



GROUNDTECH
CONSULTING

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<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
18-079/0009	A	Proposed Site Plan
8949G/SK-01	-	Exploratory Hole Location Plan

1.0 INTRODUCTION

1.1 Background

This Remedial Specification has been produced on behalf of PLP Construction and relates to the remediation of a site at Dob Brook Close in Failsworth.

The site was most recently a football ground before becoming disused and overgrown. A summary of the findings of the investigations are outlined in Section 2.0.

1.2 Proposed Works

Remediation will be undertaken at the site to prepare it for development of the residential units as shown on the 'Site Plan Proposed Layout' 18-079/1002. The proposed development comprises 24 residential plots with associated soft landscaping and infrastructure.

Guinness Developments Limited have submitted a planning application which has been approved by Manchester City Council. This Remedial Specification has been commissioned to facilitate the discharge of any pre-commencement planning conditions that are likely to be enforced with regard to land contamination.

The Full planning permission (126281/FO/2020) is for the erection of 8 No. two-storey dwelling houses and the erection of a three-storey building to form 16 No. apartments together with boundary treatments, landscaping and other associated works.

1.3 Objectives

The objective of this Remedial Specification is to present details of the remedial objectives, how the remediation of the site will be implemented and to outline how the works will be validated. This Remedial Specification details how the works will be permitted under the current regulatory regime.

The remediation will ensure that upon completion of the residential development, it can be demonstrated that the ground and groundwater conditions at the site are appropriate for its intended use and risks to identified receptors have been reduced to an acceptable level.

The following Remedial Specification includes the protection measures required during the enabling works phase and to be installed in the construction phase of the redevelopment for a residential end use with plant uptake.

This is a dynamic document that may require updating at certain stages of the process, the revisions should be undertaken in agreement with the relevant regulatory bodies. In addition, this Remedial Specification is subject to the approval of the regulators pre-commencement.

1.4 Remediation Specification Scope

The scope of the Remedial Specification is in accordance with CLR11 is as follows:

- *Summary of the Conceptual Site Model.*
- *Summary of the Pollution Linkage Risk Assessment.*
- *Remediation Options Appraisal including detailed assessment of preferred options.*
- *Implementation of preferred remedial solution.*
- *Specification for the remediation works.*

1.5 Sources of Information

In preparing the Remedial Specification the following documents were reviewed and should be read in conjunction with this report:

- *Phase 1 Desk Study and Preliminary Geo-environmental Assessment, Reference 8948G/01, dated August 2019.*
- *WML Consulting - Phase 2 Geo-Environmental Assessment and Investigation, Report No. 8948G-WML-00-XX RP-G-0002 dated October 2019.*
- *Groundtech Consulting – Ground Gas Risk Assessment referenced GRO-21052-2395, dated 23rd April 2021.*

2.0 CONCEPTUAL SITE MODEL

The following information has been taken from the WML Phase 2 Geo-Environmental Assessment and Investigation Report.

2.1 Site Details

The site comprises land located off Dob Brook Close in Failsworth and is centred on approximate Ordnance Survey National Grid Reference 388340E, 400675N.

At the time of the WML Ground Investigation on 11th September 2019, the site was undeveloped and fenced-off from the general public. The north western, western and southern areas of the site were surfaced with overgrown grass and low-lying vegetation. The central and south eastern area was surfaced with dense semi-mature and mature trees of varying species. Further mature trees were located sporadically within the northern and western sections of the site.

Historically, the western and south western section of the site included large stands of Japanese Knotweed. It is understood that these have been treated by a Japanese Knotweed specialist and evidence of dead stems and the base of large stands were visible in this section of the site. However, locally small volumes of re-growth were noted during the site inspection in August 2019.

2.2 Site History and Consultations

The earliest complete map dated 1848, indicates the site to have been predominantly undeveloped and in rural / agricultural use. A watercourse, presumably Dob Brook, extended north west to south east across the central section of the site, before being culverted to the south east. By 1892, Dob Brook had either been culverted or diverted. The site then remained unchanged until 1906 when it formed the south western section of a larger football ground. With the exception of a small structure in the south western corner of the site between 1931 and 1980 the site has never been further developed.

The nearest historic landfill is located over 250m to the north off Mill Lane. A vehicle scrap yard is located at the south western site boundary.

There are 3 No. petrol filling stations located within 250m of the site, the closest being 105m west which is obsolete.

There are no records of sites which have been determined as Contaminated Land under Section 78R of the Environmental Protection Act 1990 within 500m of the study site.

The property is not in a Radon Affected Area as defined by the Health Protection Agency as less than 1% of properties are above the Action Level of exposure. Therefore, no radon protection measures are necessary for new structures as described in publication BR211 by the Building Research Establishment.

2.3 Geology and Hydrogeology

The site is indicated to be underlain by Devensian Glacial Till comprising mainly clay but possibly with interbedded sand and gravel horizons. The superficial deposits are indicated to be underlain by strata of the Permian Collyhurst Sandstone which is recorded to comprise mainly red sandstone.

In consideration of the underlying geology, risks of subsidence from coal mining can be discounted.

The superficial deposits underlying the site are classified as a 'Secondary (Undifferentiated) Aquifer' and the underlying bedrock is classified as a 'Principal Aquifer'.

The site is not within an Environment Agency Source Protection Zone (SPZ) and there are no groundwater abstraction licences within 1km.

2.4 Geology and Hydrogeology

The nearest surface water feature is the Rochdale Canal which forms the southern site boundary.

2.5 Preliminary Contamination Risk Assessment

The following risks were determined by WML:

The Phase 1 desk study report concluded that potential pollution linkages are on the whole considered unlikely with associated preliminary risks being assessed generally as very low to low.

However, the report recommended that assumptions in the conceptual model be verified by providing information on the physical and chemical ground conditions through site investigations.

The investigations were to comprise sampling and chemical analysis of the near surface soil and the installation of ground gas monitoring standpipe with subsequent monitoring of hazardous ground gas concentrations and flow.

2.6 Ground Model

The following scope of works was undertaken on 11th September 2019:

- 6 No. window sample boreholes to a maximum depth of 5.0m bgl
- 4 No. machine excavated trial pits to a maximum depth of 2.7m bgl

Made Ground

Made Ground was encountered within all exploratory holes from ground level to depths of between 1.3m and 3.8m bgl. The upper horizon of Made Ground generally comprised brown and grey, interbedded clay, sand and gravel with a low to medium cobble content, to depths of between 0.9m and 1.9m bgl. Gravel sized fragments included brick, sandstone, concrete, slate, ash and locally coal, clinker, metal, wood and ceramic. Cobble sized fragments included sandstone, brick and concrete.

Within the majority of exploratory holes, a lower horizon of Made Ground comprising dark grey to black, locally slightly silty, sandy gravel extended to depths of between 1.3m and 3.8mbgl. Gravel sized fragments included predominantly ash and clinker but also locally wood, brick and slate.

Glacial Till

Within all of the exploratory holes, glacial till was encountered beneath the Made Ground at depths of between 1.3m and 3.8m bgl. The Glacial Till generally comprised brown and grey mottled, slightly sandy, slightly gravelly, silty clay.

Bedrock

Bedrock was not encountered during the Ground Investigation.

Groundwater

Groundwater seepages were encountered within the majority of exploratory holes at depths of between 1.0m and 2.4m bgl and mainly within the granular horizons of Made Ground. This considered to be perched water.

2.7 Geo-Environmental Testing Results

A summary of the soil testing results is provided below:

Contaminant	Number of Elevated Samples	Comments
Heavy Metals	1	Mercury and Lead slightly elevated in TP01 at 0.4m
Speciated PAHs	6	Elevations of benzo(a)anthracene, benzo(a)pyrene, dibenzo(ah)anthracene, benzo(b)fluoranthene.
Asbestos Fibres	-	None detected.

A summary of the leachate/groundwater testing results is provided below:

- *4no soil samples, namely TP1, TP2, TP3 and TP4, were submitted for the analysis of leachable concentrations of metals, semi-metals and PAH compounds. The majority of the results were below the generic criteria when compared to the EQS for freshwater, and the more stringent UKDWS, with the exception of minor exceedances of copper and lead.*

2.8 Ground Gas

No methane has been detected and a maximum concentration of carbon dioxide of 8.1% v/v has been recorded over the monitoring period. Concentrations of carbon dioxide were recorded above 5% v/v in WS1 and WS4 during the first visit and in WS1 and during the second and fifth visits. The concentrations of carbon dioxide generally reduced over the monitoring period as the gases were being exhausted off. During the last monitoring visit a maximum carbon dioxide concentration of 4.1% v/v was recorded.

Generally, no positive gas flow rates were recorded during the monitoring period. However, a positive gas flow rate was recorded during the fifth monitoring visit in WS4, on this occasion this was the only time a positive borehole pressure was recorded. This positive borehole pressure has been created as the groundwater level in WS4 rose from 2.8m to 1.3m bgl between the fourth and fifth monitoring visits. This positive borehole pressure has resulted in the gases in this standpipe being forced out once the gas valve was opened and the steady flow was lower. As a result, this positive gas flow rate is not considered to be representative of site conditions as no other positive flow rates were recorded.

WML carried out the gas monitoring and Groundtech Consulting carried out a ground gas risk assessment after discussions with Manchester City Council.

The Boyle and Witherington method was used in the assessment as the site is to be mostly developed with house containing a 150mm subfloor void.

Using the Boyle and Witherington method of assessing ground gases, the site falls within the Green traffic light zone and gas measures are not required for worst case scenario. In addition, using the Wilson and Card method to carry out the assessment, as part of the site is being developed with apartments, when considering the revised GSV value of 0.0081l/hr, in accordance with CIRIA C665 (Section A Development and Table 8.5 – Modified Wilson and Card Classification) it can be seen that the GSV values for methane and carbon dioxide correspond with CS1 criteria (GSV of <0.07l/hr) and gas protection measures are not required.

Carbon dioxide concentrations were recorded above 5% v/v after the Made Ground had been disturbed during Ground Investigation works but reduced to below 5% v/v over monitoring period due to either no or very slow rate of generation. Therefore, typical maximum concentrations are not applicable and no other major sources of permanent ground gases have been identified.

It was concluded that gas protection measures are not required, and the site is not in an area requiring radon precautions.

A copy of the Groundtech Consulting Ground Gas Risk Assessment is included in *Appendix 2*.

2.9 Remedial Strategy

Gas Protection Measures

Groundtech Consulting have concluded that no gas protection measures or radon precautions are required within the proposed residential development at the site. This is on the assumption that the buildings on site will have a suspended floor slab, sub floor void and efficient passive ventilation.

Capping Requirements for Private Gardens and Landscaped Areas

WML recommended that as the level of contamination in the Made Ground renders it unsuitable for direct use beneath proposed private gardens and shared landscaped garden areas, development will need to include the provision of a clean cover over the Made Ground to break the direct contact pollution linkage as set out below.

Therefore, all soft landscaping will need to be capped with 600mm of clean cover over the existing Made Ground to break the direct contact pollution linkage. The make-up of the 600mm cover would be expected to consist of:

- 150mm of clean imported topsoil
- 450mm of clean imported subsoil

Unexpected Ground Contamination - Soils

Due to the historical use of the site, it cannot be wholly discounted that unidentified contamination sources could be encountered during site enabling works.

Should any visual / olfactory evidence of contamination be encountered, expert advice of the most appropriate measures to deal with such contamination should be sought. This may include taking samples for geo-environmental testing and advising of appropriate routes for disposal to landfill.

Any unsuitable contaminated soil encountered during the site strip/enabling works will be segregated and stockpiled on impermeable sheeting and demarcated as contaminated soil for removal off-site.

Any contaminated soil will be stockpiled a sufficient distance from any other stockpiled clean soil such as arisings of natural soils, to prevent cross-contamination if immediate disposal to landfill is not possible.

2.10 Geotechnical

WML concluded that it is anticipated that a piled foundation solution will be the most suitable option for all structures at the site. Piles will need to be taken down through the Made Ground and any soft soils and into the underlying competent Glacial Till. Pile type, selection and design should be undertaken in conjunction with a reputable, specialist piling contractor, ideally with experience of the local ground conditions.

In consideration of the near surface ground conditions being of made ground, it is recommended that new road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 2.5%.

In consideration of the site being underlain by Made Ground and relatively impermeable Glacial Till, soakaways are not considered to be a feasible drainage option for the site.

3.0 POLLUTION LINKAGE ASSESSMENT REVIEW

The following section summarises the revised pollution linkage assessment undertaken in the WML Ground Investigation Report and Groundtech Consulting Permanent Ground Gas Risk Assessment.

3.1 Human Health

Receptor	Level of Risk	Comments
<i>Site End Users (Metals)</i>	<i>Medium</i>	<i>Cover system required in garden areas</i>
<i>Site End Users (PAHs)</i>	<i>Medium</i>	<i>Cover system required in garden areas</i>
<i>Site End Users (Asbestos)</i>	<i>Low</i>	-
<i>Site End Users (Ground Gas)</i>	<i>Low</i>	<i>Suspended floor slab and sub floor void in proposed buildings</i>

3.2 Controlled Waters

Receptor	Level of Risk	Comments
<i>Secondary Undifferentiated Aquifer</i>	<i>Low</i>	<i>Site not within a SPZ and there are no nearby groundwater abstractions.</i>
<i>Principal Aquifer</i>	<i>Low</i>	<i>Site not within a SPZ and there are no nearby groundwater abstractions.</i>
<i>Rochdale Canal</i>	<i>Very Low</i>	<i>Canal is a closed system.</i>

3.3 Groundworkers

Receptor	Level of Risk	Comments
<i>Contractors</i>	<i>Medium</i>	<i>During remediation phase</i>

4.0 REMEDIATION PROPOSALS AND APPRAISAL

Remediation will be undertaken to ensure the site is suitable for its proposed residential end use which comprises the erection of 8 No. two-storey dwelling houses and the construction of a three-storey building to form 16 No. apartments together with associated areas of gardens and soft landscaping.

The required level of remediation, to the satisfaction of the relevant regulators and discharge planning conditions, will be accomplished through a combination of techniques as outlined in the subsequent sections.

The implementation of the remediation proposals will be in accordance with the following documented quality assurance procedures:

1. **Detailed Remediation Specification** which outlines the requirements to demonstrate the effectiveness of the remediation in order to meet the remediation objectives. These are detailed in the following sections of this report.
2. **Final Verification Report** which will provide a complete record of the remediation activities undertaken during the enabling phase and construction phase as part of the verification plan to support compliance with remediation objectives and criteria. The report will also contain descriptions of the works including photographic evidence and details of any unexpected conditions encountered during the remedial works and how they were dealt with.

In addition to the above, the preferred contractor will be required to secure all necessary permits and licences to allow remediation to be undertaken and prepare appropriate health and safety risk assessments and method statements in accordance with CDM Regulations 2015 and other relevant legislation. All roles and responsibilities should be agreed/delegated at a pre-start meeting.

4.1 Outline Remediation Proposals

Based upon the findings of the Ground Investigations, risk assessment and the remediation options appraisal in accordance with CLR11, the following remediation processes will be carried out to produce a site which is suitable for its proposed residential end use and adhere with the General Requirements set out in *Appendix 3*.

The following phased remediation works will be undertaken to deliver the site suitable for the defined residential end use, the phases are divided into:

- *Enabling Works Phase.*
- *Construction Phase.*

The following remediation activities have been selected based on the Remedial Options Appraisal presented in *Appendix 4*:

- *Disposal of excess or unsuitable soils.*
- *Installation of a cover system in areas of soft landscaping.*

4.2 Enabling Works Phase

The following works are considered necessary during the enabling works phase:

- *Vegetation clearance.*
- *Reuse of appropriate soils.*

- *Offsite disposal of unsuitable or excess material.*

All works need to be undertaken in accordance with the Remedial Specification.

4.3 Construction Phase

It is anticipated that the construction phase of works will include the following:

- *Excavations for foundations.*
- *Excavations for service runs and drainage.*
- *Placement of clean validated subsoil/topsoil in areas of gardens and soft landscaping.*

All works need to be undertaken in accordance with the Remedial Specification.

4.4 Project Setup and Management

Prior to commencement of site activities, detailed planning of the project shall be undertaken including liaison with the client, supervising consultant, contractors and regulators. The Remedial Specification should be submitted to the relevant regulators for approval prior to commencement.

The project is to be operated under the Construction, Design and Management (CDM) Regulations, (2015).

Under the CDM regulations, the Client should appoint a Principal Designer, who will provide the Pre-construction Information Report and a Principal Contractor who would provide a comprehensive Construction Phase Health and Safety Plan (CPHASP) prior to works commencing. If the client does not appoint a Principal Designer, they will assume the role.

The Principal Designer will review the CPHASP and notify the local office of the Health and Safety Executive (HSE) of the works prior to commencing (via form F10), if necessary. The client is to nominate the Principal Contractor for each phase of works.

The appointed contractors will need to have suitable experience working in a similar setting, with similar ground conditions and with the contaminants of concern present at the site. It is the responsibility of the contractors to have read and understood the requirements of the Remedial Specification. Any queries should be clarified prior to the activity being undertaken.

5.0 IMPLEMENTATION OF SITE REMEDIATION PROCESSES

5.1 General

The following remedial works are required to break pollution linkages, to reduce risks to an acceptable level and make the site suitable for the proposed residential end-use.

5.2 Enabling Phase Implementation

Activity E1 – Pre-Start and Site Clearance

The enabling works contractor shall be responsible for the true and proper setting-out of the works and for the correctness of the position, levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour.

The enabling works contractor shall carefully protect and preserve all benchmarks, sight rails, pegs and other things used in setting out the works.

Should the enabling works contractor find any discrepancies on the drawings, they are to refer the matter to the client for verification before proceeding with the part of the works affected.

Before starting the site clearance works, the enabling works contractor shall verify with the client and/or architect which existing fences, gates, walls, roads, paved areas, trees, shrubs, etc., are to be removed and undertake dilapidation survey of all adjacent features/construction including but not limited to boundary walls/fences, adjacent footpaths and road constructions etc. The enabling works contractor shall be responsible for all costs associated with rectification of damage to adjacent features/construction including but not limited to boundary walls/fences, adjacent footpaths and road constructions etc. resulting from the enabling works.

The enabling works contractor shall investigate the features of the structures, ascertain if shock or vibration could damage surrounding property or equipment therein or buried utilities and check the existence of toxic or flammable substances.

Statutory service records are for information only. The enabling works contractor is to ensure that the records are current and complete through discussion with all appropriate statutory bodies and is responsible for all disconnection, diversion, sealing or removing of existing services as necessary (unless otherwise advised by the client).

Trees, boundaries and other features of interest, which are to be retained, shall be clearly identified and protected by a robust fence to avoid accidental impact damage and prevent excavation within the root zone of influence of foundations. All works shall be undertaken in accordance with BS 5387: 1991 'Trees in relation to Construction'. All other trees and shrubs shall be grubbed up and disposed of appropriately off site.

Prior to any works, the site shall be cleared of rubbish, debris and approved vegetation. Surface vegetation shall be stripped from all areas prior to trafficking with heavy plant and the surface vegetation is to be chipped and stockpiled. Topsoil should be stripped and stockpiled.

The enabling works contractor shall maintain records detailing the approximate location of any unsuitable material disposed, including a brief description.

All movement of materials shall be recorded and records shall be kept detailing the nature and quantity of materials, haulier details, final destination and any other relevant information.

Water or liquids shall not be pumped or emptied into the existing sewers/drainage system without the appropriate treatment and written permission of the relevant authority. If mobile tankers/bowsers are to be used, then disposal shall be at suitably licensed facilities in accordance with current legislation.

Documentation/certification of all materials disposed of are to be included in the H&S file prepared by the contractor.

Japanese Knotweed was present onsite which has been cleared. Treatment records will be required from the specialist contractor that treated the Japanese Knotweed for inclusion within the Final Verification Report.

Activity E2 - Reuse of Soils and Placement of Soils

Testing of soils prior to placement is required as set out in the Remedial Specification. Geotechnical acceptability testing is discussed in Section 6.

If, in the opinion of the Consultant, the material is not suitable for use, the enabling works contractor is to remove and dispose of it in accordance with the Remedial Specification, at the contractors cost.

Activity E3 - Offsite Disposal of Unsuitable or Surplus Material

Any material excavated on site may be classified as waste and it is the responsibility of the contractor to form their own view on whether or not it is waste. This includes determining when waste has been treated in some way it can cease to be classed as waste for a particular purpose. All arisings should be regarded as contaminated unless proven otherwise.

Any soils to be removed from site are to be removed to a licensed waste management facility and the waste is to be transported by a registered waste carrier in accordance with applicable Waste Management Regulations.

All testing to allow disposal of waste is to be undertaken by the contractor at their cost.

Waste consignment/transfer notices will be required and are to be retained by the contractor. Copies of all waste consignment/transfer notices are to be provided to Groundtech Consulting for inclusion in a validation report.

Activity E4 - Validation Criteria During Enabling Works

The following sections detail validation criteria to be used during the enabling works.

Testing

All testing during the enabling works shall be undertaken by the enabling works contractor and all sampling, logging and testing of soils shall be undertaken in accordance with BS 5930:2015 'Code of Practice for Site Investigations' and BS 10175:2011+A1:2013 'Investigation of Potentially Contaminated Sites – Code of Practice'.

The enabling works contractor shall undertake all testing at a laboratory which holds UKAS and MCERTS accreditation for the specific tests. Where it is not possible to obtain the testing of a material for a specific property to a UKAS or MCERTS accredited method, the enabling works contractor shall obtain permission from the Consultant for the test to be completed at the proposed laboratory, before the test is undertaken.

The results of all testing undertaken (and a copy of the test certificates), shall be submitted to the Consultant as soon as they are reported. The enabling works contractor shall advise the Consultant of any delay or deviations that they are aware of regarding the completion of any tests.

Activity E5 - Contractor's Validation Records

The enabling works contractor shall maintain a daily written and photographic record of the works undertaken.

All records provided by the enabling works contractor shall be available to the Client and Groundtech Consulting.

5.3 Construction Phase Implementation

The construction phase of works will be undertaken by a separate Contractor, referred to as the ground works contractor.

It is the responsibility of the contractor to have read and understood the requirements of the Remedial Specification and any geotechnical specification documents. If there are any queries, please contact Groundtech Consulting for clarification.

The following will be undertaken during the construction phase:

- *Excavations for foundations.*
- *Excavations for service runs and drainage.*
- *Placement of clean validated subsoil/topsoil in areas of gardens and soft landscaping.*

Activity C1 - Appropriate Materials Handling and Stockpiling to Allow Reuse of Excavated Soils

The contractor is to undertake a watching brief for materials which may potentially be contaminated during excavations of foundations and drainage. If suspect materials are encountered, the soils are to be stockpiled separately and Groundtech Consulting contacted immediately.

Any imported materials are to be tested by the contractor in accordance with this Remedial Specification to demonstrate they are suitable from a geotechnical and geo-environmental engineering perspective.

Activity C2: Installation of the Cover System in areas of Soft Landscaping

A clean cover system is required in garden areas to reduce the risk to an acceptable level. The cover system installation by the ground works contractor should be undertaken in the following steps:

1. *Undertake geo-environmental testing and assessment of all imported soils (cohesive and granular) to establish they are suitable for use. Groundtech Consulting should be provided with the testing certificates prior to import and additional testing may be required.*
2. *In areas where trees are planned as part of the landscaping, the cover system should be increased to allow for the root ball. The dimensions of the tree pit (if required) are to be specified by a qualified arboriculturist.*
3. *Install house drainage and other services and storing excavated clean soils appropriately for re-use in gardens.*
4. *Validation of the cover system to be undertaken by Groundtech Consulting.*

The cover system requirements are set out below based on the specific use:

Specific Use	Requirements
Front and Rear Gardens	<i>If Made Ground is present at garden formation level, the cover system should comprise 600mm of topsoil and subsoil (minimum of 150mm of topsoil).</i>

Physical Requirements of Cover System Soils

Imported Topsoil should be as agreed with the client and where possible should conform to BS 3882:2015. It should be noted that clay soils are not recommended as they are likely to become waterlogged during handling and placement.

The imported material is to be confirmed by visual inspection of the material by the consultant and if necessary, by laboratory particle size distribution assessment.

Topsoil and subsoil should be free from:

- *Asbestos, metal, plastic, wood, glass, tarmac, brick, paper, concrete or other potentially hazardous foreign material which could cause injury.*
- *Aggressive / invasive weeds (especially Japanese Knotweed and Giant Hogweed) and bulk vegetative growth.*

Geo-Environmental Requirements of Cover System Soils

Any imported soils should be from a source not expected to be contaminated and meet both physical and chemical criteria, as detailed in this Remediation Specification.

Prior to importation of topsoil, subsoil or granular material from a commercial supplier, certification should be obtained from the supplier detailing the source site, its previous and current land use and relevant test results. A copy of this should also be forwarded to Groundtech Consulting for review and comparison against the import criteria.

If the proposed source is not from a commercial supplier, Groundtech Consulting recommend that the source is tested to confirm it is appropriate for use prior to import.

For material from a natural source, testing should be undertaken at a rate of one test per 250m³, with a minimum of three tests to be undertaken on any individual source material.

If the source of the material is not natural, geo-environmental testing should be undertaken at a rate of one test per 100m³, with a minimum of five tests to be undertaken on any individual source material.

Depending on the source or variability of imported material, the consultant may instruct additional testing to be undertaken. If constant sources are used for the topsoil and subsoil and the results recorded are consistently low, consideration may be given to reducing the number of samples tested.

With regards to imported soils proposed for use as part of the cover system, the results of geo-environmental testing are to be compared with the criteria presented in *Appendix 8*. If any of these thresholds are exceeded the material shall be considered to be unsuitable unless treatment, further testing and risk assessment shows it to be satisfactory. Testing should be carried out for the following general suite of contaminants:

- *Arsenic, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, zinc, pH, asbestos fibres, speciated Polycyclic Aromatic Hydrocarbons and organic matter.*
- *Speciated TPH (TPHCWG), if required.*
- *Asbestos screening.*

6.0 EARTHWORKS

6.1 General

The topography of the site is generally level and significant earthworks are not anticipated. Guidance is given below if any earthworks are to take place at the site.

6.2 Site Won Material and Suitability Testing

The material generated from any cutting exercise would comprise Made Ground and natural Clay. Different material types should be kept in separate stockpiles.

Initially, the materials generated should be classified using the Specification for Highways works. Earthworks testing should be scheduled on representative samples to classify the material, and determine the following:

- *Strength/Density.*
- *Actual Water Content.*
- *Optimum Moisture Content.*
- *Grading for classification*

Actual moisture content values should be within the allowable range of 95% MDD and less than 5% air voids to be suitable for compaction.

In addition, the Moisture Condition Value provides a numerical value for the least amount of compactive effort to achieve near full compaction at a given moisture content. This enables a comparison with the actual moisture content during the earthworks process and can be used for determination of the moisture content in the field.

6.3 Validation Testing

Below is a general outline of the requirements at this stage.

Prior to placing down any of the cohesive fill, the existing subgrade should be proof rolled using suitable methods outlined in the HASHW Series 600. Proof rolling will identify any soft spots present which should be dealt with using good site practice and procedures outlined in the specification.

At each layer, testing should be carried out to confirm the properties of the filled soils including whether specified maximum dry density has been achieved. Testing should include sand replacement tests and plate load testing. These tests should be carried out varying depths as the fill materials are placed to ensure they have been compacted sufficiently.

A comprehensive surveying programme should be in place during the earthworks so levels of tests and finished levels are accurate. The earthworks specification will also need to include for sufficient testing to ensure the engineered fill meets the criteria set out in the specification, consideration of the long-term performance will be required.

All earthworks should be undertaken in accordance with the criteria set out in *Appendix 5 to 7*.

7.0 SUPERVISION, VERIFICATION AND REPORTING

Necessary changes to the agreed Implementation Plan, arising during the course of the works, are to be agreed in writing with the Local Authority prior to being undertaken on site.

It is recommended that details of environmental works undertaken, the rationale and design for the implementation of this strategy and verification details of the works undertaken are appended to the deeds for the property to ensure the site is sold with knowledge of the works undertaken and the ground conditions.

7.1 Site Supervision

The contractor is to provide appropriate engineer supervision during excavation and validation works. Supervision should be undertaken by an appropriate, experienced person who has read and understand the requirements of this Remedial Specification.

7.2 Collection of Samples

All sampling, logging and testing of soils shall be undertaken in accordance with BS 5930:2015 'Code of Practice for Site Investigations' and BS 10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites – Code of Practice'.

Soils for inorganic analysis will be sealed in air-tight polythene tubs, and soils for organic analysis will be sealed in amber glass jars with the minimal practicable headspace.

All samples shall be scheduled on chain of custody forms prior to being dispatched to the UKAS accredited laboratory for analysis.

The contractor shall undertake all testing at a laboratory which holds UKAS and MCERTS accreditation for the specific tests. Where it is not possible to obtain the testing of a material for a specific property to a UKAS or MCERTS accredited method, the contractor shall obtain permission from the consultant for the test to be completed at the proposed laboratory, before the test is undertaken.

The results of all testing undertaken (and a copy of the test certificates), shall be submitted to the consultant as soon as they are reported.

7.3 Cover System

Verification of cover system thickness is required. Testing of imported soils will be required in accordance with this Remedial Specification. Groundtech Consulting should be notified when the cover system has been placed and will undertake a visual inspection and random spot check excavations.

If the cover system is deemed to be inadequate, the site manager will be informed and advised on remedial measures. Verification of the cover system will only be carried out where the cover system has been completed. The cover system validation report will include:

- *Confirmation of the source of imported material.*
- *Confirmation of the physical suitability of the material.*
- *Confirmation that the geo-environmental test results pass when compared to the appended RTVs.*
- *Confirmation of the depth placed within the gardens.*

8.0 REUSE OF SOILS AND MATERIALS MANAGEMENT

8.1 Waste Management Background

For the enabling works, the enabling works contractor is responsible for writing and ensuring all works are undertaken in accordance with current legislation.

8.2 Certainty of Use and Quantity of Material

There will be an opportunity to reuse soils at the site following excavation. Any excess or unsuitable soils will be disposed of.

The following excavation and placement is proposed during the construction works:

- *Excavation of foundations.*
- *Excavation of drainage runs.*
- *Placement of clean natural soils for use as subsoil and topsoil in garden areas.*

Only materials deemed suitable for use by an appropriately qualified person will be utilised on site. Any out of specification material (geo-environmental and geotechnical) obtained from the site, which is not deemed suitable for use, will be classified as waste and will be disposed of or recovered in accordance with waste legislation.

Material re-used or imported to site will be subject to the necessary testing/review and comparison to this Remedial Specification prior to delivery to site to minimise the risk of the importation of unsuitable material. Any material deemed unsuitable upon arrival at the site will be rejected.

Only sufficient material required on site for the purposes of raising levels in accordance with the pre-determined proposals (planning conditions and drainage strategy) will be imported or reused on site. Any surplus material or material which does not meet the required specification will be disposed of offsite. It is the responsibility of the contractor at each stage of the works to have checked all volume calculations and have allowed for disposal of unsuitable or excess materials.

8.3 On Site Material Management

Stockpiles

Site won material for potential reuse will be stored onsite in stockpiles. The stockpiles are to be managed by the contractor during the relevant phases of work and will be subject to operational constraints at the time of stockpiling.

Stockpile locations will be clearly marked and documented on working drawings maintained in the site office.

The contractor for each phase of works is to take appropriate mitigation measures and environmental precautions as considered necessary at storage locations. However, as a minimum, stockpiles should be compacted to prevent dust and they should be kept wet in periods of dry weather.

Confirmatory Testing for Material for Offsite Disposal

Any material requiring disposal during any phase of works shall be disposed of by the contractor. They shall ensure adequate and appropriate disposal, including testing to satisfy the proposed waste facility.

Records of the removal of stockpiles offsite should be maintained by the contractor including details of the disposal or treatment site to which they have been taken. These details are to be passed to Groundtech Consulting to form part of the verification report.

Appropriate precautions should be taken by the contractor to ensure that the stockpiled material does not result in risks to neighbouring land users.

Confirmatory Testing for Imported Material

Imported soil will be tested to determine it is suitable for use.

The contractor importing the material is to provide laboratory testing results to Groundtech Consulting to prove the suitability of the material to be brought on to site in line with the requirements specified in this Remedial Specification. Once the soils are present on site, additional testing will be undertaken.

9.0 CONTINGENCY PLAN AND AREAS OF UNEXPECTED CONTAMINATION

There is potential for areas of unexpected contamination to be present due to the former use of the site. The strategy for unexpected contamination must be relayed to all site personnel during the enabling works phase and outline a clear allocation of responsibility for reporting and dealing with contamination.

Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the requirement to report this to the client and Groundtech Consulting.

A report will be prepared by Groundtech Consulting and submitted to the regulatory parties, the Local Authority and the Environment Agency where groundwater may potentially have been impacted.

As it is proposed to excavate and where appropriate reuse, the soils onsite during a separate enabling works phase, the strategy will be less relevant to the construction phase of works.

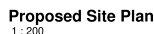
If additional materials are identified, these materials will be subject to the procedures stated in this Remedial Specification.



APPENDIX 1 - Plans

rev	date	by	ADD - Adjustment Gross Internal Floor Area added		MD
PROJECT					
Dob Brook Close					
CLIENT					
The Guinness Partnership					
DRAWING					
Proposed Site Plan					
SCALE	SHEET SIZE	DRAWN	CHECKED	DATE	

JOB No 18-079	DRAWING No 0009	REVISION A
STATUS FEASIBILITY		





GENERAL NOTES

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- NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS ALLOWED WITHOUT PRIOR PERMISSION IN WRITING.
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- THE CONTRACTOR SHALL INCORPORATE ALL THE REQUIREMENTS OF THE PRE-TENDER STAGE HEALTH & SAFETY PLAN.

KEY

- SITE BOUNDARY
- WS1 WINDOW SAMPLE PROBEHOLES
- TP1 WINDOW SAMPLE PROBEHOLES
- AREA OF KNOWN JAPANESE KNOTWEED

P1	FIRST PRELIMINARY ISSUE	AUG 18	SC	PD
Rev	Amendment	Date	By	Check

Project
DOB BROOK CLOSE

Client
THE GUINNESS PARTNERSHIP

Title
EXPLORATORY HOLE LOCATION PLAN

Drawn	Checked	Date	Scale
SCS	PGD	2210-19	1:200

WML CONSULTING
Chartered Civil and Structural Engineers

Job No. **8949G** Drawing No. **SK-01**

Drawn: SCS, Checked: PGD, Date: 2210-19, Scale: 1:200

WML CONSULTING
Chartered Civil and Structural Engineers

Job No. 8949G, Drawing No. SK-01

APPENDIX 2 – Groundtech Consulting Ground Gas Risk Assessment



GROUNDTECH
CONSULTING

Job title: Dob Brook Close, Failsworth

Report type: Ground Gas Risk Assessment

Prepared for: Adapt Civils

Date: April 2021

Document Control Form

PROJECT DOB BROOK CLOSE, FAILSWORTH

REPORT NAME GROUND GAS RISK ASSESSMENT

REPORT REFERENCE GRO-21052-2395

STATUS FINAL

ISSUE DATE 23 APRIL 2021

REVISION

CLIENT ADAPT CIVILS

CLIENT CONTACT JOHN DUNNE

For and Behalf of Groundtech Consulting

SIGNATURE



AUTHOR

Cameron Wallace BSc (Hons)

SIGNATURE



CHECKED

Richard Wyatt MEng (Hons) FGS

SIGNATURE



REVIEWED

James Doyle BSc (Hons) CGeol FGS

Introduction

We are pleased to present our findings following the completion of the gas monitoring programme undertaken at Dob Brook Close in Failsworth for the proposed residential development.

The following previous reports have been prepared for the site:

- *WML Consulting - Phase 2 Geo-Environmental Assessment and Investigation, Report No. 8948G-WML-00-XX RP-G-0002 dated October 2019.*
- *WML Consulting – Updated Ground Gas Risk Assessment referenced 8948G/TPB/SCS, dated 23rd January 2020.*

The site comprises land located off Dob Brook Close in Failsworth. It is centred on approximate Ordnance Survey National Grid Reference 388340E, 400675N.

At the time of the investigation on 11th September 2019, the site was undeveloped and fenced-off from the general public. The north-western, western and southern area of the site was surfaced with overgrown grass and low-lying vegetation. The central and south eastern area was surface with dense semi-mature and mature trees of varying species. Further mature trees were located sporadically within the northern and western sections of the site.

The site is indicated to be underlain by Devensian Glacial Till comprising mainly clay but possibly with interbedded sand and gravel horizons. The superficial deposits are indicated to be underlain by strata of the Permian Collyhurst Sandstone which is recorded to comprise mainly red sandstone.

The property is not in a Radon Affected Area as defined by the Health Protection Agency as less than 1% of properties are above the Action Level of exposure. Therefore, no radon protection measures are necessary for new structures as described in publication BR211 by the Building Research Establishment.

The nearest historic landfill is located over 250m to the north off Mill Lane. A vehicle scrap yard is located at the south-western site boundary.

The earliest complete maps dated 1848 indicate the site to have been predominantly undeveloped and in rural / agricultural use. A watercourse, presumably Dob Brook, extended north west to south east across the central section of the site, before being culverted to the south east. By 1892, Dob Brook had either been culverted or diverted. The site then remained unchanged until 1906 when it formed the south western section of a larger football ground. With the exception of a small structure in the south western corner of the site between 1931 and 1980 the site has never been further developed.

Ground Model

Made Ground

Made Ground was encountered within all exploratory holes from ground level to depths of between 1.3m and 3.8m bgl. The upper horizon of Made Ground generally comprised brown and grey, interbedded clay, sand and gravel with a low to medium cobble content, to depths of between 0.9m and 1.9m bgl. Gravel sized fragments included brick, sandstone, concrete, slate, ash and locally coal, clinker, metal, wood and ceramic. Cobble sized fragments included sandstone, brick and concrete.

Within the majority of exploratory holes a lower horizon of Made Ground comprising dark grey to black, locally slightly silty, sandy gravel extended to depths of between 1.3m and 3.8mbgl. Gravel sized fragments included predominantly ash and clinker but also locally wood, brick and slate.

Glacial Till

Within the all of the exploratory holes, glacial till was encountered beneath the Made Ground at depths of between 1.3m and 3.8m bgl. The Glacial Till generally comprised brown and grey mottled, slightly sandy, slightly gravelly, silty clay.

Bedrock

Bedrock was not encountered during the Ground Investigation.

Groundwater

Groundwater seepages were encountered within the majority of exploratory holes at depths of between 1.0m and 2.4m bgl and mainly within the granular horizons of Made Ground. This considered to be perched water.

The exploratory hole positions are shown on the Exploratory Hole Location Plan 8949G-SK-01 and the logs are in *Appendix 1*.

Gas Monitoring

During the Ground Investigation works, monitoring standpipes were installed in the following holes and a summary of the installations is provided in the table below.

Location	Depth (m bgl)	Response Zone (m bgl)	Targeted Strata	Reason
WS1	2.70	1.00 – 2.70	Natural Strata	Ground Gas
WS2	3.00	1.00 – 3.00	Natural Strata	Ground Gas
WS4	3.00	1.00 – 3.00	Natural Strata	Ground Gas

Six ground gas monitoring visits have been completed between 17 October and 04 December 2019.

Permanent gas and groundwater monitoring results are presented in *Appendix 2*.

Gas Monitoring Results

During the monitoring period, no concentrations of methane (CH₄) have been recorded within the standpipes. However, detectable levels of carbon dioxide (CO₂) were recorded within the standpipes, up to a maximum level of 8.4% v/v together with associated depleted oxygen (O₂) concentrations (minimum 0.1% v/v).

In addition, flow rates were generally recorded below the limit of detection of the gas analyser on all occasions. However, a positive flow rate of 2.4l/hr was recorded in WS4 during the fifth monitoring visit.

Groundwater levels were recorded within the standpipes ranging from 1.25m to 2.80m bgl. The groundwater was present within the response zone of the standpipes.

The atmospheric pressure ranged between 970mb and 1016mb during the monitoring period and was carried out during periods of rising, steady and falling barometric pressure.

Characterisation of the Gas Screening Value (GSV)

In accordance with CIRIA Report C665, November 2007 it is felt that an adequate risk assessment can be undertaken based on the following limiting factors:

- *The proposed development has been considered as **high sensitivity** based on the site being developed with residential dwellings (Table 5.5 – Typical/Idealised frequency and period of monitoring, after Wilson et al, 2005).*

- The risk associated with the generation potential of a source is considered as **very low**, (assessment based on the environmental setting) as well as observations noted during the fieldworks.
- Negligible and relatively low flow rates have been recorded (Table 8.5 – Modified Wilson & Card classification). For this site, one of the monitoring visits was targeted to correlate with a falling atmospheric pressure trend. As a comparison, monitoring has also been undertaken during rising and steady atmospheric pressure trends.

Based upon the results recorded, in accordance with CIRIA Report C665, the risk to the site from ground gases has been assessed by converting the results to gas screening values (GSVs), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates. In addition, individual “hazardous gas flow rates” (Q_{hg}) have been derived for each monitoring point. As no levels of methane have been recorded a GSV for carbon dioxide only has been calculated.

$$GSV (l/hr) = \text{max borehole flow rate (l/hr)} \times \text{max gas concentration (\%)}$$

For this assessment, the maximum recorded concentration of carbon dioxide of 8.1%v/v has been used together with the maximum flow rate of 2.4l/hr to calculate the GSV.

$$\text{Carbon Dioxide GSV} = 0.081 (8.1\%) \times 2.4 = 0.1944 \text{ l/hr}$$

$$\text{Methane GSV} = 0.0 \text{ l/hr}$$

Assessment

Ground gas monitoring has been carried out as part of the proposed residential development.

No methane has been detected and a maximum concentration of carbon dioxide of 8.1% v/v has been recorded over the monitoring period. Concentrations of carbon dioxide were recorded above 5% v/v in WS1 and WS4 during the first visit and in WS1 and during the second and fifth visits. The concentrations of carbon dioxide generally reduced over the monitoring period as the gases were being exhausted off. During the last monitoring visit a maximum carbon dioxide concentration of 4.1% v/v was recorded.

The carbon dioxide concentrations recorded are likely associated with the Made Ground beneath the site and was highest at the start of the monitoring period as a result of the ground being disturbed.

Generally, no positive gas flow rates were recorded during the monitoring period. However, a positive gas flow rate was recorded during the fifth monitoring visit in WS4, on this occasion this was the only time a positive borehole pressure was recorded. This positive borehole pressure has been created as the groundwater level in WS4 rose from 2.8m to 1.3m bgl between the fourth and fifth monitoring visits. This positive borehole pressure has resulted in the gases in this standpipe being forced out once the gas valve was opened. As a result, this positive gas flow rate is not considered to be representative of site conditions as no other positive flow rates were recorded.

Based on the site being developed with low-rise housing, the Boyle and Witherington, 2006 method has been used to carry out the assessment. This is a risk-based approach that is designed to allow an identification of gas protection for a low-rise housing development by comparing the measured gas emission rates to generic ‘traffic lights’ scenarios. The traffic lights include ‘typical maximum concentrations’ and are provided for initial screening purposes and risk-based gas screening values for consideration in situations where the typical maximum concentrations are exceeded.

When considering the results, in accordance with CIRIA C665 (Situation B – Low-rise housing with a ventilated underfloor void (min 150mm) and Table 8.7 – NHBC Traffic light system for 150mm void) it can be seen that the GSV value for carbon dioxide is below the assessment GSV of <0.78l/hr and falls within the Green traffic light zone.

NHBC - Green Traffic Light

An extract of the table is presented below.

Traffic Light Classification	Methane ¹		Carbon Dioxide ¹	
	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.63	10	1.56
Amber 2	20	1.56	30	3.10
Red				

Notes:

1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated;
2. Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, as defined in Wilson and Card (1999), which is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered;
3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

Table 8.7 – NHBC Traffic light system

In addition, as the positive gas flow rate is considered to be anomalous and using a gas flow rate of 0.1l/hr for the site, i.e. the limit of detection of the gas analyser, and the worst case gas concentrations, the GSV for carbon dioxide is 0.0081l/hr. Using the Wilson and Card method to carry out the assessment, as part of the site is being developed with apartments, when considering the revised GSV value of 0.0081l/hr, in accordance with CIRIA C665 (Section A Development and Table 8.5 – Modified Wilson and Card Classification) it can be seen that the GSV values for methane and carbon dioxide correspond with CS1 criteria (GSV of <0.07l/hr) and gas protection measures are not required.

The proposed construction is to have a suspended floor slab which will provide passive ventilation.

Radon Gas

In accordance with BRE 211 'Radon Guidance on Protective Measures for New Buildings' 2015 and UKRadon, the site falls in an area where less than 1% of homes are affected by radon gas, therefore no radon precautions are required within the proposed dwellings.

Conclusions

No gas protection measures are required within the proposed dwellings at the site.

No radon precautions are necessary.

It is recommended that confirmation of these findings is made with the Local Authority prior to any irrevocable action being taken.

PLANS



Station	Easting	Northing	Level
1	388361.508	400715.560	88.568
2	388307.208	400695.132	88.311

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- THE CONTRACTOR SHALL INCORPORATE ALL THE REQUIREMENTS OF THE PRE-TENDER STAGE HEALTH & SAFETY PLAN.

KEY

- SITE BOUNDARY
- ⊕ WS1 WINDOW SAMPLE PROBEHOLES
- ⊞ TP1 WINDOW SAMPLE PROBEHOLES
- AREA OF KNOWN JAPANESE KNOTWEED

P1	FIRST PRELIMINARY ISSUE.	AUG '19	SCS	PGD
Rev.	Amendment	Date	By	Chkd

Project	DOB BROOK CLOSE			
Client	THE GUINNESS PARTNERSHIP			
Title	EXPLORATORY HOLE LOCATION PLAN			

Drawn	Checked	Date	Scale
SCS	PGD	2210-19	1:200

WML CONSULTING Chartered Civil and Structural Engineers		No.8 Oak Green Earl Road Stanley Green Business Park Cheadle Hulme Cheshire SK8 6QL Tel 0161 482 0600 Fax 0161 486 9210 e-mail info@wmlconsulting.com www.wmlconsulting.com
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Job No.	8949G	Drawing No.	SK-01
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EXPLORATORY HOLE LOGS

		Project Title: Dob Brook Close				WS1	
		Project Number: 8948G		Client: Guinness Partnership			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 11/09/2019		Method: Window Sample		Driller: LOT Geotechnics		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.40	E				1.00	Dark brown, slightly clayey, gravelly SAND with rootlets. Gravel is angular to subangular, fine to coarse, including brick, concrete, ash, clinker and coal. Low cobble content. Cobbles are subangular, including brick. (MADE GROUND)		
1.40	D	N=21	1.20		Brown, slightly gravelly, sandy CLAY. Gravel subangular, fine to coarse, including brick, ash and sandstone. (MADE GROUND)			
		N=3	1.90 2.00		Dark grey, slightly silty, sandy, angular to subangular, fine to coarse GRAVEL including ash and clinker. (MADE GROUND)			
		N=15	2.30 3.00		Dark brown, slightly clayey, silty SAND with occasional organic flecks (MADE GROUND)			
		N=15	4.00		Stiff, brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone and siltstone. (GLACIAL TILL)			
		N=32	5.00		End Of Borehole At 5.00 m			
			6.00					

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa - Groundwater Strike - Groundwater Level 	REMARKS Scale: 1:40	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="6">Water Strikes</th> </tr> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> <tr> <td>12/09/2019</td> <td>1</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="3">Daily Log Of Depths</th> <th colspan="3">Chiselling</th> </tr> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Hours</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>	Water Strikes						Date	Strike	Level	Minutes	Casing	Sealed	12/09/2019	1																	Daily Log Of Depths			Chiselling			Date	Casing	Water	From	To	Hours												
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Date	Strike	Level	Minutes	Casing	Sealed																																																			
12/09/2019	1																																																							
Daily Log Of Depths			Chiselling																																																					
Date	Casing	Water	From	To	Hours																																																			

		Project Title: Dob Brook Close				WS2	
		Project Number: 8948G		Client: Guinness Partnership			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 11/09/2019		Method: Window Sample		Driller: LOT Geotechnics		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.40	E				0.30	Turf over brown and grey, slightly sandy, subangular, fine to coarse GRAVEL including sandstone and brick. (MADE GROUND)		
		N=5			0.70			
					1.00	Brownish grey, slightly clayey, gravelly SAND with occasional organic flecks. Gravel is subangular, fine to coarse, including brick, ash, wood, sandstone, ceramic. (MADE GROUND)		
1.70	D				1.70			
		N=10			2.00	Brown, slightly gravelly, sandy CLAY. Gravel is subangular, fine to coarse, including brick and sandstone. (MADE GROUND)		
					3.00			
		N=18			4.00	Firm, becoming stiff, brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone and siltstone. (GLACIAL TILL)		
		N=32			4.60			
		N=26			5.00			
					6.00			
						End Of Borehole At 4.60 m		

KEY

D - Disturbed Sample
 B - Bulk Sample
 U - Undisturbed
 W - Water Sample
 S - Standard Penetration Test
 C - Cone Penetration Test
 N - Penetration Test 'N' Value
 V - Hand Shear Vane kPa
 - Groundwater Strike
 - Groundwater Level

REMARKS

No Groundwater Encountered
 Sampler refused at 4.60mbgl.

Scale: 1:40

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed

Daily Log Of Depths Chiselling

Date	Casing	Water	From	To	Hours

		Project Title: Dob Brook Close				WS4	
		Project Number: 8948G		Client: Guinness Partnership			
		Date: 11/09/2019		Method: Window Sample		Driller: LOT Geotechnics	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
					0.15	Dark brown clayey organic sand with many roots. (MADE GROUND)		
					0.40			
		N=8			1.00	Bricks and flagstones. (MADE GROUND)		
					1.90			
		N=7			2.00	Brown clayey sandy gravel with low cobble content. Gravel is sandstone brick and concrete. Cobbles are concrete. (MADE GROUND)		
					2.30			
					2.30	Black sand and gravel of ash and clinker. (MADE GROUND)		
					3.00			
		N=6			3.10	Soft grey slightly sandy CLAY with some decayed roots. (GLACIAL TILL)		
					3.10			
					3.10	Soft becoming firm brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone and mudstone. (GLACIAL TILL)		
					4.00			
		N=19			4.00			
					4.00			
					4.00			
					4.00			
		N=16			5.00	End Of Borehole At 5.00 m		
					5.00			
					5.00			
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		Project Title: Dob Brook Close				WS5	
		Project Number: 8948G		Client: Guinness Partnership			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 11/09/2019		Method: Window Sample		Driller: LOT Geotechnics		Logged By: KE	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
					0.15	Black clayey organic sand with many roots. (MADE GROUND)		
		N=18			1.00	Soft black and brown sandy gravelly clay with low cobble content. Gravel is fine to coarse brick and concrete and clinker. Cobbles are brick. (MADE GROUND)		
		N=6			1.90 2.00	Black sand and gravel of ash and clinker. (MADE GROUND)	▼	
					2.40	Soft dark brown organic peaty clay. (MADE GROUND)		
		N=5			2.90 3.00	Black sand and gravel of ash and clinker. (MADE GROUND)		
		N=10			3.80 4.00	Soft becoming firm brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone and mudstone. (GLACIAL TILL)		
		N=23			5.00	End Of Borehole At 5.00 m		
					6.00			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level		REMARKS 	Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> </thead> <tbody> <tr> <td>13/09/2019</td> <td>2.1</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Date	Strike	Level	Minutes	Casing	Sealed	13/09/2019	2.1																
Date	Strike	Level	Minutes	Casing	Sealed																						
13/09/2019	2.1																										
		Scale: 1:40	Daily Log Of Depths <table border="1"> <thead> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Hours</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Date	Casing	Water	From	To	Hours																		
Date	Casing	Water	From	To	Hours																						



GROUND GAS MONITORING RESULTS

Gas & Groundwater Monitoring Record Sheet



Project Name:- Dob Brook Close
Project No:- 8948G
Client:- The Guinness Partnership

Date:- 17.09.2019
Start Time:- 12:00
End Time:- 13:00
Ground Conditions:- Dry
Weather Conditions:- Sunny

Atmospheric Pressure
Start:- 1016mb
End:- 1015mb
Trend:- Rising

Instrument:- Gas Data GFM436

Operator:- P Hobson

Hole ID	Peak Flow l/hr	Steady Flow l/hr	DP	CH4			CO2			Min O2 %	Peak H2S ppm	Peak CO ppm	Hexane %	Water Level mbgl	Base of Hole mbgl
				Peak %	Steady %	Qhg l/hr	Peak %	Steady %	Qhg l/hr						
WS1	<0.1	<0.1	0	0.0	0.0	0.0000	8.1	8.1	0.0081	1.8	0	0	0.000	2.10	2.70
WS2	<0.1	<0.1	0	0.0	0.0	0.0000	2.4	2.4	0.0024	15.9	0	0	0.000	2.80	3.00
WS4	<0.1	<0.1	0	0.0	0.0	0.0000	7.6	7.4	0.0074	14.4	0	0	0.000	1.76	3.00

Additional Comments

WMLCONSULTING

Atmospheric Pressure
Start:- 1000mb
End:- 999mb
Trend:- Rising

Operator:- P Hobson

[illegible]

Additional Comments

Gas & Groundwater Monitoring Record Sheet



Project Name:- Dob Brook Close
Project No:- 8948G
Client:- The Guinness Partnership

Date:- 21/10/2019
Start Time:- 09:47
End Time:- 10:15
Ground Conditions:- Wet
Weather Conditions:- Overcast

Atmospheric Pressure
Start:- 1010mb
End:- 1010mb
Trend:- Rising

Instrument:- Gas Data GFM436

Operator:- P Hobson

Hole ID	Peak Flow l/hr	Steady Flow l/hr	DP	CH4			CO2			Min O2 %	Peak H2S ppm	Peak CO ppm	Hexane %	Water Level mbgl	Base of Hole mbgl
				Peak %	Steady %	Qhg l/hr	Peak %	Steady %	Qhg l/hr						
WS1	<0.1	<0.1	0	0.0	0.0	0.0000	3.2	0.9	0.0009	18.3	0	0	0.000	2.00	2.72
WS2	<0.1	<0.1	0	0.0	-0.1	-0.0001	3.7	3.7	0.0037	15.2	0	0	0.000	1.50	3.00
WS4	<0.1	<0.1	0	0.0	-0.1	-0.0001	0.4	0.1	0.0001	20.1	0	0	0.000	2.80	3.00

Additional Comments

Gas & Groundwater Monitoring Record Sheet



Project Name:- Dob Brook Close
Project No:- 8948G
Client:- The Guinness Partnership

Date:- 04/11/2019
Start Time:- 09:30
End Time:- 09:50
Ground Conditions:- Wet
Weather Conditions:- Overcast

Atmospheric Pressure
Start:- 970mb
End:- 970mb
Trend:- Steady

Instrument:- Gas Data GFM436

Operator:- P Hobson

Hole ID	Peak Flow l/hr	Steady Flow l/hr	DP	CH4			CO2			Min O2 %	Peak H2S ppm	Peak CO ppm	Hexane %	Water Level mbgl	Base of Hole mbgl
				Peak %	Steady %	Qhg l/hr	Peak %	Steady %	Qhg l/hr						
WS1	<0.1	0	0	0.0	0.0	0.0000	4.4	3.5	0.0000	13.5	0	0	0.000	1.90	2.70
WS2	<0.1	0	0	0.0	0.0	0.0000	3.2	3.2	0.0000	15.2	0	0	0.000	1.40	3.00
WS4	<0.1	0	0	0.0	0.0	0.0000	4.1	2.1	0.0000	12.1	0	0	0.000	2.80	3.00

Additional Comments

Gas & Groundwater Monitoring Record Sheet



Project Name:- Dob Brook Close
Project No:- 8948G
Client:- The Guinness Partnership

Date:- 15/11/2019
Start Time:- 10:30
End Time:- 11:10
Ground Conditions:- Wet
Weather Conditions:- Overcast

Atmospheric Pressure
Start:- 990mb
End:- 998mb
Trend:- Rising

Instrument:- Gas Data GFM436

Operator:- P Hobson

Hole ID	Peak Flow l/hr	Steady Flow l/hr	DP	CH4			CO2			Min O2 %	Peak H2S ppm	Peak CO ppm	Hexane %	Water Level mbgl	Base of Hole mbgl
				Peak %	Steady %	Qhg l/hr	Peak %	Steady %	Qhg l/hr						
WS1	<0.1	0	0	0.0	0.0	0.0000	5.4	5.4	0.0000	6.3	0	0	0.000	1.88	2.70
WS2	<0.1	0	0	0.0	0.0	0.0000	3.4	3.4	0.0000	13.2	0	0	0.000	1.30	3.00
WS4	2.4	1.5	8	0.0	0.0	0.0000	1.9	1.4	0.0210	16.0	0	0	0.000	1.30	3.00

Additional Comments

Gas & Groundwater Monitoring Record Sheet



Project Name:- Dob Brook Close
Project No:- 8948G
Client:- The Guinness Partnership

Date:- 04/12/2019
Start Time:- 08:10
End Time:- 08:35
Ground Conditions:- Frozen
Weather Conditions:- Sunny

Atmospheric Pressure
Start:- 1007mb
End:- 1006mb
Trend:- Steady

Instrument:- Gas Data GFM436

Operator:- P Hobson

[illegible]

Additional Comments

APPENDIX 3 - General Requirements

1. Compliance with Legislation and Standards

The works are to be undertaken in compliance with all relevant British Standards, codes of practice, regulations, guidance and legislation. Whilst not an exhaustive list, works shall be in compliance with the latest revision of all relevant legislation, HSE Guidelines and good working practice including, but not be limited to, the following:

- *The Health and Safety at Work etc. Act 1974.*
- *Construction Health Safety and Welfare Regulations 1996.*
- *Health and Safety Executive 'Protection of Workers and the General Public during Redevelopment of Contaminated Land' HS (G) 66, HMSO 1991.*
- *The Construction, Design and Management Regulations 2007.*
- *The Control of Substances Hazardous to Health Regulations 2002 (COSHH Regulations).*
- *The Control of Asbestos Regulations, 2012.*

The Contractor is responsible for obtaining all necessary approvals, licences, consents and permits from regulatory bodies and third parties prior to commencement.

2. Licences, Permits and Consents

Any conditions associated planning permission should be addressed prior to carrying out the works.

It will be a requirement of the Contractor to obtain any of the necessary permits and undertake the appropriate notifications and assessments.

The Contractor should only expect approvals have been sought by others where explicitly provided to the Contractor or advised in writing.

3. Health and Safety Requirements

The Principal Contractor must manage the risks in accordance with their legal requirements and all works are to be undertaken in compliance with all relevant regulations, guidance and legislation. A Construction Phase Health and Safety Plan (CPHASP) will be required to be submitted to the CDM co-ordinator, the Client and the LPA in advance of mobilisation to site. The CPHASP will be passed to the Site Manager who will implement all Health and Safety measures on site. The Site Manager will fully induct the Site Operatives prior to commencement of any works. The CPHASP will be kept as an open document and will be adapted as required to during the project. As a minimum, this will include:

- *Welfare arrangements, storage and security.*
- *Air monitoring requirements (and action levels).*
- *Traffic management plan.*
- *Segregation of working areas and site welfare (and decontamination units if required).*
- *Site inductions, daily safety briefings and toolbox talks.*
- *Activity specific risk assessments.*
- *Method statement briefings.*
- *Daily inspection records.*
- *Permits to work.*

During the works it will be necessary to protect the health and safety of the site personnel.

General guidance on these matters is given in the Health and Safety Executive (HSE) document 'Protection of Workers and the General Public during the Redevelopment of Contaminated Land' HS (G) 66. In summary, the following measures are suggested to provide a minimum level of protection:

- *All ground workers should be issued with protective clothing (including high visibility clothing), hard hats, footwear and gloves, personnel instructed as to how it should be used.*
- *All personnel shall wear hard hats, high visibility clothing and protective footwear at all times.*
- *Ensure that everyone on site complies with the health and safety plan.*
- *Take reasonable steps to ensure that only authorised persons are allowed on site.*
- *Display, where they can be easily read, any notification that has been sent to the Health and Safety Executive.*
- *Hand washing and boot cleaning facilities shall be provided.*
- *No smoking except in designated areas.*
- *Good practices relating to personal hygiene shall be adopted.*
- *Prepare method statements for construction operations as required by the Principal Designer.*
- *Provide the CDM Co-ordinator with any other relevant information.*

Before site operations are commenced, the necessary COSHH Assessments, Method Statements and Health and Safety Plans should be completed, approved to the Principal Designers satisfaction and issued in accordance with the CDM Regulations.

The Construction Phase Health and Safety Plan (CPHASP) should pay particular attention to the following hazards which may be encountered:

- *Potentially hazardous or contaminated materials used or encountered on site.*
- *Deep excavations.*
- *The potential for ground gases and risks on confined spaced entry.*
- *Working in the vicinity of existing underground or overhead services.*
- *Working in confined spaces.*
- *Working on, or in the vicinity of highways.*
- *Working with materials which have the potential to contain asbestos and the risk of inhalation of asbestos fibres.*
- *Manual handling.*
- *The potential for fire.*
- *Working with electrical apparatus in the vicinity of mobile plant and the potential presence of water.*
- *Poor lighting.*
- *The potential for falling/slipping/tripping and sustaining injury.*
- *The possibility for biological agents to be present, including, but not limited to psittacosis, leptospirosis (Weill's disease), tetanus, legionella, human waste.*
- *Working in the vicinity of voids and openings.*

The Contractor shall take all necessary safety precautions throughout the ground treatment operations and shall comply with the Health and Safety at Work Act 1974 or any subsequent re-enactment thereof.

The Contractor shall submit for approval all necessary method statements to the Client prior to commencing the works.

The Contractor shall provide details of emergency procedures. Emergency services shall be informed of the site operations prior to commencement.

All statutory records to be kept in the site manager's office and these may include (not an exhaustive list and note not all may be required):

- *ASB NNLW1 – Notification of non-licensed asbestos work if the work is deemed not be requiring a licence (if required).*
- *Appropriate licence with regards to CAR 1012 if the work is deemed to require a licence.*
- *HSE Notification F10.*
- *Construction Phase Health and Safety Plan.*
- *Method Statements and Risk Assessments; Environmental Permit deployment form and associated paperwork.*
- *Discharge Consents for disposal of groundwater.*
- *Competence records (including asbestos awareness training and face-fit test records).*
- *Utility records.*
- *Plant and machinery maintenance records.*
- *Duty of Care paperwork.*

4. Site Establishment and Security

Prior to the commencement of any works, the contractor, in conjunction with the Client and the Supervising Engineer, shall establish the boundaries of the site and working areas.

The Contractor shall make adequate provision to secure the site boundary and prevent unauthorised access onto the site during the course of the works.

Prior to the commencement of any works, the contractor, shall undertake a dilapidation survey of all adjacent features/construction including but not limited to boundary walls/ fences, adjacent footpath and road constructions etc. The survey is to be agreed with the Client or their representative prior to commencing any work on site.

The Contractor shall be responsible for all costs associated with rectification of damage to adjacent features/construction including but not limited to properties, boundary walls/fences, adjacent footpath and road constructions etc. resulting from the demolition works.

The Contractor is to provide surveying capability as set out in this document facilitate the above. Prior to the completion of the works the Contractor is to discuss the continuation of the site security, including the fences, with the client and acceptable arrangements for continued security are to be agreed prior to the removal of the contractor's security provision.

5. Traffic Safety and Management

The Contractor shall comply in all respects with Chapter 8 of the Traffic Signs Manual for works on or affected the public highway and/or private roads forming the highway access to/from the site. The Enabling Works Contractor shall obtain all necessary consents from the Local Highway Authority for works on the public highway.

Onsite access and haul routes should be provided and maintained by the Enabling Works Contractor in such a manner so as not to endanger either the user, those working in the vicinity of such accesses/haul routes and or the Works. Access to the site will be agreed with the Clients prior to commencement.

Suitable precautions shall be taken to prevent the spread of mud and debris on the public highways. Regular inspections of the public highway adjacent to the site shall be carried out. If deemed necessary by the Contractor, the Client or the Supervising Engineer, the highway shall be swept regularly to remove any mud, slurry or dust deposited by vehicles entering or departing the site. If the Supervising Engineer considers that significant amounts of any detritus have been deposited on the public highway then operations shall be temporarily suspended until appropriate cleaning operations have been undertaken.

The Contractor is to co-operate with other Contractors if they are present during the works. The proposed works will generate a number of vehicle movements associated with the removal of soils and delivery to site of materials. Consideration should be given to the route and the timing of these vehicle movements, to minimise risk and disturbance to sensitive locations (such as schools, residential areas).

Risks associated with the transport of soils that are potentially containing contaminated, such as dust emission, should be appropriately managed.

6. Welfare Facilities

Site cabins and welfare facilities will be established at a location to be agreed with the Supervising Engineer.

The Contractor is deemed to have made provision and arrangements for all temporary utilities associated with the welfare facilities.

7. Working Hours

Noisy operations such as the use of hydraulic breakers shall be restricted to operating times as specified by the Client and by the Planning Permission. It is understood that these are 8:30am to 5:30pm, or other hours agreed with the Local Authority, Monday to Friday and 9.00am to 1.00pm on Saturday. No working shall take place on Sunday or Bank Holidays.

Prior to commencement the Contractor is to make contact with the Local Authority to establish if any further restrictions apply.

8. Mobile Plant

Mobile plant shall be operated by suitably trained and qualified operators experienced for each item of plant. When not in use all plant shall be locked to prevent all plant shall be locked to prevent unauthorised operation.

All traffic entering or working on site shall comply with a maximum 10mph speed limit.

Fuelling of any plant shall be undertaken in a designated area and all above ground fuel storage tanks shall comply with the requirements of the Pollution Prevention Guidelines PPG2. Specifically, any storage tanks used should:

- *Be sited within an oil-tight secondary containment system such as an impermeable bund.*
- *The secondary containment must provide storage for at least 110% of the tank's maximum capacity.*
- *Be located within a secure area.*
- *All taps and valves should be fitted with a lock and kept locked shut when not in use. Maintenance of mobile plant should be undertaken in a designated area, unless absolutely necessary.*

Waste oil, hydraulic fluid etc. should not be tipped directly or discharged on to site. Such materials shall be stored separately, in a secure bunded area, for off-site disposal. Waste oil may be a special waste and disposal shall be undertaken by a registered carrier in accordance with the Duty of Care Regulations.

A spill kit shall be kept on site in an accessible place adjacent to the designated refuelling area.

9. Unexploded Ordnance (UXO)

The site is in an area which is considered to be at a low risk with regards to UXO.

10. Surveying

The Contractor shall provide full time surveying personnel and equipment to undertake the following activities and any other requirement for topographical information relating to the project that arises through the duration of the

enabling works contract. The survey personnel and equipment should be capable of providing accurate levels and co-ordinates in relation to the national grid and topographical survey provided within 1 day of request.

The following key activities are covered by the requirements for surveying:

- *Confirmation of topographical survey on possession of the site and setting out of the site boundary.*
- *Confirmation of positions of existing utilities and site features.*
- *Surveying the base and extent of all excavations and remaining obstructions prior to backfilling.*
- *All setting out and levelling relating to delivery of the enabling works.*
- *Interim surveys to be undertaken during the infilling works to provide information on issues such as depth of excavation, progress of earthwork, quantities of materials, testing depths and locations etc.*
- *The location and elevation of test samples and locations.*
- *As built survey information.*

The Contractor is required to undertake all necessary topographical survey works to verify these levels before the commencement of the contract. Should the Contractor find any discrepancies on the drawings they are to refer the matter to the Engineer for verification before proceeding with the part of the works affected.

The Contractor shall undertake a topographical survey following completion of the enabling works.

All topographical surveys shall include levels at maximum 10m spacing and details of any features, changes in slope, structures, services and any other features of interest.

All of the above features shall be surveyed for line and level at the site boundary and marked on a plan. Levels shall be to Ordnance Datum and locations to National Grid. The survey shall be calibrated against existing site surveys and benchmarks in the vicinity of the site.

11. Testing

The Contractor shall be responsible for undertaking all testing necessary to satisfy the Supervising Engineer that the works have been carried out in accordance with and comply with this Remedial Specification and the Earthworks specification.

All soils and geo-environmental testing shall be carried out by a UKAS and MCERTS accredited laboratory, with accreditation for the specific analysis, to the approval of the Supervising Engineer.

The Enabling works Contractor is to make available on site at all times a file containing all test certificates in addition to the testing summary, for inspection by the Consultant.

12. Offsite Disposal

Materials for offsite disposal shall be sampled and analysed, by the contractor, at rates sufficient to allow the material to be adequately classified by assessment.

WAC testing should be undertaken on material exported from site to landfill, or other appropriately licensed facility. Material shall be hauled by a registered waste carrier in accordance with the requirements of the Duty of Care Regulations, 1991, Environmental Permitting (England and Wales) Regulations 2016 and where appropriate the Special Waste Regulations, 1996 and Hazardous Waste (England and Wales) Regulations 2005. A transfer note shall be completed, signed and retained by all parties involved. The transfer note shall state the volume of waste, the nature of the material and statement to the chemical composition. The waste transfer notes shall be kept by the Contractor for a period of at least 2 years.

13. Contamination

Contractors should be made aware of the possibility of encountering contaminants within soils or groundwater at the site (including asbestos) through 'toolbox' talks.

Safe working procedures should be implemented in accordance with CIRIA 132 and good standards of personal hygiene should be observed and appropriate levels of PPE provided and utilised.

Eating, drinking and smoking should be strictly prohibited in the development site other than in designated mess areas.

14. The Control of Noise, Vibration and Dust Nuisance

The Contractor shall comply with the recommendations for practical measures to reduce noise and vibration set out in BS5228-1:2009 and BS5228-2:2009 and with any specific Principal Contractor requirements.

The Contractor shall take all reasonable measures to prevent dust nuisance from being generated by construction traffic, etc.

If necessary, working methods will be altered in order to ensure that the level of noise generated from the works is within published tolerable limits.

The requirements of the LPA are to be sought and undertaken.

General

No fires shall be permitted on site.

Dust Mitigation

Appropriate measures shall be implemented at all times during the demolition and enabling works to minimise any dust emissions.

Any main temporary haul roads shall, where practical to do so, be constructed of crushed hardcore products. The haul roads shall be maintained for the duration of their use to minimise any build-up of loose spoil etc.

Traffic both entering and working on site shall obey a maximum speed limit of 10 mph. Wagons that are to be used for the haulage of any contaminated material from site shall be appropriately sealed or sheeted to prevent the release of fugitive dust.

Mobile water bowsers and sprayers shall be available on site at all times to water unpaved haul roads and working areas. The water spray may include chemical dust suppressants or wetting agents to improve dust control. An adequate supply of water shall be maintained on site at all times to allow for dust suppression activities to be carried out at short notice.

Where mobile water bowsers are not effective in suppressing dust then vapour masts shall be used. Such vapour masts shall be deployed at 20m centres on the downwind side of haul roads or excavations giving rise to significant dust or emissions of odour.

Air quality and dust monitoring stations will be set up and monitored by the Contractor to record the dust concentrations during the works.

With regards to stockpiles:

- *Stockpiles should be kept to a minimum to reduce 'wind whip' causing potentially hazardous material to be blown from the pile.*
- *Stockpiles should be placed on a suitable polythene membrane in a bunded area to prevent any cross contamination and care should be taken not to pierce the sheeting when placing the bulky elements of the material.*
- *Stockpiles should be dampened down or covered to prevent dust, whilst the final choice should be made by the Contractor based on site constraints, but the options include covering with plastic/polythene membrane, or by a layer of clean soil material.*
- *The drop distance from excavator bucket to stockpile will be kept as short as reasonably practicable to reduce dust.*

Odour

In general terms the excavation works are not considered likely to give rise to any significant odour problems. However, possible 'hotspots' of hydrocarbon contamination cannot be discounted and it is advised that odours are assessed by twice daily inspections of all Site boundaries.

If highly odorous materials are encountered, which may give rise to nuisance to neighbouring properties, appropriate vapour masts shall be deployed to provide suitable odour control. Any odorous materials shall be covered at the end of each working day and any stockpiles will be located away from any sensitive areas.

Plant and machinery shall be serviced regularly to ensure that exhaust fumes are compliant with best practice and relevant regulations.

Noise

The requirements of the Local Planning Authority and BS 5228: 1997 'Noise and vibration control on construction sites' shall be adhered to at all times.

All machinery shall be fitted with effective silencers and shall be serviced at regular intervals. No items of plant shall be operated with engine covers raised.

The location of any crushing plant shall take into consideration the location of neighbouring properties and other noise sensitive receptors and shall be located away from these areas and located adjacent to proposed stockpile locations where possible.

15. Asbestos in Soils

The Contractor must manage the risks in accordance with their legal requirements and will need to prepare appropriate health and safety documentation and obtain appropriate approvals, licences, consents and permits prior to commencement.

The remediation works are designed to break the pollution linkage with regards to contaminants within the soil. Whilst appropriate measures are required for all contaminants present, the Contractor should note the additional details provided below with regards to asbestos in the soils:

- *Asbestos is a hazard to Human Health when airborne fibres are inhaled. Asbestos containing material (ACM) that is in a bound form (such as asbestos cement tiles) is not hazardous where the asbestos fibres cannot become airborne. However, if lagging is present or the ACM is broken or crumbled in a dry condition the asbestos fibres could become airborne and could then be inhaled. When soil with asbestos is covered by hardstanding, buildings or a cover of clean soil or when the soil is kept damp, the asbestos fibres are less likely to become airborne and the risk is greatly reduced.*
- *The Health and Safety at Work Act 1974 forms the basis of health and safety legislation in the UK. In addition, the Control of Asbestos Regulations 2012 (CAR 2012) applies throughout the UK. CAR 2012*

applies if land has significant asbestos content and is relevant to any work conducted on asbestos contaminated land.

- *CAR 2012 defines a “control limit” of 0.1 fibres per cubic centimetre of air averaged over a continuous period of 4 hours. This limit is not risk based and may be much higher than the levels for control of environmental pollution.*
- *CAR 2012 applies even where exposure to asbestos of employees is sporadic and of low intensity and where exposure to asbestos of any employee will not exceed the control limit. The work must be of short non-continuous activities where non-friable materials are handled, or removal without deterioration of non-degraded materials in which asbestos fibres are firmly linked in a matrix.*
- *The contractor should determine whether the works being undertaken would be exempt from CAR 2012 licensing requirements.*

It should be noted that information presented in this document is provided to assist in managing the soil at the site which contains asbestos. It is the responsibility of the contractor how the control measures associated with these risks are implemented and recommend that an appropriate asbestos specialist assist with both the preparation of documents and licences and site supervision.

Task specific risk assessments and method statements should be in place, and risks and required mitigation measures communicated to all relevant personnel prior to the works commencing. Appropriate PPE and if required RPE should be provided and utilised.

16. Water Quality Controls

The Contractor shall provide for such measures as may be necessary to ensure that water, whether groundwater, from precipitation or any other source does not accumulate in excavations or on sub-grades.

Adequate drainage sumps will be installed during works and cut off trenches/dewatering measures will be used as required to manage surface water run-off, to prevent any water from entering watercourses, either directly as surface water run-off, or indirectly via the surface water drainage systems. If materials escape, the Contractor is to undertake (at their cost) appropriate remedial action as soon as possible.

17. Utilities

Utility records are to be provided by the Client for information purposes within the enabling works documentation. However, the Contractor shall be responsible for liaison with the statutory utility providers to ensure all service records are current and correct. The Contractor is also responsible for the safe disconnection of existing utilities entering the site, except those which are to remain operational.

Prior to site work commencing, the position of all utilities indicated as on site or offsite but close to the site boundary shall be determined and clearly identified where on site. The locations should be confirmed on site by appropriate investigation, observations and survey. Any discrepancies between the anticipated positions and confirmed locations are to be reported to the Supervising Engineer.

All retained manholes should be located and clearly identified on site to prevent damage. The location, depth, diameter and invert level of each manhole and the size and depth of all stream connections shall be recorded. Where drains or sewers are to be grubbed up the downstream ends should be plugged prior to commencement to prevent offsite systems becoming blocked or contaminated.

Where existing drains or sewers are to remain, CCTV surveys are to be provided by the contractor. These surveys must be undertaken on commencement prior to any physical work and on completion to demonstrate no damage has occurred.

Where damage has occurred, any remedial work must be agreed with the Supervising Engineer and relevant authority/owner prior to repairs commencing. The repair costs will be borne by the contractor.

All utilities on site that are to be retained through the works are to be positively located on site, reliance shall not be placed on existing records. Utilities are to be visibly marked and protected for the duration of the works. Appropriate methods are to be put in place to ensure all site staff working in the vicinity of retained utilities are fully briefed.

The Contractor is responsible for ensuring that all hydrant covers, stop tap boxes manhole covers and the like are raised or lowered to suit the finished levels associated with the proposed enabling works plateaus and future construction thicknesses.

Following the completion of the works, a survey plan of the location of terminated services is to be provided.

18. Damage to Property

All works are to be undertaken in accordance with the Party Wall etc Act 1996. The Contractor shall ensure that all precautions are taken in order to avoid any damage to existing property arising from the Works and shall be responsible for same in the event that any damage should arise from his failure to exercise due care.

Any adjacent structures, services and the like shall be inspected prior to commencement of the Works for evidence of existing defects and, if necessary, a dilapidation survey shall be carried out by the contractor, with the agreement of the Client and/or the Supervising Engineer, prior to works commencing on site. A re-inspection shall take place on completion of the Contract to verify that no damage or deterioration of the said structure, service or apparatus has occurred as a result of the Works. A schedule of the findings of this re-inspection shall be circulated to all parties concerned for their records.

The Contractor shall execute the works with care so as to avoid damage to existing structures and drains or other services to be retained.

All fences, trees, paths, shrubs, grassed areas and other surfaces required to be retained shall be protected by the Contractor from spillage and damage caused by site operations and upon completion of the works they shall be handed over in an undamaged and proper state to the satisfaction of the Engineer.

Refer to landscape architect drawings and specifications that define the areas that require protection. The Contractor shall not raise or lower the ground level beneath the spread of the branches of any tree to be retained without the approval of the Engineer.

19. Drawings and Supplied Information

Whilst efforts have been made to ensure that the information provided to the Contractor is correct and current, the Contractor is responsible for corroborating the existing information with the benefit of their site presence and to report any discrepancies encountered or anticipated to the Supervising Engineer immediately.

Where cutting and filling operations are to be carried out the Contractor is to undertake comparative assessments with the benefit of existing information, additional survey and their anticipated sequence of work to ensure sufficient and suitable material is available to undertake the works as proposed. Any anticipated shortfall or surplus is to be report immediately.

20. Photographs

A detailed dilapidation survey shall be undertaken of the site and adjacent properties including joint site boundaries, in conjunction with adjacent landowners. Such survey shall include roads, footpaths, street lighting

and road signs. A copy of the survey, including record photographs shall be provided to the Client within seven days of commencement of site works.

The Contractor is to provide on-site a digital camera and e-mail facilities to enable electronic transfer of site photographs and other information for the full duration of the contract. Progress photographs are to be taken at least weekly across all parts of the site for inclusion within the contractor's report. Photographs are to be made available to the Engineer/Client in electronic format should they be requested during the contract. Record photographs should be provided as part of the validation information.

APPENDIX 4 - Remediation Options Appraisal

Introduction

This Options Appraisal has been undertaken in general accordance with Chapter 3 (Options Appraisal) of CLR11 'Model Procedures for Management of Land Contamination'. There are four main stages to this appraisal:

- *Identifying Key Risk Drivers.*
- *Identifying viable remediation options for each relevant pollutant linkage.*
- *Carrying out a detailed evaluation of viable remediation options to identify the most appropriate option for each pollution linkage.*
- *Producing a remediation strategy that reduces all relevant pollutant linkages to an acceptable level.*

Key Risk Drivers for Remedial Action

The Groundtech Consulting Geo-Environmental Appraisal has identified that the key risk drivers requiring remediation are:

- *Elevated mercury, lead and PAHs within the Made Ground.*

The following sections of this report are intended to identify suitable and practical remedial techniques which can be applied in order to achieve a site which is suitable for the proposed residential development.

Remediation Options and Evaluation of Feasibility

Preliminary Assessment of Remediation Options

Investigation and risk assessment has concluded that the requires remediation to reduce the risk to receptors to an acceptable level.

The objectives of the remediation are to remove one or more elements of each of the *source-pathway-receptor* linkages.

The initial screening process considers the available remedial techniques based on following key criteria:

- | | | |
|------------------------------------|---|---|
| • <i>Effectiveness</i> | - | <i>the strategy must work within the context of the site and be effective in the removal of contamination linkages.</i> |
| • <i>Practicality</i> | - | <i>the strategy has to have been successfully used in similar situations on other sites and readily available within the UK market. Novel solutions or those still in the research stage are not considered here.</i> |
| • <i>Durability</i> | - | <i>the strategy needs to be durable and not reliant on ongoing maintenance to continue being effective.</i> |
| • <i>Relative Cost</i> | - | <i>the strategy must not be excessive cost.</i> |
| • <i>Relative Operational Time</i> | - | <i>the strategy should work in a feasible and realistic time scale.</i> |
| • <i>Sustainability</i> | - | <i>more sustainable options are preferred.</i> |

The table below summarises all of the accepted remedial techniques readily available and assess each against the six key parameters listed above.

In the first instance, the feasibility of each of the listed remedial option is assessed in terms of effectiveness at treating the contamination, which is broken down into; effective (Y), partially effective (P) or ineffective (N).

The techniques are then assessed in terms of relative cost ranging from negligible cost (£) through moderately expensive (££) to prohibitively expensive (£££+).

The timescale the remedial technique is operational has been generally assessed in units of weeks, months, years and decades. The longevity of the technique should be for the duration of the development to be effective.

The main reasons for rejection of a remedial option are generally the ongoing operational constraints, the cost and the ineffectiveness to mitigate the risk from all contaminants present. In some situations, several treatment options may be applicable and will therefore be considered as part of the appraisal.

Viable Remedial Options

As described above, certain technologies were rejected based on the above reasons. The short-list of options presented below represents those technologies which were not rejected at the pre-screening process and as such, are taken forward to the options appraisal process:

- *Installation of a cover system in garden areas.*

Cover System

A cover system is a proven technology for mitigating the risk from numerous contaminants. The process comprises the placement of a cover system to form a barrier between the contaminated Made Ground and site users breaking the pollution linkage.

This option is technically simple and represents a low-cost strategy that can be implemented rapidly, subject to favourable site levels to accommodate the cover system.

The timescale for installing a barrier is relatively quick allowing for rapid completion of the remediation objectives and this remediation solution could be designed and implemented within a matter of weeks/months.

Applicability of Remediation Options and Initial Assessment – Soils

Remedial Activity	Effective on metals	Effective on PAHs	Relative Cost	Relative Operational Time	Comments (Practicality/Sustainability/Durability)	Feasibility (Y / N)
Cover System	Y	Y	£	Weeks	Will break pollution linkage between future site users and contaminants in Made Ground soils.	Y

APPENDIX 5 - 1/5 Goods, Material, Sampling and Testing

Table 1/5

Goods, Materials, Sampling and Testing

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 600						
	Acceptable Material					
	Class	General Description				
	1	General Granular fill	Grading	3 per source 2 per week 1 per 500m ³		
			Moisture Content	3 per source 2 per week 1 per 500m ³		
			Dry Density/ mc relationship (4.5kg rammer)	3 per source 1 per week 1 per 500m ³		
	2	General Cohesive fill	Grading	3 per source 2 per week 1 per 500m ³		
			MCV	3 per source 1 per week 1 per 500m ³		
			PI	3 per source 2 per week 1 per 500m ³		
			Dry Density/ mc relationship (4.5kg rammer)	3 per source 1 per week 1 per 500m ³		
			Undrained shear strength of re-moulded materials	3 per source 1 per week 1 per 500m ³		
	6F2	Selected granular material (coarse grading)	Grading	3 per source 1 per week 1 per 500m ³		
			Optimum moisture Content	3 per source 1 per week 1 per 500m ³		
			10% fines value	3 per source 1 per week 1 per 500m ³		
			Dry Density/ mc relationship (4.5kg rammer)	3 per source 1 per week 1 per 500m ³		

Test	Frequency	Compliance Criteria
CBR's under road platform	2 per 50m road length, undertaken at 1.0m below finished contract levels and at finished contract levels.	CBR value min 5%
Sand Replacement or Nuclear Density Gauge	1 per 400m ² , undertaken at 0.25m to 0.50m depth intervals.	-



APPENDIX 6 - 6/1 Requirements for Acceptability and Testing of Earthworks Materials

APPENDIX 6/1 - REQUIREMENTS FOR ACCEPTABILITY AND TESTING ETC OF EARTHWORKS MATERIALS.

1. The following classes of material may be used for incorporation into the work:

- Class 1 General Granular Fill
- Class 2 General Cohesive Fill
- Class 4 Landscape Fill
- Class 6F2 Selected granular material (coarse grading)

2. The use and distribution of these materials will be determined by the Clients Representative prior to the commencement of the site works.
3. The classification of compaction and testing requirements for acceptable earthworks shall be in accordance with this Appendix and Table 6/1.
4. The classification and confirmation of acceptability of the earthworks materials shall be carried out by the Remediation Contractor at the point of excavation for on-site materials. Locations for classification purposes shall be agreed with the Clients Representative in advance.
5. If in the opinion of the Clients Representative the material has altered its classification or become unacceptable for whatever reason, the Remediation Contractor may be required to repeat the classification and acceptability tests given in Table 6/1 at the rate of testing given in Appendix 1/5.
6. The Remediation Contractor shall submit copies of all test results to the Clients Representative within one working day of the completion of the test. The copies shall be signed by the Remediation Contractor's responsible engineer/technician. Notwithstanding the testing schedule given in Appendix 1/5 the Remediation Contractor shall be responsible for ensuring the acceptability of all materials used on site.
7. At this stage, it is not anticipated any material will require importing for the earthworks.
8. In this document the upper and lower MCV and moisture content limits set for Class 1 and Class 6 material should be considered indicative only. These will be formally assigned by the Clients Representative for the selected material upon receipt of appropriate testing details supplied by the Remediation Contractor. Where this is site won material a "source" will constitute material with similar composition when assessed visually and described in accordance with BS5930: 2015.

Acceptability Criteria

9. Fill materials for use in the permanent works shall comply with the acceptability criteria set out in below (supplementing Table 6/1). Permitted constituents shall be as set out in Table 6/1 and Clause 601. Fill materials shall exclude materials classifying as Class U1B and Class U2 as defined in Clause 601.

Determination of Earthworks Acceptability

10. The Remediation Contractor shall be responsible for classifying earthworks materials and for ensuring that all materials incorporated in the permanent works are acceptable. Contract-specific Classification and Acceptability Criteria are as given in Table 6/1. It is currently anticipated that all noncontaminated material arising from the site will conform to one or other of the classes once sorting crushing and screening has taken place. However should materials excavated not conform to the classification and acceptability Criteria given in the tables it should be classified as Class U1A material. Class U1A material shall be dealt with in accordance with Appendix 6/1 below. Any contaminated material: Class U1B and U2 shall be dealt with in accordance with Appendix 6/2. The Remediation Contractor shall carry out testing at the frequencies set out in Appendix 1/5, and supply the results to the Client's representative.

Processing of Unacceptable Material (Class U1A)

11. Unacceptable material Class U1A arising from excavations on site shall as far as practicable be processed to render it acceptable for use as General Fill of Classes 1A, 1B, 2A, 2B, 2C, 4 or 6F2 as appropriate to the grading of the material being treated.
12. Processing shall include one or more of the following treatments as appropriate to the material being treated and the prevailing site conditions:
 - Improvement of moisture content and/or plasticity by the addition of quicklime or hydrated lime;
 - Drying by stockpiling or spreading;
 - Removal of oversized material by screening;
 - Removal of deleterious constituents (i.e. those constituents listed in Clause 601. 2(i)(b);
 - Addition of water.

APPENDIX 7 - 6/2 Requirements for Dealing with Class U1B and U2 Unacceptable Material

APPENDIX 6/2 - REQUIREMENTS FOR DEALING WITH CLASS U1B AND U2 UNACCEPTABLE MATERIAL

1. This Appendix addresses the management issues associated with the assessment, classification, excavation, stockpiling and offsite disposal of potentially contaminated soils encountered on site.
2. The classification of the contamination status of the soils shall be conducted in conjunction with the general classification as detailed in Table 6/1.

General Instructions Regarding Material Classification

3. The Remediation Contractor shall be responsible for keeping records of the location, volumes, extent, nature and test results for all Class U1B and U2 materials encountered. The Remediation Contractor shall keep the Clients Representative informed of the Class U1B and U2 materials encountered on a daily basis. The Remediation Contractor shall not classify material as Class U2 except with the agreement of the Clients Representative.
4. It is not anticipated material will require importing for the earthworks.
5. Testing of the clean excavation face to determine the extent of Class U1A material and/or U2 material will take place at a frequency of 1 test per 20m² on the side of the excavation with a minimum of 3 tests and 1 test per 50m² on the base with a minimum of 1 test.

Processing of Class U1B

6. Processing of Class U1B shall include one or more of the following treatments as appropriate to the material being treated and the prevailing site conditions:
 - careful excavation and sorting of arisings to avoid mixing of contaminated material with clean material.
 - bioremediation of selected excavated and screened materials.
7. Once processing is complete the processed material shall be classified in accordance with Appendix 6/1 for incorporation into the works.

Treatment of Class U2

8. Class U2 Material will be disposed offsite.

APPENDIX 8 - Table 6/4 Series 600 Method Compaction for Earthworks Materials

TABLE 6/4: (02/16) Method Compaction for Earthworks Materials: Plant and Methods (Method 1 to Method 6)
(This Table is to be read in conjunction with sub-Clause 612.10)

Type of Compaction Plant	Ref No.	Category	Method 1		Method 2		Method 3		Method 4		Method 5		Method 6		
			D	N#	D	N#	D	N#	D	N	D	N	N for D = 110 mm	N for D = 150 mm	N for D = 250 mm
Smoothed wheeled roller (or vibratory roller operating without vibration)	1	Mass per metre width of roll: over 2100 kg up to 2700 kg	125	8	125	10	125	10*	175	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 2700 kg up to 5400 kg	125	6	125	8	125	8*	200	4	unsuitable		16	unsuitable	unsuitable
	3	over 5400 kg	150	4	150	8	unsuitable		300	4	unsuitable		8	16	unsuitable
Grid roller	1	Mass per metre width of roll: over 2700 kg up to 5400 kg	150	10	unsuitable		150	10	250	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 5400 kg up to 8000 kg	150	8	125	12	unsuitable		325	4	unsuitable		20	unsuitable	unsuitable
	3	over 8000 kg	150	4	150	12	unsuitable		400	4	unsuitable		12	20	unsuitable
Deadweight tamping roller	1	Mass per metre width of roll: over 4000 kg up to 6000 kg	225	4	150	12	250	4	350	4	unsuitable		12	20	unsuitable
	2	over 6000 kg	300	5	200	12	300	3	400	4	unsuitable		8	12	20
Pneumatic-tyred roller	1	Mass per wheel: over 1000 kg up to 1500 kg	125	6	unsuitable		150	10*	240	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1500 kg up to 2000 kg	150	5	unsuitable		unsuitable		300	4	unsuitable		unsuitable	unsuitable	unsuitable
	3	over 2000 kg up to 2500 kg	175	4	125	12	unsuitable		350	4	unsuitable		unsuitable	unsuitable	unsuitable
	4	over 2500 kg up to 4000 kg	225	4	125	10	unsuitable		400	4	unsuitable		unsuitable	unsuitable	unsuitable
	5	over 4000 kg up to 6000 kg	300	4	125	10	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable
	6	over 6000 kg up to 8000 kg	350	4	150	8	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable
	7	over 8000 kg up to 12000 kg	400	4	150	8	unsuitable		unsuitable		unsuitable		10	16	unsuitable
	8	over 12000 kg	450	4	175	6	unsuitable		unsuitable		unsuitable		8	12	unsuitable
Vibratory tamping roller		Mass per metre width of a vibrating roll:													
	1	over 700 kg up to 1300 kg	100	12	100	12	150	12	100	10	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1300 kg up to 1800 kg	125	12	125	12	175	12*	175	8	unsuitable		12	unsuitable	unsuitable
	3	over 1800 kg up to 2300 kg	150	12	150	12	200	12*	unsuitable		unsuitable		8	12	unsuitable
	4	over 2300 kg up to 2900 kg	150	9	150	9	250	12*	unsuitable		400	5	6	10	unsuitable
	5	over 2900 kg up to 3600 kg	200	9	200	9	275	12*	unsuitable		500	6	6	10	unsuitable
	6	over 3600 kg up to 4300 kg	225	9	225	9	300	12*	unsuitable		600	6	4	8	unsuitable
	7	over 4300 kg up to 5000 kg	250	9	250	9	300	9*	unsuitable		700	6	3	7	12
	8	over 5000 kg	275	9	275	9	300	7*	unsuitable		800	6	3	6	10

TABLE 6/4: (02/16) Method Compaction for Earthworks Materials: Plant and Methods (Method 1 to Method 6)
(This Table is to be read in conjunction with sub-Clause 612.10) (Continued)

Type of Compaction Plant	Ref No.	Category	Method 1	Method 2	Method 3	Method 4	Method 5	Method 6		
			D N#	D N#	D N#	Δ N	D N	N for D = 110 mm	N for D = 150 mm	N for D = 250 mm
Vibratory roller		Mass per metre width of vibratory roll:								
	1	over 270 kg up to 450 kg	unsuitable	75 16	150 16	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable
	2	over 450 kg up to 700 kg	unsuitable	75 12	150 12	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable
	3	over 700 kg up to 1300 kg	100 12	125 10	150 6	125 10	unsuitable	16	unsuitable	unsuitable
	4	over 1300 kg up to 1800 kg	125 8	150 8	200 10*	175 4	unsuitable	6	16	unsuitable
	5	over 1800 kg up to 2300 kg	150 4	150 4	225 12*	unsuitable	unsuitable	4	6	12
	6	over 2300 kg up to 2900 kg	175 4	175 4	250 10*	unsuitable	400 5	3	5	11
	7	over 2900 kg up to 3600 kg	200 4	200 4	275 8*	unsuitable	500 5	3	5	10
	8	over 3600 kg up to 4300 kg	225 4	225 4	300 8*	unsuitable	600 5	2	4	8
	9	over 4300 kg up to 5000 kg	250 4	250 4	300 6*	unsuitable	700 5	2	4	7
	10	over 5000 kg	275 4	275 4	300 4*	unsuitable	800 5	2	3	6
Vibrating plate compactor		Mass per m ² of base plate:								
	1	over 880 kg up to 1100 kg	unsuitable	unsuitable	75 6	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable
	2	over 1100 kg up to 1200 kg	unsuitable	75 10	100 6	75 10	unsuitable	unsuitable	unsuitable	unsuitable
	3	over 1200 kg up to 1400 kg	unsuitable	75 6	150 6	150 8	unsuitable	unsuitable	unsuitable	unsuitable
	4	over 1400 kg up to 1800 kg	100 6	125 6	150 4	unsuitable	unsuitable	8	unsuitable	unsuitable
	5	over 1800 kg up to 2100 kg	150 6	150 5	200 4	unsuitable	unsuitable	5	8	unsuitable
Vibro-tamper		Mass:								
	1	over 50 kg up to 65 kg	100 3	100 3	150 3	125 3	unsuitable	4	8	unsuitable
	2	over 65 kg up to 75 kg	125 3	125 3	200 3	150 3	unsuitable	3	6	12
	3	over 75 kg up to 100 kg	150 3	150 3	225 3	175 3	unsuitable	2	4	10
Power rammer		Mass:								
	1	100 kg up to 500 kg	150 4	150 6	unsuitable	200 4	unsuitable	5	8	unsuitable
Dropping-weight compactor		Mass of rammer over 500 kg weight drop:								
	1	over 1 m up to 2 m	600 4	600 8	450 8	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable
	2	over 2 m	600 2	600 8	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable



APPENDIX 9 - Remedial Target Values



Remedial Target Values

Proposed End Use	Unit	Residential with Plant Uptake			Source
SOM	%	1	2.5	6	
Arsenic	mg/kg	32	32	32	SGVs
Beryllium	mg/kg	1.7	1.7	1.7	LQM S4ULs
Boron (water soluble)	mg/kg	290	290	290	LQM S4ULs
Cadmium	mg/kg	10	10	10	SGVs
Chromium (Total)	mg/kg	910	910	910	LQM S4ULs
Chromium (VI)	mg/kg	21	21	21	DEFRA C4SLs
Copper	mg/kg	2400	2400	2400	LQM S4ULs
Lead	mg/kg	200	200	200	DEFRA C4SLs
Organic Mercury	mg/kg	1.2	1.2	1.2	LQM S4ULs
Nickel	mg/kg	130	130	130	SGVs
Selenium	mg/kg	350	350	350	SGVs
Vanadium	mg/kg	410	410	410	LQM S4ULs
Zinc	mg/kg	3700	3700	3700	LQM S4ULs
Aliphatic EC 5 - 6	mg/kg	42	78	160	LQM S4ULs
Aliphatic EC 6 - 8	mg/kg	100	230	530	LQM S4ULs
Aliphatic EC 8 - 10	mg/kg	27	65	150	LQM S4ULs
Aliphatic EC 10 - 12	mg/kg	130 (48) ^{vap}	330 (118) ^{vap}	760 (283) ^{vap}	LQM S4ULs
Aliphatic EC 12 - 16	mg/kg	1100 (24) ^{sol}	2400 (59) ^{sol}	4300 (142) ^{sol}	LQM S4ULs
Aliphatic EC 16 - 35	mg/kg	65000 (8.48) ^{sol}	92000 (21) ^{sol}	110000 ^f	LQM S4ULs
Aliphatic EC 35 - 44	mg/kg	65000 (8.48) ^{sol}	92000 (21) ^{sol}	110000 ^f	LQM S4ULs
Aromatic EC 5 - 7	mg/kg	70	140	300	LQM S4ULs
Aromatic EC 7 - 8	mg/kg	130	290	660	LQM S4ULs
Aromatic EC 8 - 10	mg/kg	34	83	190	LQM S4ULs
Aromatic EC 10 - 12	mg/kg	74	180	380	LQM S4ULs
Aromatic EC 12 - 16	mg/kg	140	330	660	LQM S4ULs
Aromatic EC 16 - 21	mg/kg	260 ^f	540 ^f	930 ^f	LQM S4ULs
Aromatic EC 21 - 35	mg/kg	1100 ^f	1500 ^f	1700 ^f	LQM S4ULs
Aromatic EC 35 - 44	mg/kg	1100 ^f	1500 ^f	1700 ^f	LQM S4ULs
Benzene	mg/kg	0.33	0.33	0.33	SGVs
Toluene	mg/kg	610	610	610	SGVs
Ethyl Benzene	mg/kg	350	350	350	SGVs
Xylene - o	mg/kg	250	250	250	SGVs
Xylene - m	mg/kg	240	240	240	SGVs
Xylene - p	mg/kg	230	230	230	SGVs
MTBE (methyl tert-butyl)	mg/kg	49	84	160	CL:AIRE 2010
Acenaphthene	mg/kg	210	510	1100	LQM SAULs
Acenaphthylene	mg/kg	170	420	920	LQM S4ULs
Anthracene	mg/kg	2400	5400	11000	LQM S4ULs
Benz(a)anthracene	mg/kg	7.2	11	13	LQM S4ULs
Benzo(a)pyrene	mg/kg	2.2	2.7	5*	DEFRA C4SL*/LQM S4ULs
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	LQM S4ULs
Benzo(ghi)perylene	mg/kg	320	340	350	LQM S4ULs
Benzo(k)fluoranthene	mg/kg	77	93	100	LQM S4ULs
Chrysene	mg/kg	15	22	27	LQM S4ULs
Dibenz(ah)anthracene	mg/kg	0.24	0.28	0.3	LQM S4ULs
Fluoranthene	mg/kg	280	560	890	LQM S4ULs
Fluorene	mg/kg	170	400	860	LQM S4ULs
Indeno(123-cd)pyrene	mg/kg	27	36	41	LQM S4ULs
Naphthalene	mg/kg	2.3 f	5.6 f	13 f	LQM S4ULs
Phenanthrene	mg/kg	95	220	440	LQM S4ULs
Pyrene	mg/kg	620	1200	2000	LQM S4ULs
Phenol	mg/kg	420	420	420	SGVs
Asbestos	No fibres detected				

APPENDIX 10 - Limitations

Limitations

This contract was completed by Groundtech Consulting on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with due skill and care, taking into consideration the project brief provided, project objectives, agreed scope of works, prevailing site conditions and budget allocation.

Other than that defined in the paragraph above, Groundtech Consulting provides no other accountability or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted industry practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Groundtech Consulting. A third party who relies on this report, does so at their own and sole risk and no liability to such parties is provided by Groundtech Consulting.

It is the understanding of Groundtech Consulting that this report is to be used for the intended purpose as set out in the introduction. The purpose was instrumental in determining the scope and level of the services provided. Should the purpose of the report or the proposed end use of the site change, this report will no longer be directly applicable, and its validity readdressed. No reliance upon the report in the revised situation should be assumed by the client without the permission of Groundtech Consulting.

The report was written in 2021, later changes in legislation, statutory requirements and industry best practices have not been considered and this should be allowed for. Ground conditions can also change and should be investigated if there is any significant delay in acting on the findings of this report. The period of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions in this report should not be relied upon in the future without the written confirmation from Groundtech Consulting that it is safe to do so.

The observations and conclusions outlined in this report are based exclusively on the services that were provided as set out in the agreement between the client and Groundtech Consulting.

Groundtech Consulting are not liable for the existence of any condition, the discovery of which would require additional investigation outside the agreed scope of works or core competency. The services provided are based upon Groundtech Consulting observations of existing physical conditions at the site gained from site reconnaissance together with interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and Groundtech Consulting assume the information to be correct.

No responsibility can be accepted for errors for third party information presented in this report. Groundtech Consulting were not authorised to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Groundtech Consulting are not liable for any inaccurate information, misrepresentation of data or conclusions, which may inform the scope of investigation undertaken by Groundtech Consulting and forms the contract with the client.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable due to its heterogeneous properties and as investigation exploratory locations only allow examination of the ground at discrete

locations. The potential exists for ground conditions to be encountered which are different to those considered in this report, particularly between exploratory holes. The extent of the limited area depends on the soil and groundwater conditions, together with other constraints such as the position of any existing structures and underground utilities. Geo-Environmental testing was carried out for a limited number of parameters [as stipulated in the contract] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The groundwater level often has not had time to reach equilibrium and a monitoring period is required. Furthermore, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawings provided in this report are not meant to be an accurate base plan, but are preliminary and used to present the general relative locations of features on, and surrounding, the site.

