UXO Safety &amp; Awareness Briefings;</b> the briefings are essential when there is a possibility of explosive ordnance encounter and are a vital part of the general safety requirement. All personnel working on the Site should receive a general briefing concerning the identification of an Unexploded Bomb (UXB), what actions they should take to keep people and equipment away from such a hazard and to alert Site management. Posters and information concerning the general nature of the UXB threat should be held in the Site office and displayed for general information on notice boards, both for reference and as a reminder for ground workers. The safety awareness briefing is an essential part of the Health and Safety Plan for the Site and helps to evidence conformity with the principles laid down in the CDM regulations 2007, (6 Alpha can supply this brief).</p>	ALARP
Area B only	<p><b>In addition to the mitigation measures stated above. All Boreholes and Window Sampling in Area B (see Figure 8 for Area designation):</b></p> <p><b>3. Intrusive Magnetometer Survey;</b> an intrusive survey (employing down-hole magnetometer or MagCone techniques) should be conducted ahead of/during all window sampling and boreholes within Area B. This survey should extend to the calculated bomb penetration depth or to the maximum depth of the investigative activities, whichever is encountered first, (6 Alpha can provide this service).</p>	

This assessment has been conducted based on the information provided by the Client, should the proposed works change then 6 Alpha should be re-engaged to refine this risk assessment.

## Report Figures

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# Figure One

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## Site Location







## Figure Two

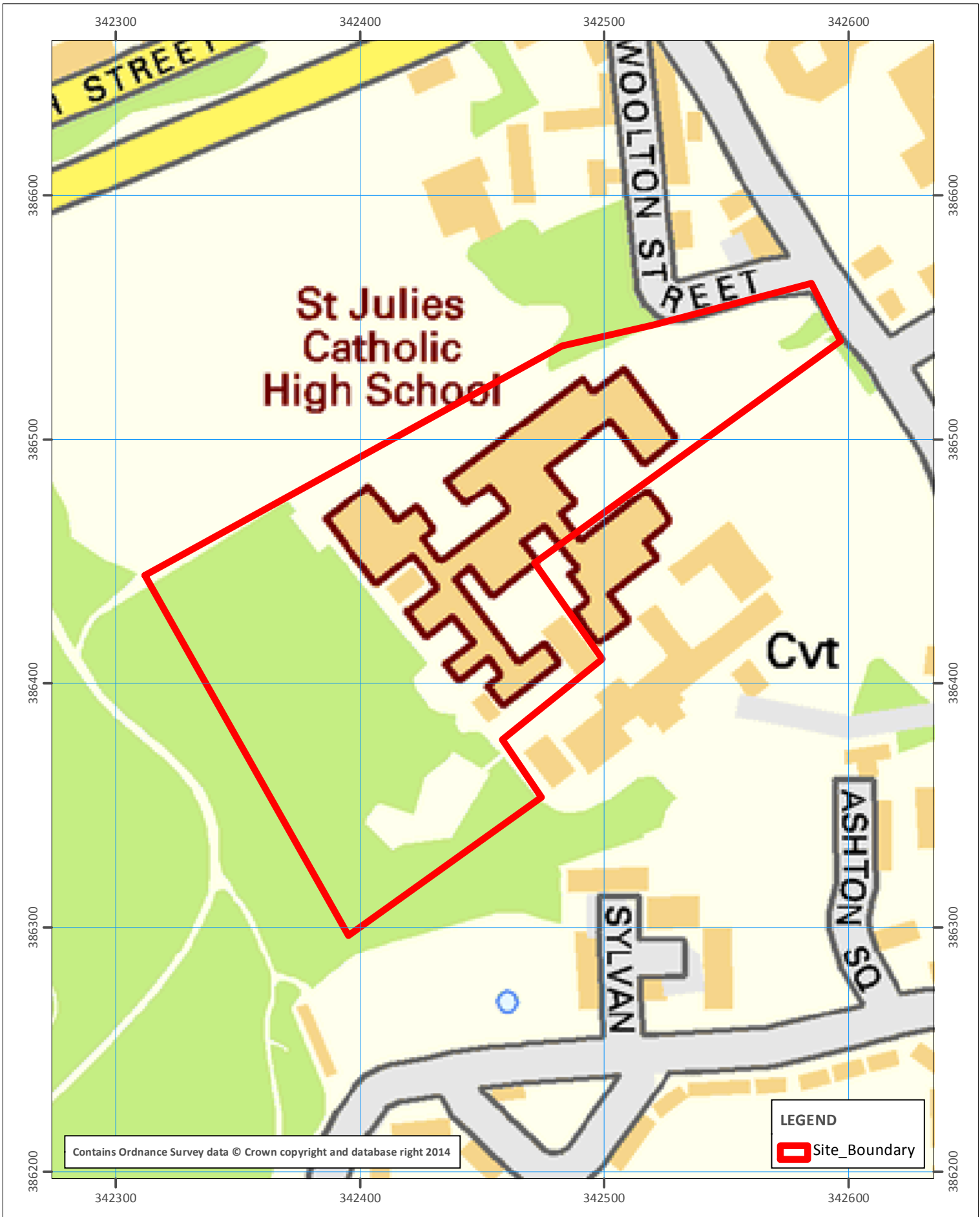
---

### Site Boundary

# Site Boundary

Figure 2

BRITISH NATIONAL GRID



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 Users noting any errors please forward to 6 Alpha.



PROJECT NO.	<b>P4123</b>
DRAWN BY	<b>DR</b>
CHECKED BY	<b>RR</b>
DATE	<b>15 October 2014</b>

## Figure Three

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### Current Aerial Photography



# 

Figure 3

BRITISH NATIONAL GRID



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PROJECT NO.	<b>P4123</b>
DRAWN BY	<b>DR</b>
CHECKED BY	<b>RR</b>
DATE	<b>15 October 2014</b>

## Figure Four

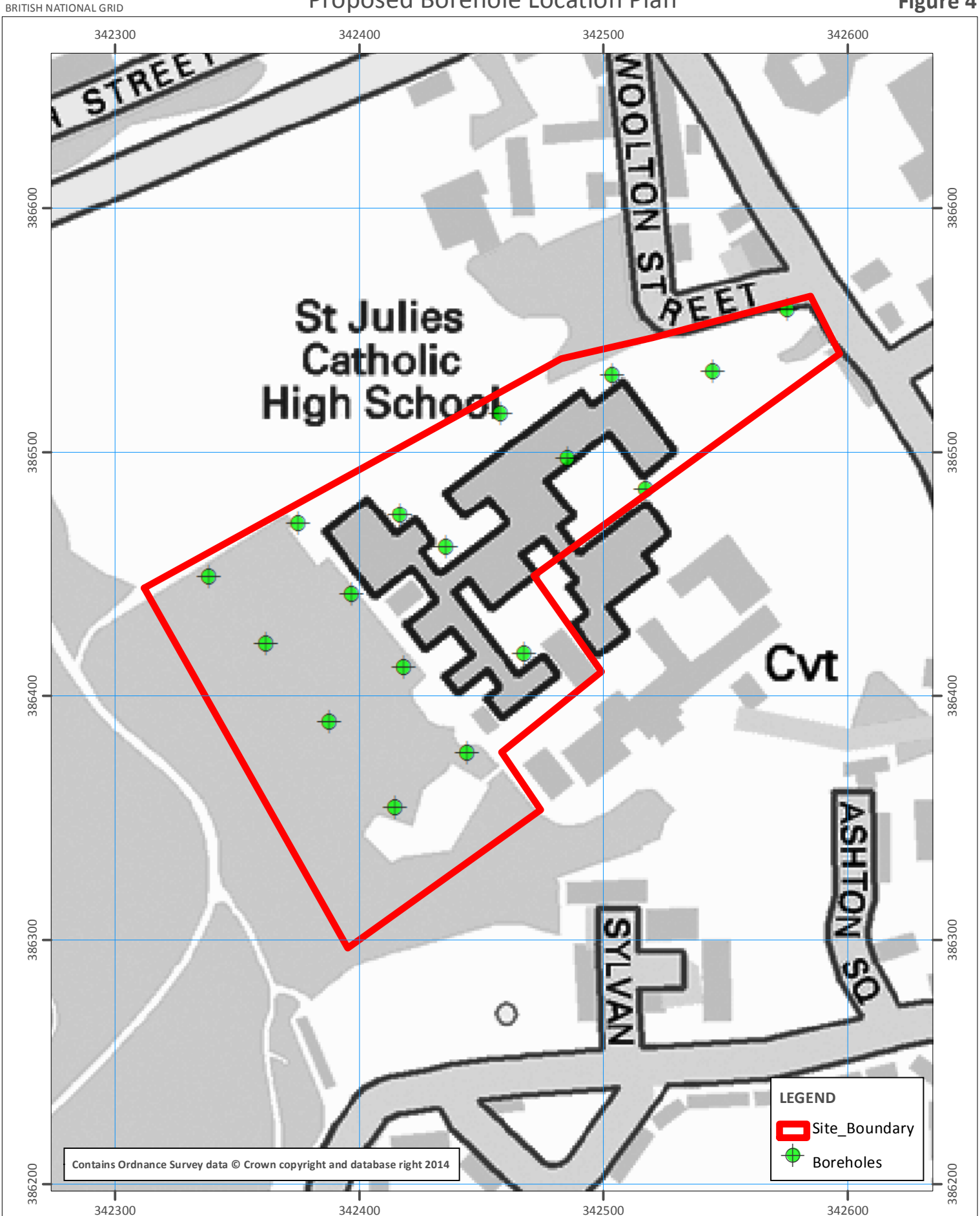
---

### Proposed Borehole Location Plan



# HIGH STREET, WOOLTON, LIVERPOOL, L25 7TE Proposed Borehole Location Plan

Figure 4



## Figure Five

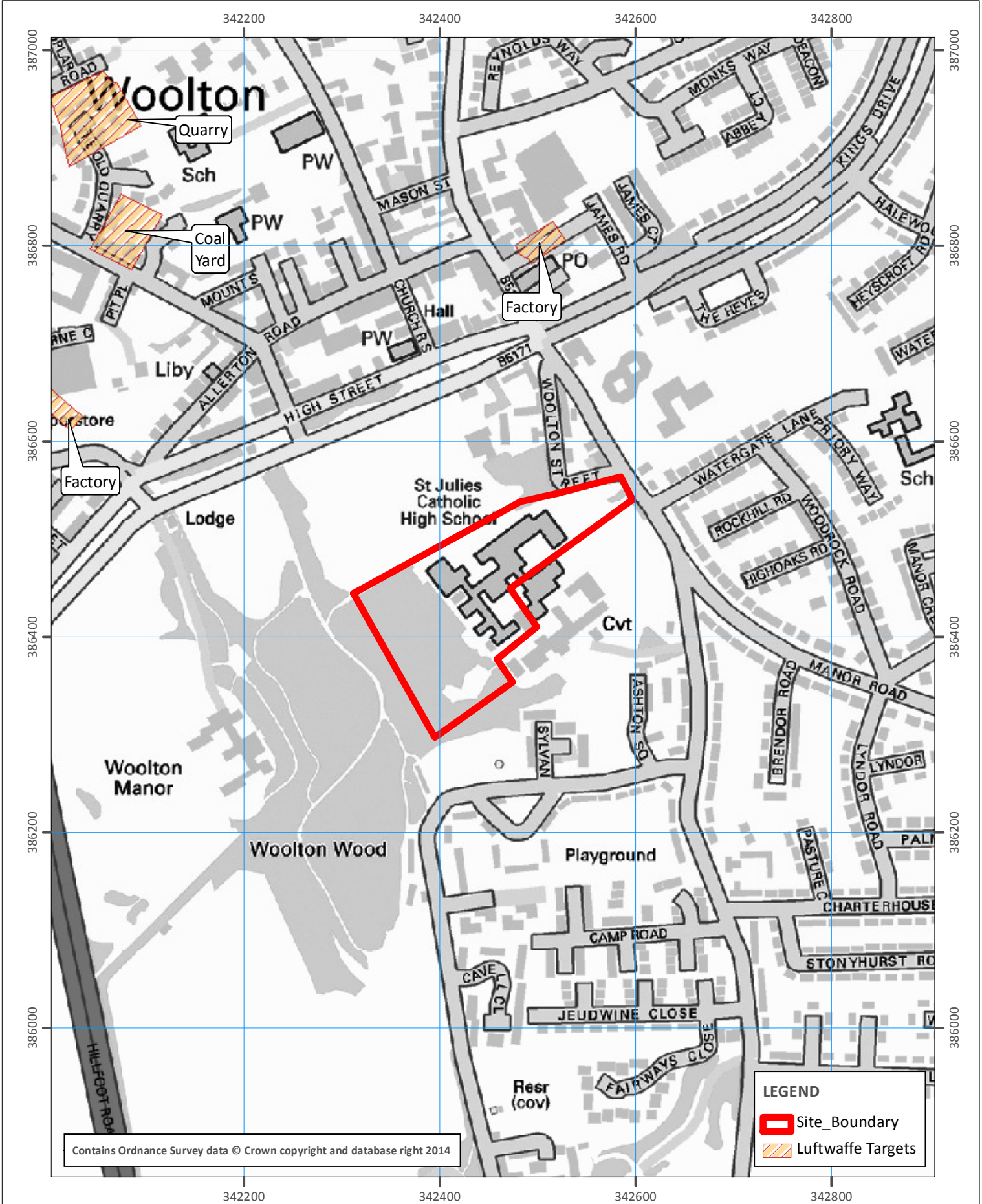
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### WWII Luftwaffe Bombing Targets

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Figure 5

BRITISH NATIONAL GRID





## Figure Six

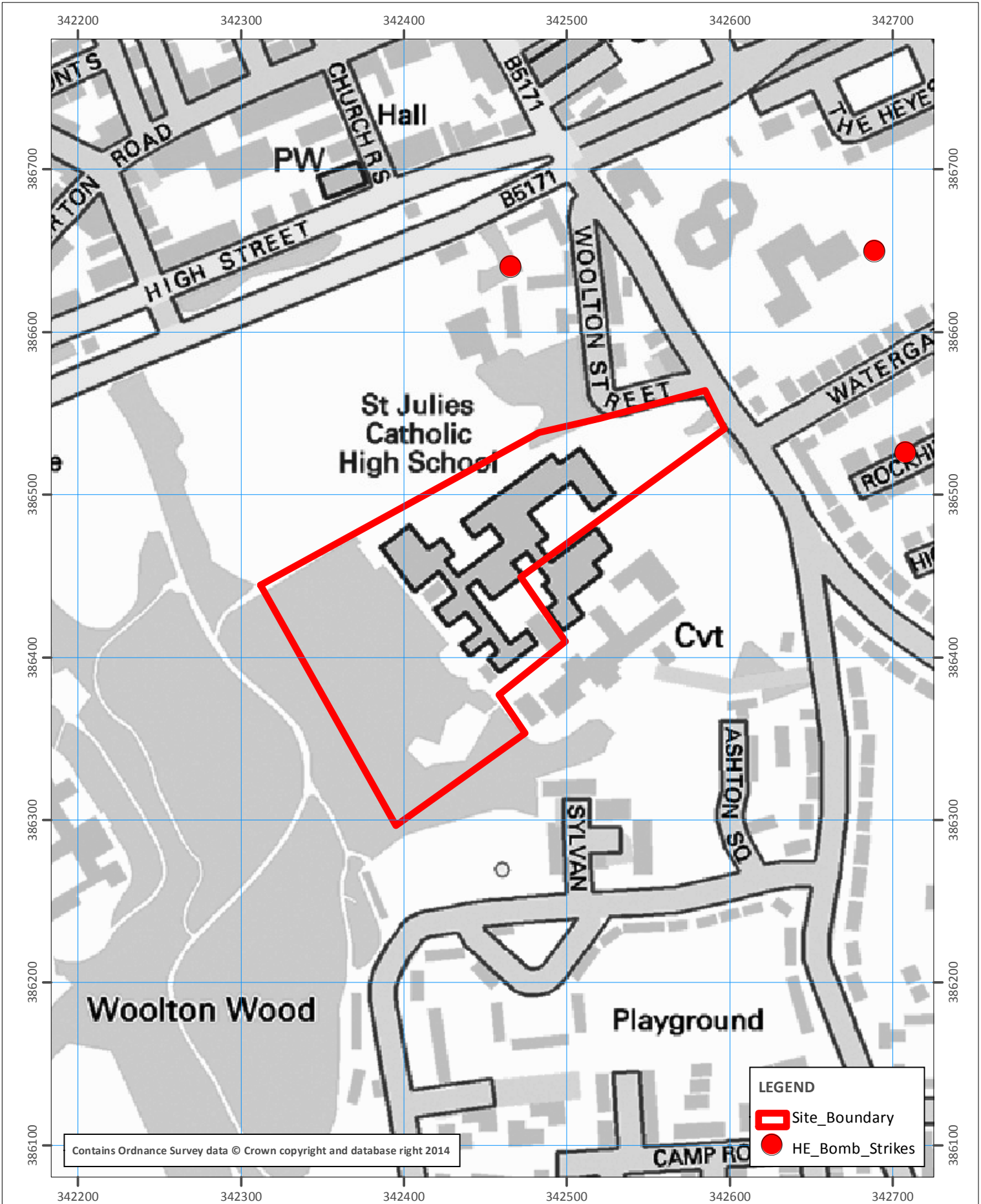
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### WWII High Explosive Bomb Strikes

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Figure 6

BRITISH NATIONAL GRID



## Figure Seven

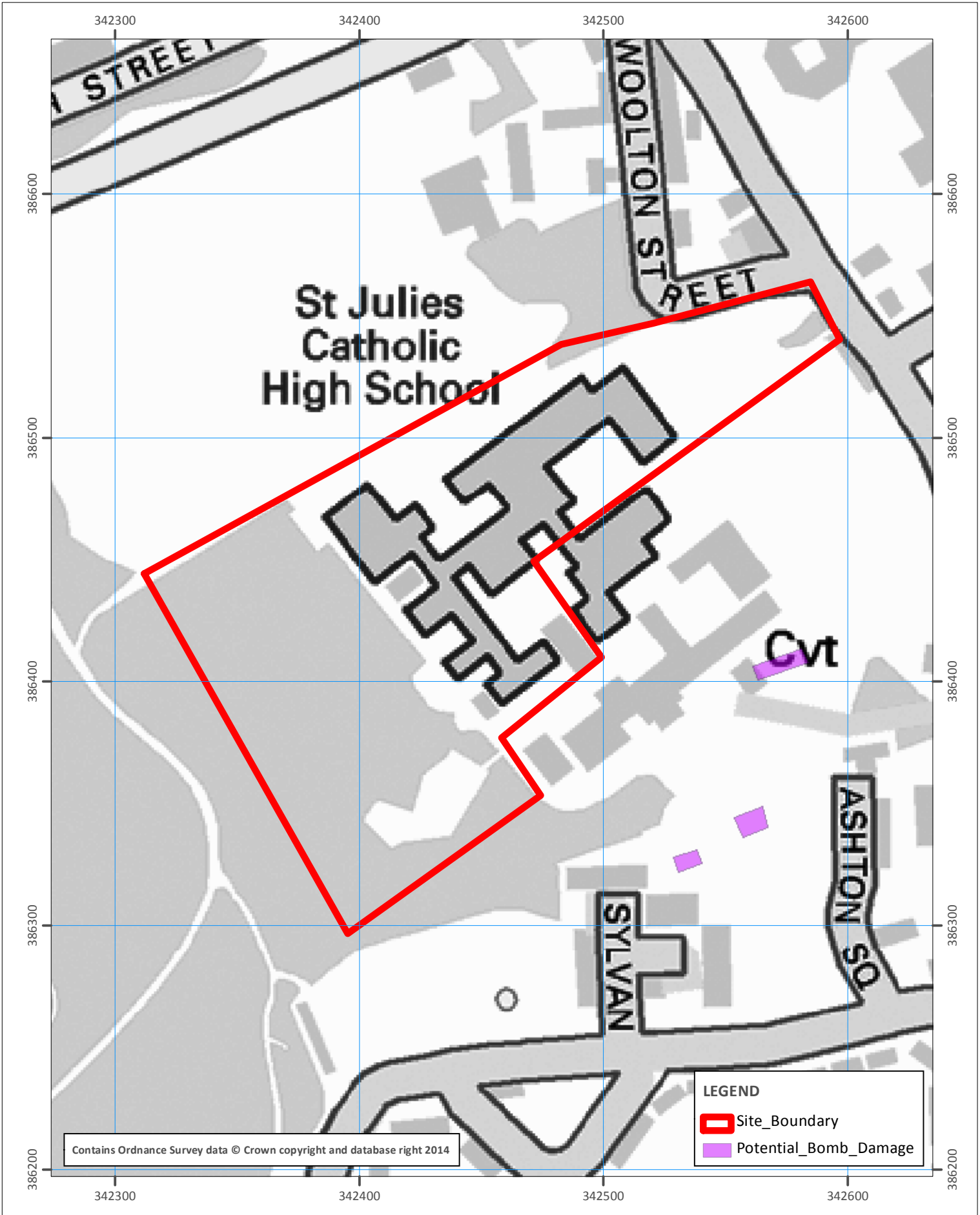
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### Areas of Potential WWII Bomb Damage

# HIGH STREET, WOOLTON, LIVERPOOL, L25 7TE Areas of Potential WWII Bomb Damage

Figure 7

BRITISH NATIONAL GRID



## Figure Eight

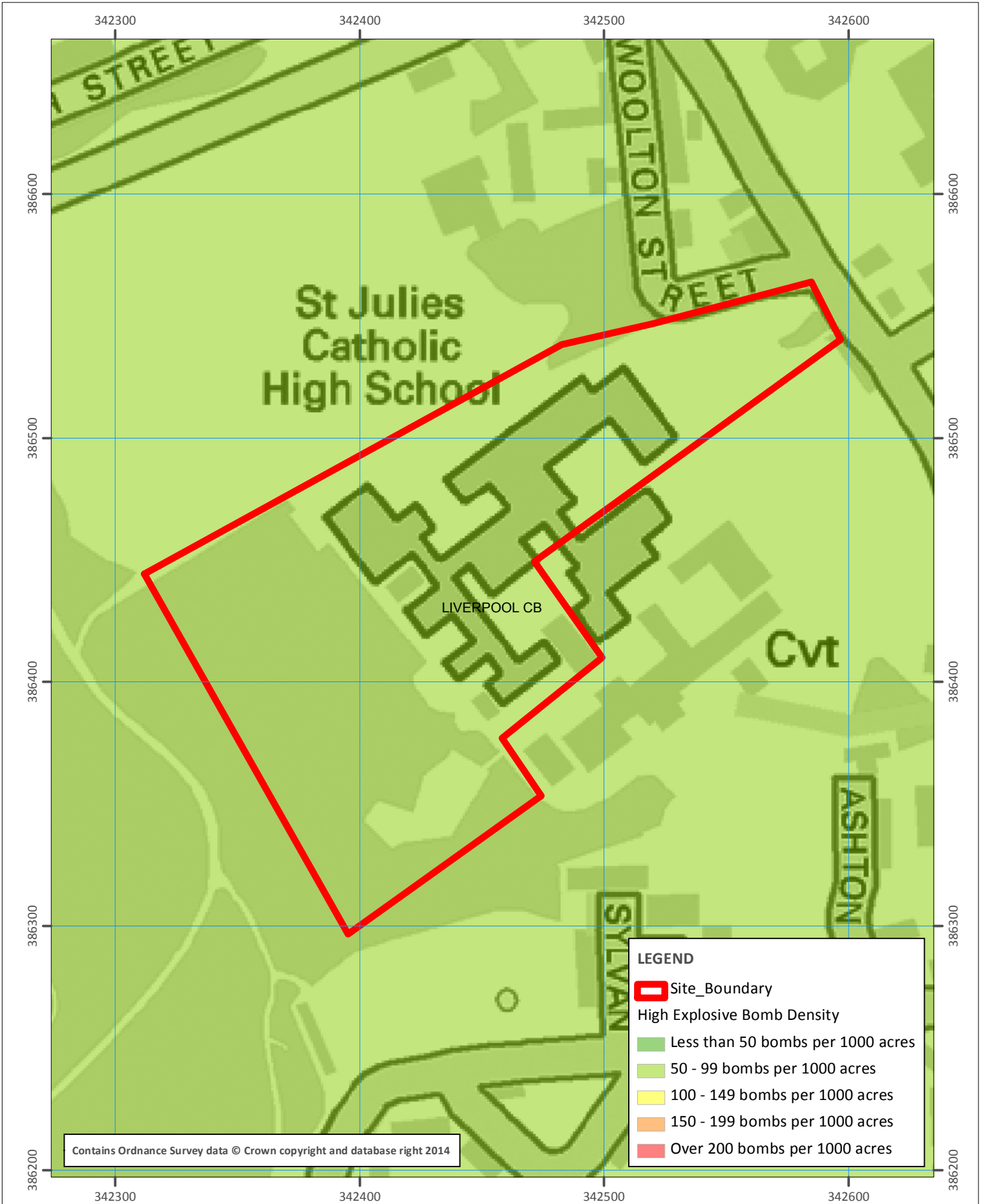
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### WWII High Explosive Bomb Density

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Figure 8

BRITISH NATIONAL GRID



## Figure Nine

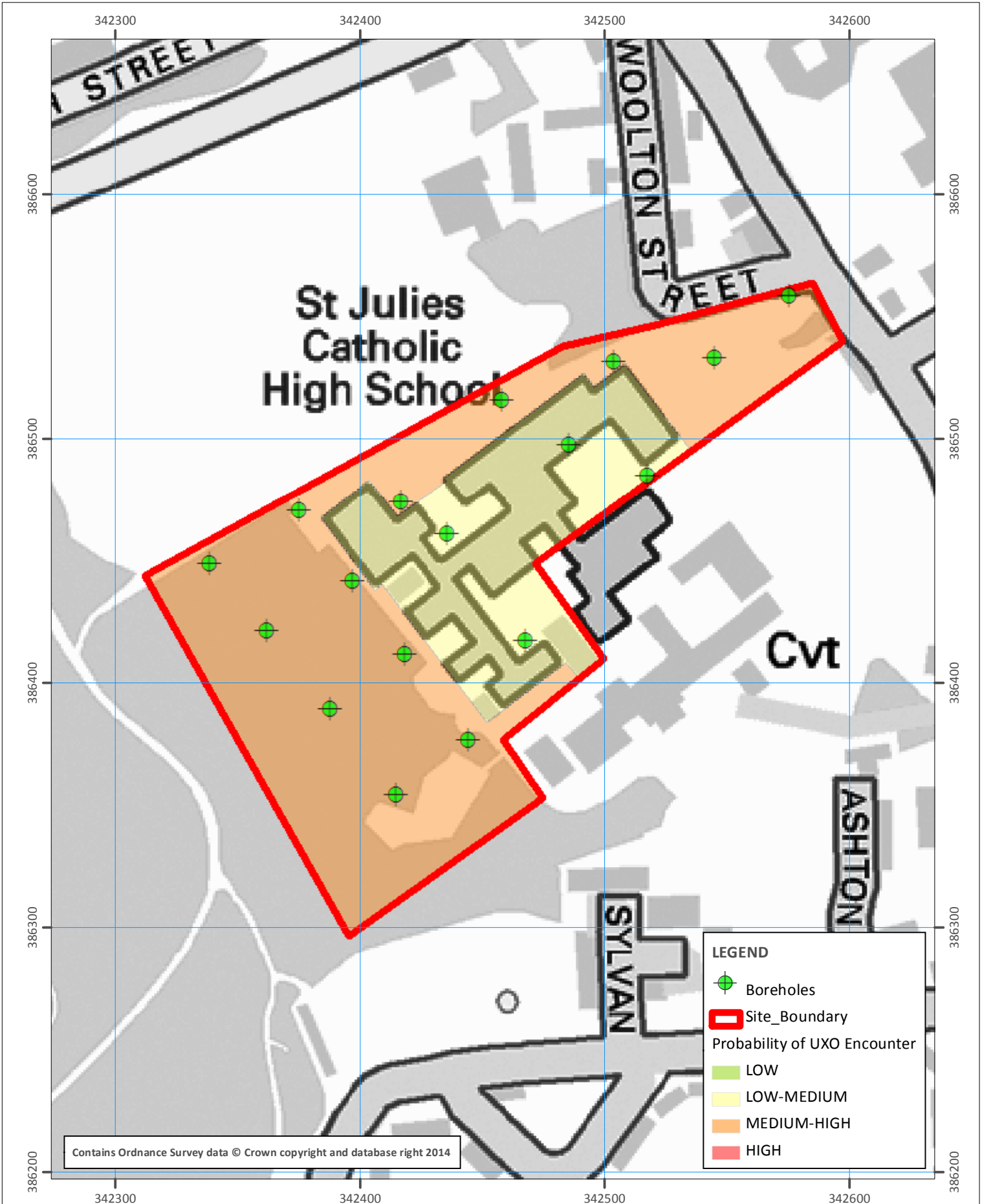
---

### Probability of UXO Encounter

# HIGH STREET, WOOLTON, LIVERPOOL, L25 7TE Probability of UXO Encounter

Figure 9

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