
Phase 2 Intrusive Investigation

ED 40287 Oswalds Road Primary School

Manchester

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For and on behalf of **Curtins Consulting Ltd**

- 1.0 In July 2012 Curtins Consulting Ltd were instructed by Manchester City Council to undertake a Phase 1 Geo-Environmental Desk Top Study on the site at Oswald Road Primary School, Oswald Road, Manchester. It is understood that the proposed development comprises the construction of extensions to the existing school buildings.
- 2.0 The exploratory holes revealed that the site is underlain by a variable thickness of made ground, with a minimum thickness of 0.90m encountered at WS1. The base of the made ground remained unproven at 5.45m depth in WS3. Made ground in four exploratory holes comprised a thin veneer of tarmac at the surface, with grass and topsoil underlain by made ground recorded in the other two exploratory holes (WS4 and WS5).
- 3.0 Beneath the made ground at four locations, Glacial Till was encountered and proven to a depth of 5.45m. The consistency of the clay was generally logged as firm.
- 4.0 Nine samples representative of the made-ground and natural soils were subjected to environmental chemistry analysis for a broad suite of potential contaminants. Given that the current and proposed end use of the site (educational) is not directly accounted for by published UK guidance the report compares the chemistry analysis results against a *Commercial* end use generally and as a conservative assessment against *Residential* end use for volatile compounds/fractions.
- 5.0 With reference to the Tier 1 Thresholds initial assessment shows that the thresholds have been exceeded in the shallow soils with respect to the proposed end use at three locations.
- 6.0 The results of the groundwater analysis have been compared against the relevant UK water quality criteria (Environmental Quality Standards, EQS or Drinking Water Standards, DWS). A slight DWS exceedance of sulphate has been recorded within WS5.
- 7.0 Exceedances of some Poly Aromatic Hydrocarbons (PAHs) have also been recorded with groundwater sample from WS3. It is recommended that further groundwater samples are obtained from this borehole to determine if the contamination encountered is persistent or if it has occurred through contaminated material being dragged down as part of the drilling process.
- 8.0 Although contamination is recorded within the sites made ground it is considered that any risk presented to surface water receptors is Low due to the presence of non-productive superficial deposits (Diamicton Till) and the distance to the nearest receptor (263m north east) and the lack of any surface water abstractions within 1000m of the site.
- 9.0 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 and gas screening value indicate CS2 requiring gas protection measures. An allowance should be made for a passively ventilated sub floor void with a Visqueen CO2 membrane or similar approved by the engineer with all joints and penetrations sealed.
- 10.0 Upon the completion of gas monitoring the results and recommendations will be issued as an addendum to this report.

- 11.0 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.
- 12.0 Elevated concentrations of PAHs with respect to water supply protection were determined within the made ground at one isolated location on the site (WS3), at a depth of 1.22m below existing ground level. Therefore, as a precautionary measure it is recommended that appropriate materials for water supply pipes would comprise a 'barrier' (PE-AI-PE) pipe. The exact requirements are to be confirmed with the relevant utility supplier.
- 13.0 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 shallow spread foundations to support the proposed structure. However, due to the depth of made ground within the central area of the site, it is considered unlikely that a traditional shallow foundation solution could be adapted. Alternative solutions would include a piled foundation solution, or the predominantly granular nature of the fill may make it amenable to ground improvement techniques such as vibro-stone columns.
- 14.0 It is likely that further information with respect to the maximum depth of the fill likely to be encountered on site may be required.
- 15.0 On the basis of observations on site together with the results of laboratory tests it is recommended that, outside the zone of influence of trees, consideration is given to constructing a lightly loaded ground floor slab on formation prepared in granular made ground natural strata. Any soft or deleterious material should be removed and replaced with properly compacted granular fill.
- 16.0 Within the zone of influence of trees, the floor slabs should be suspended over a void, in accordance with NHBC guidelines. Where the final levels dictate that the depth of sub floor fill exceeds 600mm, ground floor slabs should be suspended in accordance with NHBC requirements.
- 17.0 Concrete design may be based on a Design Sulphate Class of DS-1 and an ACEC class of AC-1.
- 18.0 The revised Conceptual Site Model has identified that some risk still remains on the site and as such it is considered that it will be necessary to produce a Remediation Strategy and a Verification Report to remove these residual risks.

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1.1 Project Background

In July 2012 Curtins Consulting Ltd were instructed by Manchester City Council to undertake a Phase 1 Geo-Environmental Desk Top Study and Phase 2 Intrusive Investigation on the site at Oswald Road Primary School, Oswald Road, Manchester. It is understood that the proposed development comprises the construction of extensions to the existing school buildings.

1.2 Scope of Works

The 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 intrusive 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. Within the limitations discussed above the intrusive investigation was undertaken to confirm the geo-environmental conceptual model and associated risk determined in the Phase 1 Desk Top Study.

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 maybe present on the site due to its known current, recent and historical use.
- b) If there is a risk of groundwater and or surface water being adversely impacted upon by potential contamination that maybe present on the site due to its known current, recent and 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 Desk Study & Existing Reports

This section of the report presents a summary of the Geo-Environmental Appraisal Phase 1-Desk Study Report; document reference no. 50974/SH/2426 dated September 2012.

2.1 Current Setting

The site's boundaries are indicated on the location plan in Appendix A1. The site is approximately centred on National Grid Reference 381510, 394250.

2.2 Site History

Early maps from the mid-19th Century indicate that the site is occupied by farmland with Marl Pits marked on the map. By the 1890's, the site is occupied by farmland. There are a number of ponds in the centre and northern half of the site, with a wooded area on the northern boundary. By 1907, the site is an open field and is a part of Redgate Farm, with no ponds or wooded areas marked.

This remains unchanged until the 1920's, when Redgate Farm is removed. From the 1920's, the site is occupied by Oswald Road Primary School. Up until the 1970's, the site contains two large school buildings and two small buildings in the southern half of the site. A school house occupies the north east corner. Extensions to the school and to the school house occur in the 1930's and the 1950's respectively.

In 1971, the large building at the southern end of the site has been demolished. A new small building has been added to the school, east of the building in the centre of the site which has been extended eastwards. The building is further extended during the 1980's. In 1992, a new building has been constructed in the south east corner of the site. The site remains this way up to the present day.

Early historical maps of the area surrounding the site show that the area is predominantly occupied by farmland. Brick Kiln Pits are located on the western boundary, with Redgate Farm to the east. Longford Brook and Chorlton Brook are located 200m north and 900m south of the site respectively, flowing in westerly directions. The village of Chorlton-cum-Hardy is located 750m south of the site.

From the end of the 19th Century, residential properties become the more prominent land-use in the area as the village of Chorlton-cum-Hardy expands. A railway line is located about 200m east of the site. Remaining farmland north and west of the site contain ponds, located at 150m south west and 200m north west of the site. A Goods Shed and small set of sidings are located 200m east of the site. In the 1920's, Redgate Farm is removed and a library established on the north east boundary of the site.

As the city of Manchester expands, residential housing slowly occupies the open fields and by the 1930's completely surrounds the site. While the site has predominantly been surrounded by a mixture of residential housing with recreational grounds and allotment gardens, some commercial/industrial works with contaminative end uses have existed in the surrounding area. These include a brick works with chimney, brick kiln, tanks, pond and refuse heap; electricity sub-stations, Thirlmere Aqueduct, public baths, miniature rifle range, builders yard, dairy, ice cream factory, depots and trading estates.

2.0 Summary of Desk Study & Existing Reports

2.3 Geology

A study of the Envirocheck records and British Geological Survey (BGS) 1:50000 mapping records (Bedrock and Superficial Editions) Sheet 85 Manchester indicates the following geological succession underlying the site.

- | | | | |
|---|--------------------------|-------------|----------------|
| • | Till | (Diamicton) | (Devensian) |
| • | Sherwood Sandstone Group | (Sandstone) | (Late Permian) |

One fault is located within 1000m of the site, east of the site.

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

The Envirocheck report states the site is not within an area affected by coal mining activity.

Both the Radon Atlas for England and Wales and the Envirocheck report confirm that the site is not in a Radon Affected Area, with less than 1% properties above the action level. Consequently, no radon protection measures are necessary in the construction of new dwellings.

2.4 Hydrogeology and Hydrology

The 1:100000 Sheet 17 Derbyshire & North Staffordshire groundwater map indicates that the site is underlain by unproductive superficial deposits which overly a Principal Aquifer.

An Unproductive Aquifer is classed as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

A Principal Aquifer is a layer 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 aquifers.

Soils overlying the site are classed as having a 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 located within a Source Protection Zone.

The nearest surface water feature, which is an unnamed drain, is located around 263m to the north east of the site.

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

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

2.0 Summary of Desk Study & Existing Reports

There are no discharge consents or pollution incidents to controlled waters arising from the site.

The site is not within a flood risk area.

2.5 Landfill

One landfill and two historic landfills are recorded within 750m of the site of interest. Ivy Green Tip is located about 700m south west of the site, with the historic landfills at the same location, recorded at 689m and 699m south west of the site.

Historically on site there were a number of ponds located in the northern and eastern half of the site which were back-filled prior to 1922.

3.0 Phase 2 Investigation Proposals

3.1 General

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

Review of the Desk Study identified that site investigation was required to investigate potentially contaminating material, to provide groundwater monitoring results and to provide foundation design for the proposed buildings. A strategy for the Phase 2 intrusive investigation was derived accordingly and comprised the following operations:

- Logging and sampling of representative soils in six window sample boreholes to around 5.50m below existing ground level with three upgraded to allow groundwater sampling and soil gas monitoring.
- Logging of soils in four hand excavated trial pits to inspect existing building foundations.
- Environmental Chemistry Analysis for a suite of determinands reflecting the known historical use of the site on a number of samples representative of the made-ground and natural materials encountered.
- Environmental Chemistry Analysis for a suite of determinands reflecting the known historical use of the site on a number of groundwater samples obtained from the upgraded boreholes.
- Monitoring soil gases initially on six occasions over three months for methane, carbon dioxide, oxygen, hydrogen sulphide, gas flow in l/hr, weather conditions, and barometric pressure with confirmation if falling, steady or rising.

4.0 Fieldwork

4.1 General

The site investigation fieldwork was undertaken in August 2012 under the supervision of a suitably qualified engineer.

The locations of all the exploratory holes are recorded within Appendix A2.

4.2 Window Sample Borehole Investigation

Six window sample boreholes, WS1 to WS6, were advanced on the subject site by Ian Farmer Associates in August 2012 under the supervision of a suitably experienced engineer. All boreholes were logged in general accordance with BS5930:1999.

The boreholes were advanced to depths of 4.45m or 5.45m below ground level (bgl) at five locations. The hand dug pit at WS2 collapsed at a depth of 1.00m below ground level and was not extended further.

Single well installations were incorporated within three of the boreholes. A summary of the response zones is presented in Table 4.2 below.

Table 4.2 Borehole Response Zones

Borehole Reference	Response Zone(s) (mBGL)	Strata Description(s)
WS1	1.00 – 5.00	Clay
WS3	1.00 – 4.00	Made ground
WS5	1.00 – 4.00	Made ground & Clay

The window sample borehole logs can be referred to in Appendix A3 of this report.

4.3 Hand Excavated Trial Pit Investigation

Four hand excavated trial pits (HP1 to HP4) were advanced on the subject site by Ian Farmer Associates in August 2012. These were logged in general accordance with BS5930: 1999. All four trial pits were completed to between 0.50m and 1.30m below existing ground level and were conducted to prove the location and presence of the ground floor slab of the school building already on site, which was successfully located and recorded at locations HP3 and HP4 only.

HP1 was excavated to a depth of 1.30m and no foundations were uncovered. At HP2, a concrete slab was located at 0.50m and the hole could not be extended further.

The trial pit logs can be referred to in Appendix A3 of this report.

5.0 Laboratory Testing

5.1 Soil Analysis

A programme of environmental chemistry testing was scheduled reflecting the findings of the Desk Study and site observations during the investigation. The soil samples were analysed for the determinands shown in Table 5.1a below.

Table 5.1a Environmental Chemistry Analysis Suite: Soils

Suite Ref	Analysis	LOD
S1A	Asbestos Screen	
	pH	
	Soil Organic Matter	
	Arsenic	5 mg/kg
	Boron (water soluble)	1 mg/kg
	Cadmium	0.5 mg/kg
	Chromium	5 mg/kg
	Chromium VI	5 mg/kg
	Copper	5 mg/kg
	Lead	5 mg/kg
	Mercury	0.1 mg/kg
	Nickel	5 mg/kg
	Selenium	5 mg/kg
	Zinc	5 mg/kg
	Cyanide (total)	10 mg/kg
	Sulphate (total)	200 mg/kg
	Sulphide	2 mg/kg
	Sulphur (elemental)	20 mg/kg
	Phenols (screen)	1 mg/kg
	PAH's (USEPA16)	0.1 mg/kg
	TPH (CWG Banding - Aro/Alk Split)	0.01 mg/kg to 0.1mg/kg

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

5.0 Laboratory Testing

5.2 Water Analysis

Water analysis was undertaken from two water samples obtained from WS1 and WS5. The water samples were analysed for the determinands shown in Table 5.2a below.

Table 5.2a Environmental Chemistry Analysis Suite: Water

Suite Ref	Analysis	LOD
W1	pH	
	Total hardness (CaCO ₃)	1mg/l
	Arsenic	1µg/l
	Boron (water soluble)	0.1mg/l
	Cadmium	0.5µg/l
	Chromium	0.1µg/l
	Copper	0.1µg/l
	Lead	1µg/l
	Mercury	0.1µg/l
	Nickel	1µg/l
	Selenium	1µg/l
	Zinc	1µg/l
	Cyanide (total)	0.2mg/l
	Sulphate (total)	10mg/l
	Sulphide	0.2mg/l
	Phenols	0.1mg/l
Suite Ref	Analysis	LOD
W2	PAH's (USEPA16)	0.01µg/l
Suite Ref	Analysis	LOD
W3	TPH (CWG Banding)	10µg/l

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

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 and indicative thickness of strata are provided below:

Table 6.1 Generalised Geological Succession

Strata Encountered	Depth Encountered (m)		Strata Thickness (m)
	From	To	
Made Ground	0.00	0.90 to 5.45	0.45 to Unknown
Clay	0.45 to 4.50	5.45	Not Proved

6.1 Made Ground

Made ground has been encountered in all exploratory holes formed to depths of between 1.00m and >5.45m, with the greatest depths being encountered within WS3 and WS4.

The material encountered generally comprised a sandy gravel including fragments of clinker and ash, however locally soft clay layers were encountered at depths of between 1.10m and 1.50m.

All of the exploratory holes were located close to the existing school buildings and encountered made ground comprising sandy gravel with limestone, sandstone, ash, clinker, brick, concrete, and ceramic fragments. WS4 and WS5 has grass over topsoil at surface level, while the remaining exploratory holes had a thin veneer of tarmac at the surface, all overlying the made ground.

6.2 Existing Foundations

Four hand dug trial pits were excavated adjacent to the existing buildings as existing foundation observation pits.

HP1 – Trial pit terminated at a depth of 1.30m, and probed to 1.50m without encountering the foundation.

HP2 – A concrete slab was encountered at a depth of 0.50m, which could not be penetrated due to the presence of services.

HP3 – Foundation encountered at a depth of 1.11m, within made ground comprising gravel including fragments of brick, ash and clinker.

HP4 – Foundation encountered at a depth of 1.11m within made ground comprising soft gravelly clay including gravel of ash, brick and sandstone.

6.3 Clay

Clay was encountered below made ground in all of the exploratory holes where the base of made ground was proved. The clay was typically described as brown slightly gravelly clay including fragments of sandstone, siltstone and mudstone. The consistency of the clay was generally logged as firm.

6.0 Ground Conditions

Boreholes were terminated in clay at a maximum depth of 5.45m in WS1 and WS4. At boreholes WS5 and WS6, clay was proven to a depth of 4.45m below ground level.

Work undertaken by Stroud determined a relationship between SPT 'N' values, plasticity and the undrained shear strengths of many over-consolidated clays. Further work by Stroud and Butler, in which data was analysed from sites covering a wide range of glacial deposits, confirmed there to be a correlation between the 'N' value, plasticity and undrained shear strength.

The relationship was of the form:

$$C_u = F_1 \times N$$

where C_u = Undrained shear strength

and F_1 = Factor

It was determined by Stroud that F_1 varied between 4kPa for material of high plasticity and 6kPa for material of low plasticity.

It is considered that for the strata encountered on this site a value of around $F_1 = 6\text{kPa}$ would be appropriate.

Nine SPT's were carried out and recorded N values of between 2 and 17 corresponding to shear strengths in the range of 12 (very soft) kPa and 102 kPa (stiff)

6.4 Groundwater

Water was encountered in WS2 at 0.60m, WS3 at 1.20m and at WS4 at 3.40m depth below ground level. It is likely that this water was perching on the top of the clay.

Water was also encountered in HP4 at a depth of 1.10m below ground level.

Groundwater was not encountered at the remainder of the locations.

7.0 Geochemical Ground and Groundwater Assessment

7.1 Overall Assessment

A Phase 1 Desk Top Study undertaken by Curtins Consulting revealed that the site has been occupied by fields and hedgerows, marl pits, ponds, a school house, playing fields and a school which has extended and changed with the demolition of old buildings, over time.

A strategy for a Phase 2 intrusive investigation was consequently developed with reference to this information, the initial conceptual site model and the proposed development use as educational premises. The intrusive investigation was undertaken in order to provide an assessment of the ground conditions on the subject site with respect to geotechnical properties, potential contamination in the underlying soils and groundwater and the risk from soil gases.

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 of harm to the proposed end users, associated utilities and the wider environment.

Curtins Consulting 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 intrusive investigation. This assessment is based solely on the results of the chemical and other testing data obtained as part of Curtins Consulting's investigation.

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, subsequently reissued in January 2009 (CLEA v1.04) and again in October 2009 (CLEA v1.06).

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'.

7.0 Geochemical Ground and Groundwater Assessment

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 in-house derived 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 for a wide range of organic compounds, petroleum hydrocarbons, volatile and semi-volatile organic compounds. Therefore other guidance from outside the UK maybe referred to, for example the TPH Criteria Working Group series of documents.

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.

7.2 Site Soils

As discussed previously, six exploratory holes were undertaken in total across the development site. Representative samples of any made-ground and underlying natural soils were taken from these exploratory holes.

7.0 Geochemical Ground and Groundwater Assessment

Nine samples representative of the made-ground and natural soils were subjected to environmental chemistry analysis for a broad suite of potential contaminants. Given that the current and proposed end use of the site (educational) is not directly accounted for by published UK guidance the report compares the chemistry analysis results against a *Commercial* end use generally and as a conservative assessment against *Residential* end use for volatile compounds/fractions.

The average soil organic matter (SOM) content of the made-ground and natural soils across the development site are 2.06% and 5.75% respectively. For risk assessment purposes the SOM evaluated as 1.0%.

The environmental chemistry results have been compared with the Tier 1 criteria as shown in Appendix A6, for soils with respect to human health for the intended end use for a Soil Organic Matter value of 1% for a Residential end use and 1% for Commercial end use. The results of the environmental testing can be referred to in Appendix A4.

With reference to the Tier 1 Thresholds initial assessment shows that the thresholds have been exceeded in the shallow soils with respect to the proposed end use in three locations.

The locations where Tier 1 thresholds have been exceeded are shown in Table 7.2 below.

Table 7.2 Location of exceeded Tier 1 Thresholds Soils

Location	Depth (m)	Strata	Contaminant	Conc'n (mg/kg)	Tier 1 (mg/kg) 1% SOM Residential	Tier 1 (mg/kg) 1% SOM Commercial
WS2	0.30	Made ground	Mercury	10.8	0.06	4.3
WS3	1.50	Made ground	Mercury	6.5	0.06	4.3
WS4	0.40	Made ground	Benzo(a)pyrene	15.6	0.989	14.3
WS4	0.40	Made ground	Naphthalene	3.5	1.50*	8180
WS4	1.80	Made ground	Sulphate (total)	3600	2400	2400
WS4	1.80	Made ground	Sulphide	272	250	250

* LQM Criteria

7.2.1 Toxic Metals

7.2.1.1 Mercury

Mercury was observed above Tier 1 thresholds at a concentration which could present a risk of significant harm to the proposed end user by risk of direct contact and ingestion in two locations within the made-ground, with a maximum concentration of 10.8mg/kg in WS2 at 0.30m.

7.0 Geochemical Ground and Groundwater Assessment

Elemental mercury's risk driver pathway is volatilisation specifically intrusion of vapours into buildings. Inquiries at various laboratories into the availability of mercury speciation have indicated no such techniques are commercially available or at least at practicable costs.

For risk assessment purposes there exists therefore two options where no specific evidence is available: either; assume a worst case scenario of elemental mercury for the total concentration (lowest SGV) or; assume, based upon the guideline literature (Science Report SC050021 / Mercury SGV), that the majority of mercury present within the soil environment is inorganic with elemental mercury as a minor constituent and organic mercury, unless evidence suggests otherwise, as negligible.

Given the site's historical use as fields and hedgerows, marl pits, ponds, a school house, playing fields and a school, it is considered unlikely that organic mercury will be present at levels that could present a risk to human health.

7.2.2 Inorganics

7.2.2.1 Sulphide

Where tested, there is one location of an elevated sulphide concentration present within the made ground. Sulphide was found at a concentration of 272mg/kg WS4 at 1.80m.

Sulphide at this concentration is not likely to present either an acute, chronic or dermal risk of harm to human health. However sulphides at this concentration can result in malodorous hydrogen sulphide in acid conditions. The soils in this location are neutral to alkaline and Hydrogen sulphide has not been recorded during the current gas monitoring visits.

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

7.2.2.2 Sulphate

Sulphate was observed above the Tier 1 thresholds at concentrations which could present a risk to sub-surface building materials in three locations in the made ground, with the highest concentration being 21000mg/kg in window sample hole WS5 at a depth of 0.50m bgl.

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.

Where tested, there is no evidence of elevated sulphate concentrations present within the underlying natural strata.

7.0 Geochemical Ground and Groundwater Assessment

7.2.3 Organics

7.2.3.1 Poly Aromatic Hydrocarbons (PAH's)

Benzo(a)pyrene was observed above Tier 1 thresholds at a concentration which could present a risk of to the proposed end user in one isolated location within the made-ground, with a recorded concentration of 15.6mg/kg in WS4 at 0.40m. The observed concentrations of Benzo(a)pyrene could present a risk of significant harm to the proposed end user by risk of direct contact, ingestion and inhalation.

It is considered that the proposed development will mitigate the risk from this potential contamination given that the site is to be covered with buildings and or hard standing thus breaking the source-pathway-receptor linkage.

Naphthalene was observed at a concentration of 3.5mg/kg within the made ground at WS4 at a depth of 0.40m below ground level. Initial Tier 1 screening assessment revealed four elevated samples above 'Residential without the Consumption of Produce', value of 0.598mg/kg. Further assessment via LQM/CIEH General Assessment Criteria for Human Health Risk Assessment (2nd Edition) revealed one isolated elevated Naphthalene concentration above the Residential Land-use with 1% SOM threshold of 1.5mg/kg. This concentration of 3.5mg/kg is located at WS4 at a depth of 0.40m below ground level.

It is recommended that further shallow intrusive works are carried out to delineate this isolated occurrence of naphthalene.

Construction workers are to be provided with appropriate PPE and sanitary facilities with reference to the contaminants of concern observed in the site soils.

There is no evidence of elevated PAH concentrations present within the underlying natural strata.

7.3 Groundwater

Water was encountered in WS1, WS3 and WS5 at depths between 1.22m and 2.35m below ground level.

After purging, three well volumes of water were obtained from all three well installations. The waters were sent to a laboratory for chemical analysis as detailed in Table 5.2a.

Response zones within the monitoring exploratory holes were targeted at; a) strata likely to have the highest permeability, b) water bearing strata and c) strata with the greatest gassing potential.

The results of the groundwater analysis have been compared against the relevant UK water quality criteria (Environmental Quality Standards, EQS or Drinking Water Standards, DWS). There was an exceedance recorded for sulphate in WS5 with an elevated concentration of 376mg/l being recorded. The DWS threshold level for sulphate is 250mg/l.

7.0 Geochemical Ground and Groundwater Assessment

The water sample obtained from WS3 also recorded a number of Poly Aromatic Hydrocarbons (PAH) exceedances, including Fluoranthene and Naphthalene. It is recommended to obtain further groundwater samples from this borehole to determine if the contamination encountered is persistent or if it has occurred through contaminated material being dragged down as part of the drilling process.

Due to the presence of firm brown clay underlying the site, a low likelihood to the groundwater reserves is deemed to exist as it is believed that this water is perched above the natural clay strata. Additionally, there are no groundwater or potable water abstractions within 1000m of the site. As such the risk to Principle Aquifer is considered to be Low.

Copies of the environmental chemistry certificates can be referred to in Appendix A4.

7.4 Surface Water

The nearest surface water feature, which is an unnamed drain, is located around 263m to the north east of the site. There are no surface water abstractions within 1000m of the site.

Although contamination is recorded within the sites made ground it is considered that any risk presented to surface water receptors is Low due to the presence of non-productive superficial deposits (Diamicton Till) and the distance to the nearest receptor (263m north east) and the lack of any surface water abstractions within 1000m of the site.

7.5 Soil Gases

Gas monitoring pipe work was installed in boreholes WS1, WS3 and WS5.

Gas monitoring has been undertaken across the site on two occasions to date and is ongoing with a further four visits to be completed. Barometric pressure was recorded at 1013mb and 1003mb during the two visits. No flow or methane or hydrogen sulphide was recorded during the visits.

During the initial gas monitoring visit, elevated carbon dioxide concentrations were recorded in two the monitored holes (WS1 and WS5) with a maximum recorded reading of 12.9% v/v in WS5.

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 and gas screening value indicate CS2 requiring gas protection measures. An allowance should be made for a passively ventilated sub floor void with a Visqueen CO2 membrane or similar approved by the engineer with all joints and penetrations sealed.

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

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

7.0 Geochemical Ground and Groundwater Assessment

7.6 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 PAHs with respect to water supply protection were determined within the made ground at one isolated location on the site (WS3), at a depth of 1.22m below existing ground level. It is recommended to obtain further groundwater samples from this borehole to determine if the contamination encountered is persistent or if it has occurred through contaminated material being dragged down as part of the drilling process.

The presence of Tier 1 exceedances of Benzo(a)pyrene and Naphthalene in the made ground soil samples collected at a depth of 0.40m in WS4 may be a source of these elevated concentrations of PAH's in the groundwater of WS3.

As a precautionary measure it is recommended that appropriate materials for water supply pipes would comprise a 'barrier' (PE-Al-PE) pipe. The exact requirements are to be confirmed with the relevant utility supplier.

8.0 Geotechnical Assessment

8.1 Structural Details

It is understood that the proposed development comprises the construction of extensions to the existing school buildings.

8.2 Foundation Design

The results of laboratory tests indicate the clay is of low, intermediate and high plasticity and of low to medium volume change potential as defined by the National House Building Council. Changes in moisture content will result in moderate to small changes in volume, seasonal changes being exacerbated by the presence of trees. It is recommended that for design purposes, medium volume change potential should be adopted.

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 shallow spread foundations to support the proposed structure.

Due to the depth of made ground within the central area of the site, it is considered unlikely that a traditional shallow foundation solution could be adopted.

Alternative solutions would include a piled foundation solution, or the predominantly granular nature of the fill may make it amenable to ground improvement techniques such as vibro-stone columns.

The carrying capacity of such methods depends not only on their size and the ground conditions but also on their method of installation. Such methods design and installation are continuously evolving and state-of-the-art processes are often employed before they reach the public domain, perhaps several years down the line. Therefore, it is recommended that specialist contractors be contacted as to the suitability and capacity of their techniques in the ground conditions pertaining to the site.

It is likely that further information with respect to the maximum depth of the fill likely to be encountered on site may be required.

8.3 Ground Slab

On the basis of observations on site together with the results of laboratory tests it is recommended that, outside the zone of influence of trees, consideration is given to constructing a lightly loaded ground floor slab on formation prepared in granular made ground natural strata. Any soft or deleterious material should be removed and replaced with properly compacted granular fill.

Within the zone of influence of trees, the floor slabs should be suspended over a void, in accordance with NHBC guidelines.

Where the final levels dictate that the depth of sub floor fill exceeds 600mm, ground floor slabs should be suspended in accordance with NHBC requirements.

8.0 Geotechnical Assessment

8.4 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 1.20m 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.

Perched groundwater could be present in the made ground overlying the clay. It is considered that this could be dealt with by pumping.

8.5 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest 1 as brownfield 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 in the non-pyritic soils indicate a sulphate concentration in the soil of between <100mg/l and 200mg/l as a 2:1 water/soil extract, with pH values in the range of 7.0 to 8.0.

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 site may be taken as DS1, the requirements specified in BRE Digest 1: 2005 (Third Edition) "Concrete in aggressive ground: Part C: Assessing the aggressive chemical environment". The site conditions would suggest that an ACEC class for the site of AC-1 would be appropriate.

9.0 Pre-Remediation Constraints and Outline Remediation Strategy

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

9.1 Invasive Plants

The presence of the invasive plant species, Japanese Knotweed and or Giant Hogweed, was not readily apparent during the fieldwork but it is recommended that an ecological report for the site be obtained to confirm this.

9.2 Services

Prior to site works, all exploratory hole locations were scanned for services and consequently some investigation locations may have been moved slightly.

9.3 Buildings and Hardstanding

At the time of the investigation the site comprised three buildings, with the main school building aligned east-west on the eastern side of the site. The existing school buildings comprise 'red brick' buildings up to two storeys in height with pitched tile roofs. The school buildings are surrounded by tarmac covered parking and playground areas with occasional soft landscaping. The site was sensibly level.

During the site investigation four hand dug trial pits (HP1 and HP4) next to the existing school buildings encountered vertical brickwork extended down to depths of greater than 1.50m (HP1) and found to be resting on a concrete footing in the other three hand dug pits (HP2 – HP4). The thickness and width of the concrete slab was only encountered in HP3 and HP4 which are located at the site's southern building. This concrete slab was around 0.57m thick and the concrete extended out from the face of the brickwork by around 30mm.

9.4 Land Condition and Outline Remediation

The exploratory holes revealed that the site is underlain by a variable thickness of made ground, with a minimum thickness of 0.90m encountered at WS1. The base of the made ground remained unproven at 5.45m depth in WS3. Made ground in four exploratory holes comprised a thin veneer of tarmac at the surface, with grass and topsoil underlain by made ground recorded in the other two exploratory holes (WS4 and WS5).

Beneath the made ground at four locations, Glacial Till was encountered and proven to a depth of 5.45m. The consistency of the clay was generally logged as firm.

Nine samples representative of the made-ground and natural soils were subjected to environmental chemistry analysis for a broad suite of potential contaminants. Given that the current and proposed end use of the site (educational) is not directly accounted for by published UK guidance the report compares the chemistry analysis results against a *Commercial* end use generally and as a conservative assessment against *Residential* end use for volatile compounds/fractions.

9.0 Pre-Remediation Constraints and Outline Remediation Strategy

With reference to the Tier 1 Thresholds initial assessment shows that the thresholds have been exceeded in the shallow soils with respect to the proposed end use at three locations. It is recommended that the presence of PAH's, particularly Naphthalene, is delineated. Particular attention should be given to the area between WS3 and WS4, as the groundwater sample from WS3 had elevated PAH concentrations, including Naphthalene.

The results of the groundwater analysis have been compared against the relevant UK water quality criteria (Environmental Quality Standards, EQS or Drinking Water Standards, DWS). There was an exceedance recorded for sulphate in WS5 with an elevated concentration of 376mg/l being recorded. The DWS threshold level for sulphate is 250mg/l.

The water sample obtained from WS3 also recorded a number of Poly Aromatic Hydrocarbons (PAH) exceedances, including Fluoranthene and Naphthalene. It is recommended to obtain further groundwater samples from this borehole to determine if the contamination encountered is persistent or if it has occurred through contaminated material being dragged down as part of the drilling process.

Due to the presence of firm brown clay underlying the site, a low likelihood to the groundwater reserves is deemed to exist as it is believed that this water is perched above the natural clay strata. Additionally, there are no groundwater or potable water abstractions within 1000m of the site. As such the risk to Principle Aquifer is considered to be Low.

Although contamination is recorded within the sites made ground it is considered that any risk presented to surface water receptors is Low due to the presence of non-productive superficial deposits (Diamicton Till) and the distance to the nearest receptor (263m north east) and the lack of any surface water abstractions within 1000m of the site.

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 and gas screening value indicate CS2 requiring gas protection measures. An allowance should be made for a passively ventilated sub floor void with a Visqueen CO2 membrane or similar approved by the engineer with all joints and penetrations sealed.

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

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 PAHs with respect to water supply protection were determined within the made ground at one isolated location on the site (WS3), at a depth of 1.22m below existing ground level. Therefore, as a precautionary measure it is recommended that appropriate materials for water supply pipes would comprise a 'barrier' (PE-Al-PE) pipe. The exact requirements are to be confirmed with the relevant utility supplier.

9.0 Pre-Remediation Constraints and Outline Remediation Strategy

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 shallow spread foundations to support the proposed structure.

Due to the depth of made ground within the central area of the site, it is considered unlikely that a traditional shallow foundation solution could be adopted.

Alternative solutions would include a piled foundation solution, or the predominantly granular nature of the fill may make it amenable to ground improvement techniques such as vibro-stone columns.

The carrying capacity of such methods depends not only on their size and the ground conditions but also on their method of installation. Such methods design and installation are continuously evolving and state-of-the-art processes are often employed before they reach the public domain, perhaps several years down the line. Therefore, it is recommended that specialist contractors be contacted as to the suitability and capacity of their techniques in the ground conditions pertaining to the site.

It is likely that further information with respect to the maximum depth of the fill likely to be encountered on site may be required.

On the basis of observations on site together with the results of laboratory tests it is recommended that, outside the zone of influence of trees, consideration is given to constructing a lightly loaded ground floor slab on formation prepared in granular made ground natural strata. Any soft or deleterious material should be removed and replaced with properly compacted granular fill.

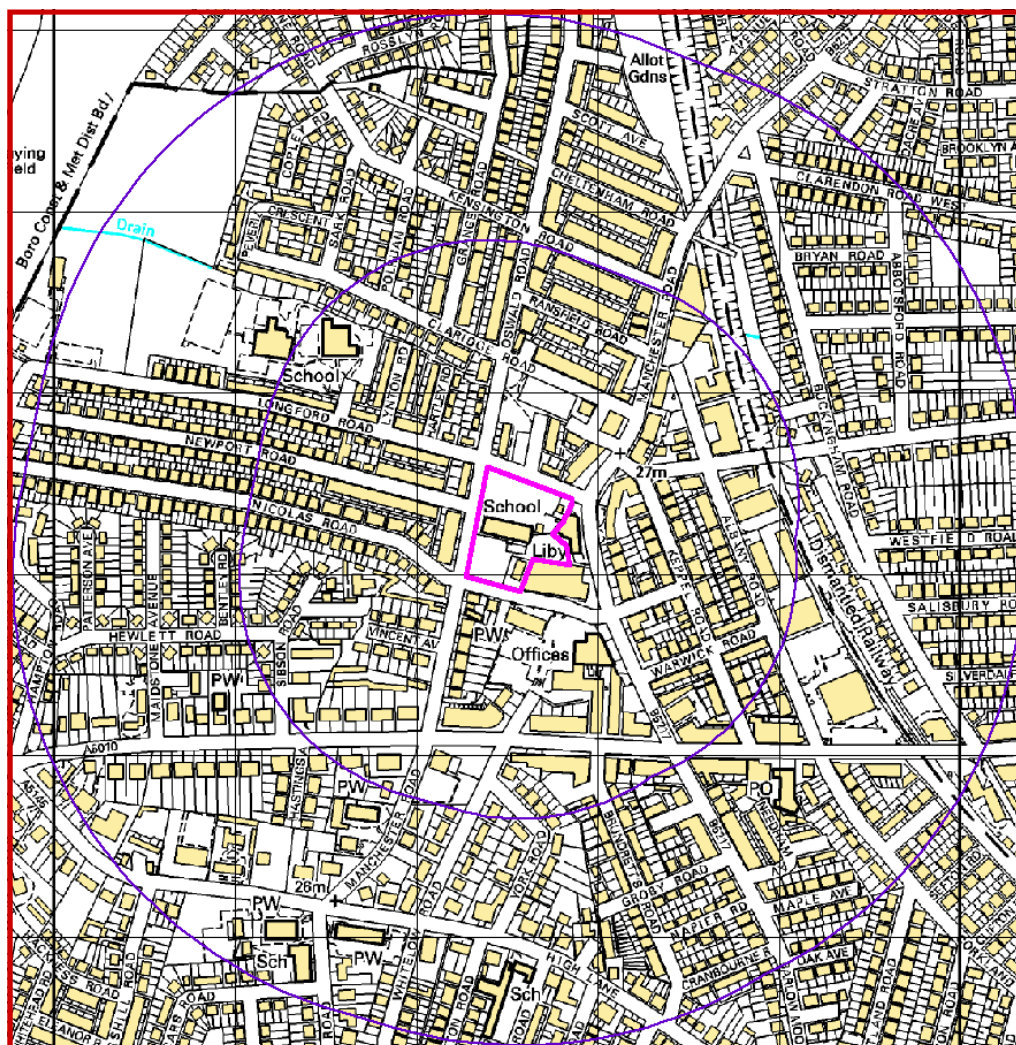
Within the zone of influence of trees, the floor slabs should be suspended over a void, in accordance with NHBC guidelines.

Where the final levels dictate that the depth of sub floor fill exceeds 600mm, ground floor slabs should be suspended in accordance with NHBC requirements.

Concrete design may be based on a Design Sulphate Class of DS-1 and an ACEC class of AC-1.

As can be seen from the revised Conceptual Site Model in Appendix A7, if some risk still remains on the site and as such it is considered that it will be necessary to produce a Remediation Strategy and a Verification Report to remove these residual risks.

Appendix A1 – Site Location Plan



Key



Project

Job Reference

Author

Drawing Title

Date _____

Checked

DJS



10 Oxford Court,
Bishopsgate,
Manchester
M2 3WQ

Tel: 0161 236 2394

Appendix A2 – Exploratory Hole Location Plan

Curtins Consulting drawing 50974/L001

NOTES:

- 1. This drawing is to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
- 2. Do not scale this drawing. All details and dimensions are to be checked by the contractor prior to commencement of construction. Any discrepancies to be reported to the engineer.
- 3. All dimensions are in millimetres unless noted otherwise

 WS01 – Indicates location of window sample hole

 HD01 – Indicates location of hand dug trial pit



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Curtins Consulting Ltd 10 Oxford Court, Bishopsgate, Manchester, M2 3WQ t: 0161 236 2394 f: 0161 228 7302 e: manchester@curtins.com www.curtins.com Structures • Civils • Environmental • Infrastructure • Transport Planning • Health & Safety • Design Resolution Birmingham • Bristol • Cardiff • Douglas • Edinburgh • Leeds • Liverpool • London • Manchester • Nottingham				
Status:				
Project: ST OSWALDS PRIMARY SCHOOL				
Dwg Title: EXPLORATORY HOLE LOCATION PLAN				
Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	26/10/12	P CASWELL	R ALLEN
Dwg No:	ED40287-50974/L001			Rev: /

Appendix A3 – Exploratory Hole Logs

Curtins Consulting Window Sample Borehole Logs (WS1 – WS6)
Curtins Consulting Trial Pit Logs (HP1 – HP4)



Site Oswald Road Primary School	Number WS01
Excavation Method Drive-in Window Sampler	Client Manchester City Council
Dimensions	Job Number 41072
Location	Engineer Curtins Consulting
Dates 29/08/2012	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.40	D1				(0.10)	MADE GROUND: Tarmacadam.			
0.40	J2				0.10				
0.40	V3				(0.13)	MADE GROUND: Grey, slightly sandy, angular and subangular, fine to coarse GRAVEL including limestone.			
0.50	B4				0.23 (0.67)				
1.00	D5				0.90	MADE GROUND: Dark grey, sandy, angular and subangular, fine to coarse GRAVEL including ash, clinker and brick.			
1.00	D8				(0.20)				
1.00	J6				1.10	MADE GROUND: Soft, grey/brown mottled, slightly sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine and medium including brick and ash.			
1.20-1.65	SPT(C) N=2		1,0/0,1,0,1						
1.00	V7								
1.20	D9								
1.50	D10								
1.50	J11								
1.50	V12								
1.60	D13								
2.00-2.45	SPT(C) N=10		1,0/0,3,3,4						
2.00	D14								
2.30	D15								
2.60	D16								
3.00-3.45	SPT(C) N=7		1,1/1,2,2,2						
3.00	D17				(4.35)	Below 2.00m: grey mottled absent.			
						Between 3.00m and 4.00m: no recovery.			
4.00-4.45	SPT(C) N=8		2,2/2,2,2,2						
4.00	D18								
4.30	D19								
4.60	D20								
5.00-5.45	SPT(C) N=13		2,3/3,3,3,4						
5.00	D21				5.45	Complete at 5.45m			

Remarks Excavating from 0.00m to 1.20m for 1.00 hour.	Scale (approx) 1:50	Logged By HH
	Figure No. 41072.WS01	



**IAN FARMER
ASSOCIATES**

Site
Oswald Road Primary School

Number
WS02

Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client Manchester City Council	Job Number 41072
	Location	Dates 29/08/2012	Engineer Curtins Consulting	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40 0.40 0.40 0.40 0.80 0.80 0.80	B1 D2 J3 V4 D5 J6 V7		Water strike(1) at 0.60m.		(0.10) 0.10 (0.10) 0.20 (0.50) 0.70 (0.30) 1.00	MADE GROUND: Tarmacadam. MADE GROUND: Grey, sandy, angular and subangular, fine to coarse GRAVEL of limestone. MADE GROUND: Dark grey, clayey, angular and subangular, fine to coarse GRAVEL including ash, clinker and brick. MADE GROUND: Brown, sandy, angular and subangular, fine to coarse GRAVEL including ash and clinker. Terminated at 1.00m	 	▽1

Remarks Window sample terminated at 1.00m due to water and collapse of inspection pit - possible drain pipe.	Scale (approx)	Logged By
	1:50	HH
	Figure No. 41072.WS02	



**IAN FARMER
ASSOCIATES**

Site

Oswald Road Primary School

**Number
WS03**

Excavation Method

Drive-in Window Sampler

Dimensions

Ground Level (mOD)

Client

Manchester City Council

**Job
Number
41072**

Location

Dates

29/08/2012

Engineer

Curtins Consulting

**Sheet
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.40	D1				(0.20)	MADE GROUND: Tarmacadam.			
0.40	J2				0.20				
0.40	V3				(0.10)	MADE GROUND: Dark grey, slightly sandy, angular and subangular, fine to coarse GRAVEL of limestone.			
0.50	B4				0.30				
0.90	D5				(0.50)				
0.90	J6				0.80	MADE GROUND: Dark grey/brown, slightly sandy, angular and subangular, fine and medium GRAVEL including brick, ash, clinker and concrete. Between 0.35m and 0.40m: low cobble content of brick.			
0.90	V7				(0.50)				
1.00	B8		Water strike(1) at 1.20m. 1,0/0,0,0,0		1.30	MADE GROUND: Soft, grey/brown, sandy, slightly gravelly CLAY. Gravel is subangular, fine and medium including brick and ash.			
1.20-1.65	SPT(C) N=0								
1.30	D9								
1.50	D10								
1.50	J11								
1.50	V12								
2.00-2.45	SPT(C) N=2		1,0/0,0,1,1			MADE GROUND: Very loose, dark grey clayey, medium SAND with occasional brick fragments.			
2.00	D13								
2.30	D14								
3.00-3.45	SPT(C) N=2		1,1/0,1,0,1			Between 2.00m and 3.00m: no recovery due to water.			
3.00-4.00	D15					Between 3.00m and 4.00m: poor recovery.			
					(4.15)				
4.00-4.45	SPT(C) N=8		2,2/2,2,2,2			Between 4.00m and 5.00m: poor recovery. Below 4.00m: loose.			
4.00-5.00	D16								
5.00-5.45	SPT(C) N=20		3,4/5,5,5,5			Below 5.00m: medium dense.			
					5.45				
						Complete at 5.45m			

Remarks

Excavating from 0.00m to 1.20m for 1.00 hour.

**Scale
(approx)**

1:50

**Logged
By**

HH

Figure No.

41072.WS03



Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client Manchester City Council	Job Number 41072
	Location	Dates 29/08/2012	Engineer Curtins Consulting	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	B1				(0.20)	Grass over MADE GROUND: Brown, sandy TOPSOIL.		
0.40	D2				0.20	MADE GROUND: Brown, slightly gravelly, fine and medium SAND. Gravel is angular and subangular, fine to coarse including brick, sandstone, ceramic and clinker.		
0.40	J3				(1.00)			
0.40	V4							
0.90	D5							
0.90	J6							
0.90	V7				1.20			
1.20-1.65	SPT(C) N=9		1,2/2,2,2,3		(0.30)	MADE GROUND: Soft, brown, slightly sandy, slightly gravelly CLAY. Gravel is angular and subangular, fine to coarse including brick, ash, sandstone and quartz.		
1.20	D8				1.50			
1.40	D10							
1.40	D9							
1.40	J11					MADE GROUND: Very loose, black, sandy, angular and subangular, fine to coarse GRAVEL including ash, brick and clinker.		
1.40	V12							
1.80	D13							
1.80	J14							
2.00-2.45	SPT(C) N=0		0,0/0,0,0,0					
1.80	V15							
2.20	D16							
2.20	J17							
2.20	V18							
2.80	D19				(3.00)			
3.00-3.45	SPT(C) N=0		1,0/0,0,0,0					
3.00-4.00	D20							
			Water strike(1) at 3.40m.					
4.00-4.45	SPT(C) N=4		1,1/1,1,1,1			Below 4.00m: very loose to loose.		
4.20	D21							
4.50	D22				4.50			
						Very soft, brown, slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse including mudstone and sandstone.		
5.00-5.45	SPT(C) N=3		1,0/0,1,1,1		(0.95)			
					5.45			
						Complete at 5.45m		

Remarks

Excavating from 0.00m to 1.20m for 1.00 hour.

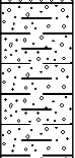
Scale (approx)
1:50

Logged By
HH

Figure No.
41072.WS04



Site Oswald Road Primary School	Number WS05
Excavation Method Drive-in Window Sampler	Client Manchester City Council
Dimensions	Job Number 41072
Location	Engineer Curtins Consulting
Dates 29/08/2012	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.50 0.50 0.50 0.50 1.00 1.00 1.00 1.20-1.65 1.20 1.50	B1 D2 J3 V4 D5 J6 V7 SPT N=2 D8 D9		1,0/0,1,0,1		(0.20) 0.20 (0.70) 0.90	Grass over MADE GROUND: Brown, sandy TOPSOIL. MADE GROUND: Brown, slightly gravelly, fine and medium SAND. Gravel is angular to subrounded, fine to coarse including sandstone, brick and ash. Very soft locally firm, brown, slightly sandy, slightly gravelly CLAY.	  		
2.00-2.45 2.00	SPT N=17 D10		3,3/3,4,5,5			Below 2.00m: firm.			
2.50	D11				(3.55)				
3.00-3.45 3.00 3.30	SPT N=3 D12 D13		1,0/0,1,1,1			At 3.00m: very soft.			
3.80	D14								
4.00-4.45 4.00	SPT N=11 D15		2,3/2,3,3,3		4.45				
						Complete at 4.45m			

Remarks Excavating from 0.00m to 1.20m for 1.00 hour.	Scale (approx) 1:50	Logged By HH
	Figure No. 41072.WS05	



Site Oswald Road Primary School	Number WS06
Client Manchester City Council	Job Number 41072
Engineer Curtins Consulting	Sheet 1/1

Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)
	Location	Dates 29/08/2012

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-1.20	B1 D2 J3 V4 D5 J6 V7				(0.06) 0.06 (0.14) 0.20 (1.00)	MADE GROUND: Tarmacadam. MADE GROUND: Grey, sandy, angular and subangular, fine to coarse GRAVEL including limestone. MADE GROUND: Grey, sandy, clayey, angular and subangular, fine to coarse GRAVEL including clinker, slag, ash, brick, sandstone and concrete.	  	
1.20-1.65	SPT(C) N=4 D8 D9 J10 V11		1,1/1,1,1,1		1.20	Soft, brown, sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse including mudstone, sandstone and siltstone.	    	
2.00-2.45	SPT(C) N=12 D12 D13		2,3/3,3,3,3			Below 1.80m: firm, dark brown, slightly sandy.	    	
2.60	D14				(3.25)		    	
3.00-3.45	SPT(C) N=9 D15 D16		2,2/2,2,2,3				    	
3.60	D17						    	
4.00-4.45	SPT(C) N=19 D18		3,4/4,5,5,5		4.45	Below 4.00m: stiff.	    	
						Complete at 4.45m		

Remarks Excavating from 0.00m to 1.20m for 1.00 hour.	Scale (approx) 1:50	Logged By HH
	Figure No. 41072.WS06	



Oswald Road Primary School

**Trial Pit
Number**
HP01

Hand excavated

0.50m x 0.50m x 1.30m

Dates	29/08/2012
--------------	------------

Manchester City Council

Job Number
41072

Curtins Consulting

Sheet
1/1

Depth
(m)

Sample / Tests

Water
Depth
(m)

Field Records

Level
(mOD)Depth
(m)
(Thickness)

Description

Legend

Water	
-------	--

MADE GROUND: Tarmacadam.

MADE GROUND: Grey, angular and subangular, fine to coarse GRAVEL of limestone.

MADE GROUND: Black, sandy, angular and subangular, fine to coarse GRAVEL including ash and brick.

Between 0.30m and 0.40m: cobble.

Complete at 1.30m

Plan

Remarks

Trial pit remained dry and stable during excavation.
No foundation was encountered during excavation - probed to 1.50m.

Scale (approx)

1:50

Logged By

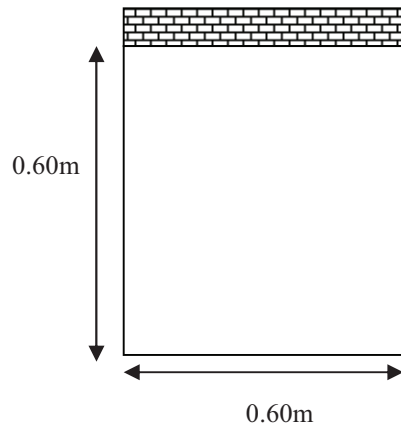
HH

Figure No.

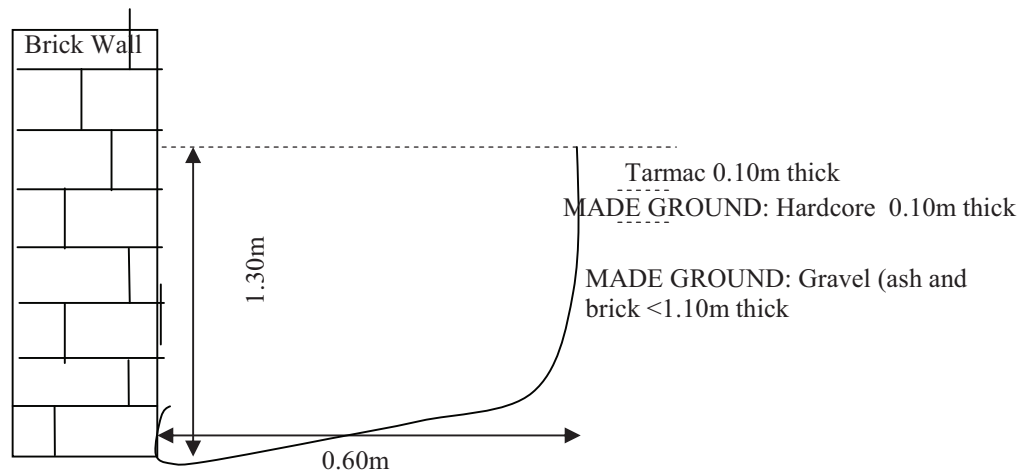
41072.HP01

Hand Pit HP01

Plan view



Cross section



Hand Pit HP01





**IAN FARMER
ASSOCIATES**

Site

Oswald Road Primary School

**Trial Pit
Number**

HP02

Excavation Method

Hand excavated

Dimensions

0.50m x 0.50m x 0.50m

Ground Level (mOD)

Client

Manchester City Council

**Job
Number**

41072

Location

Dates

29/08/2012

Engineer

Curtins Consulting

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.05) 0.05 (0.45) 0.50	MADE GROUND: Tarmacadam. MADE GROUND: Dark grey, slightly clayey, angular and subangular, fine to coarse GRAVEL with low cobble content of brick. Gravel includes, brick, concrete, ash and sandstone. Complete at 0.50m		

Plan

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Remarks

Trial pit remained dry and stable during excavation.
At 0.50m: concrete obstruction encountered, possible drain cap. Extended pit but pipe exposed (light brown/oragne 0.10m iron pipe).

Scale (approx)

1:50

Logged By

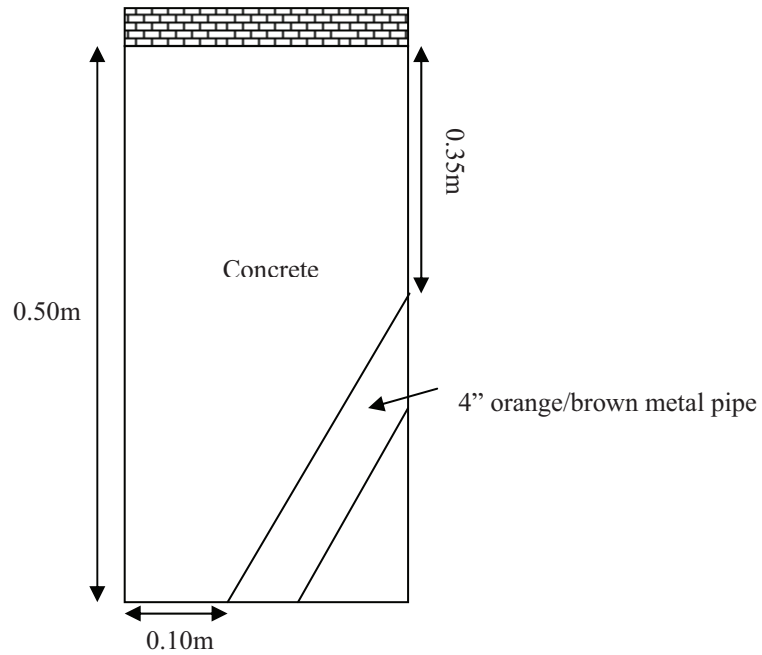
HH

Figure No.

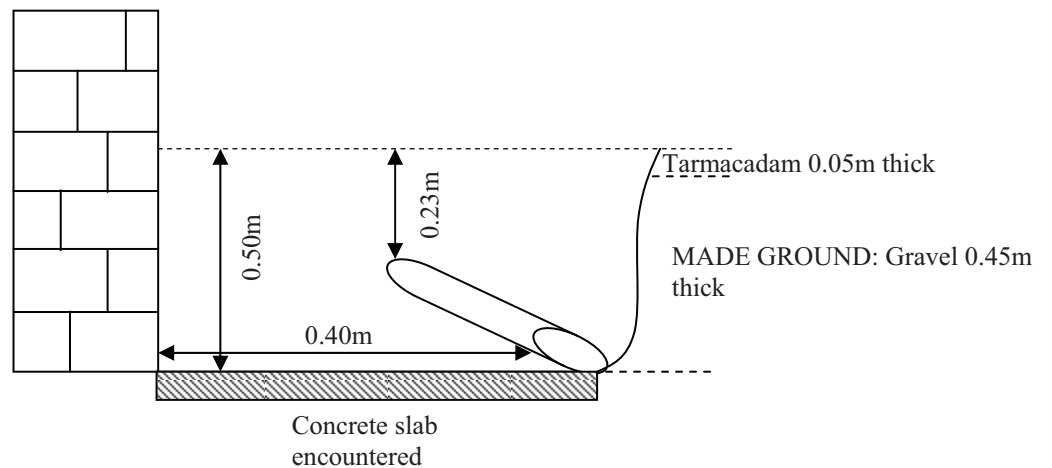
41072.HP02

Hand Pit HP02

Plan view



Cross section



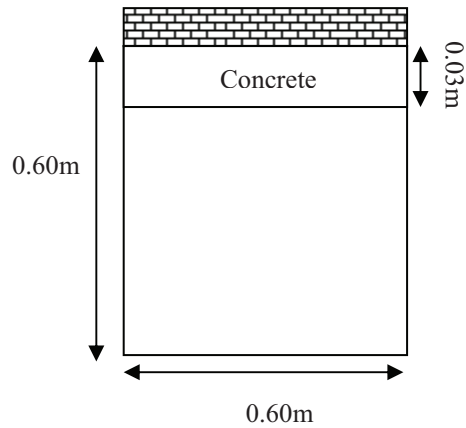
Hand Pit HP02



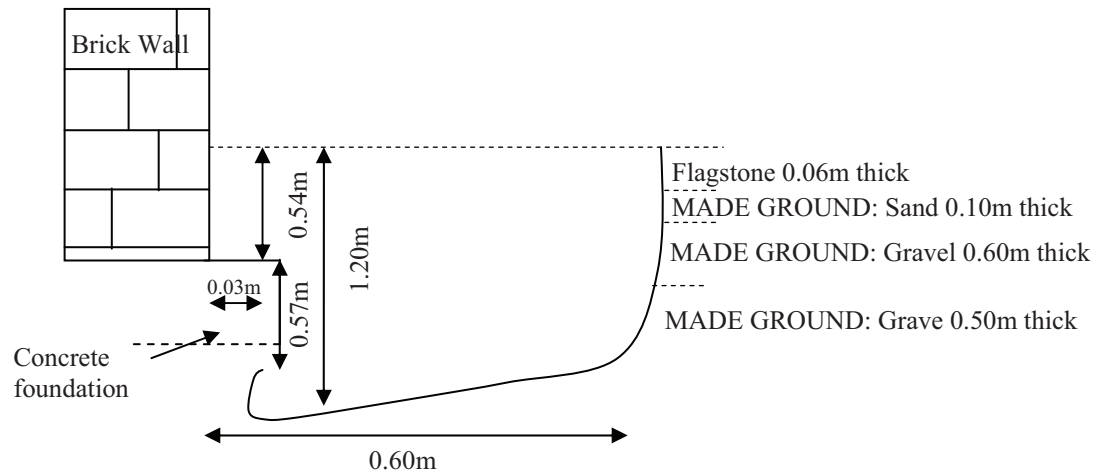
 IAN FARMER ASSOCIATES						Site Oswald Road Primary School		Trial Pit Number HP03	
Excavation Method Hand excavated		Dimensions 0.60m x 0.60m x 1.20m		Ground Level (mOD)		Client Manchester City Council		Job Number 41072	
		Location		Dates 29/08/2012		Engineer Curtins Consulting		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
					(0.06) 0.06 (0.04) 0.10 (0.60) 0.70 (0.50) 1.20	MADE GROUND: Flagstone. MADE GROUND: Brown, coarse SAND. MADE GROUND: Light grey, sandy, angular and subangular, fine to coarse GRAVEL including limestone. MADE GROUND: Black, clayey, sandy, angular and subangular, fine to coarse GRAVEL including brick, ash and clinker. Complete at 1.20m		   	
Plan						Remarks Major spalling of trial pit sides between 0.30m and 1.00m during excavation. Foundation found and base collapsed when taking photographs. Trial pit remained dry during excavation.			
						Scale (approx) 1:50		Logged By HH	
						Figure No. 41072.HP03			

Hand Pit HP03

Plan view



Cross section



Hand Pit HP03





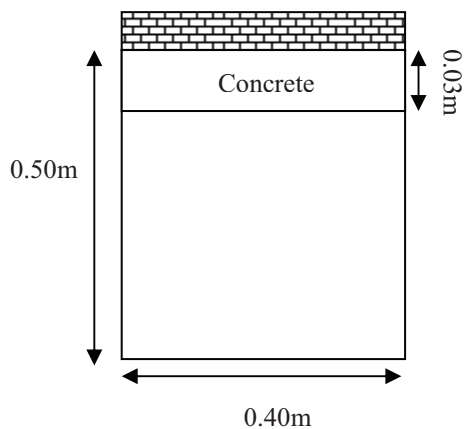
Excavation Method Hand excavated		Dimensions 0.50m x 0.40m x 1.20m	Ground Level (mOD)	Client Manchester City Council	Job Number 41072
		Location	Dates 29/08/2012	Engineer Curtins Consulting	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Water strike(1) at 1.10m.		(0.05) 0.05 (0.05) 0.10 (0.58) 0.68 (0.52) 1.20	MADE GROUND: Flagstone. MADE GROUND: Light brown, coarse SAND. MADE GROUND: Grey, slightly sandy, angular and subangular, fine to coarse GRAVEL of limestone. MADE GROUND: Soft, black/dark grey, sandy, slightly gravelly CLAY including ash, brick and sandstone. Complete at 1.20m	   	

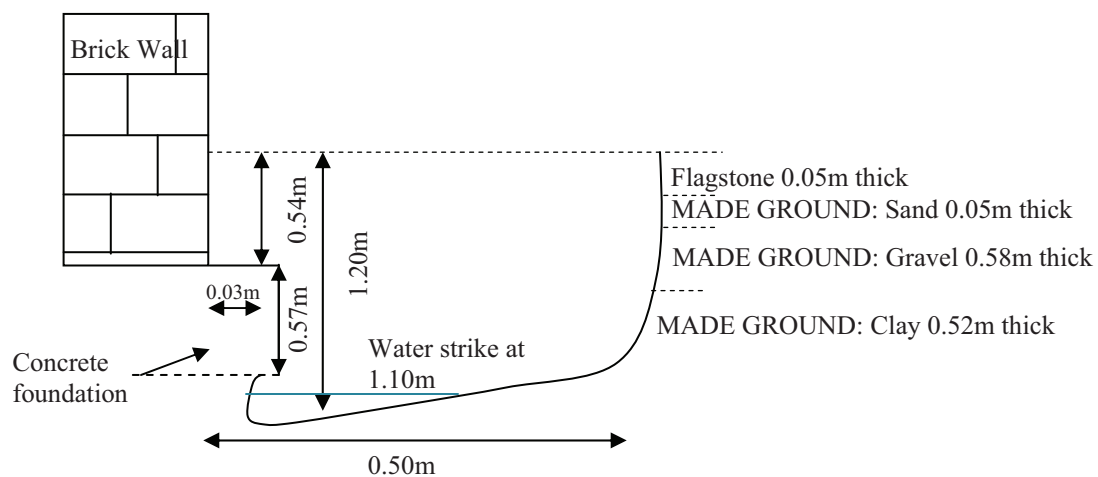
Plan					Remarks		
.	.	.	.	.	Trial pit remained stable during excavation.		
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					Scale (approx)	Logged By	Figure No.
					1:50	HH	41072.HP04

Hand Pit HP04

Plan view



Cross section



Hand Pit HP04



Appendix A4 – Chemical and Geotechnical Laboratory Testing Results



Test Certificate

Client: Curtins Consulting Ltd
10 Oxford Court, Bishopsgate, Manchester, M2 3WQ
Site: 50974/RA/2392 Oswald Primary School, Manchester
Date Tested: 10/09/12, 11/09/12, 12/09/12, 13/09/12, 17/09/12, 19/09/12
Date Reported: 19 September, 2012
Date Received: 6 September, 2012
Sample Type: Solid

Certificate No: 12/2095/R/S/C1
File No: 12/2095/R/S
Client Ref: None Supplied

Lab sample ref:	B439516	B439517	B439518	B439519	B439520
Client sample ref:	WS01	WS01	WS02	WS03	WS03
	0.4m	1.0m	0.4m	0.4m	1.5m
Date sampled:	29/08/12	29/08/12	29/08/12	29/08/12	29/08/12
Sample matrix (see notes page):	S	S	S	S	S

Determinand	Method	Units	ISO17025	MCERTS	LOD					
Deviation Assessment										
Deviation(s)	C. Review	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MCERTS Sample Prep										
% Stones	Stones	% w/w	N/A	N/A	0	14.0	0.0	22.2	19.3	0.0
Moisture Content @ 35°	CTP01	% w/w	N/A	N/A	0.1	16.2	19.8	12.2	17.8	16.3
Sample Description^	SGP5		N/A	N/A		4A	5	6A	6AC	5
Misc										
pH	CTP07		Y	Y		6.8	7.3	7.0	6.6	6.2
Sulphate (total)	CTP14	mg/kg	Y	Y	200	810	210	690	750	260
Sulphide _M	CTP16	mg/kg	Y	N	2	14	5	18	13	67
Sulphur (elemental)	SOP11	mg/kg	Y	Y	20	72	<20	<20	33	206
Cyanide (total) _M	CTP18c	mg/kg	Y	Y	10	<10	<10	<10	<10	<10
Phenols (screen) _M	CTP20	mg/kg	Y	Y	1	<1	<1	<1	<1	<1
Organic Matter	CTP22b	g/kg	N	N	0.1	248	89.0	168	186	41.4
Arsenic	CTP11A 2	mg/kg	Y	Y	2	16	16	65	19	5
Boron (water soluble)	CTP12	mg/kg	Y	N	1	1	1	<1	<1	1
Cadmium	CTP11A 0.5	mg/kg	Y	Y	0.5	0.7	<0.5	1.8	0.8	<0.5
Chromium (total)	CTP11A 3	mg/kg	Y	Y	3	21	33	24	18	15
Chromium (VI)	CTP15a	mg/kg	Y	N	1	<1	<1	<1	<1	<1
Copper	CTP11A 3	mg/kg	Y	Y	3	128	48	222	153	16
Lead	CTP11A 1	mg/kg	Y	Y	1	165	138	442	654	32
Mercury	CTP11A 0.5	mg/kg	Y	Y	0.5	0.5	<0.5	10.8	1.1	6.5
Nickel	CTP11A 2	mg/kg	Y	Y	2	28	28	44	24	12
Selenium	CTP11A 2	mg/kg	Y	Y	2	<2	<2	<2	<2	<2
Zinc	CTP11A 2	mg/kg	Y	Y	2	136	81	262	191	31
Asbestos Screen*	subcontract*		Y	N/A		NAD	NAD	NAD	NAD	NAD
PAH (USEPA16)										
Acenaphthene _M	GCM 501	mg/kg	Y	Y	0.1	2.4	3.1	0.3	0.6	1.4
Acenaphthylene _M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	0.2	0.1	<0.1
Anthracene _M	GCM 501	mg/kg	Y	Y	0.1	3.6	2.0	1.1	1.3	<0.1
Benz(a)anthracene _M	GCM 501	mg/kg	Y	Y	0.1	6.6	3.9	4.0	3.8	<0.1
Benzo(a)pyrene _M	GCM 501	mg/kg	Y	Y	0.1	5.4	2.9	3.0	3.0	<0.1
Benzo(b)fluoranthene _M	GCM 501	mg/kg	Y	Y	0.1	6.1	3.2	3.3	3.3	<0.1
Benzo(ghi)perylene _M	GCM 501	mg/kg	Y	Y	0.1	3.0	1.6	1.6	1.7	<0.1
Benzo(k)fluoranthene _M	GCM 501	mg/kg	Y	Y	0.1	2.5	1.6	1.4	1.6	<0.1
Chrysene _M	GCM 501	mg/kg	Y	Y	0.1	6.4	3.9	3.6	4.0	<0.1
Dibenz(a,h)anthracene _M	GCM 501	mg/kg	Y	Y	0.1	0.8	0.4	0.5	0.5	<0.1
Fluoranthene _M	GCM 501	mg/kg	Y	Y	0.1	17.2	9.5	8.9	9.0	<0.1
Fluorene _M	GCM 501	mg/kg	Y	Y	0.1	2.0	2.1	0.5	0.5	0.6
Indeno(1,2,3-cd)pyrene _M	GCM 501	mg/kg	Y	Y	0.1	2.5	1.1	1.4	1.3	<0.1
Naphthalene _M	GCM 501	mg/kg	Y	Y	0.1	0.7	0.7	0.2	<0.1	<0.1
Phenanthrene _M	GCM 501	mg/kg	Y	Y	0.1	13.5	12.0	4.7	5.0	0.5
Pyrene _M	GCM 501	mg/kg	Y	Y	0.1	15.9	8.5	8.0	8.6	<0.1



Test Certificate

Client: Curtins Consulting Ltd
10 Oxford Court, Bishopsgate, Manchester, M2 3WQ
Site: 50974/RA/2392 Oswald Primary School, Manchester
Date Tested: 10/09/12, 11/09/12, 12/09/12, 13/09/12, 17/09/12, 19/09/12
Date Reported: 19 September, 2012
Date Received: 6 September, 2012
Sample Type: Solid

Certificate No: 12/2095/R/S/C1
File No: 12/2095/R/S
Client Ref: None Supplied

Lab sample ref:	B439516	B439517	B439518	B439519	B439520
Client sample ref:	WS01	WS01	WS02	WS03	WS03
	0.4m	1.0m	0.4m	0.4m	1.5m
Date sampled:	29/08/12	29/08/12	29/08/12	29/08/12	29/08/12
Sample matrix (see notes page):	S	S	S	S	S

Determinand	Method	Units	ISO17025	MCERTS	LOD				
TPH Banded(Alk/Aro)									
>C5-C6 Aliphatic _M	SOP05	µg/kg	Y	N	10	14	<10	<10	34
>C6-C8 Aliphatic _M	SOP05	µg/kg	Y	N	10	158	31	51	353
>C8-C10 Aliphatic _M	SOP05d	µg/kg	N	N	500	<500	<500	<500	<500
>C10-C12 Aliphatic _M	SOP05d	µg/kg	N	N	500	<500	<500	<500	<500
>C12-C16 Aliphatic _M	SOP05a	µg/kg	Y	N	1000	<1000	<1000	<1000	<1000
>C16-C21 Aliphatic _M	SOP05a	µg/kg	Y	N	1000	<1000	<1000	<1000	<1000
>C21-C35 Aliphatic _M	SOP05a	µg/kg	Y	N	1000	<1000	<1000	<1000	<1000
Total Aliphatics _M	SOP05a	µg/kg	Y	N	1000	<1000	<1000	<1000	<1000
>C5-C6 Aromatic _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
>C6-C8 Aromatic _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
>C8-C10 Aromatic _M	SOP05d	µg/kg	N	N	500	955	<500	<500	<500
>C10-C12 Aromatic _M	SOP05d	µg/kg	N	N	500	716	<500	<500	<500
>C12-C16 Aromatic _M	SOP05a	µg/kg	Y	N	1000	18100	<1000	1140	4750
>C16-C21 Aromatic _M	SOP05a	µg/kg	Y	N	1000	96900	4240	35300	48100
>C21-C35 Aromatic _M	SOP05a	µg/kg	Y	N	1000	178000	13000	86400	143000
Total Aromatics _M	SOP05a	µg/kg	Y	N	1000	295000	17200	123000	195000
Methyl t-butyl ether _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
Benzene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
Toluene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
Ethylbenzene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
m&p-Xylene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	15
o-Xylene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
Total VPH _M	SOP05	µg/kg	Y	N	10	172	31	51	401
TPH _M	SOP05a	µg/kg	Y	N	1000	295000	17200	123000	196000



Test Certificate

Client: Curtins Consulting Ltd
10 Oxford Court, Bishopsgate, Manchester, M2 3WQ
Site: 50974/RA/2392 Oswald Primary School, Manchester
Date Tested: 10/09/12, 11/09/12, 12/09/12, 13/09/12, 17/09/12, 19/09/12
Date Reported: 19 September, 2012
Date Received: 6 September, 2012
Sample Type: Solid

Certificate No: 12/2095/R/S/C1
File No: 12/2095/R/S
Client Ref: None Supplied

Lab sample ref:	B439521	B439522	B439523	B439524
Client sample ref:	WS04	WS04	WS05	WS06
	0.4m	1.8m	0.5m	0.3m
Date sampled:	29/08/12	29/08/12	29/08/12	29/08/12
Sample matrix (see notes page):	S	OS	S	S

Determinand	Method	Units	ISO17025	MCERTS	LOD				
Deviation Assessment									
Deviation(s)	C. Review	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MCERTS Sample Prep									
% Stones	Stones	% w/w	N/A	N/A	0	7.3	20.2	8.4	10.8
Moisture Content @ 35°	CTP01	% w/w	N/A	N/A	0.1	8.2	25.4	15.0	12.8
Sample Description^	SGP5		N/A	N/A		4A	7A	4A	6A
Misc									
pH	CTP07		Y	Y		7.0	7.0	6.6	7.2
Sulphate (total)	CTP14	mg/kg	Y	Y	200	440	3600	380	980
Sulphide _M	CTP16	mg/kg	Y	N	2	52	272	20	16
Sulphur (elemental)	SOP11	mg/kg	Y	Y	20	<20	349	<20	<20
Cyanide (total) _M	CTP18c	mg/kg	Y	Y	10	<10	<10	<10	<10
Phenols (screen) _M	CTP20	mg/kg	Y	Y	1	<1	<1	<1	<1
Organic Matter	CTP22b	g/kg	N	N	0.1	124	259	174	128
Arsenic	CTP11A 2	mg/kg	Y	Y	2	28	77	18	20
Boron (water soluble)	CTP12	mg/kg	Y	N	1	<1	1	<1	<1
Cadmium	CTP11A 0.5	mg/kg	Y	Y	0.5	0.9	1.5	0.6	0.8
Chromium (total)	CTP11A 3	mg/kg	Y	Y	3	18	23	17	22
Chromium (VI)	CTP15a	mg/kg	Y	N	1	<1	<1	<1	<1
Copper	CTP11A 3	mg/kg	Y	Y	3	189	547	120	122
Lead	CTP11A 1	mg/kg	Y	Y	1	325	1355	167	184
Mercury	CTP11A 0.5	mg/kg	Y	Y	0.5	1.1	1.6	<0.5	0.8
Nickel	CTP11A 2	mg/kg	Y	Y	2	31	37	24	27
Selenium	CTP11A 2	mg/kg	Y	Y	2	<2	<2	<2	<2
Zinc	CTP11A 2	mg/kg	Y	Y	2	156	524	81	182
Asbestos Screen*	subcontract*		Y	N/A		NAD	NAD	NAD	NAD
PAH (USEPA16)									
Acenaphthene _M	GCM 501	mg/kg	Y	Y	0.1	9.5	2.1	<0.1	4.4
Acenaphthylene _M	GCM 501	mg/kg	Y	Y	0.1	0.2	<0.1	<0.1	0.1
Anthracene _M	GCM 501	mg/kg	Y	Y	0.1	8.4	3.8	<0.1	7.0
Benz(a)anthracene _M	GCM 501	mg/kg	Y	Y	0.1	21.1	3.6	0.2	8.4
Benzo(a)pyrene _M	GCM 501	mg/kg	Y	Y	0.1	15.6	2.7	0.2	7.0
Benzo(b)fluoranthene _M	GCM 501	mg/kg	Y	Y	0.1	17.3	3.6	0.2	7.8
Benzo(ghi)perylene _M	GCM 501	mg/kg	Y	Y	0.1	8.6	1.6	<0.1	3.8
Benzo(k)fluoranthene _M	GCM 501	mg/kg	Y	Y	0.1	6.2	1.1	0.1	3.9
Chrysene _M	GCM 501	mg/kg	Y	Y	0.1	21.8	4.4	0.2	8.0
Dibenz(a,h)anthracene _M	GCM 501	mg/kg	Y	Y	0.1	3.2	0.5	<0.1	0.9
Fluoranthene _M	GCM 501	mg/kg	Y	Y	0.1	51.1	14.1	0.4	26.0
Fluorene _M	GCM 501	mg/kg	Y	Y	0.1	5.3	2.4	<0.1	3.8
Indeno(1,2,3-cd)pyrene _M	GCM 501	mg/kg	Y	Y	0.1	6.1	1.2	<0.1	3.3
Naphthalene _M	GCM 501	mg/kg	Y	Y	0.1	3.5	<0.1	<0.1	0.9
Phenanthrene _M	GCM 501	mg/kg	Y	Y	0.1	46.6	18.8	0.2	26.6
Pyrene _M	GCM 501	mg/kg	Y	Y	0.1	48.6	12.9	0.4	21.6



Test Certificate

Client: Curtins Consulting Ltd
10 Oxford Court, Bishopsgate, Manchester, M2 3WQ
Site: 50974/RA/2392 Oswald Primary School, Manchester
Date Tested: 10/09/12, 11/09/12, 12/09/12, 13/09/12, 17/09/12, 19/09/12
Date Reported: 19 September, 2012
Date Received: 6 September, 2012
Sample Type: Solid

Certificate No: 12/2095/R/S/C1
File No: 12/2095/R/S
Client Ref: None Supplied

Lab sample ref:	B439521	B439522	B439523	B439524
Client sample ref:	WS04	WS04	WS05	WS06
	0.4m	1.8m	0.5m	0.3m
Date sampled:	29/08/12	29/08/12	29/08/12	29/08/12
Sample matrix (see notes page):	S	OS	S	S

Determinand	Method	Units	ISO17025	MCERTS	LOD				
TPH Banded(Al/Aro)									
>C5-C6 Aliphatic _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
>C6-C8 Aliphatic _M	SOP05	µg/kg	Y	N	10	78	137	114	86
>C8-C10 Aliphatic _M	SOP05d	µg/kg	N	N	500	<500	<500	<500	917
>C10-C12 Aliphatic _M	SOP05d	µg/kg	N	N	500	<500	<500	<500	<500
>C12-C16 Aliphatic _M	SOP05a	µg/kg	Y	N	1000	2400	<1000	<1000	<1000
>C16-C21 Aliphatic _M	SOP05a	µg/kg	Y	N	1000	8820	<1000	<1000	<1000
>C21-C35 Aliphatic _M	SOP05a	µg/kg	Y	N	1000	8170	11500	<1000	12300
Total Aliphatics _M	SOP05a	µg/kg	Y	N	1000	19500	11700	<1000	13300
>C5-C6 Aromatic _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
>C6-C8 Aromatic _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
>C8-C10 Aromatic _M	SOP05d	µg/kg	N	N	500	871	<500	<500	2410
>C10-C12 Aromatic _M	SOP05d	µg/kg	N	N	500	1960	<500	<500	<500
>C12-C16 Aromatic _M	SOP05a	µg/kg	Y	N	1000	81800	3750	<1000	<1000
>C16-C21 Aromatic _M	SOP05a	µg/kg	Y	N	1000	241000	55900	<1000	25300
>C21-C35 Aromatic _M	SOP05a	µg/kg	Y	N	1000	427000	92500	7060	71400
Total Aromatics _M	SOP05a	µg/kg	Y	N	1000	753000	152000	7060	99200
Methyl t-butyl ether _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
Benzene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
Toluene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
Ethylbenzene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
m&p-Xylene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
o-Xylene (VPH) _M	SOP05	µg/kg	Y	N	10	<10	<10	<10	<10
Total VPH _M	SOP05	µg/kg	Y	N	10	78	137	114	86
TPH _M	SOP05a	µg/kg	Y	N	1000	772000	164000	7170	112000

Notes

- All analyses performed on the sample dried at 35°C, except analyses suffixed with 'M'.
- Analyses suffixed 'M' were performed on the sample as received and corrected for '% moisture at 35°C' where applicable.
- All results are expressed as dry weight.
- MCERTS accreditation applicable to Sample Matrix 'S' only.
- Natural stones (pebbles, gravels etc.) which do not pass a 2mm sieve are excluded from dried analyses.
- Tests marked * indicate subcontracted analyses.
- NAD denotes 'No Asbestos Detected'.
- The laboratory has tested the material/items supplied by the client as sampled in accordance with the client's own requirements.
- Sample Description key: 1. - Sand, 2. Loam, 3. Clay, 4. Sandy loam, 5. Sandy clay, 6. Clayey loam, 7. Other.
suffixed with: A - Stones, B - Construction rubble, C - Visible Hydrocarbons
- Dates of testing for all parameters are available on request.
- Please note 'Asbestos screen' testing has been analysed at Exova (Glasgow). This laboratory holds UKAS accreditation (UKAS No. 0568) for both 'Asbestos Screen' and 'Identification' as per document 'HSG 248'.

Signed for, and on behalf of Exova (UK) Ltd.

Prepared by:

S. Blemings

S Blemings
Account Manager

Approved by:

A. Young

A Young
Operations Manager



0871



Test Certificate

Client: Curtins Consulting Ltd
10 Oxford Court, Bishopsgate, Manchester, M2 3WQ
Site: 50974/RA/2420 St Oswald Primary School
Date Tested: 20/09/12, 24/09/12, 27/09/12, 28/09/12, 02/10/12, 03/10/12
Date Reported: 3 October, 2012
Date Received: 19 September, 2012
Sample Type: Liquid

Certificate No: 12/2204/R/W/C1
File No: 12/2204/R/W
Client Ref: None Supplied

		Lab sample ref: B439962		B439963		B439964	
		Client sample ref: WS01		WS03		WS05	
		Date sampled: 11/09/12		11/09/12		11/09/12	
		Sample matrix (see notes page): GW		GW		GW	
Determinand	Method	Units	ISO17025	LOD			
Deviation Assessment							
Deviation(s)	C. Review	N/A	N/A	N/A	N/A	N/A	N/A
Misc							
pH (w)	CTP07		Y		7.4	6.8	6.9
Hardness	Hardness	mg/l CaCO ₃	N	1	767	485	808
Sulphate (w)	CTP29a	mg/l	Y	10	203	13	376
Sulphide (w)	CTP16a	mg/l	Y	0.2	<0.2	<0.2	<0.2
Cyanide (total) (w)	CTP18f	mg/l	Y	0.2	<0.2	<0.2	<0.2
Phenols (screen) (w)	CTP20a	mg/l	Y	0.1	<0.1	<0.1	<0.1
Arsenic (w)	CTP30a	µg/l	Y	1	3	5	5
Boron (w)	CTP10	mg/l	Y	0.1	0.2	0.2	0.1
Cadmium (w)	CTP30b	µg/l	Y	0.5	<0.5	<0.5	<0.5
Chromium (w)	CTP30c	µg/l	Y	0.1	0.2	0.5	0.1
Copper (w)	CTP30c	µg/l	Y	0.1	1.4	<0.1	4.7
Lead (w)	CTP30a	µg/l	Y	1	<1	<1	<1
Mercury (w)	CTP30c	µg/l	Y	0.1	<0.1	<0.1	<0.1
Nickel (w)	CTP30a	µg/l	Y	1	6	2	6
Selenium (w)	CTP30a	µg/l	Y	1	3	<1	2
Zinc (w)	CTP30a	µg/l	Y	1	2	3	<1
PAH(USEPA16) (w)							
Acenaphthene (w)	SOP06	µg/l	Y	0.01	0.03	14.3	0.01
Acenaphthylene (w)	SOP06	µg/l	Y	0.01	<0.01	0.16	<0.01
Anthracene (w)	SOP06	µg/l	Y	0.01	<0.01	0.06	<0.01
Benzo(a)anthracene (w)	SOP06	µg/l	Y	0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene (w)	SOP06	µg/l	Y	0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene (w)	SOP06	µg/l	Y	0.01	<0.01	<0.01	<0.01
Benzo(ghi)perylene (w)	SOP06	µg/l	Y	0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene (w)	SOP06	µg/l	Y	0.01	<0.01	<0.01	<0.01
Chrysene (w)	SOP06	µg/l	Y	0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene (w)	SOP06	µg/l	Y	0.01	<0.01	<0.01	<0.01
Fluoranthene (w)	SOP06	µg/l	Y	0.01	<0.01	0.09	<0.01
Fluorene (w)	SOP06	µg/l	Y	0.01	<0.01	1.94	<0.01
Indeno(1,2,3-cd)pyrene (w)	SOP06	µg/l	Y	0.01	<0.01	<0.01	<0.01
Naphthalene (w)	SOP06	µg/l	Y	0.01	<0.01	25.1	<0.01
Phenanthrene (w)	SOP06	µg/l	Y	0.01	<0.01	0.79	<0.01
Pyrene (w)	SOP06	µg/l	Y	0.01	<0.01	0.06	<0.01



Test Certificate

Client: Curtins Consulting Ltd
10 Oxford Court, Bishopsgate, Manchester, M2 3WQ
Site: 50974/RA/2420 St Oswald Primary School
Date Tested: 20/09/12, 24/09/12, 27/09/12, 28/09/12, 02/10/12, 03/10/12
Date Reported: 3 October, 2012
Date Received: 19 September, 2012
Sample Type: Liquid

Certificate No: 12/2204/R/W/C1
File No: 12/2204/R/W
Client Ref: None Supplied

Lab sample ref:	B439962	B439963	B439964
Client sample ref:	WS01	WS03	WS05
Date sampled:	11/09/12	11/09/12	11/09/12
Sample matrix (see notes page):	GW	GW	GW

Determinand	Method	Units	ISO17025	LOD			
TPH Banded (w)							
>C8-C10 (w)	SOP03e	µg/l	N	10	<10	<10	<10
>C10-C12 (w)	SOP03e	µg/l	N	10	<10	<10	<10
>C12-C16 (w)	SOP03e	µg/l	N	10	<10	<10	<10
>C16-C21 (w)	SOP03e	µg/l	N	10	<10	<10	<10
>C21-C35 (w)	SOP03e	µg/l	N	10	<10	<10	<10
Chain Lengths	CL	µg/l	N		NR	NR	NR
Product Identification	ID	µg/l	N		NR	NR	NR

Notes

- Tests marked * indicate subcontracted analyses.
- The laboratory has tested the material/items supplied by the client as sampled in accordance with the client's own requirements.
- Results reported for metals are 'dissolved' unless otherwise stated.
- Dates of testing for all parameters are available on request.
- NR denotes analysis 'Not Required'.

Signed for, and on behalf of Exova (UK) Ltd.

Prepared by:

S Blemings
Account Manager

Approved by:

A Young
Operations Manager



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Ian Farmer Associates (1998) Ltd
17 Rivington Court
Warrington
Cheshire
WA1 4RT

F.A.O. Mr A Latimer

TEST REPORT - 41072

Site : Oswald Road Primary School

Job Number : 41072

Originating Client : Manchester City Council

Originating Reference : 41072

Date Sampled : Not Given

Date Scheduled : 07/09/12

Date Testing Started : 11/09/12

Date Testing Finished : 19/09/12

Remarks :

- First Report for above Job Number
- Samples will be disposed of 28 days after the report is issue unless otherwise agreed
- This report may contain results from tests which are not included within the scope of the UKAS accreditation. Please see final sheet for details.

Authorised By:



Craig Lilley

Position :

Quality Manager

Date : 19/09/12

Page 1 of 4

Job Number
41072

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Borehole/ Trial Pit	Depth (m)	Sample	Natural / Sieved	Natural Moisture Content %	Sample Passing 425µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description / Remarks
					Percentage %	Moisture Content %						
WS01	1.20	D9	Natural	26	97	27	52	25	27	0.07	CH	Brown silty sandy CLAY
WS05	1.00	D5	Natural	24	98	24	44	21	23	0.13	CI	Brown grey sandy silty gravelly organic CLAY includes fibrous organic material
WS06	1.40	D9	Natural	16	97	16	26	14	12	0.17	CL	Brown sandy silty gravelly CLAY

Method of Test : BS 1377:PART 2:1990:3.2 Determination of moisture content 4.3 Determination of the liquid limit 5.3 Determination of the plastic limit and plasticity index

Job Number
41072

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Borehole/ Trial Pit	Depth (m)	Sample	Concentration of Soluble Sulphate			Percentage of sample passing 2mm Sieve %	pH	Description / Remarks
			Soil		Groundwater g /l			
			Total S04 %	S04 in 2:1 water:soil g /l				
WS01	0.40	D1		0.2		50	7.8	Black organic gravelly SAND
WS01	1.20	D9		<0.1		76	8.0	Brown silty sandy CLAY
WS03	0.90	D5		0.1		89	7.0	Brown black organic silty gravelly clayey SAND
WS04	0.90	D5		<0.1		73	7.5	Brown black organic silty gravelly clayey SAND
WS05	1.00	D5		<0.1		93	8.0	Brown grey sandy silty gravelly organic CLAY includes fibrous organic material
WS06	0.30	D2		0.2		38	7.8	Black organic gravelly silty sandy CLAY

Method of Test : BS 1377:PART 3:1990:5 Determination of the sulphate content of soil and ground water BS 1377:PART 3:1990:9 Determination of the pH value

Test Report : 41072

Site : Oswald Road Primary School
Job Number : 41072
Originating Client : Manchester City Council

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

The following tests contained within this report are not UKAS Accredited.

Date of Issue : 19/09/12

Appendix A5 – Gas Monitoring Results

Gas and Groundwater Monitoring Results

Contract Number:		W12/41072				Gas Monitor:		GA 2000					
Contract Name:		Oswald Road Primary School				Readings Taken By:		DM					
Date:		11th September 2012				Checked By:		AL					
Background Readings:		Weather Conditions:				Cloudy, showers		O ₂ %	CO ₂ %	CH ₄ %	CO	H ₂ S	
		Ground Conditions (dry / wet etc):				Damp		v/v	v/v	v/v	ppm	ppm	
		Atmospheric Pressure (Start):				1013mb		21.0	0.0	0.0	0.0	0.0	
		Atmospheric Pressure (Finish):				1013mb							
Hole No:	VOC	O ₂ %	CO ₂ %	CH ₄ %		LEL	CO	H ₂ S	Diff	Gas flow	Depth to	SWL	LNAPL
	ppm	v/v	v/v	v/v			ppm	ppm	Pressure	Rate (l/hr)	base of		or
	Steady	Steady	Steady	Peak	Steady	Steady	Steady	Steady	Steady	Range	mBGL	mBGL	mBGL
WS01	0.0	17.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.04	2.35	ND
WS03	0.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.08	1.22	ND
WS05	0.0	10.4	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.08	1.41	ND

>>>> = Flow above detection limit of 30 l/hr, <<< = Negative flow greater than -10 l/hr. >Max = In excess of lower explosive limit.

Remarks: Groundwater samples collected from all installations.

All other gases recorded at 'steady state' unless otherwise stated

All other gases recorded at 'steady state' unless otherwise stated

Appendix A6 – Tier 1 Thresholds

- Tier 1 Thresholds 'Residential without the Consumption of Produce' 1% SOM
- Tier 1 Thresholds 'Commercial' 1% 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 sandy matrix with an average Soil Organic Matter (SOM) content of 1% 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 ^{soil} Soil Screening Value	394
Arsenic	ATRISK ^{soil} Soil Screening Value	35
Beryllium	ATRISK ^{soil} Soil Screening Value	94.7
Boron	Recognised threshold to prevent phytotoxic affects	3
Cadmium	ATRISK ^{soil} Soil Screening Value	83.6
Chromium (VI)	ATRISK ^{soil} Soil Screening Value	38.1
Copper	ATRISK ^{soil} Soil Screening Value	8370
Cyanide (Free)	ATRISK ^{soil} Soil Screening Value	34
Lead	Currently accepted threshold	450
Mercury	ATRISK ^{soil} Soil Screening Value	0.06 ; 238 ; 7
Nickel	CLEA SGV for residential end use published May 09	130
Selenium	ATRISK ^{soil} 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 ^{soil} Soil Screening Value	353
Zinc	ATRISK ^{soil} 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 (Hg²⁺) and methyl mercury (Hg⁺⁴).
3. For human health consider using ATRISK^{soil} Soil Screening Value of 262mg/kg.

Table 1.1 BTEX Species

Contaminants	Threshold Trigger Concentration For Planned End Use	
	Source	Value (mg/kg)
Benzene	ATRISK ^{soil} Soil Screening Value	0.09
Toluene	ATRISK ^{soil} Soil Screening Value	219
Ethylbenzene	ATRISK ^{soil} Soil Screening Value	59.7
m-Xylene	ATRISK ^{soil} Soil Screening Value	19.7
o-Xylene	ATRISK ^{soil} Soil Screening Value	21.1
p-Xylene	ATRISK ^{soil} Soil Screening Value	18.9

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 ^{soil} Soil Screening Value (ref. 4)	4710
Anthracene	ATRISK ^{soil} Soil Screening Value (ref. 4)	22000
Benz(a)anthracene	ATRISK ^{soil} Soil Screening Value (ref. 4)	5.42
Benzo(a)pyrene	ATRISK ^{soil} Soil Screening Value (ref. 4)	0.989
Benzo(b)fluoranthene	ATRISK ^{soil} Soil Screening Value (ref. 4)	9.68
Benzo(ghi)perylene	ATRISK ^{soil} Soil Screening Value (ref. 4)	102
Benzo(k)fluoranthene	ATRISK ^{soil} Soil Screening Value (ref. 4)	99.7
Chrysene	ATRISK ^{soil} Soil Screening Value (ref. 4)	852
Dibenz(ah)anthracene	ATRISK ^{soil} Soil Screening Value (ref. 4)	0.949
Fluoranthene	ATRISK ^{soil} Soil Screening Value (ref. 4)	3110
Fluorene	ATRISK ^{soil} Soil Screening Value (ref. 4)	3180
Indeno(123cd)pyrene	ATRISK ^{soil} Soil Screening Value (ref. 4)	9.53
Naphthalene	ATRISK ^{soil} Soil Screening Value	0.598
Pyrene	ATRISK ^{soil} Soil Screening Value (ref. 4)	2330

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

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

Carbon Range	Threshold Trigger Concentration For Planned End Use		
	Source	Aromatic	Aliphatic
C5 – C6	ATRISK ^{soil} Soil Screening Value (ref. 5)	0.0925 (C5-C7)	30.2
C6 – C8	ATRISK ^{soil} Soil Screening Value (ref. 6)	219 (C7-C8)	70
C8 – C10	ATRISK ^{soil} Soil Screening Value	16	9.8
C10 – C12	ATRISK ^{soil} Soil Screening Value	97.1	1750 (ref. 4)
C12 – C16	ATRISK ^{soil} Soil Screening Value	1800 (ref. 4)	5210 (ref. 4)
C16 – C21	ATRISK ^{soil} Soil Screening Value	1330	146000
C21 – C35	ATRISK ^{soil} Soil Screening Value	1330	

5. Based on total benzene concentration in the soil.

6. Based on total toluene concentration in the soil.

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

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 sandy matrix with an average Soil Organic Matter (SOM) content of 1% to present a risk of significant harm to the 'Commercial' end user.

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

Table 1.0 Inorganic Species and Phenols

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

1. The tables are for guidance only and must be read in conjunction with relevant source documentation.
2. Three values correspond to: elemental mercury (Hg); inorganic mercury (Hg²⁺) and methyl mercury (Hg⁺⁴).
3. For human health consider using ATRISK^{soil} Soil Screening Value of 686mg/kg.

Table 1.1 BTEX Species

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

Tier 1 Thresholds

Soil Contaminants: Initial Assessment of Risk

Table 1.2 PAH Species

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

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

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

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

5. Based on total benzene concentration in the soil.

6. Based on total toluene concentration in the soil.

8. Aliphatic & Aromatic: where free product is not observed, otherwise consider revising.

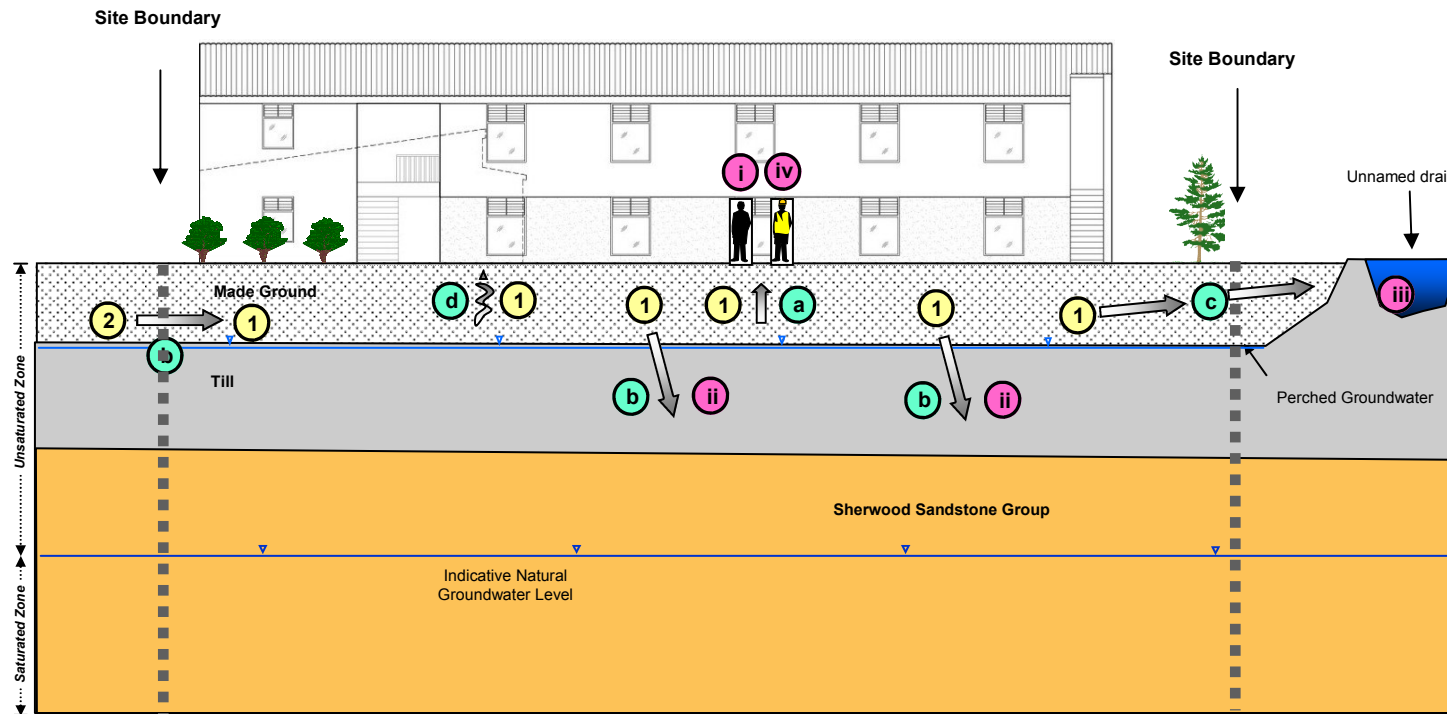
9. Modelled threshold <1kg/kg; lowest of either aqueous or vapour saturation limits presented.

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

Appendix A7 – Conceptual Site Model (CSM)

- Diagrammatic Conceptual Site Model (CSM)
- Tabulated Conceptual Site Model (CSM)

ED40287 Oswald Road Primary School



Sources

- 1 Made Ground (On Site)
- 2 Made Ground (Off Site)

Pathways

- a Direct contact, ingestion, inhalation (volatiles and dust)
- b Vertical and/or lateral percolation to groundwater
- c Lateral percolation to surface water
- d Vertical and lateral migration of soil gases

Receptors

- i Proposed end user of site. (Education)
- ii Groundwater (Principal Aquifer)
- iii Surface water (Unnamed drain, 263m NE)
- iv Construction workers



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Project

ED40287 Oswald Road Primary School

Drawing Title

Site Conceptual Model

Job Reference

50974

Date

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Author

SH

Checked

DM

Client

Manchester City Council

Scale

Not to scale

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		
Contaminant	Location	Receptors	Pathways to Receptors	Associated Hazard (Potential Severity)	Likelihood of Occurrence	Risk*
On site contaminants from past and present land use.	Possibly within sub surface strata.	Ground water (Principal Aquifer)	Vertical percolation to groundwater	Groundwater (Medium – High Sensitivity receptor and no water abstractions within 1000m)	Low (Due to presence of non-productive superficial deposits)	Moderate / Low
		Surface Water (Unnamed drain)	Lateral percolation to surface water	Surface Water (Mild – non-sensitive water resource)	Low (Due to the proximity of the water course from the site)	Low
		End user of site (Educational)	Direct contact, Ingestion, Inhalation (Dust and Vapours)	Human Health (Medium – sensitivity of end user)	Low (Due to limited potentially contaminative historic site use)	Moderate / Low
		Construction workers if applicable	Direct contact, Ingestion, Inhalation (Dust and Vapours)	Human Health (Minor – Providing suitable PPE equipment is worn)	Low (Due to limited potentially contaminative historic site use)	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		
Contaminant	Location	Receptors	Pathways to Receptors	Associated Hazard (Potential Severity)	Likelihood of Occurrence	Risk*
Off site contaminants from surrounding land use including nearby industry	Possibly within made-ground surrounding site.	End user of site (Educational)	Direct contact, Ingestion, Inhalation (Dust and Vapours)	Human Health (Medium – sensitivity of end user)	Low (Limited potential contaminative historical industry within the near vicinity)	Moderate / Low
		Construction workers if applicable	Direct contact, Ingestion, Inhalation (Dust and Vapours)	Human Health (Minor – Providing suitable PPE equipment is worn)	Low (Potential contaminative historical industry within the near vicinity)	Negligible
Gas associated with landfills and back-filled ponds / opencast quarries	Possibly within strata beneath the site.	End user of site (Educational)	Migration through strata and accumulation under buildings of explosive and asphyxiating gases.	Human Health (Severe – acute damage)	Likely (Back-filled ponds on site)	High

* 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

SOURCE – PATHWAY - RECEPTOR LINKAGE				QUANTITATIVE RISK ASSESSMENT		
Contaminant	Location	Receptors	Pathways to Receptors	Associated Hazard (Potential Severity)	Likelihood of Occurrence	Risk*
On site contaminants from past and present land use.	Possibly within sub surface strata.	Ground water (Principal Aquifer)	Vertical percolation to groundwater	Groundwater (Medium – High Sensitivity receptor and no water abstractions within 1000m)	Unlikely (Due to presence of non-productive superficial deposits)	Low
		Surface Water (Unnamed drain)	Lateral percolation to surface water	Surface Water (Mild – non-sensitive water resource)	Low (Due to low on site contamination and distance to receptor)	Low
		End user of site (Educational)	Direct contact, Ingestion, Inhalation (Dust and Vapours)	Human Health (Medium – sensitivity of end user)	Low (Due to limited recorded contamination of soil samples)	Moderate / Low
		Construction workers if applicable	Direct contact, Ingestion, Inhalation (Dust and Vapours)	Human Health (Minor – Providing suitable PPE equipment is worn)	Low (Due to limited recorded contamination of soil samples)	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

SOURCE – PATHWAY - RECEPTOR LINKAGE				QUANTITATIVE RISK ASSESSMENT		
Contaminant	Location	Receptors	Pathways to Receptors	Associated Hazard (Potential Severity)	Likelihood of Occurrence	Risk*
Off site contaminants from surrounding land use including nearby industry	Possibly within made-ground surrounding site.	End user of site (Educational)	Direct contact, Ingestion, Inhalation (Dust and Vapours)	Human Health (Medium – sensitivity of end use)	Unlikely (No evidence of contaminants migrating from nearby sources)	Low
		Construction workers if applicable	Direct contact, Ingestion, Inhalation (Dust and Vapours)	Human Health (Minor, providing suitable PPE equipment is worn)	Unlikely (Providing suitable PPE equipment is worn)	Negligible
Gas associated with landfills and backfilled opencast clay pits.	Possibly within strata beneath the site.	End user of site (Educational)	Migration through strata and accumulation under buildings of explosive and asphyxiating gases.	Human Health (Severe)	Low (No flow or elevated concentrations of Methane recorded on site)	Moderate

* 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.