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**KINGS BUSINESS PARK, KINGS DRIVE,
PRESCOT, L34 1PJ**

PHASE 1 & 2 SITE INVESTIGATION REPORT

Carried out for:

Alfred H Knight International Ltd



TerraConsult

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Date: 28/01/2015

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KINGS BUSINESS PARK, KINGS DRIVE, PRESCOT, L34 1PJ

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KINGS BUSINESS PARK, KINGS DRIVE, PRESCOT, L34 1PJ

PHASE 1 & 2 SITE INVESTIGATION REPORT

1. INTRODUCTION

1.1 Background Information

1.1.1 TerraConsult Limited was commissioned by Alfred H Knight International Ltd to carry out a site investigation for an area of land within Kings Business Park off Kings Drive, Prescot, L34 1PJ. The purpose of the report is to provide an interpretation of the previous ground investigation report undertaken for the site in association with a supplementary intrusive investigation prior to developing the site for new laboratory and office accommodation.

1.1.2 This report has been devised to generally comply with the relevant principles and requirements of a range of guidance including:

- Part IIA of the Environment Protection Act, 1990;
- Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, April 2012);
- National Planning Policy Framework (HCA, March 2012);
- BS5930:1999 +A2:2010: “Code of practice for site investigations”;
- BS10175: 2011 +A1:2013 “Investigation of Potentially Contaminated Sites - Code of Practice”;
- DEFRA/Environment Agency (2004) Report CLR11 “Model Procedures for the Management of Land Contamination”;
- Environment Agency (2011) Report GPLC1 “Guiding Principles for Land Contamination”;
- Environment Agency (2013) Report GP3 “Groundwater protection: Principles and Practice” Version 1.1.

1.1.3 TerraConsult’s service constraints and report limitations are presented in Appendix A and a description of environmental risk assessment methodology and terminology is presented in Appendix B.

1.2. Development Proposals

1.2.1 The proposed development of the site is understood to comprise:

- the demolition of any existing structures;
- the removal from site or the treatment of any contaminated material encountered during demolition;
- earthworks to prepare the site for construction including cut-fill earthworks to form the required development platform;
- the construction of both single storey and two storey light industrial units including access roads, parking areas to the southwest and service provision.

1.2.2 The initial development proposal provided to TerraConsult was the Client's Option 2 (see Figure 1a below) and this option was similar to Option 1 (see Figure 1b) but includes three additional buildings within the north-eastern part of the site. The investigation and fieldwork was designed on the basis of the Option 2 proposed building layout. The development proposal has changed during the investigation and it is understood that the current development proposal is for Option 1 on the following page. However, the three additional buildings remain an option for future development.



Figure 1a: Development Plan (taken from Mouchel Drawing 1057338_A_060 – Option 2)



Figure 1b: Development Plan (taken from Mouchel Drawing 1057338_A_060 – Option1)

- 1.2.3 The findings and conclusions of the risk assessments have been set out and recommendations given for the proposed light industrial units end use. If there is a subsequent change in the proposed land the risk assessments and conclusions should be reviewed to determine whether they are still applicable for the revised end use.

1.3. Planning Status & Requirements

- 1.3.1 This report is designed to comply with the requirements of The National Planning Policy Framework (NPPF, 2012) and is intended to be used by the developer as part of the submission to gain planning approval for the works.

1.4 Objectives of the Investigation

1.4.1 The main objectives of the investigation were to meet the requirements to provide information for planning purposes and for design of the development. The specific activities to be carried out are as follows:

- to obtain sufficient information about the subsoil and groundwater regime to enable adequate and economic designs to be prepared for the building foundations, pavements and drainage;
- to establish former site uses and any significant geo-environmental features or risks;
- to identify the presence and extent of contaminated material on site and establish if the levels are within acceptable limits for the intended site use including soft landscape areas;
- to assessment whether any contaminants on site have the potential to migrate to adjacent sensitive receptors, i.e. water courses, aquifers, ground water source protection zones;
- the carrying out of a statistical analysis of the results and benchmark them against human health toxicology data and derived site specific SGVs and GAC where values are not available in current published information;
- to assess the potential suitability of any made ground for ground improvement;
- to assess the suitability of excavated material for re-use as backfill;
- to identify the presence and quantity of potentially harmful ground gases;
- to determine the contamination status of surplus excavated material for disposal;
- to determine if the underlying soils are suitable for filtration drainage;
- to identify the presence of any material which is deleterious to buried concrete or harmful to construction workers;
- to investigate the presence of shallow mine workings;
- to support a full planning application for the new development and to satisfy all planning authority requirements relating to site contamination

1.5 Previous Investigations

1.5.1 One previous investigation carried out on the site has been made available by the Client, FWS Consultants Ltd carried out an investigation in 2007 entitled “Contamination and Geotechnical Investigation of Areas ‘A’ and ‘B’, Kings Business Park, Knowsley, Liverpool. The information from this report is discussed in Section 3 and is used to derive the preliminary conceptual site model.

2. SITE LOCATION AND DESCRIPTION

2.1 Site Location

2.1.1 The site is indicated in Figure 2 below and the site location is summarized in Table 1:



Figure 2: Site Location

Table 1: Summary of Site Location	
Location	Approximately 1 km west of Prescot town centre, within Kings Business Park off Kings Drive.
Grid Reference	345500,39250
Post Code	L34 1PJ
Site Area	3.1 ha (approx.)
Site Shape	The site has maximum plan dimensions of 300 m by 100 m and is roughly rectangular in shape.
Topography	The elevation is at approximately 68 mOD. In the eastern half of the site the ground level slopes south eastwards by around 5 m towards the boundary within Huyton Lane. The western half of the site slopes westwards by approximately 4 m.

2.2 Site Description

2.2.1 A site visit was undertaken on 7th November 2014. The locations of various features are discussed below and photographs of the site are presented in Appendix C.

2.2.2 Access to the site is via a tarmac road off Kings Drive within Kings Business Park. There is a second gated access point via an overgrown entrance from Huyton Lane. The site has currently two primary uses, The eastern half of the site having remained undeveloped is being let to dog walkers whilst the western half is presently being used as

an temporary overspill carpark. The site is bordered by mature and semi-mature trees along the north-western, north-eastern and south-eastern margins.

- 2.2.3 The ground surface comprises unkempt grasses and bramble in the eastern half of the site and primarily a gravel surface to the west. A pathway runs parallel with the north western margin of the site. There are four existing structures identified on site; an electrical substation on the western site boundary, an unspecified building near the southern corner of the site as well as brick structure housing a pipe and concrete foundations adjacent to the north-western site boundary.
- 2.2.4 A number of service covers were noted primarily in the western half of the site as well as the pipe extruding from the structure adjacent to the north-western site boundary. No storage tanks were noted above ground and no below ground tanks are suspected. It is known from the previous investigation discussed in Section 3 that there is an electrical cable running near the north of the site from Huyton Lane towards a substation/communications tower close to the north-western corner of the site.
- 2.2.5 No potential Asbestos Containing Material (ACMs) were noted on either the ground or on existing buildings during the walkover.
- 2.2.6 There is no evidence of protected burrowing animals (e.g. badgers) or habitats suitable for protected amphibians (e.g. Great Crested Newts). Trees are present on the site and these should not be cut down during the nesting season. No evidence of invasive plant species were noted. These comments on the ecology are for initial preliminary assessment. They are based on the assessment of personnel who are not trained ecologists and does not constitute a Phase I Habitat Survey or similar.
- 2.2.7 The land surrounding the area is occupied by wooded ground to the north, residential to the east, a golf course to the south and an industrial park to the west and north-west.

3. PREVIOUS INVESTIGATION

3.1 FWS Consultants Ltd Contamination and Geotechnical Investigation Report- 2007

- 3.1.1 The relevant information from the above report provided by the Client has been summarised below. For full details the original report should be referred to Appendix D.

History

- 3.1.2 Prior to 1850 the site remained undeveloped, comprising fields and woodland to the north-west and south-east. Additionally a pond was shown to encroach into the south-western corner of the site and a path is noted to cross the north of the site orientated north-east south-west. Huyton Lane is present bounding the south-eastern margin of the site.
- 3.1.3 Both a quarry and a glasshouse were shown to be present within the wooded region to the north of the site from 1850. Further afield two collieries were also noted at this time 250 m north-east and 600 m south-east of the site. No significant changes are noted to the site or region immediately surrounding the site by 1893, apart from the former collieries

being no longer noted. By 1928 there had been the construction of a tramway on Liverpool road and terraced housing east and south-east of the site respectively.

- 3.1.4 The site remained unchanged prior to 1955, by which time the City of Liverpool CF Training College had been built west of the site and it extends into the western half of the site. Additional college buildings were then constructed by 1973/1976 extending into the central and south-western regions of the site. The extensions of existing college buildings off-site and construction of the M57 motorway neighbouring the eastern site boundary had also occurred during this time. No significant changes occurred to the site or in the immediate areas prior to 1993, however by 1994 the college building in the central region of the site was demolished. The remaining buildings were subsequently demolished by 2004 and an office building of the existing business park had been constructed adjacent to the southern half of the site.

Geology

- 3.1.5 The British Geological Survey indicated that the southern part of the site is underlain by superficial deposit comprising Glacial Till (Boulder Clay). The bedrock geology underlying the site is shown to be a Sandstone unit part of the Carboniferous Pennine Lower Coal Measures Formation. The bedrock is dipping at around 8degrees to the south. Predominantly Mudstone with siltstone and sandstone beds from the Pennine Lower Coal Measures are located adjacent to the site.
- 3.1.6 The previous intrusive investigation showed that the glacial clay was largely absent. Made Ground primarily in the south-western half of the site comprised predominately sandy gravelly clay, the gravel including brick and concrete. Underlying the Made Ground and across the entire site was shown to be varying deposits of weathered sandstone. Sandstone bedrock was encountered in all trial pits excluding TP1 where firm to stiff clay was present to a depth of 3.00 m (base of excavation). Note TP1 is located west of the site and is not within the current development plan.

Coal Mining

- 3.1.7 The Coal Authority Report indicated that the site is not within the likely zone of influence from any past, present or known future underground workings. It is also not located within the boundary or within the likely influence of any known historic, current or future opencast sites.

Hydrogeology and Hydrology

- 3.1.8 The nearest surface water feature is identified as the balancing pond 60 m west of the south-western corner of the site. There are no surface watercourses within 500 m of the site and there are no recorded surface water abstraction licences within at least 350 m of the site boundary.
- 3.1.9 The Glacial Till present is classified as Unproductive strata whilst the underlying Coal Measures are classified as a minor aquifer.
- 3.1.10 During the intrusive investigation groundwater strike was encountered within only one of the boreholes in the south-western corner of the site at a depth of 2.5 m, rising to 2.4 m after 20 minutes.

Radon Risk

- 3.1.11 The site is shown to not be in an area where radon neither basic or full protective measures are required for new buildings.

Environmental Risk Assessment

- 3.1.12 The intrusive investigation had found there to be occasional slightly elevated levels of sulphate within made ground samples and slightly elevated lead within a sample taken from a soil mound near a car park. Additionally low pH (acidic) levels were noted within both natural and Made Ground deposits. Concentrations of the remaining contaminants were low and no asbestos fibres or ACM were detected.
- 3.1.13 The results of the previous contamination analysis will be used along with the results of samples obtained as part of the current investigation and compared to the present-day screening level criteria for an industrial end use.

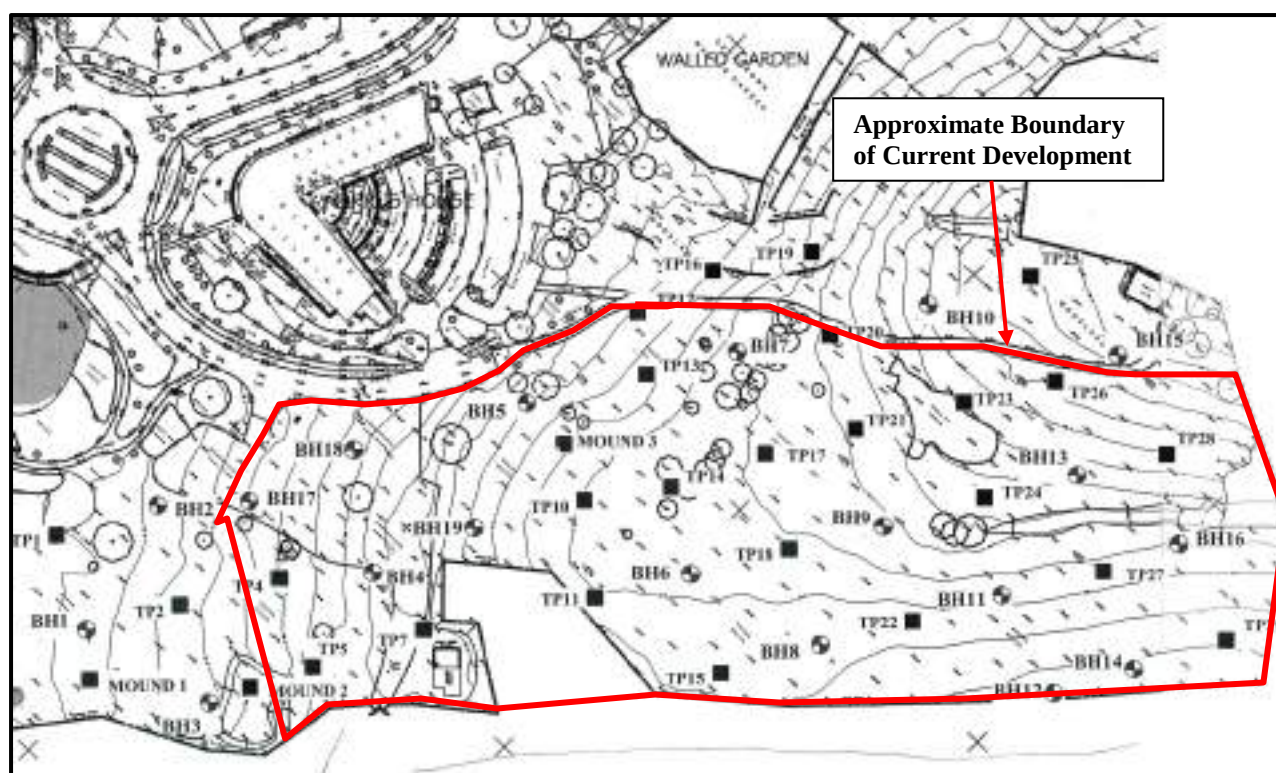


Figure 3: Exploratory Hole Locations in FWS Report

4. ENVIRONMENTAL REVIEW

4.1 History

- 4.1.1 Subsequent to the FWS Consultants Ltd 2007 report, there has been the construction of an office complex adjacent to the south-western site boundary. This is believed to include an electrical substation along the south-western margin of the site.

4.2 Geology

- 4.2.1 From a review of the British Geological Survey (BGS) Superficial and Bedrock Map (Sheet 97), superficial deposits of Glacial Till are expected to be present on site. However from the previous investigation typical Glacial Till deposits are largely absent from the region, and when present consists of a thin layer of sandy clay.
- 4.2.2 The bedrock geology indicated by both BGS mapping and the previous investigation indicates Sandstone from the Carboniferous Penning Lower Coal Measures Formation. The Rushy Park and Arley coal seams are possibly at great depth beneath the site. The Coal Authority report indicates no risk from past, current or future coal mining.
- 4.2.3 There are two normal faults near the site, located approximately 130 m east of the north-eastern corner of the site and 200 m south-west of the south-western boundary of site.

4.3 Hydrogeology and Hydrology

- 4.3.1 The previous report described the bedrock aquifer as a minor aquifer. From 1st April 2010 new aquifer designations replace the old Environment Agency system of classifying aquifers as Major, Minor and Non-Aquifer. This new system is in line with the EA Groundwater Protection Policy (GP3) and the Water Framework Directive (WFD) and is based on British Geological Survey mapping.
- 4.3.2 The new classification indicates the bedrock to a Secondary A Aquifer. This classification is based on the general Carboniferous Pennine Coal Measures consisting of predominantly Mudstone interbedded with siltstone and sandstone. The geology map and previous investigation has shown the site is underlain by sandstone. Therefore the Secondary A aquifer designation may be underestimating the permeability of the bedrock on site.
- 4.3.3 The Environmental Agency indicates there are no groundwater abstraction licences within 1km of the site.
- 4.3.4 The Environmental Agency has defined source protection zones (SPZs) for 2,000 groundwater sourced such as wells, boreholes and springs used for public drinking water supply. Where these SPZs are present there is an increased risk that contamination from any activities on site might cause pollution of the groundwater and water supply in the area however the site does not lie within or near a SPZ.

- 4.3.5 The Environmental Agency has also designated a number of surface water features and groundwater bodies with additional protective status and has highlighted areas where the groundwater may be at risk. Based on this, the site is not located within either a surface water safeguard zone or a groundwater safeguard zone.
- 4.3.6 The site is in a Flood Zone 1, where the risk of flooding from rivers is classified as low where there is less than 0.1 % annual chance of flooding.

4.4 Archaeology and Woodland

- 4.4.1 There are no ancient monuments, archaeological features of interest or ancient woodland within the vicinity of the site however there is a Grade II listed historical building (Garden Wall to the Hazels) located 25 m north of the site within the woodland.

5. HAZARD ASSESSMENT & PRELIMINARY CONCEPTUAL SITE MODEL

5.1 Hazards Identified with the Proposed Development

- 5.1.1 The hazard identification is based on the assumptions presented below:

- the site will be a light industrial development;
- the development will include both single storey and two storey light industrial units including access roads, parking areas to the southwest and service provision.
- Landscaped areas will be present;
- drinking water will be from mains supply.

5.2 Potential Sources of Contamination

- 5.2.1 No significant potential sources of contamination have been identified on site or within the vicinity of the site. The eastern half of the site has remained undeveloped whilst the western half has had limited development of a City of Liverpool CF Training College. There is known to be Made Ground relating to the demolition of this development from the previous investigation in 2007, of which showed elevated levels of sulphate as well as a low pH (acidic) conditions. Other possible contaminants relating to demolition material are:

- Metals and Metalloids;
- TPH from fuel sources;
- PAHs from ash deposits; and
- Asbestos Containing Materials (ACMs)

- 5.2.2 In the southwest of the site there is an electrical substation immediately adjacent to the site boundary. The sub-station could represent a point contaminant source of PCBs if there has been a historical spillage.
- 5.2.3 Other contaminants that may need consideration include ground gas or vapours from geogenic sources (Lower Coal Measures) and from Made Ground on site, the main source being the Made Ground as no known worked mines are thought to be within the vicinity of the site.

5.3 Potential Receptors of Contamination

- 5.3.1 Based on the data previously discussed, the following potential receptors to contamination have been identified:

Table 2: Identified Potential Receptors	
Sensitive Receptors	
A	Humans – Pre development completion, i.e. working on site during demolition and construction.
B	Humans working on the site post construction.
C	Controlled waters – Surface Waters (balancing pond).
D	Perched groundwater in Made Ground and Controlled waters – (groundwater – Secondary A Aquifer).
E	Local flora and fauna during and post demolition and construction.
F	Building structure and services.

- 5.3.2 The preliminary assessment of risks undertaken for the development considers potential risks to receptors A to F in Table 2 above. The receptors A to F incorporate each of the receptors normally required by the Local Authority to be considered in their planning conditions relating to land contamination;
- Human Health (A & B)
 - Property (including buildings, crops, livestock, pets, woodland, service lines) (E & F)
 - Adjoining land (D & F)
 - Groundwater and surface water (C & D)
 - Ecological systems (E)
 - Buildings and structures (F)
- 5.3.3 It should be noted that there are no archaeological sites or ancient monuments considered to be within the zone of influence of the site. They are therefore not considered in the risk assessment.

5.3.4 The closest of each of the above receptor categories to the site are considered to be;

On-site

- Current and future site users
- Future buildings
- Flora and fauna
- Secondary A bedrock aquifer

Off-site

- Lake (60 m west)
- Flora and fauna
- Industrial/Commercial
 - Office (10 m west and 20 m north of southern half of site)

5.3.5 The possible contaminant linkages are discussed below. It should be noted not all may be formed between all sources and receptors.

5.4 Identification of Pathways

Pathways to Human Health

5.4.1 There are various routes by which a potential contaminant may reach a receptor. For example, in areas where contaminated material is exposed, dermal contact with the material, inhalation or ingestion of dust may occur.

5.4.2 The whole of the site is currently exposed and not covered in hard standing and it is anticipated that an earthworks operation is required to modify ground levels. Inhalation or ingestion of dust and water could occur during the construction and development phase at the site. Pathways from dermal contact with soil and groundwater may also arise. It is considered that the risk of short term exposure for ground workers and other construction workers is low unless there are asbestos fibres in the Made Ground.

5.4.3 Post construction, the surface of the development area will be occupied with buildings and hard standing, however landscaped areas will still be present. This is significant in that a number of potential pathways are possible such as long term direct contact and dust inhalation/ingestion is also applicable.

5.4.4 Gas and vapour entry into buildings is considered to be an unlikely pathway for the proposed development due to the possibility of advection and diffusion into buildings, which may occur regardless of the presence of hard standing across the site.

Pathways to Controlled Waters

5.4.5 Groundwater levels at the site are anticipated to be low and at a depth of more than 5 m within the bedrock. Lateral migration of potentially contaminated groundwater offsite (either via permeable made ground or the underlying aquifer) must be considered.

- 5.4.6 The vertical leaching of contaminants from the Made Ground into the groundwater is a potential pathway for contaminants to impact upon groundwater. The absence of drift deposits means it is possible that Made Ground contaminated materials are in contact with the Superficial A Aquifer (Pennine Lower Coal Measures Formation). However the unsaturated bedrock will act as an attenuator to potential contaminants leaching into the groundwater at depth.
- 5.4.7 Surface run off from contaminated areas into surface watercourses must also be considered. Due to a lack of a hard standing site surface, this will be uncontrolled prior to and during the groundworks phase when this must be carefully managed. Post construction the majority of the site and surface run-off will be limited and controlled through drains. There is a viable overland migration pathway for surface run off to reach the controlled water receptor of the balancing pond, being 60 m away.

Other Pathways

- 5.4.8 Other potential pathways that are possibly less significant to the site but still require consideration are; potential phytotoxic effects on sensitive landscaping plants; chemical attack on foundations and services and permeation of contaminants through domestic water pipes. The risk to buildings from ground gases has been discussed under human health above.

5.5 Contaminant Linkages

5.5.1 For each contamination source there are potential contaminant linkages with all receptors. However, in the context of this site, not all of the contaminant linkages are plausible. The likelihood of the various pathways linking the contaminants to the receptors is presented in Table 3 below:

Table 3: Matrix of Contaminant Linkages							
Source/ Contaminated Medium	Pathway	Receptor					
		A - Humans using the site pre-development completion	B - Humans living on the site post construction	C – Surface Water	D - Groundwater	E - Flora & fauna	F - Building & Services
Soil/Made Ground/Bund Material	Ingestion	S	P	-	-	-	-
	Dermal Contact/Direct Contact	S	P	-	-	P	P
	Inhalation	S	P	-	-	S	-
	Infrastructure/Drainage	P	P	P	U	U	P
	Groundwater	U	U	U	U	U	P
	Surface water	U	U	U	P	P	P
Groundwater	Ingestion	P	P	-	-	U	-
	Inhalation	P	P	-	-	-	-
	Dermal Contact	P	P	-	-	U	-
	Groundwater	P	U	U	U	U	P
	Surface Water	U	U	U	P	P	P
Gas (CH₄ CO₂)	Migration	P	P	-	-	P	P
Key to significance of contaminant linkages S = Significant Pathway P = Possible Pathway U = Unlikely Pathway - =Not Applicable Only Significant and Possible contaminant linkages are taken forwards to the next part of the risk assessment.							

5.6 Conceptual Site Model

5.6.1 In accordance with BS 10175, a schematic section has been developed for the site based on the previously presented data and contaminant linkage assessment:

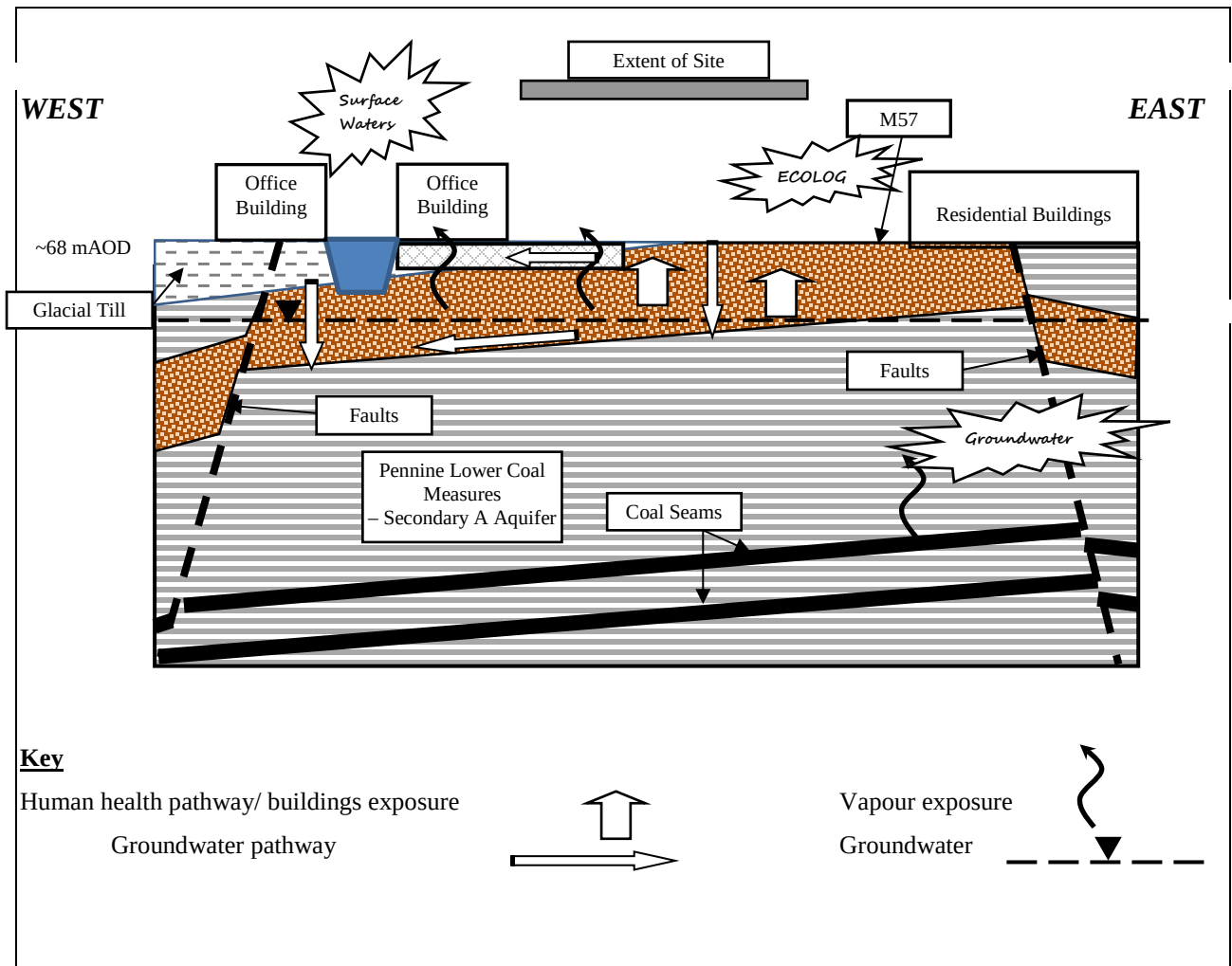


Figure 4: Preliminary Conceptual Ground Model - Schematic Section (not to scale)

- 5.6.2 The model shows the predicted geology and topography, the major on site potential contamination sources and vulnerable receptors. Levels shown are relative to Ordnance Datum and are based on published data previously presented in the report, although the drawing may not be considered to scale.
- 5.6.3 The information presented above represents the preliminary conceptual ground model that may need to be revised based on information obtained as part of the intrusive investigation. A number of sensitive receptors and potential pathways and sources (in association with a list of likely contaminants) have been identified.
- 5.6.4 The ground model and proposed end use described above should be considered broadly representative of the standard industrial land-use as defined in SR3 “Updated Technical Model to the CLEA Model” (SC050021/SR3, 2011) for the purpose of this report.

5.7 Preliminary Contamination Hazard Assessment

5.7.1 The preliminary hazard assessment is based on current available guidance published by a number of sources and is summarised in Appendix B. A preliminary conceptual site model for this site has been established using the desk study information and has been used as a basis for the preliminary hazard assessment. The significant and possible potential pathways are only considered for the hazard assessment.

5.7.2 The preliminary hazard assessment is a qualitative assessment of the risks posed by each viable pollution link identified. The hazard assessment leads to a recommended subsequent activity that could be:

- Action Required (AR) in the short term to break existing contaminant-pathway-receptor (CPR) link;
- Site Investigation Required (SIR) with objectives for risk estimation, or
- No Action Required (NAR) at this stage.

5.7.3 The hazard assessment is summarised in Table 4 below.

Table 4: Preliminary Hazard Assessment							
Hazard Identification				Hazard Assessment			
Link	Contaminant	Pathway	Receptor	Probability	Consequence	Risk	Hazard Assessment
1	Contaminated soil/groundwater	Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	A- Humans using the site during construction.	High Likelihood	Mild	Medium/Low	SIR - Total soil concentration of relevant contaminants for contractors and designer's risk assessments.
2	Contaminated soil/groundwater	Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	B- Humans using the site after development completion.	Medium/Reasonably Foreseeable	Mild	Low	NAR – However relevant data will be collected as part of any SI undertaken.
3	Contaminated soil/groundwater	Via service pipes	B- Humans using the site after construction. F- Building structures and services	Medium/Reasonably Foreseeable	Mild	Low	NAR – However relevant data will be collected as part of any SI undertaken.
4	Contaminated soil/groundwater	Downward migration	D- Perched groundwater	Medium/Reasonably Foreseeable	Medium	Medium	SIR - Total soil concentration of relevant contaminants for contractors and designer's risk assessments.
5	Contaminated soil/groundwater	Downward migration	D - Secondary A aquifer	Low/Unlikely	Mild	Low	NAR – However relevant data will be collected as part of any SI undertaken.
6	Gas – methane	Inhalation, explosion	A & B- Humans	Medium/	Severe	High	SIR – Gas

Table 4: Preliminary Hazard Assessment

Hazard Identification				Hazard Assessment			
Link	Contaminant	Pathway	Receptor	Probability	Consequence	Risk	Hazard Assessment
	& carbon dioxide		using the site during construction and after development completion.	Reasonably Foreseeable			monitoring wells and monitoring wells for methane and carbon dioxide
7	Contaminated soil/waste/groundwater	Ingestion, inhalation, dermal/direct contact	E- Ecology (Flora/Fauna)	Low/ Unlikely	Negligible	Near Zero	NAR – However relevant data will be collected as part of any SI undertaken.
8	Contaminated groundwater	Secondary A Aquifer/ Surface water	E- Ecology (Flora/Fauna)	Low/ Unlikely	Medium	Medium/ Low	SIR - Total soil concentration of relevant contaminants for designer's risk assessments.
9	Contaminated soil/groundwater	Direct contact.	F- Building structures.	Medium/ Reasonably Foreseeable	Mild	Low	SIR - Total soil concentration of relevant contaminants for contractors and designer's risk assessments.

5.7.4 From Table 4 a range of risk ranking from near zero to high was established. Potentially moderate and high risks require quantification and consideration prior to development. The site investigation objectives described above should represent part of a detailed main stage investigation that should include overall characterisation of the ground in association with obtaining and analysing the information described above.

5.8 Geotechnical Hazards Associated with the Development

5.8.1 In addition to the environmental hazards, there are also geotechnical hazards associated with the stability of the ground (including load bearing capacity, slope stability and effects of ground (mining) cavities). Local Authorities follow NPPF (2012) which requires that “site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining.”

5.8.2 The results of the previous report using information from Landmark (Envirocheck Report), BGS and the Coal Authority has been shown the site to have no risk from mining, mineral extraction or quarrying. The Coal Authority report indicates that the site is not within the likely zone of influence from any past, present or known future underground workings.

5.8.3 A summary of the geotechnical considerations is provided below:

Table 5: Summary of Geotechnical Hazards

Geohazards:	
Highly Compressible Ground	No – Peat deposits or soft Alluvium or Made Ground of thickness more than 1 m are not anticipated.
Collapsible Soils	No
Swelling Clay	Yes – Anticipate low or medium volume change potential clay present
Running Sand	No
Ground Dissolution	No
Landslip	No
Mining & Quarrying (see Section 3)	There is no evidence of coal mining or mineral extraction or quarrying at the site.
Geotechnical Design Considerations	
Site Clearance	Currently open land with overgrown grass and semi-mature trees mostly around the perimeter. Some trees to be removed and topsoil strip required. All green waste and deleterious material to be removed from site. Excavation required for the construction of the surface water balancing pond.
Trees	Trees present on site mostly located around perimeter. Check whether there are any Tree Preservation Orders. Foundation design to take into account trees.
Existing Buildings / Obstructions	No buildings in area of new house. No below ground obstructions expected.
Foundations	Anticipate that shallow spread foundations will be suitable at this site designed following NHBC guidance to take into account of the presence of the trees and hedges. Need to confirm the volume change potential of the formation material.
Floor Slabs	Ground bearing floor slabs envisaged.
Groundwater	Groundwater not encountered in previous ground investigation (max depth 5m)
Earthworks	Bulk earthworks will be required in order to construct the required development platform on this gently sloping site. Excavation for the surface water balancing pond in the southwest of the site.
Slopes	Currently very gentle slope but likely to have some short steeper slopes formed as part of the development
Retaining Walls	May require a series of low height retaining walls due to the site slope.
Chemically aggressive ground conditions	Low pH and high sulphate concentrations have been recorded in previous investigation which could be detrimental to below ground concrete.

6. INVESTIGATION METHODOLOGY

6.1 Investigation Strategy

- 6.1.1 The site investigation was designed to supplement the information provided as part of the previous site investigation, fill any data gaps from that investigation and provide further geotechnical information with the consideration of the new development proposal.
- 6.1.2 The previous investigation did not investigate the nature of the bedrock other than proving its depth and carrying out SPT tests at the top of the stratum in each borehole. Rotary drilling was proposed in areas of the proposed buildings in order to enable rock core to be recovered for assessment and sub-samples taken for laboratory analysis (no rotary drilling in the region of the proposed car park). The eight rotary holes were proposed to consist of rotary open hole within the drift deposits and followed by 6 m of rock coring which was commenced when drilling reached competent bedrock.
- 6.1.3 The exploratory locations are shown on Figure 5 below.



Figure 5: Exploratory Location Plan

6.1.4 The purpose of the various exploratory holes are as follows:

- No 21 Machine dug trial pits
 - o to assess the conditions for proposed cut-fill earthworks
 - o enable CBR testing to be carried out in regions of proposed driveways,
 - o for permeability testing and for determining site conditions; and
 - o undertake sampling across the entire site.
- No 8 Rotary boreholes – for enable rock core to be recovered for assessment and sub-samples taken for laboratory analysis as well as to enable the installation of gas and groundwater monitoring wells.
- No 1 Hand dug trial pit – for determining site conditions adjacent to an electrical substation and undertake sampling for chemical laboratory testing with analysis suite to include PCBs because the sub-station could represent a point contaminant source of PCBs if there has been a historical spillage.

6.2 Chemical and Geotechnical Testing Strategy

- 6.2.1 The chemical testing strategy for soils was designed to be sufficiently broad to enable the identification of potentially elevated contaminants which were considered plausible from the preliminary risk assessment as the previous investigation had not highlighted any specific contaminants on site.
- 6.2.2 Geotechnical sampling and testing was designed to enable classification of both soils and rock across the entire site to support future foundation design.

6.3 Monitoring Strategy

- 6.3.1 The ground gas monitoring will be in accordance with BS 8576 : 2013 and comprise 3 visits over one month months. This monitoring period is in accordance with Table 5.5 of CIRIA C665 (2007) based on a Very Low Generation Potential of Source and a Commercial Development this suggests three readings over one month but based on the conceptual ground model it is assessed that three rounds over one month is sufficient unless adverse gas conditions are present. The Gas monitoring involves the measurement of flow, relative pressure, carbon dioxide, oxygen, methane, carbon monoxide, hydrogen sulphide and ambient barometric pressure.
- 6.3.2 Groundwater levels were measured at every monitoring visit.

7. FIELDWORK

7.1 General Observations

7.1.1 The fieldwork was carried out between 15th and 19th December 2014. TerraConsult personnel were present to supervise all work, describe the ground encountered, carry out in situ testing and decide on the depths and response zones of monitoring wells. A services search was carried out prior to the site work and a CAT scan performed at the location of each exploratory hole location. Fieldwork procedures were undertaken in accordance with the relevant sections of:

- British Drilling Association “Guidance for Safe Intrusive Activities on contaminated or Potentially Contaminated Land” (2008);
- BS EN 1997-2:2007 [Eurocode 7 Part 2];
- BS5930:1999 +A2 (2010) "Code of Practice for Site Investigations;"
- BS10175:2011 + A1 (2013) “Investigation of potentially contaminated sites – Code of practice.”

7.1.2 The investigation comprised the following fieldwork scope:

- 21 No. trial pits using a JCB 3CX hydraulic excavator and a single hand dug trial pit;
- 8 No. rotary boreholes carried out using a truck mounted drilling rig using open hole and coring drilling methods with air flush;
- installation of 6 No. Gas and groundwater monitoring wells (all 51 mm internal diameter HDPE with slotted sections having a 250 µm geotextile filter wrap);
- 4 No Soakaway tests to BRE Digest 365 (2003);
- sampling and testing of soils and groundwaters;
- description of the ground encountered in accordance with BS5930:1999+A2 (2010) "Code of Practice for Site Investigations;"
- gas and groundwater monitoring.

7.2 Trial Pits

7.2.1 Twenty-one trial pits were excavated using a 12 tonne tracked excavator, where access permitted, across the site to depths of between 1.35 m (TP111) and 2.85 mbgl (TP102). One trial pit was hand excavated to 1.00 m (HP1), in the southern area of the site adjacent to the electrical substation where services were expected to enable a sample of soil to be taken from adjacent to this potential point source of contamination.

7.2.2 Groundwater was encountered within three of the trial pits (TP102, TP112 and TP121) at depths of between 2.10 m bgl and 2.75 m bgl. The rate on ingress was slow to moderate.

7.2.3 Four of the trial pits were used for soakaway testing discussed in Section 7.4 and twelve CBR tests were undertaken during. Once sampling, in situ testing and logging were all completed the exploratory holes were backfilled with arisings from the excavation.

7.2.4 The trial pit logs and photographs are included in Appendix C.

7.3 Rotary Boreholes

7.3.1 Eight rotary open holes (R101 to R108) were completed to maximum depths of 6.50 m (R107) and 8.20 m (R102). The boreholes were commenced by using Open holes drilling techniques through the Made Ground and drift deposits which produced a 130 mm fully cased hole. The drilling in the bedrock was carried out using diamond core (92mm Core size and air-water flush). The rotary borehole logs and core photographs are included in Appendix C

7.4 Soakaway Tests

7.4.1 Five soakaway tests were carried out in accordance with BRE Digest 365 (2003) in trial pits TP105, TP112, TP114, TP114A and TP118. The test in TP114A was carried out after encountering a very poor infiltration rate in TP114 with a higher rate encountered in TP114A. The results are presented in Appendix F.

7.5 California Bearing Ratio (CBR)

7.5.1 Twelve California Bearing Ratio (CBR) tests were carried out using a falling (light) weight deflectometer (FWD) to provide design parameters for road/pavement design. The tests were carried out on the ground after the topsoil had been stripped. from the ground surface. The results are presented in Appendix F.

7.6 Samples and Sample Containers

7.6.1 Soil samples for chemical analysis each comprised a pair of samples: a plastic tub for metals and inorganics, and an amber glass jar for organics.

7.6.2 Prior to taking any water samples, the wells were developed and three well volumes of water was purged from the wells using dedicated disposable bailers (also called a grab sampler). If recharge was relatively slow and not sufficient to allow a purged sample from being taken then a sample was taken of the water during the purging and the volume of purged water was noted.

7.6.3 The water samples were tested on site in accordance with EA recommendations for pH, conductivity, redox potential, temperature and dissolved oxygen. A 1 litre plastic bottle for metals and inorganics and a 1 litre glass bottles for SVOC's were used for sampling groundwater

- 7.6.4 Water samples and soil samples for organic analysis were stored in a cool box, with plastic tubs stored in a plastic crate. They were couriered directly to the testing laboratory.

7.7 Monitoring

- 7.7.1 After completion of the fieldwork, three visits were made to the site to carry out monitoring of groundwater levels and ground gas concentrations. Ground gas monitoring was carried out in accordance with BS8576:2013 and comprised measurement of the atmospheric air pressure, gas flow rate, methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide.
- 7.7.2 The results of this monitoring are presented in Appendix G, together with details of the instrumentation specifications.
- 7.7.3 It should be noted that no free phase hydrocarbons were encountered in any of the monitoring wells.

7.8 Topographical Survey

- 7.8.1 The location and level of each exploratory position was surveyed to National Grid Co-ordinates and Ordnance Datum. The positions of the exploratory holes were then plotted on the topographic survey plan which was supplied by the client.

8. LABORATORY TESTING

8.1 Chemical Laboratory Testing

- 8.1.1 The soil samples were submitted to QTS Environmental of Lenham in Kent. Groundwater testing was carried out by Scientific Analysis Laboratory (SAL) in Manchester. Both laboratories are UKAS accredited in accordance with ISO17025 for the relevant analysis and are also MCERTS accredited for soil analysis in accordance with the Environment Agency's scheme. The laboratories carry out Quality Assurance and Quality Control in accordance with BS ISO 17025 and participate in external laboratory comparison and quality control schemes. Details of the accreditation and the methods of analysis are provided on the relevant test reports.
- 8.1.2 The selection of samples for laboratory testing and analytes to be determined were made based on the Phase 1 assessment, the excavation records and other observations during the investigations. The sample selection rational was as follows:
- to gain a good coverage across the site and of the various material types and strata encountered;
 - to characterise samples from the interface of permeable and less permeable horizons within the ground;
 - to characterise the groundwater.
- 8.1.3 The selected soil and groundwater samples were tested for a range of typical contamination indicators including specific tests for contaminants suspected as being present from the desk study and from observations made on site. Tests were also performed which were used to support the modelling of contaminant transport and impacts (e.g. TOC) and for waste classification purposes.
- 8.1.4 Each of the soil samples were analysed for the 'total' concentration of a suite of potential contaminants. Two leachate samples were also prepared from selected soil samples in accordance with BS EN 12457: Part 4 : 2002 with a 10:1 water:soil extract prepared. The results of the leaching are presented in terms of µg/l and also in mg/kg.
- 8.1.5 The results of the laboratory analysis are presented in Appendix H. The various suites of analysis for the soil, leachate and water were as follows:

Table 6: Suites of Analysis for Soil and Water Samples

Determinand	Soil Suite 1	Soil Suite 2	Landfill WAC Suite	Water Suite
Index Tests				
Asbestos Screen	**	**	-	-
pH	✓	✓	✓ (L)	✓
Electrical Conductivity	-	-	✓ (L)	✓
BOD	-	-	-	✓
COD	-	-	-	✓
Dissolved Solids	-	-	✓ (L)	✓
Alkalinity	-	-	-	✓
Hardness	-	-	-	✓
Metals				
As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, V, Zn (all totals)	✓	✓	✓ (L)	✓
Ba, Mo, Sb	-	-	✓ (L)	-
Boron (water soluble on soil samples)	✓	✓	-	✓
Ca, Fe, K, Mg, Mn, Na	-	-	-	✓
Inorganics				
Ammonium	-	✓	-	✓
Cyanide - Total	✓	✓	-	✓
Chloride (2:1 extract on soil samples)	✓	✓	✓ (L)	✓
Fluoride (2:1 extract on soil samples)	-	✓	✓ (L)	✓
Nitrate (2:1 extract on soil samples)	-	✓	✓ (L)	✓
Sulphate (2:1 extract on soil samples)	✓	✓	✓ (L)	✓
Sulphide	-	-	-	-
Carbonate Content	-	-	-	-
Organics				
Phenols - Total (monohydric)	✓	✓	✓ (L)	✓
Total Organic Carbon (TOC)	-	✓	DOC & TOC	-
PAH (Speciated USEPA 16)	✓	✓	✓ (S)	✓
TPH (C ₈ to C ₃₆)	✓	✓	-	✓
TPH (C ₈ to C ₃₆) TPH CWG (RBCA) Speciation	-	✓	-	-
Mineral Oil (C ₁₀ to C ₄₀)	-	✓	✓ (S)	-
Benzene, Toluene, Ethyl Benzene, Xylenes (BTEX);	-	✓	✓ (S)	✓
Volatile Organic Compounds (VOCs) and Chlorinated Solvents	-	✓	-	✓
Semi Volatile Organic Compounds (SVOCs)	-	-	-	✓
Poly Chlorinated Biphenyls (PCBs)	-	-	✓ (S)	-

NOTE

- ✓ = Test carried out on all samples **= Test required on selected samples only
- 2. All soil samples to be tested and reported in accordance with EA MCERTS for Soils Scheme
- 3. WAC Leachate preparation and reporting in accordance with ISO/EN/BS12457:Part 4 with results reported in terms of both mg/kg and mg/l for a 10:1 extract.
- 4. (S) test carried out on soil sample, (L) test on leachate prepared from soil sample in accordance with Landfill WAC Criteria
- 5. In addition to the above, two samples were also tested for the presence of Asbestos fibres.

8.2 Geotechnical Laboratory Testing

8.2.1 Soil samples were submitted to PSL Limited in Doncaster who are UKAS accredited in accordance with ISO17025 who carried out soil testing and Strata Renewables Ltd who carried out the rock testing. The following geotechnical testing was undertaken:

- 1 No. Moisture Content Determinations in accordance with BS1377: Part 2: 1990
- 1 No. Liquid and Plastic Limit Determinations in accordance with BS1377: Part 2: 1990
- 6 No. Particle Size Distribution tests in accordance with BS1377: Part 2: 1990
- 27 No. Axial and Diametrical Point Load Index Tests - ISRM Commission.
- 23 No. Moisture Content & Density on rock samples - ISRM Commission

8.2.2 The results of the geotechnical testing are included in Appendix I.

9. GROUND CONDITIONS

9.1 General

9.1.1 The site investigations have allowed the site specific ground conditions to be described and this information was used to provide an improved conceptual ground model.

9.1.2 The geology encountered during the site investigations was generally consistent with that anticipated from the previous reports and is summarised below;

9.2 Ground Surface

9.2.1 Rough grass over topsoil generally consisting of Dark brown slightly sandy slightly gravelly CLAY or Brown clayey slightly gravelly fine to coarse SAND ranging between 0.1m and 0.5m in thickness. Gravel is fine subrounded to rounded of mudstone and sandstone. Frequent rootlets.

9.3 Made Ground

9.3.1 Made Ground was present in TP101-105 together with FWS exploratory holes TP4, BH4, BH17 to BH19. All of these holes are located at the western end of the site within the area currently used as a car park. The Made Ground ranges in thickness from 0.40 to greater than 1.90 m (Made Ground not fully penetrated in TP101) but was typically between 0.5 and 1.0 m thick. In addition in HP1 located on the edge of the car park area there was 0.15 m of Made Ground/Topsoil.

9.3.2 There were three distinct types of Made Ground:

- At ground level in TP101, TP102, TP104 and TP105 there was a thin layer of typically grey slightly clayey, sandy fine to coarse angular to subangular gravel of limestone – this is the gravelled car park surfacing.
- The Made Ground at ground level within TP103 was also present below the limestone gravel within the exploratory locations discussed previously. This Made Ground varied considerably and is characterised as fluctuating between a slightly sandy slightly gravelly CLAY to a slightly clayey gravelly SAND/ sandy GRAVEL. The gravel comprises fine to coarse angular to subrounded brick, metal, concrete, tile, timber as well as other demolition materials. Occasional cobbles of brick and paving slabs are also present within the stratum.
- The final Made Ground present within TP101 separated from the second Made Ground by a geo-membrane was also of demolition origin, comprising of sandy GRAVEL of predominately brick and concrete with a high cobble and boulder content also of brick and concrete. Fragments of metal, wire and timber were also present. Note that asbestos fibres were found in just TP101 as part of the laboratory analysis.

9.4 Drift Deposits

Glacial Deposits

- 9.4.1 The Glacial deposits were present within four of the exploratory locations (TP102, TP103, TP107 and TP109), with a maximum thickness of 0.90 m bgl in TP102 the unit thins and shallows towards the east. The deposits are characterised as reddish brown or orangish brown clayey fine sand.

9.5 Solid Geology

- 9.5.1 Rock head was encountered at between 0.30 m and 2.35 m however is generally between 0.6 m and 1.0 m bgl.
- 9.5.2 Predominantly the bedrock has encountered interbedded units of sandstone and siltstone with the occasional unit of mudstone. Typically the top 0.15 m to 1.00 m of bedrock is completely weathered as is characterised as a clayey slightly gravelly to gravelly fine to coarse SAND. The general descriptions of the rock types encountered are given below.
- SANDSTONE - Very weak occasional extremely weak light brownish grey finely laminated fine grained Sandstone. Joints are horizontal to 10 degrees, extremely closely spaced, planar and smooth.
 - SILTSTONE - Extremely weak to very weak and locally weak brownish grey mottled dark greyish brown Siltstone. Joints are horizontal and vertical, extremely closely to very closely spaced, planar and rough.

- **MUDSTONE** - Extremely weak dark grey thinly bedded Mudstone. Joints are horizontal to vertical, extremely closely spaced, planar and smooth.

Table 7: Summary of Rockhead Details

Hole ID	Rockhead (mbgl)	Final Depth (mbgl)	Hole ID	Rockhead (mbgl)	Final Depth (mbgl)
BH101	0.50	7.50	TP108	0.65	2.30
BH102	1.80	8.20	TP109	0.75	2.05
BH103	1.20	7.20	TP110	1.10	2.10
BH104	0.30	7.00	TP111	0.65	1.35
BH105	0.40	7.00	TP112	1.90	3.00
BH106	0.40	6.80	TP113	0.90	2.65
BH107	0.30	6.50	TP114	1.45	1.60
BH108	0.40	7.10	TP115	0.50	2.40
TP101	Not Encountered	1.90 in Made Ground	TP116	1.55	2.05
TP102	2.35	2.85	TP117	0.65	2.10
TP103	1.60	2.70	TP118	0.45	1.40
TP104	0.70	2.20	TP119	1.70	2.00
TP105	0.45	1.40	TP120	1.30	2.10
TP106	0.45	1.50	TP121	1.60	2.35
TP107	0.65	1.70			

9.6 Groundwater

- 9.6.1 Groundwater is present within all of the monitoring wells at depths ranging between 55.95 m OD (BH102) and 63.30 m OD (BH103). Groundwater levels have fluctuated typically between 0.17 m and 0.24 m during the monitoring visits with the exception of BH105 which only had a rise of 0.07 m and BH104 which fluctuated by 0.35 m.
- 9.6.2 The average groundwater levels relative to ordinance datum during the monitoring period are shown in Figure 5. Considering geology encountered groundwater flow is expected to be in continuity across the entire site, however due to the lack of highly permeable sandstone within BH103 and BH104 flow will be slow across this eastern region of the site. The main flow direction of the groundwater is expected to be flowing southwest across the majority of the site, however the north eastern edge of the site is thought to have a localised south eastern flow direction.
- 9.6.3 No visual or olfactory evidence were encountered during the sampling or monitoring of the groundwater.

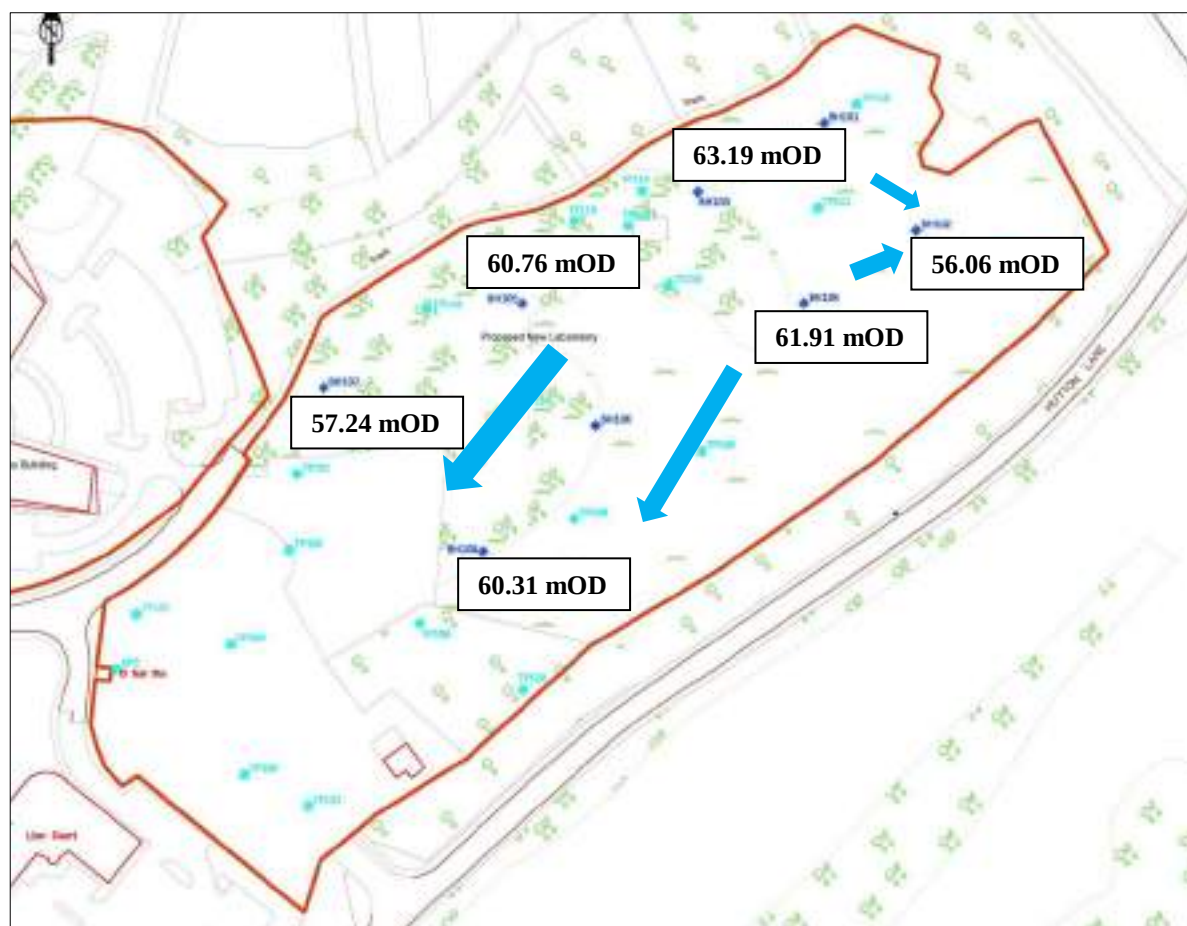


Figure 6: Groundwater Levels (approximate direction of flow in blue)

10. GENERIC QUANTITATIVE RISK ASSESSMENT

10.1 Introduction

10.1.1 The assessment of contamination has been carried out in accordance with the overall guidance presented in CLR11 Model Procedures for the Management of Land Contamination using the procedures as indicated in the following sections in accordance with current relevant guidance and legislation:

- **Human Health**

The overall methodology for assessing the risk to human health from potential contaminants in soil is presented in Appendix J in accordance with the guidelines as set out in the Environment Agency's guidance "Using Soil Guideline Values" SC050021/SGV Introduction, March 2009 and using the CLEA 1.06 model software. These have been used for a Tier 2 assessment of soil contamination for the protection of human health. The limited number of SGVs that have been published are for a soil organic matter of 6%. For this site the CLEA 1.06 software has been used to derive generic assessment criteria are for a soil organic matter of 1% in accordance with the following:

- Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil;

- Science Report SC050021/SR3: Updated technical background to the CLEA model;
- Science Report SC050021/SR4: CLEA Software (Version) Handbook;
- Toxicological reports and SGV technical notes;
- Toxicological data published by LQM/CIEH (2009) and CL:AIRE/EIC/AGS (2009).

In March 2014 six ‘proposed’ Category 4 Screening Levels (pC4SL) were issued by Defra. These screening values are considered to be within Category 4 as defined in the Contaminated Land Statutory Guidance. The pC4SL represent safe levels for new developments passing through the planning system. The SGV for lead has been withdrawn, and the pC4SL for lead has been derived using current best practice.

- **Controlled Waters**

The risk posed to controlled waters from total soil concentrations cannot be directly assessed. The risk is assessed either by comparison of results of leachate tests carried out on soil samples, or from the direct testing of samples of groundwater to screening criteria. Leachate testing generally forms a conservative assessment and is not appropriate for organic contaminants. Further details of the Tier 1 methodology is presented in Appendix L. There is a hierarchy of screening criteria which is as follows:

- Updated Recommendations on Environmental Technical Standards, River Basin Management (2015-21), April 2012 by the UK Technical Advisory Group on the Water Framework Directive;
- Environmental Quality Standards (EQS) for freshwaters;
- Surface Waters (Abstraction for Drinking Water)(Classification) Regulations (1996)
- Surface Waters (Fishlife) (Classification) Regulations (1997)
- UK Drinking Water Standards (DWS) (Water Supply (Water Quality) Regulations 2000);
- World Health Organisation Guidelines for Drinking Water (2004)

- **Phytotoxic Risks**

Generic assessment of phytotoxicity is by comparison with guideline values presented in the MAFF document “Code of Good agricultural practice for the protection of soil”, October 1998. This is in accordance with CLR’s reference to DEFRA notice CLAN 4/04.

- **Chemical attack on buildings**

Generic assessment of the chemical attack on building materials has been assessed using guidance presented in the BRE Special Digest 1: “Concrete in aggressive ground” 2005.

- **Tier 2 Ground Gas Assessment**

Concentrations and flow rates of ground gases (and vapours) have been assessed in accordance with the guidance given in CIRIA C665 “Assessing risks posed by hazardous gases to buildings” and BS:8485:2007 “Code of practice for the characterization and remediation from ground gas in affected developments”. The assessment follows the BS8485:2007 gas characterisation system and the NHBC traffic light system in CIRIA C665. Other gases may need to be assessed on a site specific basis (e.g. hydrogen sulphide, carbon monoxide). The risk due to radon has already been assessed and this assessment indicates that no special precautions are required due to the potential risk from radon.

10.2 Assessment for the Protection of Human Health

10.2.1 The Generic Qualitative Risk Assessment (GQRA) based on a soil with a Soil Organic Matter of 1% was carried in accordance with the methodology for assessing soil samples set out in Appendix H based on a commercial end use. A full summary of the chemical test results is presented in Appendix J. There were no exceedance of applicable Generic Assessment Criteria (GAC) or pC4SL/S4UL threshold concentrations of any of the chemical contaminants analysed and therefore there is no risk to health and no remediation is required.

10.2.2 Whilst there is no risk to human health there are low concentrations of both PAH's and TPH's found within both Made Ground the expected extent of which is shown in Figure 6 below and natural deposits. As the contaminants were also located in natural deposits in addition to no sources of either contaminant being identified on site during the investigation it is thought that these are the natural background levels for the local region from geological processes.

Asbestos

10.2.3 Asbestos can be present in soil as fragments of bulk Asbestos Containing Materials (ACMs) (e.g. asbestos cement sheeting) and also as discrete asbestos fibres within the soil matrix. This investigation has carried out assessments to determine whether both bulk fragments of asbestos and discrete fibres are present in the soil at the site. The asbestos assessment commenced on site with inspection of the Made Ground by our site staff for the presence of bulk ACMs. During the fieldwork no suspected ACMs were identified.

10.2.4 Two different types of laboratory assessments were carried out in order to confirm the site assessment that ACMs were absent:

- Fifteen samples underwent laboratory assessment to determine whether asbestos fibres or ACMs are present, one of which was found to have asbestos fibres (note that the laboratory detection limit for these samples is 0.001%).
- Where asbestos was found to be present in a sample then a second stage of assessment was carried out to determine full asbestos quantification and composition analysis.

-
- An aerial photograph of the University of Illinois at Chicago campus. A large, irregularly shaped area in the lower-left portion of the image is shaded in brown and outlined with a thick orange border. A red arrow points from a text box to this shaded area. The text box contains the text "Area where Made Ground to be Expected". The map shows various campus features including buildings, parking lots, roads, and green spaces. Labels like "Lien Court" and "Library Building" are visible. Numerous small blue and green markers with alphanumeric codes are scattered across the map.

10.2.7 Where Made Ground is present it is likely that there will be a variable asbestos content and it could be present at higher concentrations than measured in this investigation and ACMs could also be present.

10.2.8 The presence of asbestos does not signify that any remediation is required for a commercial development. This is because the surface hard standing will seal the asbestos into the ground breaking any pathway to receptors although soft landscaping has to be considered. However, it does highlight there is an elevated risk which could be present to

construction staff from localised “hotspots” of asbestos during the groundworks phase of the project. This is discussed in more detail in Section 13 and Appendix P.

10.3 Assessment for the Protection of Controlled Waters

- 10.3.1 The risks to controlled waters (groundwater and surface waters) have been assessed by carrying out a Tier 1 assessment in accordance with the EA Remedial Targets Methodology. A summary of the groundwater test data is presented in Appendix M. As for the soil test results, the analysis of the water samples indicate the presence of PAHs and TPHs but these are at relatively low concentrations. Six of the individual PAH's with either a EQS for freshwater or a Drinking Water Standard (DWS) exceed the standard within BH102 and BH108. TPH concentrations exceed the DWS in all of the locations.
- 10.3.2 The elevated PAHs and TPHs are found in wells where there is no Made Ground. The direction of groundwater flow is from the northeast towards the southwest (i.e. towards the Made Ground direction) so the on-site Made Ground cannot be the source of the low concentrations of PAHs or TPH. Therefore it is assessed that the source of the PAHs and TPH is either from an off-site source or from natural sources (breakdown of organic material and coal in the bedrock can release low concentrations of PAHs and TPH).
- 10.3.3 Whilst there are exceedances of PAHs and TPH within the groundwater there are no surface water features or abstraction wells within 500 m of the site apart from the balancing pond for drainage located 60 m west. As there are no controlled waters within the vicinity of the site, the source appears to be off-site or natural background and there is no direct pathway to either human or environmental receptors, there is no risk to the receptors and therefore no remediation required.

10.4 Phytotoxic Risks

- 10.4.1 The concentrations of the phytotoxic metals copper, chromium, nickel and zinc have the potential to be harmful to plants. However, all the measured concentrations of these metals are generally lower than the guideline values for the protection of plants as presented in the MAFF document “Code of Good agricultural practice for the protection of soil”. Therefore there is no general risk to plants at the site due to phytotoxicity should any be planted in the ground as part of the proposed development. There were five localised exceedances of the phytotoxic trigger concentrations out of the fifty seven samples tested for metals, four of these were for copper and a single zinc concentration exceeded the phytotoxic trigger concentrations. Based on these limited exceedances and the low mean concentrations of copper and zinc no mitigation measures are recommended due to phytotoxicity.

10.5 Chemical Attack on Structures and Materials

- 10.5.1 Below ground concrete structures are potentially at risk in areas of elevated sulphates and where there is low pH. An assessment of the soil and groundwater data (following the protocol established in BRE Special Digest 1, 2005) indicates that in general ACEC Class

AC-1s conditions prevail. However, there are localised areas within the site where there are elevated concentrations of sulphate. These include:

- One soluble sulphate concentration of 1,400 mg/l in FWS BH19D which also had a much higher pH 9.6 than elsewhere. This sample was from a depth of 0.2 to 0.4 m and this material could therefore readily be removed from site.
- Very high sulphate content of 6,400 mg/l in the groundwater in BH104. At this location the bedrock is at a shallow depth of 0.30 m below ground level and the groundwater is at a depth of 1.7 to 2.0 m. Therefore the groundwater is at a lower elevation than any foundations so this sulphate concentration is not of concern.

10.5.2 Therefore no special precautions are required at the site for the design of below ground concrete in terms of the durability and structural performance.

10.5.3 Plastic pipe materials are also potentially vulnerable to attack from elevated levels of hydrocarbons, which can potentially lead to contamination of potable water supplies and water supply companies also require the risk to their workers from other contaminants in the ground to be assessed. The water supply companies have their own screening criteria and these criteria are generally lower than the SGVs and GACs used in this report to assess the risk to residents/end users of the site. Based on the chemical test results, it is anticipated that no special precautions are required for the design and installation of water supply pipes due to hydrocarbons and other potential contaminants. However, any service trenches passing through the area where Made Ground is present (see Figure 7) should be backfilled with clean asbestos free materials rather than the Made Ground in order that if any subsequent maintenance is carried out on the serviced this will limit the exposure of utility workers to asbestos.

10.6 Ground Gases

Measured Gas Concentrations

10.6.1 Three rounds of gas monitoring carried were out by TerraConsult between the 6th and the 26th January 2015 of the six monitoring wells with atmospheric conditions varying from 993 to 1018 mbar during this period. One of the monitoring visits were carried out with atmospheric pressures less than 1000 mbar (pressures 993-994) with the other two sets of readings taken with air pressured greater than 1000 mbar. VOC, flow rates, methane and carbon dioxide concentrations, together with the oxygen levels from the monitoring visits are summarised in the table below:

Table 8: Summary of Ground Gas Monitoring

Borehole	Response Zone mbgl	Contamination evidence	No. of monitoring occasions	Steady State Flow (l/hr)	Methane (%v/v)	Carbon Dioxide (%v/v)	Oxygen (% v/v)	Carbon Monoxide (ppm)	Hydrogen sulphide (ppm)	Water Level mOD	Atmospheric pressure readings mb
BH102	2.00- 7.97	No	3	13.1- <0.1	<0.1	0.6- 1.2	9.6-16.9	<1	<1	55.95- 56-12	994- 1018
BH103	1.50- 2.99	No	3	<0.1	<0.1	2.3- 4.3	15.2- 18.4	<1	<1	63.10- 63.30	994- 1018
BH104	1.00- 2.30	No	3	<0.1	<0.1	1.0- 2.4	17.6- 19.2	<1	<1	61.70- 62.05	994- 1018
BH105	1.00- 3.10	No	3	<0.1	<0.1	1.7- 3.1	15.1- 20.1	<1	<1	60.73- 60.80	993- 1018
BH107	2.00- 6.06	No	3	<0.1	<0.1	0.4- 2.1	18.4- 19.7	<1	<1	57.10- 57.34	994- 1018
BH108	1.00- 3.27	No	3	<0.1	<0.1	0.2- 2.8	16.0- 20.2	<1	<1	60.17- 60.40	994- 1018

Ground Gas Assessment

- 10.6.2 Background information relating to the origin and production of landfill and ground gases are presented in Appendix N, together with current guidance on the assessment of ground gases. In accordance with this approach and the above measured ground gas levels, it is considered that the worst case temporal conditions may not have been measured during the monitoring period. However, as gas concentrations were measured at atmospheric pressures of 993-994 mbar, it is anticipated that the worst case temporal conditions will not be significantly worse than those presented in Table 8. The gas flow rates measured across the whole of the site with the exception of BH102 at all of the monitoring visits were less than the instrument detection limit of 0.1 l/hr. From Table 8.5 of CIRIA C665 the worst case Characteristic Situation for the borehole locations on site are as follows:

Table 9: Characteristic Gas Situations

Borehole Number	Steady State Flow	CH ₄			CO ₂		
	l/h	% v/v	GSV (l/hr)	Characteristic Situation	% v/v	GSV (l/hr)	Characteristic Situation
BH102	13.1	0.1	0.0131	1	1.2	0.157	2
BH103	0.1	0.1	0.0001	1	4.3	0.0043	1
BH104	0.1	0.1	0.0001	1	2.4	0.0024	1
BH105	0.1	0.1	0.0001	1	3.1	0.0031	1
BH107	0.1	0.1	0.0001	1	2.1	0.0021	1
BH108	0.1	0.1	0.0001	1	2.8	0.0028	1

- 10.6.3 Based on the Ground Gas Assessment it can be seen that the carbon dioxide conditions at the site are the main risk driver regarding the gas conditions. For the entire site is characterised as Characteristic Situation 2. In accordance with Table 2 of BS8485:2007 for a commercial building two points of protection is required to meet Characteristic Situation 2 ground gas conditions. This can be provided through:

- The proposed buildings will all have reinforced concrete ground bearing foundation slabs with limited service penetrations that are cast into slab – this provides 1.5 points of protection;
- Include taped and sealed membranes providing 0.5 points of protection.

10.7 Summary of Contaminant Linkage Assessment

- 10.7.1 The results of the risk assessments indicate that there is no significant source of contaminants (other than asbestos) present at the site so apart from the asbestos there is a negligible risk to humans, ecology or archaeological receptors.
- 10.7.2 Asbestos was recorded as fibres in a single sample at a percentage of 0.003%. The asbestos will only be present in any demolition material present in the Made Ground in the southwest of the site below an area of car park. The presence of asbestos does not signify that any remediation is required for a commercial development. This is because the surface hard standing will seal the asbestos into the ground breaking any pathway to receptors although soft landscaping has to be considered. However, it does highlight there is an elevated risk which could be present to construction staff from localised “hotspots” of asbestos during the groundworks phase of the project. This is discussed in more detail in Section 13 and Appendix P.
- 10.7.3 Due to localised elevated risk from carbon dioxide it is recommended the buildings are designed to meet the requirements of Characteristic Situation 2 conditions but no specific precautions are required with respect to radon or hydrocarbons for the development.
- 10.7.4 All below ground concrete should be designed to meet the requirements of ACEC Class AC-1.
- 10.7.5 Whilst there are exceedances of screening criteria for PAHs and TPH within the groundwater, there are no controlled waters within the vicinity of the site, the source is either off-site or due to natural background and there is no direct pathway to either human or controlled waters so there is no risk in relation to the proposed development.

11. WASTE ASSESSMENT

- 11.1 The results of the total concentrations from the chemical testing on soil samples have been assessed to determine their potential waste classifications in accordance with the methodology outlined in Appendix O. The samples were first assessed to determine whether they are non-hazardous or are hazardous in terms of waste classification. The results of this assessment indicate none of the materials encountered during the investigation can be classified as hazardous.

Made Ground

- 11.2 In order to determine whether soils can be sent to a licensed landfill for disposal further testing is required comprising landfill Waste Acceptance Criteria (WAC) analysis for both total concentrations for certain chemicals and for leachate analysis. Two samples were selected for WAC tests. Both of the results for the solid waste parameters complied with the Inert WAC limit indicating that the Made Ground at the site are suitable to be

sent to a landfill with a permit to accept inert waste. Alternatively the Made Ground could be sent off site to a development or quarry with a suitable Environmental Permit for site restoration.

- 11.3 It should be noted that whilst asbestos was encountered in one sample it was only present in the sample at a maximum concentration of 0.003%, this is lower than the threshold of 0.1% for hazardous waste. However, if during excavation works any ACMs are encountered, then these must be segregated from the remaining materials. The fragments require separate assessment. If the fragments contain 0.1 % or greater of asbestos then the materials will be classified as hazardous. Note that WM2 V3.1 (EA, 2013) states that if:

“the waste contains, in addition to any dispersed fibres, any asbestos in identifiable pieces they must be assessed as set out below. This would also apply to any dispersed fibres produced by deliberately breaking up such identifiable pieces.

Where the waste contains identifiable pieces of asbestos (i.e. any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye), then the asbestos must be assessed separately. The waste is hazardous if the concentration of asbestos in the pieces alone is 0.1%.”

- 11.4 Further correspondence with the Environment Agency has indicated that if soils contain fragments of ACMs greater than approximately 15 mm, then these soils will be classified as hazardous waste, even if the laboratory analysis of the matrix materials shows a concentration of less than 0.1 %.

Glacial Till and Bedrock

- 11.5 Note that the Glacial Till and any bedrock to be disposed of off-site is all classified as Inert Waste and can be sent to a landfill licensed to accept inert waste or to another development site using a CL:AIRE Materials Management Plan or to a site with a suitable Environmental Permit.

12. GEOTECHNICAL ASSESSMENT & RECOMMENDATIONS

12.1 Fieldwork and Laboratory Data Review

- 12.1.1 The fieldwork has shown a surface topsoil layer ranging between 0.1m and 0.5m and consisting of Dark brown slightly sandy slightly gravelly CLAY or Brown clayey slightly gravelly fine to coarse SAND with frequent rootlets.
- 12.1.2 Made Ground was present in TP101-105 and HP1. TP101-105 are located at the western end of the site within the area currently used as a car park. The Made Ground ranges in thickness from 0.45 to 1.9m.
- 12.1.3 BH02 and TP112 encountered Glacial Till comprised Firm and stiff brown slightly sandy slightly gravelly clay. Both exploratory holes are located at the NE corner of the site.

- 12.1.4 Rock head was encountered at between 0.30m and 2.35m however is generally between 0.6m and 1.0m.
- 12.1.5 Predominantly the bedrock has encountered interbedded units of sandstone and siltstone with the occasional unit of mudstone. The top 0.5m to 1.0m of bedrock is completely weathered. The general descriptions of the rock types encountered are given below.
- SANDSTONE - Very weak occasional extremely weak light brownish grey finely laminated fine grained Sandstone. Joints are horizontal to 10 degrees, extremely closely spaced, planar and smooth.
 - SILTSTONE - Extremely weak to very weak and locally weak brownish grey mottled dark greyish brown Siltstone. Joints are horizontal and vertical, extremely closely to very closely spaced, planar and rough.
 - MUDSTONE - Extremely weak dark grey thinly bedded Mudstone. Joints are horizontal to vertical, extremely closely spaced, planar and smooth.
- 12.1.6 The initial development included three additional buildings within the north-eastern part of the site. The fieldwork was designed on the basis of the proposed building layout. The development proposal changed during the investigation. It is understood that the three buildings in the NE will not be included within this phase of development.
- 12.1.7 The proposed buildings for this phase of development are located within the centre of the site. The Buildings are generally covered by BH105-BH108 and TP106-110, TP115, 116 and TP120. These boreholes indicate very thin drift deposits with the weathered rockhead encountered between 0.40m and 1.3m. Boreholes by FWS also indicate that the depth to bedrock is between 0.5 and 1.0m.
- 12.1.8 TP101 encountered deep Made Ground terminating at 1.9m without proving the base. The trial pit is located close to the NW corner of the proposed development and the ground conditions should be confirmed.
- 12.1.9 During the two phases of investigations a number of geotechnical testing has been carried out and the results are summarised in the following section.
- 12.1.10 Nine Particle Size Distribution tests were carried out within both phases of investigation on the granular deposits / reworked weathered bedrock.

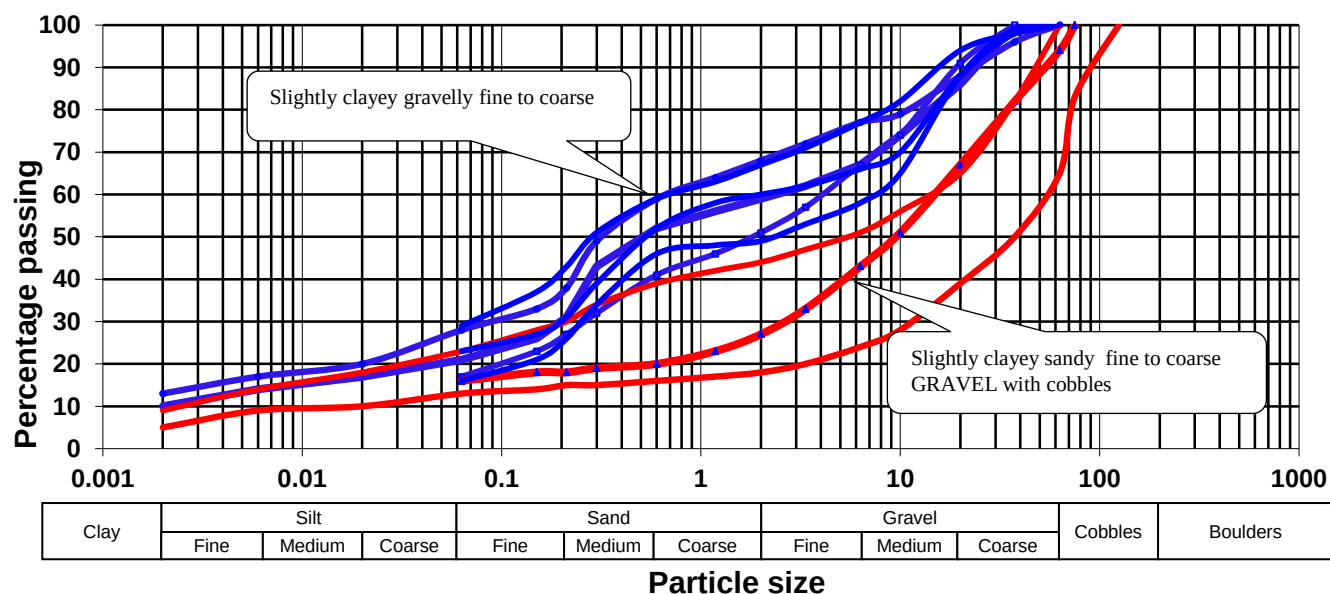


Figure 8: Summary of Particle Size Test Results

12.1.11 The fieldwork has shown that glacial clay are limited to the perimeter of the site and mostly along the south-eastern boundary. If further developments are proposed in these areas then the depth of desiccation and the volume change potential of the clays will have to be considered in the design.

Table 10: Summary of Geotechnical Laboratory Classification Testing									
Hole	Depth (m)	Moisture Content (%)	% passing 425um sieve	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Modified Plasticity Index	Plasticity	Volume Change Potential
TP112	0.50	26	100	48	24	24	24.0	Intermediate CI	Medium
TP12	0.60	22							
TP16	0.70	12							
TP19	0.60	16							
TP22	0.90	20	84	40	20	20	16.8	Intermediate CI	Medium
TP25	0.60	13							
TP27	0.90	19	100	36	19	17	17.0	Intermediate CI	Medium
TP28	0.65	21	100	36	20	16	16.0	Intermediate CI	Medium
TP29	0.90	22	93	37	21	16	14.9	Intermediate CI	Medium
Minimum		12	84	36	19	16	14.9	Intermediate CI	Medium
Average		19.0	95	39.4	20.8	18.6	17.7	Intermediate CI	Medium
Maximum		26	100	48	24	24	24.0	Intermediate CI	Medium

12.1.12 Moisture contents are typical of glacial clay and are close to or slightly higher than the plastic limit still indicating desiccation. The plasticity results indicate medium volume change potential.

12.1.13 A summary of the moisture contents and densities for the rock testing is given in the table below.

Table 11: Summary of Rock Index Testing				
		Siltstone	Sandstone	Mudstone
Moisture Content (%)	Min	4.1	3.9	5.1
	Mean	4.7	5.0	5.9
	Max	7.1	7.9	6.7
Bulk Density (Mg/m ³)	Min	2.17	2.13 *	2.10
	Mean	2.27	2.24 *	2.20
	Max	2.39	2.54	2.40
Dry Density (Mg/m ³)	Min	2.08	2.00 *	1.97
	Mean	2.16	2.13 *	2.08
	Max	2.30	2.39	2.28
* Ignoring outlier of one Density 1.73 Mg/m ³ and Dry Density of 1.64 Mg/m ³				

12.1.14 A summary of the rock strength testing is given in the table below. There were 27 pairs of axial and diametrical point loads tests carried out (54 in total).

Table 12: Summary of Point Load Testing – Axial Tests Only				
Summary of Axial Tests		Siltstone	Sandstone	Mudstone
Point Load Index I _{s(50)} MN/m ²	Min	0.82	0.82	0.64
	Mean	1.53	1.84	1.66
	Max	3.02	2.92	2.92
Approx. Compressive Strength (correction factor of 20)	Min	16.3	16.3	12.7
	Mean	31	37	33
	Max	60	58	58
EN ISO 14689-1 Term	Min	Weak	Weak	Weak
	Mean	Medium Strong	Medium Strong	Medium Strong
	Max	Strong	Strong	Strong

Table 13: Summary of Point Load Testing – Comparison Axial:Diametrical

Summary through Orientation		Diametrical	Axial
I _{s(50)} MN/m ² for Diametrical/Axial	Min	0.02	0.64
	Mean	0.63	1.66
	Max	1.64	3.02
Approx. Compressive Strength (correction factor of 20)	Min	0.35	12.7
	Mean	13	33
	Max	33	60

- 12.1.15 The results of the moisture content, density and point load testing have shown very similar results for each rock type and there is no significant increase in strength with depth which can be seen in Figure 9. Having a relatively wide range of strengths in Coal Measures bedrock is relatively common and is not unusual.
- 12.1.16 There is a notable difference between the axial and diametrical results, showing a significant increase in strength in the axial orientation. This indicates that the rock will be relatively easy to excavate with hydraulic excavators because it can be readily be broke on the horizontal or sub-horizontal bedding planes.
- 12.1.17 It should be noted that there are no test results for the rock above a depth of 2.50 m below ground level. This is due to this rock being too highly fractured to have large enough samples to test.

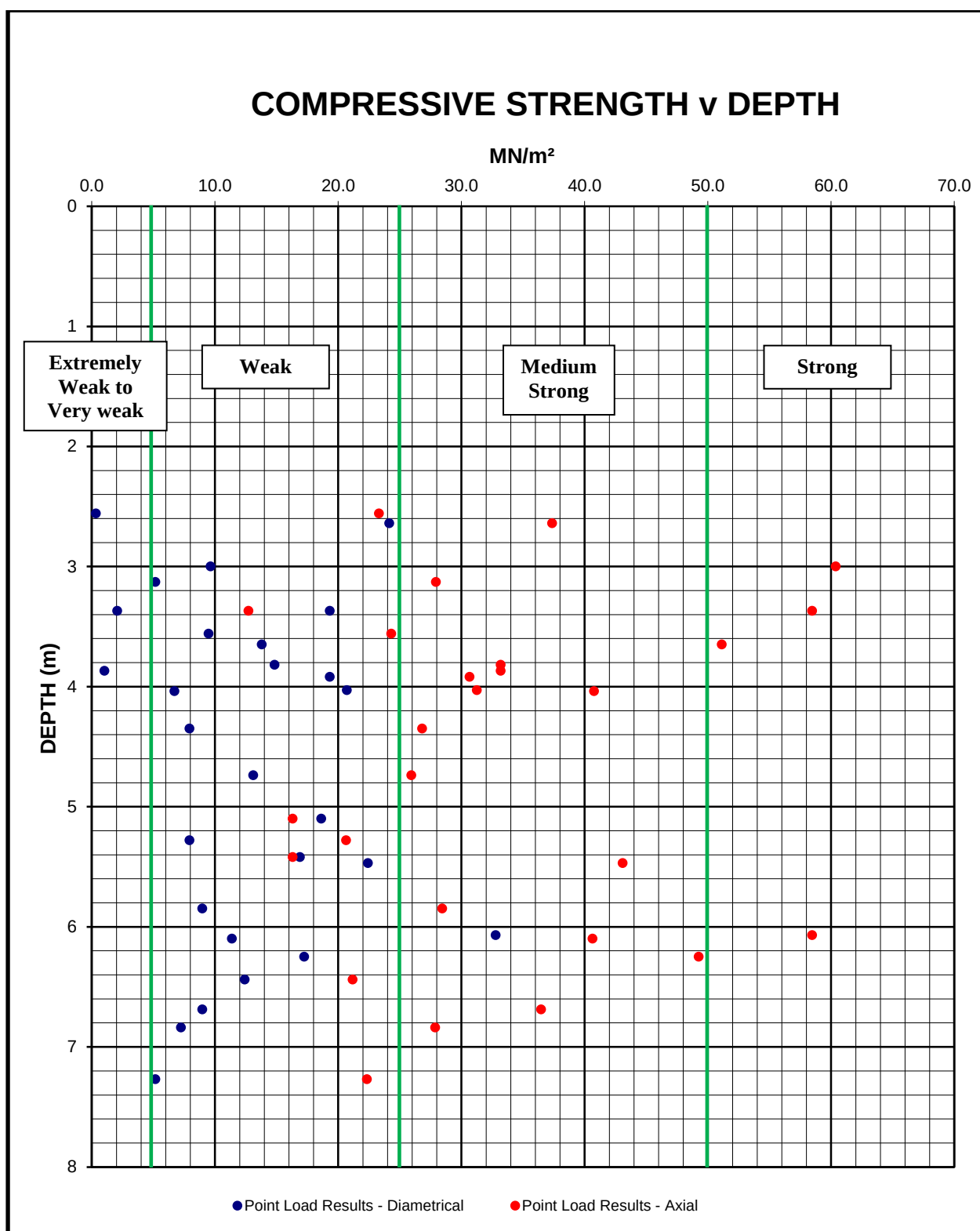


Figure 9: Summary of Point Load Test Results Against Depth Below Ground Level

12.2 Foundation Recommendations

12.2.1 In the vicinity of the proposed buildings the depth to rockhead is generally in the region of 0.4 to 0.8m. However the depth is locally higher in the north east (TP119) and in the west (TP101). This is indicated in Figure 10 below.



Figure 10: Depth to Rockhead in Vicinity of Buildings

- 12.2.2 In the FWS report there are seven boreholes within or close to the footprint of the main proposed building. The depth to rockhead varied from 0.5 to 1.0m.
- 12.2.3 Given the ground conditions it is anticipated that spread footings could be adopted for the foundations at this site. In order to limit the potential for differential settlement it is recommended that for preliminary design purposes that a net allowable bearing capacity should be limited to 700 kPa. If higher bearing capacities are required then some plate bearing tests should be carried out to confirm the stiffness of the ground. This may indicate that a bearing pressure in excess of 1,000 kPa may be possible at this site.
- 12.2.4 It should be noted that when the foundation bases are excavated it is anticipated that the excavator bucket will loosen the upper layer of bedrock. Therefore after excavation it is important that the formation is suitably re-compacted prior to blinding with concrete.

12.3 Ground Floor Slab Recommendations

- 12.3.1 It is recommended that ground bearing floor slabs are adopted with the formation in the bedrock. This will be able to take relatively high floor loadings.

12.4 Groundwater & Excavations

- 12.4.1 It is not expected that groundwater will be encountered in any excavations at this site unless relatively deep service trenches or manholes are required. It is anticipated that any groundwater in excavations can be controlled by sump pumping but relatively high inflow rates could occur in the bedrock.
- 12.4.2 In general excavations through soils will only be to a shallow depth of less than 1.0m and these should be stable in the short term (up to 8 hours). Within the bedrock near vertical to 75 degree slope faces should stand for a couple of days but any faces will need to be scaled off to remove loose bedrock. There will be some over break in excavations in the bedrock. Where excavations in rock are left open for longer period there is a risk of localised wedge and block failure. Inspection of the faces will be required to ensure that they are safe and stable.
- 12.4.3 All excavations should be carried out in accordance with CIRIA Report 97 “Trenching Practice” and BS6031: 2009: Code of Practice for Earthworks. Further guidance on this aspect of site works is given in the British Standards for “Workmanship on Building Sites”, BS 8000, Parts 1 and 14, and in the Construction Industry Training Board’s Site Safety Note 10.
- 12.4.4 Excavation depths should generally be readily achieved using conventional hydraulic plant (tracked 360° or similar) with the rock at shallow depth (<2.5m below ground level) excavating relatively easily due to the relatively close fracturing and the low horizontal strength of the rock.

12.5 Buried Concrete and Pipework

- 12.5.1 The results of laboratory pH and sulphate content indicate that ACEC Class AC-1s conditions prevail in accordance with BRE Special Digest 1, 2005 (the Design Concrete Class). Therefore no special precautions are required at the site for the design of concrete in terms of the durability and structural performance. For a more detailed discussion of the analysis for pH and sulphate please see Section 10.5.

12.6 Soakaways

- 12.6.1 The soakaway test results are summarised in Table 14. The results indicate that the infiltration rate is very variable ranging from excellent conditions to being very poor. Having variable infiltration rates in rock is relatively common. Infiltration in rock is usually via open fractures. If fractures are open then there are high infiltration rates, where fractures are closed then there is a poor infiltration rate.

Table 14: Summary of Soakaway Test Results					
Location	Base Depth (m)	Infiltration Rate (m³/m²/s)	Infiltration Rate (m³/m²/hr)	Percolation value (s/mm)	Rock Type
TP105	1.75	6.85E-04	2.46	1	Siltstone
TP112	2.00	Test not valid, water level rose during test, below the water table			Siltstone
TP114	1.60	Test not valid, very poor infiltration rate. Water only fell by 70 mm in 30 mins so test terminated			Siltstone
TP114A	1.50	5.44E-05	0.196	9	Siltstone
TP118	1.40	Test not valid, very poor infiltration rate. Water only fell by 10 mm in 1 hour so test terminated			Siltstone

- 12.6.2 It is assumed that stormwater drainage for the site will be designed in accordance with EA requirements, CIRIA Report C697 'The SUDS Manual' (2007) and other appropriate guidance.

12.7 Road Design

- 12.7.1 The results of twelve in situ CBR tests carried out on the soils immediately below the topsoil varied from 0.5% to 4.5%. The measured CBR values are relatively variable across the site with different strata. In TP103 the CBR test was carried out in the Made Ground immediately below the current gravelled surface at this location indicating that the Made Ground was relatively well compacted in this area. With the range of CBR in the natural soils varying from 0.5% to 4.5% it has to be taken into account that the overall performance of any hard standing will be determined by the weaker areas. Therefore based upon the nature of the ground conditions encountered during the site investigations undertaken, it is recommended that a CBR value of 2% is adopted for design purposes but all softened or weakened soil shall be removed from the formation to ensure that this CBR value is achieved.
- 12.7.2 If improvement measures such as lime or cement stabilisation were adopted then considerably higher CBR values would be appropriate and this sub-grade improvement may prove to be more economic than using thicker sub-base materials as there will be less excavated material and a thinner sub-base. The design of soil stabilisation should take into account the presence of sulphates at the site. All exposed formations should be proof rolled and any soft spots revealed should be excavated and replaced with suitable compacted granular fill. .
- 12.7.3 If after the site preparatory earthworks have been completed there is weathered bedrock at the formation level then a CBR value of more than 50% should be achieved.
- 12.7.4 Proposals are subject to the review of the council's Highways Department. However, we would recommend that all sub-grade materials are in situ CBR tested at proposed road formation level prior to final pavement design.

13. REMEDIATION STRATEGY

13.1 Summary of Contamination

13.1.1 The results of the risk assessments indicate that there is no significant source of contaminants (other than asbestos) present at the site so apart from the asbestos there is a negligible risk to humans, controlled waters, ecology or archaeological receptors.

13.1.2 It should be noted that:

- Asbestos has been found in one sample of Made Ground and was in the form of Chrysotile fibres;
- The maximum concentration is only 0.003%.
- However, it is likely that asbestos fibres or Asbestos Containing Materials (ACMs) will be locally present in the Made Ground at significantly higher concentrations than this.

13.1.3 The proposed development is for commercial use and a car park is present in the area where the Made Ground is present so the underlying soils will not be accessible to the end users of the site. Therefore the risk from asbestos post completion of construction is considered to be very low and no mitigation or remedial measures will be required to control the long term risks. However, appropriate control or remedial measures will be required during the construction works due to the presence of asbestos.

13.1.4 In addition to the above it is recommended that all areas of soft landscaping in the area where Made Ground is present should have the Made Ground removed to a depth of 0.75 m below the proposed ground level and replaced with 'clean' topsoil from elsewhere from the site. This will prevent there being a long term risk to landscape gardeners at the site working in the topsoil as they will not encounter the Made Ground.

13.2 Risks to Human Health (Construction Phase)

13.2.1 During the construction works there will be a risk from dust to on site workers and people occupying adjacent properties when groundworks are carried out in the Made Ground. Appropriate risk assessments should be carried out by the contractor to ensure controls for the mitigation of risk to health of construction workers and people in surrounding areas to be put in place. This risk can be controlled to within acceptable limits by:

- control of dust generation;
- workers wear suitable Personal Protective Equipment (PPE);
- having adequate site hygiene facilities allowing staff to keep a good level of personal hygiene;
- all groundworkers should have been trained in asbestos awareness and should keep a look out for this being encountered during excavations. The earthworks

contractor should have a contingency plan in place before any works commence in case the presence of asbestos is suspected in groundworks;

- only permitting smoking or eating on site in appropriate pre-designated areas;
- implementing the appropriate control measures presented in Appendix P relating to the presence of asbestos in accordance with The Control of Asbestos Regulations, 2012 and HSE ACoP (2013).

13.3 Re-use of Made Ground and Importation of Fill

13.3.1 The type of fill materials to be imported on site will depend upon local availability and costs. The simplest proposal would be to import appropriate quarried materials or recycled materials produced under a WRAP protocol. These do not require any significant environmental controls but may be the most costly.

13.3.2 Any soils re-used on site, or if soils are to be imported from other development sites to be used as fill these would require to be imported and placed in accordance with either of the following two regulatory regimes:

- the procedures are followed in the recently introduced CL:AIRE Code of Practice 'The Definition Of Waste: Development Industry Code of Practice Version 2 (2011).' If these procedures are followed, excavated arisings from other sites can be re-used on this site if the soil is natural uncontaminated soil; or Made Ground can be imported and reused if it has been treated to a required specification under an Environmental Permit. Note, untreated Made Ground cannot be imported in accordance with the CL:AIRE Code of Practice; or
- if less than 1000 T of soils/fill is to be imported then apply for an Exemption to the Environmental Permitting Regulations; or
- the site develops a Waste Recovery Plan and applies for a corresponding Environmental Permit (either a standard rules permit or a bespoke permit) from the Environment Agency under the Environmental Permitting Regulations 2007.

13.3.3 The length of time taken for the above three regimes also need to be considered:

- CL:AIRE Code of Practice takes 7 to 14 days to gain approval
- An Exemption to the Environmental Permitting Regulations has no approval period from the submission; or
- Allow 10 to 12 weeks to develop a Waste Recovery Plan and gain approval for the Environmental Permit from the Environment Agency.

13.3.4 It is recommended that the CL:AIRE Code of Practice is implemented for this project to enable re-use of soils and bedrock in the required cut-fill earthworks.

13.4 Watching Brief For Previously Unidentified Contamination

General

- 13.4.1 Whilst contamination outside the asbestos in the Made Ground indicated earlier is not anticipated, the proposed construction could encounter previously unrecorded hotspots of contaminants or other features such as pipework carrying oil residues. These will be assessed and mitigated in accordance with current good practice.
- 13.4.2 A ‘watching brief’ is to be maintained by the Principal Contractor during all earthworks at the site. This will enable any previously unidentified contamination on the site to be dealt with in an appropriate manner. The Principal Contractor’s Site Manager will be responsible for keeping this watching brief during earthworks. The Site Manager will have appropriate experience of earthworks including on brownfield sites and will have received appropriate training regarding asbestos. All groundworks personnel will have appropriate training regarding asbestos and will have been given a tool box talk on unidentified contamination at the site. The groundworks personnel will be involved with the watching brief and will advise the Site Manager as soon as they encounter suspect unidentified contamination.
- 13.4.3 During the earthworks part of the contract, the Principal Contractor will keep a daily diary of operations which will include a record of visual assessment of contamination and earthworks, photographic record and any necessary validation testing. All of this information will be incorporated into the Verification Report (see Section 13.6) for the relevant part of the work.

General Unexpected Contamination

- 13.4.4 There is the potential for areas of previously unexpected contamination to be present, as is the case with any “brownfield” site. If unexpected contamination is found the following procedures should be adhered to:
1. All site works at the position of the suspected contamination will cease.
 2. Visual and olfactory observations of the condition of the ground and the extent of contamination will be made and notification shall be made by the Principal Contractor to Mouchel, and the LCC EHO not later than one working day of discovery. Should the contamination be likely to affect controlled waters the Environment Agency shall also be informed.
 3. The suspected contaminated material will be investigated and tested appropriately in accordance assessed risks. The investigation works will be carried out in the presence of a suitably qualified environmental specialist. The investigation works shall commence to recover samples for laboratory testing and, using visual and olfactory observations of the condition of the ground, delineate the area over which contaminated materials are present.
 4. The unexpected contaminated material will either be left in situ or be stockpiled whilst testing is carried out and suitable assessments completed to determine whether the material can be re-used on site or requires to be disposed as appropriate.
 5. Where the material is left in situ awaiting results it will be reburied or covered with plastic sheeting.

6. Where the potentially contaminated material is to be temporarily stockpiled it will be placed on 2000 gauge Visqueen sheeting (or other impermeable surface) and covered to prevent dust and odour emissions.
7. Any areas where unexpected visual or olfactory ground contamination is will be surveyed, a photographic record kept and testing results incorporated into the Verification Report.
5. A photographic recorded will be made of relevant observations.
6. The testing suite will be determined by the independent geo-environmental specialist on the basis of visual and olfactory observations.
7. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
8. The results of the investigation and testing of any suspect unexpected contamination will be used to determine the relevant actions. After consultation with the Local Authority and if necessary the Environment Agency, materials should either be:
 - re-used in areas where test results indicate that it meets compliance targets so it can be reused without treatment; or
 - treatment of material on site to meet compliance targets so it can be reused; or
 - removal from site to a treatment centre or to a suitably licensed landfill or permitted treatment facility.
9. A Verification Report will be produced for the work.

Unexpected Tanks

13.4.5 No buried underground fuel storage tanks have been encountered during the site investigation works; however, there remains a low risk that tanks are present on site. Should an underground tank be encountered, operations should cease in the area. Additionally there may be pipework associated with these tanks which could have oily residues. The following procedures are to be adhered to if tanks and pipework are identified:

1. All site works at the position of the tanks/pipework should stop.
2. A description of the tank should be made by the geo-environmental engineer including; condition and surround, along with visual and olfactory observations should any contents in the tank be apparent. A photographic recorded will also be made of relevant observations.
3. The tank's position and depth should be determined and marked on a plan of the site.
4. The independent geo-environmental engineer will inform Client and the Local Authority.
5. During the presence of the independent geo-environmental engineer, investigation works should be undertaken to obtain samples of any liquid or sludge contents and to establish dimensions of the tank.

6. Testing will be determined on the basis of visual and olfactory observations by independent geo-environmental engineer.
 7. Test results will be compared against current assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.
 8. Emptying the tank and disposal of contents to a suitable licenced disposal facility.
 9. Degassing and removal of the tank by a suitably qualified contractor will be required, and a Naked Flame Certificate should be provided.
 10. Once the tank has been emptied in accordance with the above proposals, it is to be removed for disposal to a licensed waste management facility. Copies of the relevant waste consignment notes are to be kept and included in the Verification Report.
 11. Excavation and remediation of any contaminated soils around the tank will be carried out.
 12. Samples of the base and sides of the resultant hole will be sampled and supervised by the independent geo-environmental engineer to confirm whether risks to human health or controlled waters.
- 13.4.6 All of the above information will be incorporated into the Verification Report and submitted to the regulatory parties, the Local Authority and the Environment Agency where groundwater may potentially have been impacted.

13.5 Regulatory Requirements

Remediation

- 13.5.1 The type of remediation lies outside of the EA environmental permitting regime. However, as indicated in Section 13.3, the reuse of soils will need to be undertaken in accordance with the procedures outlined earlier.
- 13.5.2 The Principal Contractor will be responsible to implement the procedures identified within Appendix P (requirements for remediation of soils suspected as containing asbestos) in addition to any prescribed by the regulator.

Health and Safety Requirements

- 13.5.3 The works are to be undertaken in compliance with all relevant regulations, guidance and legislation. Whilst not exhaustive, the following list of pertinent regulations, guidance and legislation is highlighted to the Contractor and will be complied with at all times:
- The Health and Safety at Work etc Act 1974;
 - 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); and
- The Control of Asbestos Regulations, 2012 and HSE ACoP (2013).

13.5.4 The Principal Contractor is responsible for obtaining any necessary approvals from regulatory bodies and third parties to fully implement the works.

Licences, Permits and Consents

13.5.5 It will be a requirement of the Principal Contractor to obtain any of the necessary permits and undertake the appropriate notifications and assessments. All statutory records to be kept in the site manager's office and these may include (not an exhaustive list):

- HSE Notification F10;
- Pre-Construction Information Pack;
- Construction Phase Plan (CPP);
- Method Statements and Risk Assessments;
- Construction Environmental Management Plan (CEMP) including the details of the re-use of materials;
- Competence records for site personnel;
- Services records;
- Plant and machinery maintenance records; and
- Duty of Care paperwork.

13.5.6 In addition if any asbestos is encountered, operations must be planned, managed and have appropriate training to satisfy the requirements of the Control of Asbestos Regulations 2012 and the following will be required:

- ASB>NNLW1 – Notification of non-licensed asbestos work if the work is deemed not be requiring a licence;
- Appropriate licence with regards to CAR 2012 if the work is deemed to require a licence;
- Method Statements and Risk Assessments;
- Background and on-going air monitoring to be undertaken to check for presence of asbestos fibres;
- Competence records (including asbestos awareness training and RPE face-fit test records);
- posting of appropriate warning signs; and
- provision of suitable PPE and decontamination units.

13.6 Verification Report

- 13.6.1 Verification of the earthworks will be required in accordance with the MMP and a verification report produced. The Verification Report will document the source of materials and where the materials are moved to. The Verification Report will document any changes that have been made and contingency arrangements implemented such as encountering unexpected contamination. The following items will be included in the Verification Report, although this is not an exhaustive list and constitutes the basic quality control procedures:
- (i) Description of the works;
 - (ii) Contractor's documentation (e.g. method statements, plant data sheets etc.);
 - (iii) Manufacturer's/supplier's product documentation (e.g. compliance certificates & delivery notes;
 - (iv) Contractor's daily progress records;
 - (v) Records of all imported topsoil, subsoil and soil conditioning material for the site complete with laboratory test certificates demonstrating that the material is suitable for use (if appropriate);
 - (vi) Verification Engineer's daily logs;
 - (vii) Photographic Records;
 - (viii) As-built Drawings as a minimum:
 - Surveys of the finished ground level of the construction platform;
 - Location and numbering system of samples taken for laboratory testing;
 - Appropriate site plans showing extent of any excavations and where site won soils have been placed;
 - (ix) Description of how the use of materials links with the Remediation Strategy or Design Statement;
 - (x) Reference to site investigation data and risk assessments;
 - (xi) Reference to the MMP and associated tracking system or Environmental Permit Exemption, including alterations made and why;
 - (xii) Record of quantity of materials used;
 - (xiii) Details of any unexpected contamination encountered and how it was dealt with;
 - (xiv) Copies of signed Declaration(s) by Qualified Person(s);
 - (xv) In order that regulatory compliance can be confirmed, a copy of all site licenses and consents shall be included.
- 13.6.2 The Verification Report should include information identified in Appendix P due to the presence of asbestos such as monitoring records.
- 13.6.3 On completion a copy of the Verification Report should be sent to the LCC EHO for their approval and have a copy available to be presented to the Environment Agency or CL:AIRE should this be required.

14. CONCLUSION

14.1 Environmental Risk Assessment

- 14.1.1 A preliminary risk assessment has been carried out based on the contaminant-pathway-receptor model as defined in Statutory Guidance to Part IIA of the Environment Protection Act, 1990, and in accordance with BS 10175: 2011 +A1 2013 “Investigation of Potentially Contaminated Sites – Code of Practice”. In order to make a more detailed assessment of the potential hazards, a Phase 2 intrusive investigation was carried out to develop a more comprehensive conceptual ground model of the site. This detailed the characteristic ground conditions and elements of the surrounding environment and has assisted with identifying the potential contaminants of contamination, the potential receptors of the contamination and the potential pathways between them.
- 14.1.2 The results of the risk assessments indicate that there is no significant source of contaminants (other than asbestos) present at the site so apart from the asbestos there is a negligible risk to humans, ecology or archaeological receptors.
- 14.1.3 The proposed development is for commercial use and a car park is present in the area where the Made Ground is present so the underlying soils will not be accessible to the end users of the site. Therefore the risk from asbestos post completion of construction is considered to be very low and no mitigation or remedial measures will be required to control the long term risks. However, appropriate control or remedial measures will be required during the construction works due to the presence of asbestos.
- 14.1.4 In addition to the above it is recommended that all areas of soft landscaping in the area where Made Ground is present should have the Made Ground removed to a depth of 0.75 m below the proposed ground level and replaced with ‘clean’ topsoil from elsewhere from the site. This will prevent there being a long term risk to landscape gardeners at the site working in the topsoil as they will not encounter the Made Ground.
- 14.1.5 Based on the chemical test results, it is anticipated that no special precautions are required for the design and installation of water supply pipes due to hydrocarbons and other potential contaminants. However, any service trenches passing through the area where Made Ground is present should be backfilled with clean asbestos free materials rather than the Made Ground in order that if any subsequent maintenance is carried out on the serviced this will limit the exposure of utility workers to asbestos.
- 14.1.6 Due to localised elevated risk from carbon dioxide it is recommended the buildings are designed to meet the requirements of Characteristic Situation 2 conditions but no specific precautions are required with respect to radon or hydrocarbons for the development. In accordance with Table 2 of BS8485:2007 for a commercial building two points of protection is required to meet Characteristic Situation 2 ground gas conditions. This can be provided through:
- The proposed buildings will all have reinforced concrete ground bearing foundation slabs with limited service penetrations that are cast into slab – this provides 1.5 points of protection;
 - Include taped and sealed membranes providing 0.5 points of protection.

- 14.1.7 All below ground concrete should be designed to meet the requirements of ACEC Class AC-1.
- 14.1.8 Whilst there are exceedances of screening criteria for PAHs and TPH within the groundwater, there are no controlled waters within the vicinity of the site, the source is either off-site or due to natural background and there is no direct pathway to either human or controlled waters so there is no risk in relation to the proposed development.
- 14.1.9 Any unexpected visual or olfactory ground contamination should be tested appropriately in accordance assessed risks. Material should be stockpiled if necessary and subsequently disposed or re-used on site as required. No buried underground fuel storage tanks have been encountered during the site investigation works; however, there remains a low risk that tanks are present on site.

14.2 Geotechnical Design

- 14.2.1 The geotechnical hazards associated coal mining at the site are low and no special precautions are required to be made in relation to the proposed development.
- 14.2.2 The ground conditions at the site are suitable for spread footings with ground bearing floor slabs. A net allowable bearing pressure of 700 kPa is recommended for foundations in the weathered bedrock. The formation of any footings should be fully compacted before any blinding concrete is placed because excavation into the top of the rock could loosen the upper layers.
- 14.2.3 All below ground concrete should be designed to meet the requirements of ACEC Class AC-1.
- 14.2.4 The site is suitable for soakaways but the design will have to take into account the variable conditions in the top of the bedrock which indicate that the infiltration rate is very variable ranging from very poor to excellent depending upon whether or not open fissures are encountered.

14.3 Regulatory Liaison

- 14.3.1 Any proposals to remediate or develop the site should be agreed with the relevant authorities (e.g. local authority environmental health officer, Environment Agency etc) to obtain Planning Permission prior to commencement of the works and should be agreed with the NHBC or similar, or with the local authority building control officer prior to commencement of the works.
- 14.3.2 It is recommended that the CL:AIRE Code of Practice is implemented for this project to enable re-use of soils and bedrock in the required cut-fill earthworks.

14.4 Health and Safety

14.4.1 As outlined within the HSE publication “Successful Health and Safety Management – HSG65” this report should inform your development of safe systems of work and information as an input into the safety management system. The contents of this report may be used to supplement the contents of the Health and Safety File as required under the Construction Design and Management (CDM) Regulations 2007.

14.4.2 When developing risk control systems we suggest making reference to:

- The Control of Asbestos Regulations, 2012 and HSE ACoP (2013);
- CIRIA report 132 “A guide for safe working on contaminated sites” and
- HSE document “Protection of workers and the general public during the development of contaminated land – HSG66”.

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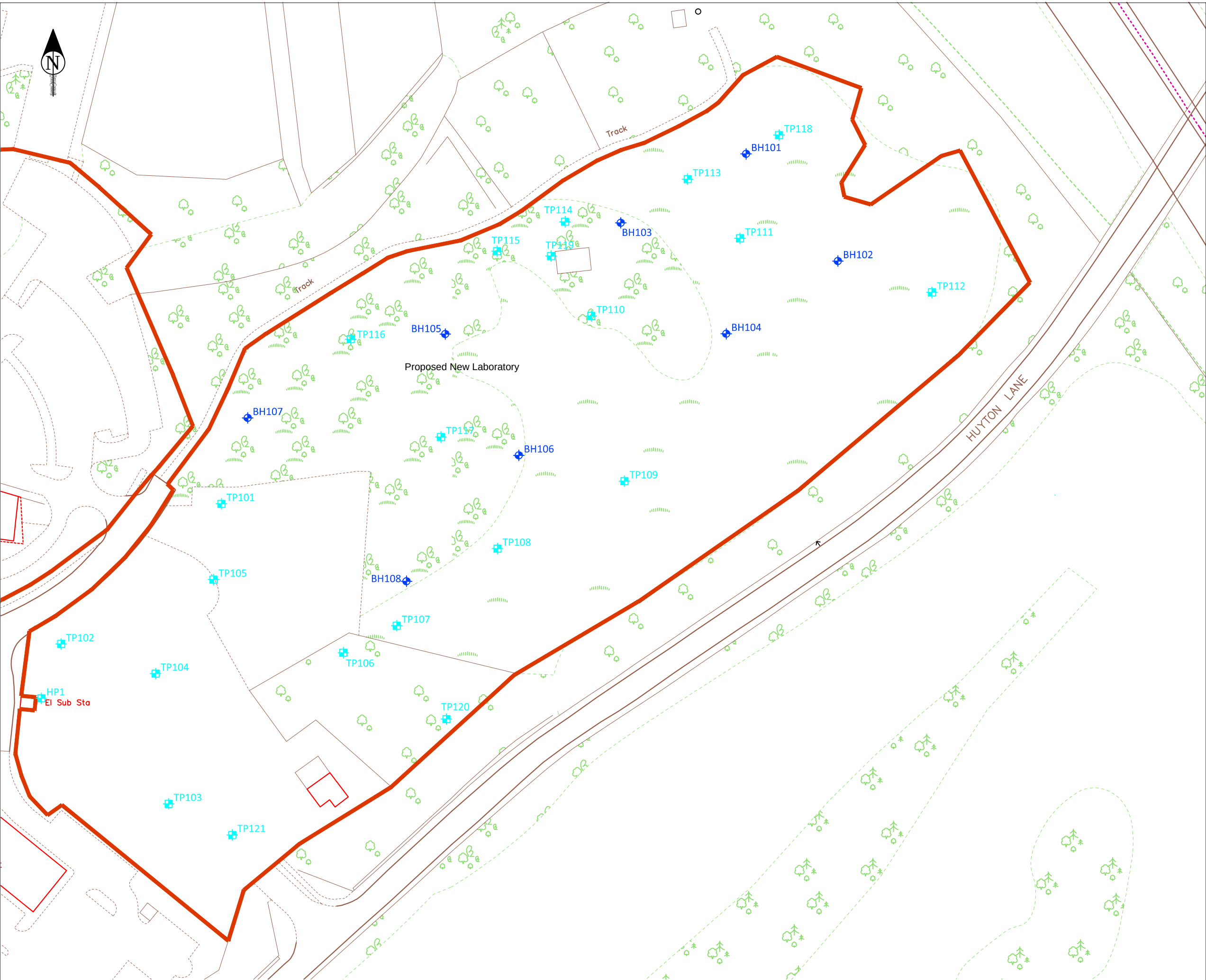
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DRAWINGS

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2173/1/001	Borehole Location Plan Current Site Conditions
2173/1/002	Proposed Development Plan



Key

TCL Borehole

TP112

TCL Trial Pit

TP112

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

Alfred H Knight
Holding

Site

Kings Business
Park

Title

Exploratory Hole
Location Plan

Scale

1:1,000

@ A3

Drawing No.

2173/1/001

Rev

Date

Description

File

21731001MonitoringLocation.dwg

Date

01/15

Engineer

CB

Drawn

PP

Checked

CSE



Key

TCL Borehole

BH102

TCL Trial Pit

TP112

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

Alfred H Knight
Holding

Site

Kings Business
Park

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Proposed Development Plan

Scale

1:1,000

@ A3

Drawing No.

2173/1/002

Rev

Date

Description

File

21731002ProposedDevelopmentPlan.dwg

Date

01/15

Engineer

CB

Drawn

PP

Checked

CSE

APPENDICES

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APPENDIX A

Service Constraints, Report Limitations & Planning

Service Constraints, Report Limitations & Planning

This report and the site investigation (together comprise the "Services") were compiled and carried out by TerraConsult Limited (TCL) for Alfred H Knight International Ltd (the "client") in accordance with the terms of a contract between TCL and the "client." The Services were performed by TCL with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by TCL taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between TCL and the client.

Other than that expressly contained in the above paragraph, TCL provides no other representation 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 consulting 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 TCL. If a third party relies on this report, it does so wholly at its own and sole risk and TCL disclaims any liability to such parties.

It is TCL's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without TCL's review and advice shall be at the client's sole and own risk.

The information contained in this report is protected by disclosure under Part 3 of the Environmental Information Regulations 2004 pursuant to the provisions of Regulation 12(5) without the consent in writing of a Director of TerraConsult Limited.

The report was written in January 2015 and should be read in light of any subsequent changes in legislation, statutory requirements and industry practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. The passage 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 contained in this report should not be relied upon in the future without the written advice of TCL. In the absence of such written advice of TCL, reliance on the report in the future shall be at the client's own and sole risk. Should TCL be requested to review the report in the future, TCL shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between TCL and the client.

The observations and conclusions described in this report are based solely upon the Services that were provided pursuant to the agreement between the client and TCL. TCL has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report. TCL is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, TCL did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, radon gas or other radioactive or hazardous materials.

The Services are based upon TCL's observations of existing physical conditions at the site gained from a walkover survey of the site together with TCL's 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

whilst TerraConsult Ltd have no reason to doubt the accuracy and that it has been provided in full from those it was requested from, the items relied on have not been verified. No responsibility can be accepted for errors within third party items presented in this report. Further TCL was not authorised and did not attempt 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. TCL is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to TCL and including the doing of any independent investigation of the information provided to TCL save as otherwise provided in the terms of the contract between the client and TCL.

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 and as investigation excavations 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. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and TCL] 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 normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, 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 drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.

Planning Requirements

The National Planning Policy Framework (NPPF, 2012) has twelve core land-use planning principles, two of which directly relate to the potential for pollution and contaminated land:

- Requirement to “*contribute to conserving and enhancing the natural environment and reducing pollution*” and setting out of a preference for developments to be on land of “*lesser environmental value*”; and
- “*encourage the effective use of land by re-using land that has been previously developed (brownfield land), providing that it is not of high environmental value.*”.

In accordance with the core principles of NPPF, Paragraph 109 clarifies that enhancing the natural environment includes:

- “*preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and*
- *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.*”.

Paragraph 121 of NPPF states that planning policies and decisions for developments should also ensure that:

- *“the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;*
- *after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and*
- *adequate site investigation information, prepared by a competent person, is presented.”.*

This report has been prepared and authorised by staff that are competent as defined in the NPPF.

APPENDIX B

Environmental Risk Assessment Methodology & Terminology

ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY & TERMINOLOGY

Legislation Overview

This report includes hazard identification and environmental risk assessment in line with the risk-based methods referred to in relevant UK legislation and guidance. Government environmental policy is based upon a “suitable for use approach,” which is relevant to both the current use of land and also to any proposed future use. The contaminated land regime is the statutory regime for remediation of contaminated land that causes an unacceptable level of risk and is set out in Part 2A of the Environmental Protection Act 1990 (“EPA 1990”). The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

“any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

- (a) Significant harm is being caused or there is a significant possibility of such harm being caused;*
- or*
- (b) Pollution of controlled waters is being, or is likely to be, caused.”*

In order to assist in establishing if there is a “*significant possibility of significant harm*” there must be a “*contaminant linkage*” for potential harm to exist. That means there must be a source(s) of contamination, sensitive receptors present and a connection or pathway between the two. This combination of contaminant-pathway-receptor is termed a “contaminant linkage or CPR linkage.”

Part IIA of The Environmental Protection Act 1990 is supported by a substantial quantity of guidance and other Regulations. Key implementing legislation of the Part 2A regime includes the Contaminated Land (England) Regulations 2006 (SI 2006/1380) as recently amended by the overarching legislation for the contaminated land regime, which implements the provisions of Part IIA of the Environmental Protection Act 1990 (as inserted by section 57 of the Environment Act 1995), came into force on 14th July 2000 together with recent amended regulations: Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263). Revised and Contaminated Land Statutory Guidance was published by DEFRA in (DEFRA, April 2012). Part IIA defines the duties of Local Authorities in dealing with it. Part IIA places contaminated land responsibility as a part of planning and redevelopment process rather than Local Authority direct action except in situations of very high pollution risk. In the planning process guidance is provided by National Planning Policy Framework (NPPF) of March 2012 which requires that a site which has been developed shall not be capable of being determined “contaminated land” under Part IIA. In practice, Planning Authorities require sites being developed to have a lower level of risk post development than the higher level of risk that is required in order to determine a site as being contaminated in accordance with Part IIA. This is to ensure that there is a suitable zone of safety below the level for Part IIA determination and prevent recently developed sites becoming reclassified as contaminated land if there are future legislative or technical changes (e.g. a substance is subsequently found to be more toxic than previously assessed this increases its hazard)..

The criteria for assessing levels of contaminants and hence determining whether a site represents a hazard are based on a range of techniques, models and guidance. Within this context it is relevant to note that Government objectives are:

- (a) to identify and remove unacceptable risks to human health and the environment;

- (b) to seek to bring damaged land back into beneficial use;
- (c) to seek to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable.

These three objectives underlie the "suitable for use" approach to remediation of contaminated land. The "suitable for use" approach focuses on the risks caused by land contamination. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Risks therefore should be assessed on a site-by-site basis.

The "suitable for use" approach then consists of three elements:

- (a) *ensuring that land is suitable for its current use* - in other words, identifying any land where contamination is causing unacceptable risks to human health and the environment, assessed on the basis of the current use and circumstances of the land, and returning such land to a condition where such risks no longer arise ("remediating" the land); the contaminated land regime provides the regulatory mechanisms to achieve this;
- (b) *ensuring that land is made suitable for any new use, as planning permission is given for that new use* - in other words, assessing the potential risks from contamination, on the basis of the proposed future use and circumstances, before official permission is given for the development and, where necessary to avoid unacceptable risks to human health and the environment, remediating the land before the new use commences; this is the role of the town and country planning and building control regimes; and
- (c) *limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought* - in other words, recognising that the risks from contaminated land can be satisfactorily assessed only in the context of specific uses of the land (whether current or proposed), and that any attempt to guess what might be needed at some time in the future for other uses is likely to result either in premature work (thereby running the risk of distorting social, economic and environmental priorities) or in unnecessary work (thereby wasting resources).

The mere presence of contaminants does not therefore necessarily warrant action, and consideration must be given to the scale of risk involved for the use that the site has, and will have in the future.

Risk Assessment

Current practice recommends that the determination of potential liabilities that could arise from land contamination be carried out using the process of risk assessment, whereby "risk" is defined as:

- "(a) The probability, or frequency, or occurrence of a defined hazard; and*
- (b) The magnitude (including the seriousness) of the consequences."*

The UK's approach to the assessment of environmental risk is set out in by the Department of the Environment Transport and the Regions (2000) publication "A Guide to Risk Assessment and Risk Management for Environmental Protection" (also called Greenleaves II). This established an iterative, systematic staged process which comprises:

- (a) Hazard identification;

- (b) Hazard assessment;
- (c) Risk estimation;
- (d) Risk evaluation;
- (e) Risk assessment;

At each stage during the development process the above steps are repeated as more detailed information becomes available for the site.

For an environmental risk to be present, all three of the following elements must be present:

- Source/Contaminant: hazardous substance that has the potential to cause adverse impacts;
- Receptor: target that may be affected by contamination: examples include human occupants/users of site, water resources (rivers or groundwater), or structures;
- Pathway: a viable route whereby a hazardous substance may come into contact with the receptor.

The absence of one or more of each component (contaminant, pathway, receptor) would prevent a contaminant linkage being established and there would be no significant environmental risk.

The identification of potential contaminant linkages is based on a Conceptual Model of the site, which is subject to continual refinement as additional data becomes available. As part of a Phase I Investigation (Desk Study and site walk over) a Preliminary Conceptual Site Model (PCSM) is formed. Based on the PCSM, potential contaminant linkages can be assessed. If the PCSM and hazard assessment indicate that a pollution linkage is not of significance then no further assessment or action is required due to this linkage. For each significant and possible linkage a risk assessment is carried out. The linkages which potentially pose significant risks may require a variety of responses ranging from immediate remedial action or risk management or, more commonly, further investigation and risk assessment. This next stage is termed a Phase II Main Site Investigation and should provide additional data to allow refinement of the Conceptual Site Model and assess the level of risk from each contaminant linkage.

Definition of Risk Assessment Terminology

The criteria used for risk assessment are broadly based on those presented in DETR's "A Guide to Risk Assessment and Risk Management for Environmental Protection" (2000). The Severity of the risk is classified according to the criteria in Table B.1 below:

Table B.1 Severity/Consequence of Risk	
Severe	Acute risks to human health. Catastrophic damage to buildings/property (e.g. by explosion). Direct pollution of sensitive water receptors or serious pollution of other controlled water (watercourses or groundwater) bodies.
Medium	Harm to human health from long-term exposure. Slight pollution of sensitive controlled waters (surface waters or aquifers) or pollution of other water bodies. Significant effects on sensitive ecosystems or species.
Mild	No significant harm to human health in either short or long term. No pollution of sensitive controlled waters, no more than slight pollution of non-sensitive waters. Significant damage to buildings or structures. Requirement for protective equipment during site works to mitigate health effects.
Negligible	Damage to non-sensitive ecosystems or species. Minor damage to buildings or structures. No harm or pollution of water.

The probability of the risk occurring is classified according to criteria given in Table B.2 below:

Table B.2: Probability of Risk Occurring	
High likelihood	Contaminant linkage may be present, and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Medium/Reasonably Foreseeable	Contaminant linkage may be present, and it is probable that the risk will occur over the long term.
Low/Unlikely	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Negligible/Not credible	Contaminant linkage may be present but the circumstances under which harm would occur are improbable.

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in Table B.3 below:

Table B.3: Comparison of Severity and Probability					
		Severity			
		Severe	Medium	Mild	Negligible
Probability	High likelihood	Very High Risk	High Risk	Medium/Low Risk	Low Risk
	Medium/Reasonably Foreseeable	High Risk	Medium Risk	Low Risk	Near Zero
	Low/Unlikely	High/Medium Risk	Medium/Low Risk	Low Risk	Near Zero
	Negligible/Not credible	Medium/Low Risk	Low Risk	Low Risk	Near Zero

The various risk rankings provide guidance for recommended actions, whether this is:

- AR - Action Required, Remediation or mitigation or site investigation works required
- SIR - Site Investigation Required, further assessment is required.
- NAR - No Action Required.

A description of the evaluated risk is as follows:

Table B.4 – Description of the Classified Risks and Likely Action Required	
Evaluated Risk	Recommended Actions
Very High Risk	AR: There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risk	AR: Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the long term.
Moderate Risk	SI: It is possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	NAR: It is possible that harm could arise to a designated receptor from an identified hazard, but there is a low likelihood of this hazard occurring and if realised, harm would at worst normally be mild.
Near Zero	NAR: There is a negligible possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Management of Contaminated Land

When risk assessment of the site has been completed and this indicates that remedial works are required, the main guidance in managing this process is set out in the DEFRA/EA publication CLR11 (2004) “Model Procedures for the Management of Land Contamination.” The stages of managing remediation are as follows:

- (a) Options Appraisal and develop Remediation Strategy;
- (b) Develop Implementation Plan and Verification Plan;
- (c) Remediation, Verification and Monitoring.

The Remediation Strategy sets out the remediation targets, identifies technically feasible remedial solutions and presents an evaluation of the options so that these can be assessed enabling that the most suitable solution is adopted. An outline of the proposed remedial method should be presented. Agreement should be sought of the appropriate statutory bodies for the Remediation Strategy before proceeding to the next stage.

The Implementation Plan is a detailed method statement setting out how the remediation is to be carried out including stating how the site will be managed, welfare procedures, health and safety considerations together with practical measures such as details of temporary works, programme of works, waste management licences and regulatory consents required. Agreement should again be sought of the appropriate statutory bodies for this Plan.

The Verification Plan sets out the requirements for gathering data to demonstrate that the remediation has met the required remediation objectives and criteria. The Verification Plan presents the requirements for a wide range of issues including the level of supervision, sampling and testing regimes for treated materials, waste and imported materials, required monitoring works during and post remediation, how compliance with all licenses and consents will be checked etc. Agreement should again be sought of the appropriate statutory bodies for the Verification Plan. On completion of the remediation a Verification Report should be produced to provide a complete record of all remediation activities on site and the data collected as required in the Verification Plan. The Verification Report should demonstrate that the remediation has met the remedial targets to show that the site is suitable for the proposed use.

APPENDIX C

Site Photographs

Locations of Photographs





Photograph 1: View southeast of temporary gravel carpark in the southwest of the site.



Photograph 2: View east of site entrance and temporary gravel carparks from the western corner of the site.



Photograph 3: View east from temporary carparks towards derelict structure and unkempt land.



Photograph 4: View southeast of gated alternate site entrance from Huyton Lane in the southern corner of the site.



Photograph 5: View northeast and east of derelict structure near the southern corner of the site.



Photograph 6: View east towards the northern half of the temporary gravel carparks.



Photograph 7: View northeast along the south eastern boundary of the north half of the temporary carparks.



Photograph 8: View of fenced construction waste adjacent to the north eastern corner of the temporary gravel carparks.



Photograph 9: View east of bramble in the south western half of the site.



Photograph 10: View northwest of unkempt grasses and bramble adjacent to the pathway running along the north western site boundary.



Photograph 11: View of brick structure surrounding a pipe adjacent to the north western site boundary in the west of the site.



Photograph 12: View southeast from the north western site boundary of unkempt land in the centre of the site.



Photograph 13: View northeast of pathway along the north western boundary of the site.



Photograph 14: View of substation and communications tower off site (close to the north western corner).



Photograph 15: View north of the forest along the north western boundary of the site.



Photograph 16: View east of the unkempt grasses towards the north eastern corner of the site.



Photograph 17: View south west of unkempt grasses from the north eastern boundary of the site.



Photograph 18: View northwest of brambles and unkempt grasses from the north eastern corner of the site.



Photograph 19: View southwest along the site boundary of the site of bramble and unkempt grasses from the north eastern site corner.



Photograph 20: View of fenced region adjacent to the derelict structure in the south eastern region of the site.

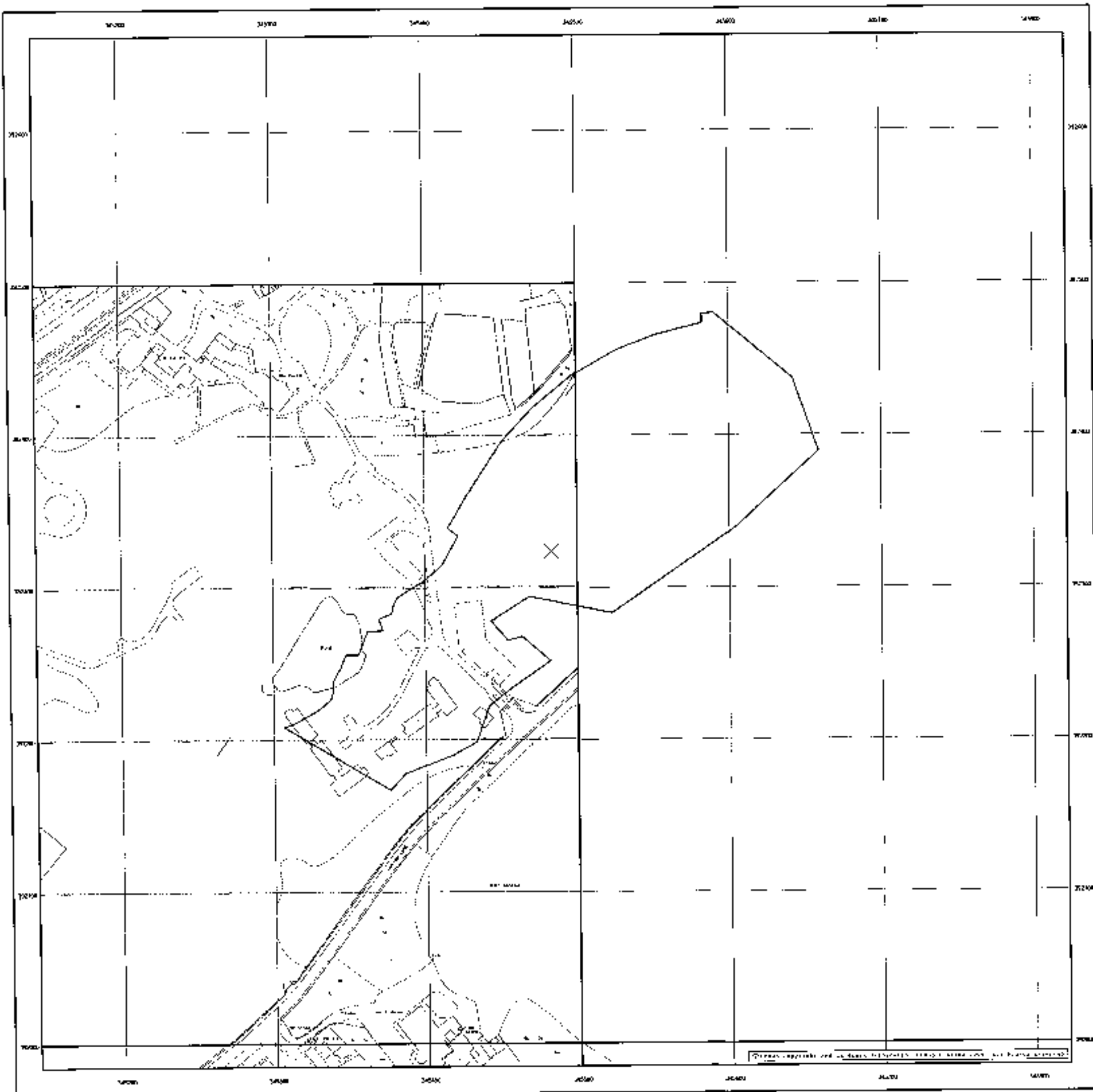


Photograph 21: View of a concrete floor foundation from a former building in the north east of site.

APPENDIX D

GroundSure EnviroInsite Report

(Historical Maps & Datasheets on Surrounding Land Use)



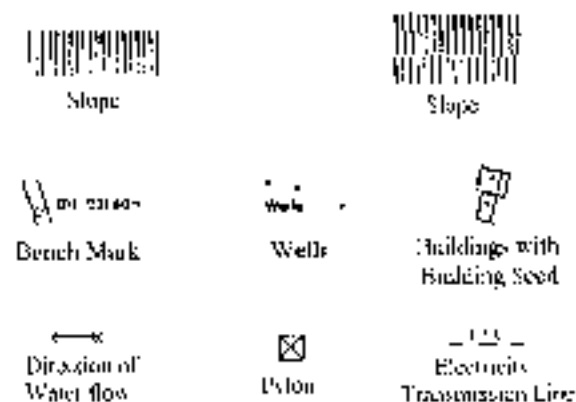
CLIENT DETAILS Envirocheck Order No. EC20523531_1_1

Customer Ref: D20000001128
FWS Consultants Ltd
Westgate House, PO Box 11 Montague Lane Trading Estate
Suttonwood
Buckingham OX18 2PP

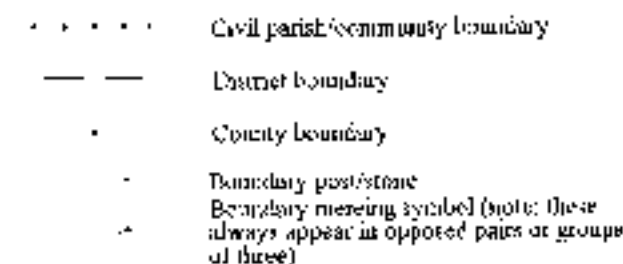
SITE DETAILS Grid Reference 345430 392120

Area A and B
King's College Park
Reading

Historical Map Legend



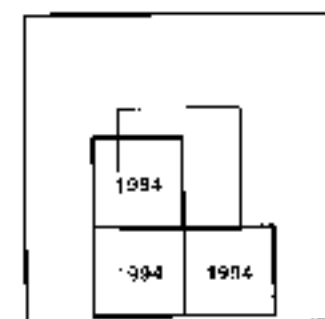
Administrative Boundaries



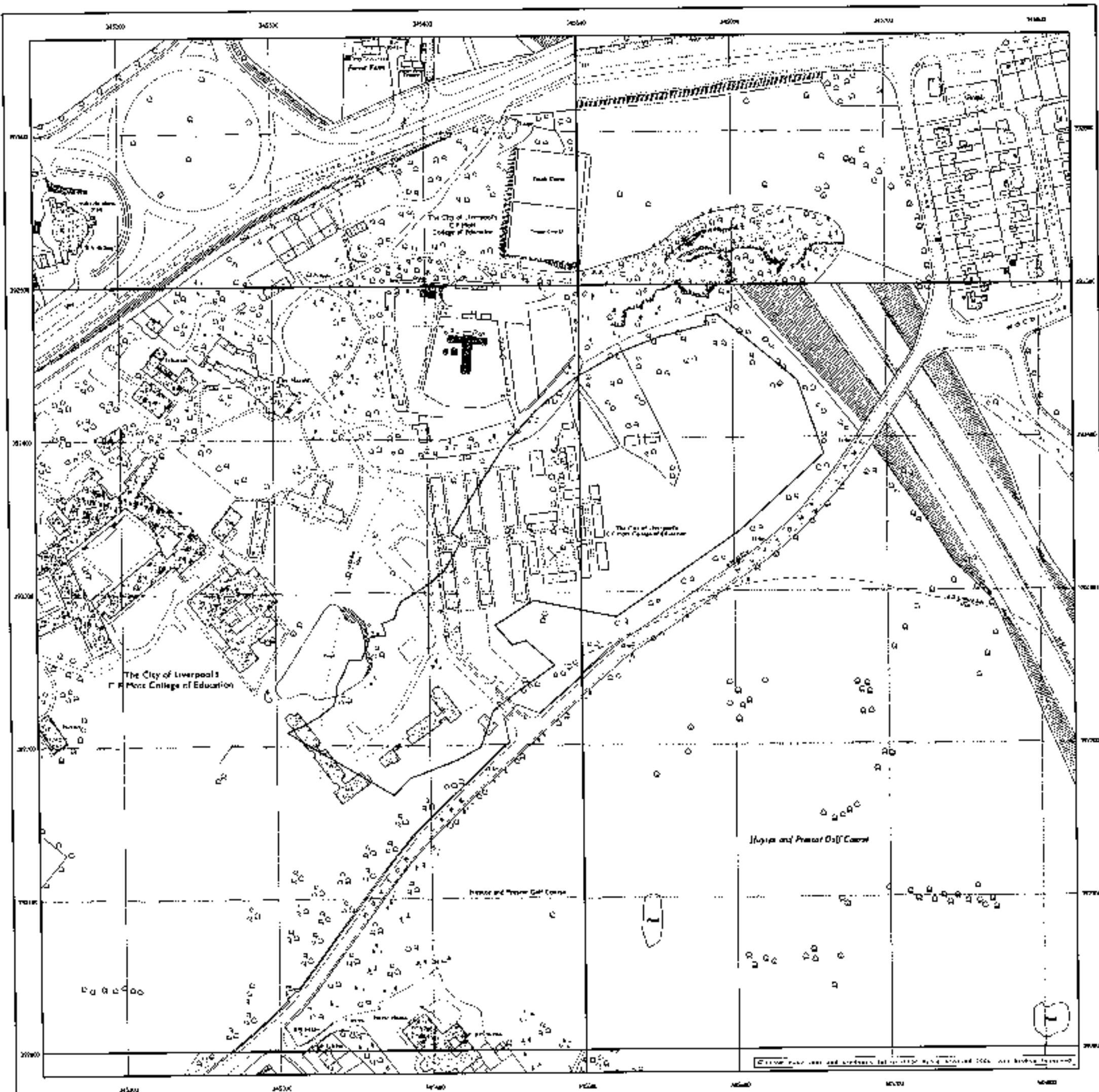
Large-Scale National Grid Data

Large-Scale National Grid Data is provided for reference only. It is not intended to be used for any other purpose. The data is provided for reference only and is not intended to be used for any other purpose. The data is provided for reference only and is not intended to be used for any other purpose.

ORDNANCE SURVEY PLAN
Published 1994
Source map scale: 1:1,250



Details of Publication: 1994



CLIENT DETAILS Envirocheck Order No. EC20523131_1_1

Customer Ref: E Underway 11/08
FMS Consultants Ltd
Northgate House, 11 Northgate Lane, Liverpool, L3 5JF
Tel: 0151 236 1111
Email: info@fms.co.uk

SITE DETAILS Grid Reference 345480 392020

Area: 0.15 Ha
Site: Kings Wayman Park
Address:

Historical Map Legend

Inactive Quarry, Chalk Pit or Clay Pit	Active Quarry, Chalk Pit or Clay Pit	Culvert
Slope	Slope	
Pylon	Electricity Transmission Line	Direction of Water Flow
Marsh	Saltings	Orchard Tree
Rough Grassland	Scrub	Heath
Coniferous Tree (Surveyed)	Coniferous Tree (Not Surveyed)	Non-coniferous Tree (Surveyed)
Coniferous Tree (Surveyed)	Coniferous Tree (Not Surveyed)	Non-coniferous Tree (Not Surveyed)

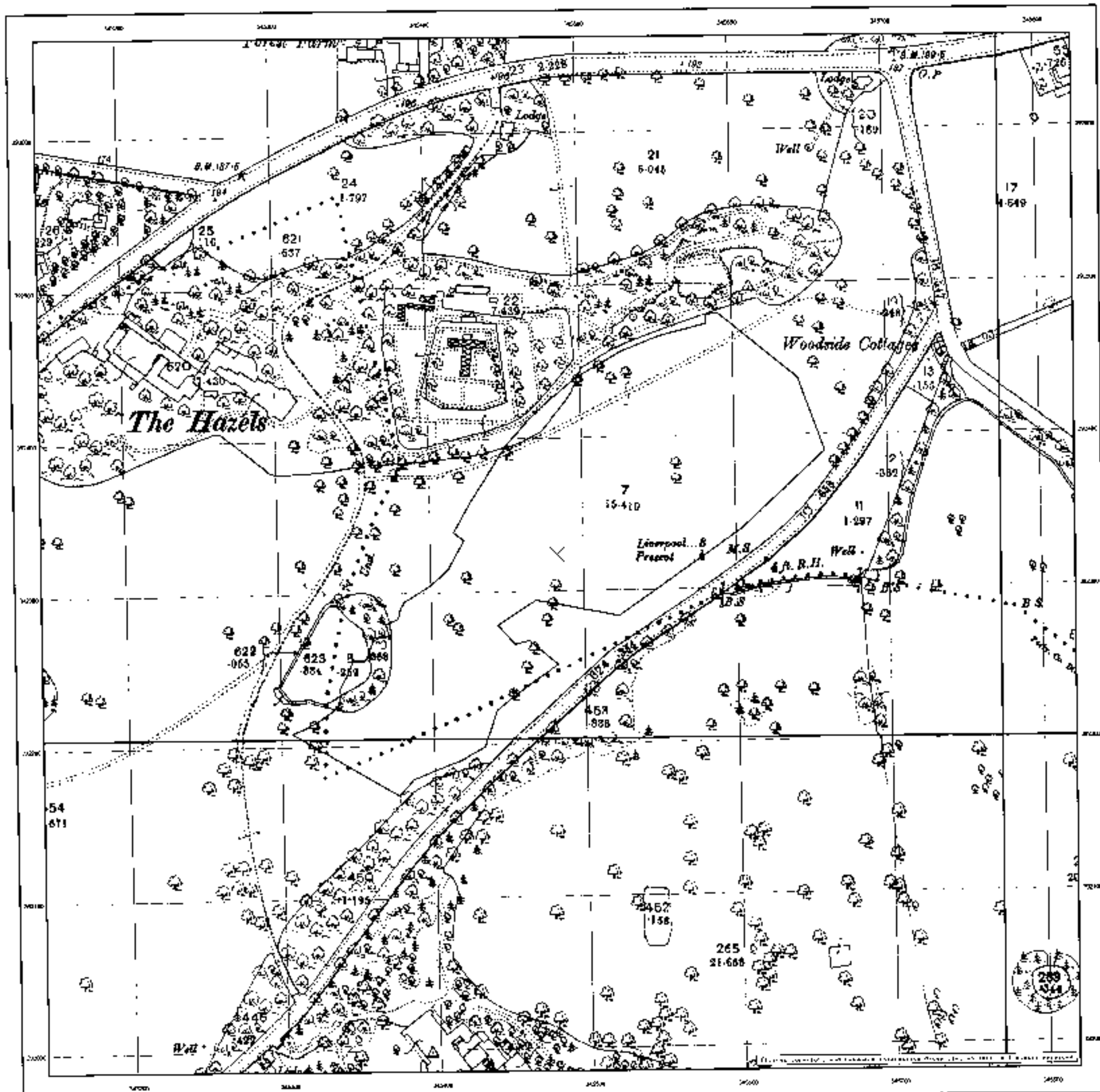
Ordnance Survey Plan

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ORDNANCE SURVEY PLAN
Published 1965 to 1976
Source map 1:25000 - 1:1,250

1976	1965
1973	1976
1966	1966

Order(s) of Publication: 1/1/76



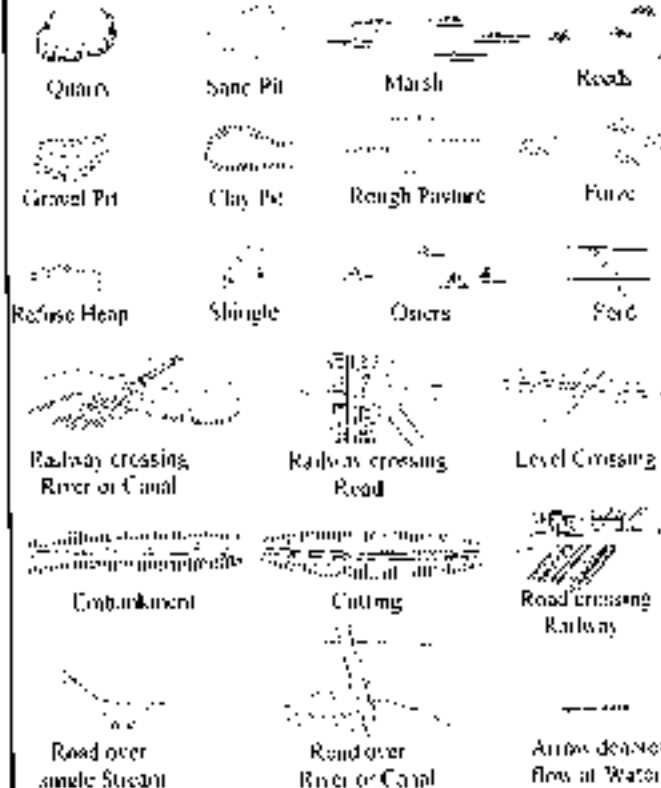
CLIENT DETAILS Envirocheck Order No. EC20523534_1_1

Customer Ref: Dunderwood, 1128
PM 5 Dunderwood Ltd
Weston Road, Bury, Lancashire, PO Box 11, Bury, Lancashire, Bury, Lancashire
Bury, Lancashire
Bury, Lancashire

SITE DETAILS Grid Reference 345480 392120

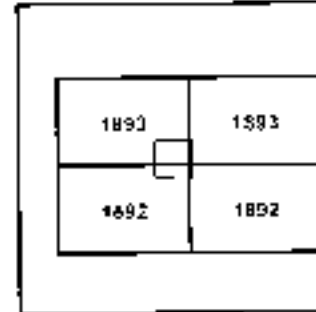
Area: 0.10
Area: 0.10
Area: 0.10

Historical Map Legend

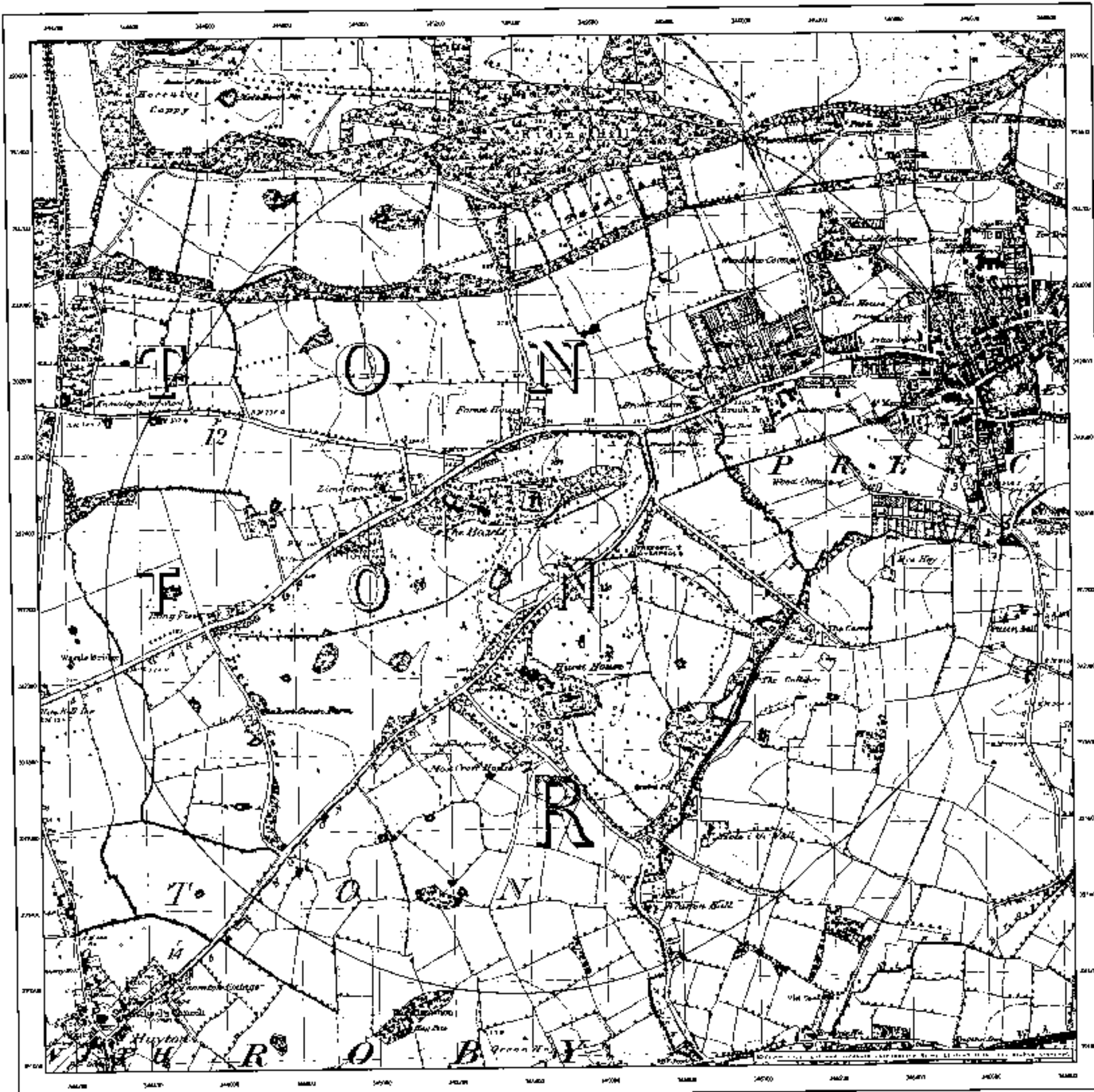


Ordnance Survey County Series
The Ordnance Survey County Series is a series of maps of Great Britain and Ireland, published by the Ordnance Survey, showing the boundaries of the counties of England, Wales, and Scotland, and the principal towns and cities of each county. The series is published in a series of sheets, each covering a specific area of the country. The sheets are published in a series of volumes, each containing a set of sheets covering a specific area of the country. The sheets are published in a series of volumes, each containing a set of sheets covering a specific area of the country.

LANCASHIRE AND FURNESS
Publ sheet 1882 to 1893
Source map scale: 1:2500



Date(s) of Publication: 1892



CLIENT DETAILS Envirocheck Order No. EC20523531_1_1

Customer Ref: 5 Underhill, 11/18
 TWE Consultants Ltd
 Wellington House, 11/18 Underhill, 11/18
 Warrington, Cheshire, WA9 7JH
 Warrington, Cheshire, WA9 7JH

SITE DETAILS Grid Reference 345480 392320

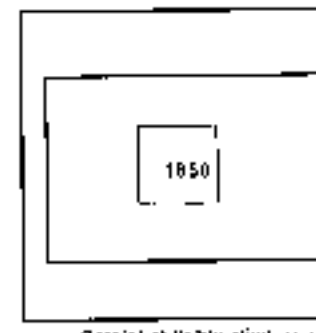
Area: 1.1 ha
 11/18 Underhill, 11/18
 Warrington, Cheshire, WA9 7JH

Historical Map Legend

Quarry	Shingle	Railway over Road	Road over Railway
Gravel Pit	Sand Pit	Level Crossing	Railway over River
Other Pits		Road over Stream	Road over Stream
Rough Pasture	Forest	Road over River or Canal	
Marsh	Reeds	Sunken Road	
Oscars		Raised Road	
		Instrumental Contour	
Arrow indicates flow of Water		Sketch Contour	

Ordnance Survey County Series
 The 1:50,000 scale series was produced from a topographical map of the area, which was revised in 1950. The map was revised in 1950 to show the changes in the area since 1945. The map was revised in 1950 to show the changes in the area since 1945. The map was revised in 1950 to show the changes in the area since 1945.

LANCASHIRE AND FURNESS
 Published 1950
 Source map scale: 1:10,560





Issued by:

The Coal Authority, Mining Reports Office, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire NG18 4RG
On-Line Service: www.coalminingreports.co.uk - Phone: 0845 762 6848 - DX 716176 MANSFIELD 5

FWS CONSULTANTS LTD,
MERRINGTON LANE TRADING ESTATE,
SPENNYMOOR,
DURHAM,
DL16 7UU

Person dealing with this matter:

Ken Rowe

Our reference:

00064608-06

Your reference:

1128 DB01 CA2710

Electronic Ref:

RRUID:

007.00014747290001

Date of your enquiry:

27 October 2006

Date we received your enquiry:

30 October 2006

Date of issue:

30 October 2006

This report is for the property described in the address below and the attached plan.

Coal and Brine Report

Site At, Kings Business Park, Knowsley, .

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	Yes
Brine extraction	No

Information from the Coal Authority

Underground Coal Mining

Past

The property is not in the likely zone of influence of any past underground coal workings.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

The property is not in an area for which a licence has been granted to remove coal using underground methods.

The property is not in an area that is likely to be affected at the surface from any planned future workings.

However reserves of coal exist in the local area which could be worked at some time in the future.

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries

There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

Coal-mining geology

At the surface, there are no known faults or other lines of weakness due to coal mining that have made the property unstable.

Opencast Coal Mining

Past

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

Present

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

Coal-mining subsidence

The Coal Authority has not received a damage notice or claim for the property since 1 January 1984. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority has not received a request to carry out preventive work before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, following the reporting of an alleged coal mining related hazard under its Emergency Surface Hazard Call Out procedures.

Withdrawal of Support

The property is not in an area for which a notice of entitlement to withdraw support has been published.

The property is not in an area for which a notice has been given under section 41 of the Coal Industry Act 1994, revoking the entitlement to withdraw support.

Working Facilities Orders

The property is not in an area for which an Order has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

Payments to Owners of Former Copyhold Land

The property is not in an area for which a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

Additional remarks

This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions 2008. The report is compliant with Home Information Pack requirements.

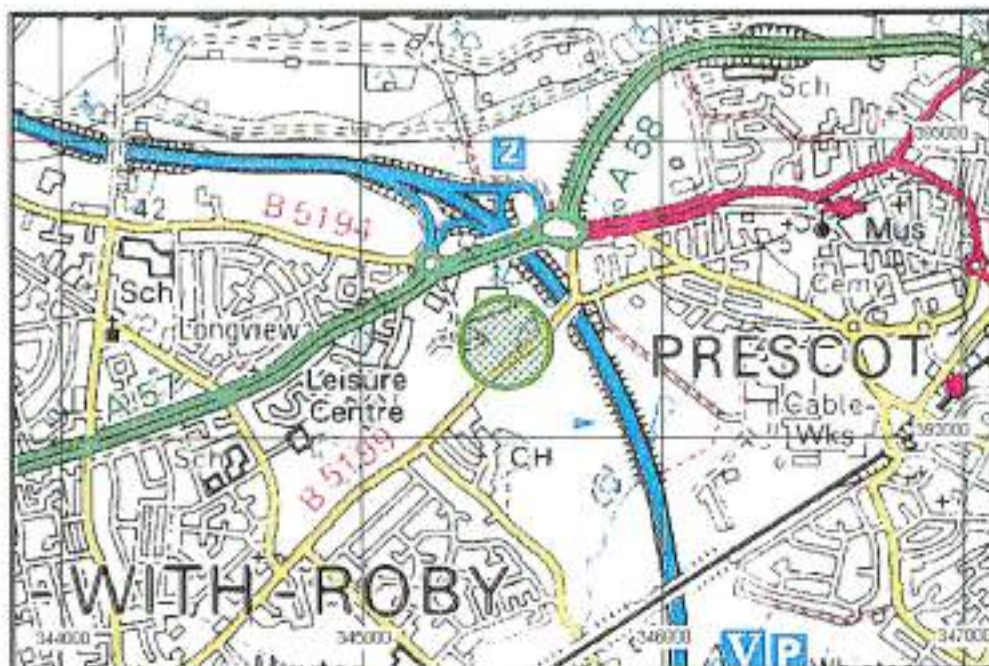
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Drawn by:	The Coal Authority, 279, Coltrane Lane, Mansfield, Nottinghamshire, NG13 4HG
Date:	30 Oct 2016
Current display report to:	Site At Kings Business Park, Knowsley
Reference number:	00004936-00
Cost:	£40.00
Plus VAT:	£7.14
Total received:	£47.14
VAT registration number:	468 5951167

Location map



Approximate
position
of property



Enquiry boundary

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Key

Approximate position of enquiry boundary shown



Envirocheck[®] Report

Datasheet

Report on:
Areas A and B
Kings Business Park
Knowsley

National Grid Reference :
345480, 392320

Site Area (Ha) :
4.19

Prepared For :
FWS Consultants Ltd
Merrington House, Po Box 11
Merrington Lane Trading Estate
Spennymoor
Durham
DL16 7UU

Client Details:
CDP Ltd.

Your Reference:
B Underwood, 1128

Summary

Agency & Hydrological

Waste

Hazardous Substances

Geological

Industrial Land Use

Sensitive Land Use

Data Currency

Data Suppliers & Copyright Statements

Useful Contacts

BGS Borehole Order Form

Introduction

The Environment Act 1996 has made the consistency a key issue, as the legislation places so much emphasis on the pathways by which contamination could spread, and to the subsequent targets of contamination, so it takes the potential sources of contamination. For this reason, Landmark's Site Sensitivity Database places great emphasis on statutory data derived by the Environment Agency and the Scottish Environment Protection Agency. It also incorporates data from English Nature (and the Scottish and Welsh equivalents), the Environment Agency (and the Scottish equivalent) and Local Authorities, and highlights hydrogeological features assumed by environmental and geotechnical consultants. It does not contain any information concerning past uses of land. The database is produced by querying the known database in turn from a single point of data boundary provided by the client.

In the attached database the National Grid References (NGRs) are rounded to the nearest 100m in accordance with Landmark's agreements with a number of Data Suppliers.

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Data Type	On Site	0 to 250m	251 to 500m	501 to 1000m (*Up to 2000m)
Agency & Hydrological				
Local Authority Pollution Prevention and Controls				1
Local Authority Pollution Prevention and Control Enforcement				
Contaminated Land Register Entries and Notices				
Discharge Consents			15	19
Enforcement and Prohibition Notices				
Integrated Pollution Controls				3
Integrated Pollution Prevention And Control				3
Local Authority Integrated Pollution Prevention And Control				
Nearest Surface Water Feature		Yes		
Polychlorinated Biphenyls in Controlled Waters			2	16
Substantiated Pollution Incident Register				
Prosecutions Relating to Authorised Processes				
Prosecutions Relating to Controlled Waters				
Water Industry Act Referrals				
Register of Radioactive Substances				
River Quality			2	
River Quality Biology Sampling Points			1	
River Quality Chemistry Sampling Points				
Water Abstractions			1	115
Groundwater Vulnerability	Yes			
Source Protection Zones				
Extreme Flooding from Rivers or Sea without Defences				
Flooding from Rivers or Sea without Defences				
Arable Benefiting from Flood Defences				
Flood Water Storage Areas				
Flood Defences				
River Flood Data (Supplan 1)				

Data Type	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste				
BGS Recorded Landfill Sites				1
Integrated Pollution Control Registered Waste Sites				
Licensed Waste Management Facilities (Landfill Boundaries)				
Licensed Waste Management Facilities (Locations)				1
Local Authority Recorded Landfill Sites				2
Registered Landfill Sites				
Registered Waste Transfer Sites				1
Registered Waste Treatment or Disposal Sites				
Hazardous Substances				
Control of Major Accident Hazards Sites (COMAH)				1
Explosive Sites				
Notification of Installations Handling Hazardous Substances (NIHHS)				
Planning Hazardous Substance Consents				
Planning Hazardous Substance Enforcement				
Geological				
BGS Boreholes	19	20	19	52
BGS Recorded Mineral Sites				
BGS 1:625,000 Soil Geology	Yes			
Bone Compensation Areas				
Coal Mining Affected Areas	Yes			
Shallow Mining Hazards	Yes	Yes		
Potential for Collapse Ground Stability Hazards				
Potential for Compressible Ground Embankment Hazards				
Potential for Ground Disturbance Stability Hazards				
Potential for Landslide Ground Stability Hazards	Yes			
Potential for Running Sand Ground Stability Hazards	Yes			
Potential for Shrinking or Swelling Clay Ground Stability Hazards	Yes			
Mining Instability	Yes			
Natural and Mining Cavities				
Radon Affected Areas				
Radon Protection Measures				
Industrial Land Use				
Contaminated Sites Directory Entries		1	1	12
Fuel Station Entries		1		2

Data Type	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Uses				
Areas of Adopted Green Belt	1			
Areas of Unadopted Green Belt	1			
Areas of Outstanding Natural Beauty				
Environmentally Sensitive Areas				
Forest Parks				
Local Nature Reserves				
Marine Nature Reserves				
National Marine Reserves				
National Parks				
National Scenic Areas				
Nitrate Sensitive Areas				
Nitrate Vulnerable Zones			1	
Ramsar Sites				
Sites of Special Scientific Interest				
Special Areas of Conservation				
Special Protection Areas				

Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NGR
1	Local Authority Pollution Prevention and Controls Name: Longview Service Station Location: Longview Drive, HU17 0CA, L36 8EB Authority: Knowsley Metropolitan Borough Council, Environmental Health and Consumer Protection Division Permit Reference: 040742515pa Date: 26 January 2004 Process Type: Local Authority Air Pollution Control Description: PC 114 Permitting system Status: Authorised Positional Accuracy: Manually positioned to the address or location	S	1km	1	345060 341250
2	Discharge Consents Operator: M. Green Property Type: Domestic Property (Single) Location: Dye House Liverpool Rd Liverpool Rd, Prescot, Merseyside L34 1nr Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 010139 Permit Version: 1 Effective Date: 14th September 1962 Issue Date: 14th September 1962 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Fresh (treated) Effluent - Not Water Company Discharge Environment: Unknown Receiving Water: Unknown Status: Pre National Rivers Authority Legislation where issue date < 01/06/1989 Positional Accuracy: Located by supplier to within 10m	N	2km	1	345170 352670
3	Discharge Consents Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescott Stn Knowsley Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Given Reference: 010140121 Permit Version: 6 Effective Date: 17th January 1999 Issue Date: Not Supplied Revocation Date: 1st April 1999 Discharge Type: Sewage Discharges - Fresh (treated) Effluent - Water Company Discharge Environment: Freshwater (Stream/River) Receiving Water: Prescott Brook Status: Authorisation revoked Positional Accuracy: Located by supplier to within 10m	SE	4km	1	345010 352050
3	Discharge Consents Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescott Stn Knowsley Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 016036121 Permit Version: 1 Effective Date: 12th January 1990 Issue Date: Not Supplied Revocation Date: 30th January 1995 Discharge Type: Sewage Discharges - Fresh (treated) Effluent - Water Company Discharge Environment: Freshwater (Stream/River) Receiving Water: Prescott Brook Status: Authorisation revoked Positional Accuracy: Located by supplier to within 10m	SE	4km	1	345010 352050

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Discharge Consents						
3	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Euxine/Knowsley/Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 016930123 Permit Version: 2 Effective Date: 31st January 1985 Issued Date: Not Supplied Revocation Date: 9th April 1987 Discharge Type: Sewage Discharges - First/Treated Effluent - Water Company Discharge: Freshwater Stream/Flow Environment: Freshwater Receiving Water: Prescot Brook Status: Authorisation revoked Positional: Located by supplier to within 10m Accuracy:	SE	498	2	346510 392560	
Discharge Consents						
3	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Euxine/Knowsley/Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 016930123 Permit Version: 3 Effective Date: 9th April 1987 Issued Date: Not Supplied Revocation Date: 8th April 1988 Discharge Type: Sewage Discharges - First/Treated Effluent - Water Company Discharge: Freshwater Stream/Flow Environment: Freshwater Receiving Water: Prescot Brook Status: Authorisation revoked Positional: Located by supplier to within 10m Accuracy:	SE	498	2	346510 392560	
Discharge Consents						
3	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Euxine/Knowsley/Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 016930123 Permit Version: 4 Effective Date: 9th April 1988 Issued Date: Not Supplied Revocation Date: 12th October 1989 Discharge Type: Sewage Discharges - First/Treated Effluent - Water Company Discharge: Freshwater Stream/Flow Environment: Freshwater Receiving Water: Prescot Brook Status: Authorisation revoked Positional: Located by supplier to within 10m Accuracy:	SE	498	2	346510 392560	
Discharge Consents						
3	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Euxine/Knowsley/Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 016930123 Permit Version: 5 Effective Date: 10th October 1989 Issued Date: Not Supplied Revocation Date: 10th January 1993 Discharge Type: Sewage Discharges - First/Treated Effluent - Water Company Discharge: Freshwater Stream/Flow Environment: Freshwater Receiving Water: Prescot Brook Status: Authorisation revoked Positional: Located by supplier to within 10m Accuracy:	SE	498	2	346510 392560	

Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NGR
Discharge Consents					
4	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: King George V Memorial Playing Field, Prescot, Knowsley Merseyside Authority: Environment Agency - North West Region Catchment Area: M6/Govan Reference: 015030642 Form Version: 2 Effective Date: 1st January 1995 Issued Date: Not Supplied Revocation Date: Not Supplied Discharge Type: Public Sewage - Storm Sewage Overflow Discharge: Freshwater Stream/river Environment: Receiving Water: Prescot Brook Status: Post National Rivers Authority Legislation where issue date > 31/03/1989 Positional Accuracy: Located by supplier to within 100m	E	400	2	346130 352380
Discharge Consents					
4	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: King George V Memorial Playing Field, Prescot, Knowsley Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 015030642 Form Version: 1 Effective Date: 1st April 1991 Issued Date: Not Supplied Revocation Date: 2nd December 1994 Discharge Type: Public Sewage - Storm Sewage Overflow Discharge: Freshwater Stream/river Environment: Receiving Water: Prescot Brook Status: Authorisation revoked Positional Accuracy: Located by supplier to within 10m	E	400	2	346130 352380
Discharge Consents					
4	Operator: Bicc Developments Ltd Property Type: Fencing & Fencing Location: Bicc Industries Ltd Prescot, Merseyside L34 5JZ Authority: Environment Agency - North West Region Catchment Area: Upper Mersey Reference: 015401107 Form Version: 1 Effective Date: 1st April 1990 Issued Date: Not Supplied Revocation Date: 1st May 1995 Discharge Type: Trade Discharges - Cooling Water Discharge: Freshwater Stream/river Environment: Receiving Water: Dillon Brook (M1 Brook) Status: Authorisation revoked Positional Accuracy: Located by supplier to within 100m	E	400	2	346140 352400
Discharge Consents					
4	Operator: Bicc Developments Ltd Property Type: Fencing & Fencing Location: Bicc Industries Ltd Prescot, Merseyside L34 5JZ Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 015401107 Form Version: 2 Effective Date: 1st June 1992 Issued Date: Not Supplied Revocation Date: 2nd November 1990 Discharge Type: Trade Discharges - Cooling Water Discharge: Freshwater Stream/river Environment: Receiving Water: Dillon Brook (M1 Brook) Status: Authorisation revoked Positional Accuracy: Located by supplier to within 10m	E	400	2	346110 352260

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Discharge Consents						
4	Operator: Bico Developments Ltd Property Type: Frying & Pressing Location: Bico Industries Ltd, Prescot, Merseyside, L34 5SZ Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 016300157 Permit Version: 3 Effective Date: 27th November 1996 Issued Date: Not Supplied Revocation Date: 10th March 1997 Discharge Type: Trade Discharges - Cooling Water Discharge: Freshwater Stream/River Environment: Receiving Water Status: Dillon Brook (M1 Brook) Authorisation revoked Position: Located by supplier to within 10m Accuracy:	E	496	2	348140 352260	
Discharge Consents						
1	Operator: Bico Developments Ltd Property Type: Frying & Pressing Location: Bico Industries Ltd, Prescot, Merseyside L34 5SZ Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 016660087 Permit Version: 4 Effective Date: 17th March 1997 Issued Date: Not Supplied Revocation Date: 26th April 1995 Discharge Type: Trade Discharges - Cooling Water Discharge: Freshwater Stream/River Environment: Receiving Water Status: Dillon Brook (M1 Brook) Authorisation revoked Position: Located by supplier to within 10m Accuracy:	E	496	2	348140 352260	
Discharge Consents						
4	Operator: Bico Developments Ltd Property Type: Frying & Pressing Location: Bico Industries Ltd, Prescot, Merseyside, L34 5SZ Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 010950197 Permit Version: 5 Effective Date: 22th April 1993 Issued Date: Not Supplied Revocation Date: 17th May 1996 Discharge Type: Trade Discharges - Cooling Water Discharge: Freshwater Stream/River Environment: Receiving Water Status: Dillon Brook (M1 Brook) Lapsed (under Environment Act 1995 - Schedule 70) Position: Located by supplier to within 10m Accuracy:	F	496	2	348140 352260	
Discharge Consents						
4	Operator: Knowsley Metropolitan Borough Council Property Type: Frying & Pressing Location: Bico Industries Ltd Prescot Merseyside L34 5SZ Authority: Environment Agency - North West Region Catchment Area: Not Given Reference: 016302555 Permit Version: 1 Effective Date: 28th April 1993 Issued Date: Not Supplied Revocation Date: 1st February 2005 Discharge Type: Trade Discharge - Process Water Discharge: Freshwater Stream/River Environment: Receiving Water Status: Prescot Brook Consent revoked - Discharge ceased (Section 37(1)) Position: Located by supplier to within 100m Accuracy:	F	570	2	348140 352260	

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Discharge Consents						
4	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Elm Knawley/Merseyside Authority: Environment Agency - North West Region Consent Area: Not Given Reference: 016020123 Permit Version: 6 Effective Date: 17th January 1990 Issued Date: Not Supplied Revocation Date: 1st April 1992 Discharge Type: Sewage Discharges - Unspecified - Water Company Discharge: Freshwater Stream/River Environment: Freshwater Receiving Water: Prescot Brook Status: Authorisation revoked Potential: Located by supplier to within 100m Accuracy:		SL	507	2	546260 362380
Discharge Consents						
5	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Elm Knawley/Merseyside Authority: Environment Agency - North West Region Consent Area: Not Supplied Reference: 016600121 Permit Version: 1 Effective Date: 12th January 1991 Issued Date: Not Supplied Revocation Date: 30th January 1992 Discharge Type: Sewage Discharges - Unspecified - Water Company Discharge: Freshwater Stream/River Environment: Freshwater Receiving Water: Prescot Brook Status: Authorisation revoked Potential: Located by supplier to within 100m Accuracy:		SE	507	2	546260 362380
Discharge Consents						
6	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Elm Knawley/Merseyside Authority: Environment Agency - North West Region Consent Area: Not Supplied Reference: 016420121 Permit Version: 2 Effective Date: 31st January 1993 Issued Date: Not Supplied Revocation Date: 05th April 1997 Discharge Type: Sewage Discharges - Unspecified - Water Company Discharge: Freshwater Stream/River Environment: Freshwater Receiving Water: Prescot Brook Status: Authorisation revoked Potential: Located by supplier to within 100m Accuracy:		SE	507	1	546260 362380
Discharge Consents						
7	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Elm Knawley/Merseyside Authority: Environment Agency - North West Region Consent Area: Not Supplied Reference: 016420123 Permit Version: 1 Effective Date: 30th April 1987 Issued Date: Not Supplied Revocation Date: 05th April 1988 Discharge Type: Sewage Discharges - Unspecified - Water Company Discharge: Freshwater Stream/River Environment: Freshwater Receiving Water: Prescot Brook Status: Authorisation revoked Potential: Located by supplier to within 100m Accuracy:		SE	507	2	546260 362380

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	MGR
Discharge Consents						
5	Operator: Property Type: Location: Authority: Consentment Area: Reference: Permit Version: Effective Date: Issued Date: Renewal Date: Discharge Type: Discharge: Environment: Receiving Water: Status: Proband: Accuracy:	United Utilities Water Plc Sewage Disposal Works - Water Company Prescot Elm Knowles/Mosseside Environment Agency - North West Region Not Supplied 016930123 4 9th April 1998 Not Supplied 12th October 1999 Sewage Discharges - Hospitalised - Water Company Freshwater Stream/River Prescot Brook Authorisation revoked Located by supplier to within 10m	SE	507	2	340360 342380
Discharge Consents						
5	Operator: Property Type: Location: Authority: Consentment Area: Reference: Permit Version: Effective Date: Issued Date: Renewal Date: Discharge Type: Discharge: Environment: Receiving Water: Status: Proband: Accuracy:	United Utilities Water Plc Sewage Disposal Works - Water Company Prescot Elm Knowles/Mosseside Environment Agency - North West Region Not Supplied 016930123 5 13th October 1999 Not Supplied 15th January 2000 Sewage Discharges - Hospitalised - Water Company Freshwater Stream/River Prescot Brook Authorisation revoked Located by supplier to within 10m	SE	507	2	340360 342380
Discharge Consents						
6	Operator: Property Type: Location: Authority: Consentment Area: Reference: Permit Version: Effective Date: Issued Date: Renewal Date: Discharge Type: Discharge: Environment: Receiving Water: Status: Proband: Accuracy:	United Utilities Water Plc Sewage Disposal Works - Water Company Prescot Elm Knowles/Mosseside Environment Agency - North West Region Not Given 016930123 3 0th April 1997 Not Supplied 8th April 1998 Sewage Discharges - The Storm Overflow/Storm Tank - Water Company Freshwater Stream/River Prescot Brook Authorisation revoked Located by supplier to within 10m	E	509	2	340370 342390
Discharge Consents						
6	Operator: Property Type: Location: Authority: Consentment Area: Reference: Permit Version: Effective Date: Issued Date: Renewal Date: Discharge Type: Discharge: Environment: Receiving Water: Status: Proband: Accuracy:	United Utilities Water Plc Sewage Disposal Works - Water Company Prescot Elm Knowles/Mosseside Environment Agency - North West Region Not Supplied 016930123 1 12th January 1998 Not Supplied 30th January 1999 Sewage Discharges - The Storm Overflow/Storm Tank - Water Company Freshwater Stream/River Prescot Brook Authorisation revoked Located by supplier to within 10m	E	509	2	340370 342390

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Discharge Consents						
6	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Etw Knowsley, Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 01/03/125 Permit Version: 2 Effective Date: 31st January 1985 Issued Date: Not Supplied Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Site Storm Overflow/Storm Tank - Water Company Discharge: Freshwater Stream/River Environment: Prescot Brook Receiving Water Status: Authorisation revoked Positional Accuracy: Located by supplier to within 10m	E	550	2	346210 352300	
Discharge Consents						
6	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Etw Knowsley, Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 01/03/125 Permit Version: 1 Effective Date: 4th April 1984 Issued Date: Not Supplied Revocation Date: 12th October 1978 Discharge Type: Sewage Discharges - Site Storm Overflow/Storm Tank - Water Company Discharge: Freshwater Stream/River Environment: Prescot Brook Receiving Water Status: Authorisation revoked Positional Accuracy: Located by supplier to within 10m	E	550	2	346210 352300	
Discharge Consents						
6	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Etw Knowsley, Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 01/03/023 Permit Version: 5 Effective Date: 10th October 1989 Issued Date: Not Supplied Revocation Date: 16th January 1990 Discharge Type: Sewage Discharges - Site Storm Overflow/Storm Tank - Water Company Discharge: Freshwater Stream/River Environment: Prescot Brook Receiving Water Status: Authorisation revoked Positional Accuracy: Located by supplier to within 10m	L	550	2	346210 352300	
Discharge Consents						
6	Operator: United Utilities Water Plc Property Type: Sewage Disposal Works - Water Company Location: Prescot Etw Knowsley, Merseyside Authority: Environment Agency - North West Region Catchment Area: Not Supplied Reference: 01/03/021 Permit Version: 6 Effective Date: 17th January 1990 Issued Date: Not Supplied Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Site Storm Overflow/Storm Tank - Water Company Discharge: Freshwater Stream/River Environment: Prescot Brook Receiving Water Status: Authorisation revoked Positional Accuracy: Located by supplier to within 10m	E	550	2	346210 352300	

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Discharge Consents						
7	Operator	Executors Of Rivers The Eal Of	N	567	2	345493 353700
	Property Type	Unflooded Or Other				
	Location	Padlock Road Knowsley, Knowsley Merseyside				
	Authority	Environment Agency, North West Region				
	Catchment Area	Not Supplied				
	Reference	0160111				
	Form Version	1				
	Effective Date	8th July 1993				
	Issued Date	08th July 1993				
	Revocation Date	Not Supplied				
	Discharge Type	Sewage Discharges - Final Treated Effluent - Not A Water Company				
	Discharge	Unknown				
	Environment					
	Receiving Water	Unknown				
	Status	Pre National Rivers Authority Legislation where issue date < 01/03/1989				
	Positional Accuracy	Located by supplier to within 10m				
Discharge Consents						
8	Operator	Provision Cables & Systems Ltd	SE	605	2	345500 351770
	Property Type	Industry & Processing				
	Location	Carr Lane Prescot Merseyside				
	Authority	Environment Agency, North West Region				
	Catchment Area	Not Given				
	Reference	016114158				
	Form Version	3				
	Effective Date	12th April 1990				
	Issued Date	Not Supplied				
	Revocation Date	Not Supplied				
	Discharge Type	Trade Discharge - Process Water				
	Discharge	Freshwater Stream/River				
	Environment					
	Receiving Water	Frescot Brook				
	Status	Pre National Rivers Authority Legislation where issue date < 01/03/1989				
	Positional Accuracy	Located by supplier to within 10m				
Discharge Consents						
8	Operator	Bent Rod Rubber Ltd	SE	605	2	345500 351770
	Property Type	Logging & Processing				
	Location	Carr Lane Prescot Merseyside				
	Authority	Environment Agency, North West Region				
	Catchment Area	Not Supplied				
	Reference	010950158				
	Form Version	1				
	Effective Date	1st April 1990				
	Issued Date	Not Supplied				
	Revocation Date	31st May 1993				
	Discharge Type	Trade Discharge - Process Water				
	Discharge	Freshwater Stream/River				
	Environment					
	Receiving Water	Frescot Brook				
	Status	Authorisation revoked				
	Positional Accuracy	Located by supplier to within 10m				
Discharge Consents						
8	Operator	Bent Rod Rubber Ltd	SE	605	2	345500 351770
	Property Type	Logging & Processing				
	Location	Carr Lane Prescot Merseyside				
	Authority	Environment Agency, North West Region				
	Catchment Area	Not Supplied				
	Reference	010950195				
	Form Version	2				
	Effective Date	1st June 1993				
	Issued Date	Not Supplied				
	Revocation Date	11th April 1998				
	Discharge Type	Trade Discharge - Process Water				
	Discharge	Freshwater Stream/River				
	Environment					
	Receiving Water	Frescot Brook				
	Status	Authorisation revoked				
	Positional Accuracy	Located by supplier to within 10m				

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Discharge Consents						
2	Operator	Pyramus Cakes & Systems	SE	606	2	345650 351760
	Property Type	Food & Processing				
	Location	Hill Lane & Carr Lane, Prescot, Merseyside				
	Authority	Environment Agency - North West Region				
	Catchment Area	Not Supplied				
	Reference	010980199				
	Permit Version	3				
	Effective Date	7th November 1986				
	Issued Date	7th November 1986				
	Renewal Date	Not Supplied				
	Discharge Type	Trade Discharge - Process Water				
	Discharge	Freshwater Stream/River				
	Environment					
	Receiving Water	Prescot Brook				
	Status	Pre National Rivers Authority Legislation where issue date < 01/04/1989				
	Position	Located by supplier to within 100m				
	Accuracy					
Discharge Consents						
2	Operator	Qee Rod Refers Ltd	SE	606	2	345650 351760
	Property Type	Food & Processing				
	Location	Hill Lane & Carr Lane, Prescot, Merseyside				
	Authority	Environment Agency - North West Region				
	Catchment Area	Not Supplied				
	Reference	010980199				
	Permit Version	-				
	Effective Date	1st April 1980				
	Issued Date	Not Supplied				
	Renewal Date	31st May 1983				
	Discharge Type	Trade Discharge - Process Water				
	Discharge	Freshwater Stream/River				
	Environment					
	Receiving Water	Prescot Brook				
	Status	Authorisation revoked				
	Position	Located by supplier to within 100m				
	Accuracy					
Discharge Consents						
2	Operator	Qee Rod Refers Ltd	SE	606	2	345650 351760
	Property Type	Food & Processing				
	Location	Hill Lane & Carr Lane, Prescot, Merseyside				
	Authority	Environment Agency - North West Region				
	Catchment Area	Not Supplied				
	Reference	010980199				
	Permit Version	2				
	Effective Date	1st June 1986				
	Issued Date	Not Supplied				
	Renewal Date	0th November 1986				
	Discharge Type	Trade Discharge - Process Water				
	Discharge	Freshwater Stream/River				
	Environment					
	Receiving Water	Prescot Brook				
	Status	Authorisation revoked				
	Position	Located by supplier to within 100m				
	Accuracy					
Integrated Pollution Controls						
5	Name	Park Cakes Ltd	E	642	2	346220 352570
	Location	P.O. Box 21 Carr Lane, FRESBOT, Merseyside, L34 1PD				
	Authority	Environment Agency - North West Region				
	Permit Reference	431627				
	Date	27th October 1995				
	Process Type	IPC application for process that was required by HMIP in its 1986/87 authorisation legislation				
	Description	22 A/Dy (the former) cake processors within the Merseyside				
	Status	Authorisation superseded by a substantial or non-substantial variation				
	Position	Unknown				
	Accuracy					

Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NGR
Integrated Pollution Controls					
9	Name: Peak Coates Ltd Location: Po Box 21, Carr Lane, FRESHFOT, Mossydale, L34 1PD Authority: Environmental Agency - North West Region Permit Reference: A23292 Issue: 16th Aug, 1998 Process Type: IPC minor (non-substantial) variation to previous variation Description: 2.2 A (D) Non-ferrous Metal processes within the Metal Industry Status: Authorisation superseded by a substantial or non-substantial variation Position: Unknown Accuracy:	E	643	2	346220 397070
Integrated Pollution Controls					
5	Name: Peak Coates Ltd Location: P O Box 21, Carr Lane, FRESHFOT, Mossydale, L34 1PD Authority: Environmental Agency - North West Region Permit Reference: 010473 Issue: 24th November 1990 Process Type: IPC minor (non-substantial) variation to previous variation Description: 2.2 A (D) Non-ferrous Metal processes within the Metal Industry Status: Revoked - Now IPPC Position: Unknown Accuracy:	F	646	2	346220 397070
Integrated Pollution Prevention And Control					
10	Name: Peak UK Ltd Location: Precast Road Rulers Unit, Po Box 21, Carr Lane, Prescot, L34 1PD Authority: Environmental Agency - North West Region Permit Reference: C08003su Original Permit Reference: BR4546 Effective Date: 11th October 2004 Status: Superseded By Variation Application Type: Variation Application Sub Type: Minor Position: Automatically positioned to the address Accuracy: Activity Code: 22 A(1) (B) (I) Activity Description: Non-Ferrous Metals, Melting With Capacity Greater Than 4T/D Load/Component Or 20T/D Others	L	652	2	346340 392190
Priority Activity: Y.....					
Integrated Pollution Prevention And Control					
10	Name: Freeman Lathes And Systems Ltd Location: Freeman Lathes & Systems Ltd Post Office Unit, Po Box 21 Carr Lane, FRESHFOT, L34 1PD Authority: Environmental Agency - North West Region Permit Reference: 0170394 Original Permit Reference: 0140546 Effective Date: 31st October 2005 Status: Effective Application Type: Transfer Application Sub Type: Whole without FI and Proper Person Position: Manually positioned to the address & location Accuracy: Activity Code: 22 A(1) (B) (I) Activity Description: Non-Ferrous Metals, Melting With Capacity Greater Than 4T/D Load/Component Or 20T/D Others	E	733	2	346340 392130
Priority Activity: Y.....					

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Integrated Pollution Prevention And Control						
11	Name Location Authority Permit Reference Original Permit Reference Effective Date Status Application Type Application Sub Type Functional Accuracy Activity Code Activity Description Priority Activity	Peak Oil Ltd Preston Road Refinery Unit Site Box 21 Oak Lane Preston L34 1PD Environment Agency - North West Region BM2046 BM2046 3rd December 2002 Superseded By Variation Application New Generally positioned to the address or location 2251111610 Non-Hazardous Mobile, Making With Capacity Greater Than 4110 Lbs/L Cadmium Cr 2010 01ms Y	E	8.54	2	495100 191900
Nearest Surface Water Feature			W	27	-	445320 392270
Pollution Incidents to Controlled Waters						
12	Property Type Location Authority Pollutant Note Incident Date Incident Reference Catchment Area Receiving Water Cause of Incident Severity of Incident Positional Accuracy	Not Given Location Description Not Available Environment Agency - North West Region Miscellaneous - Unknown Preston Brook 3rd August 1993 93440095 Dillon Brook Not Given Unknown Category 3 - Minor Incident Located by supplier to within 100m	SE	447	2	316000 392100
Pollution Incidents to Controlled Waters						
13	Property Type Location Authority Pollutant Note Incident Date Incident Reference Catchment Area Receiving Water Cause of Incident Severity of Incident Positional Accuracy	Not Given Location Description Not Available Environment Agency - North West Region Miscellaneous - Natural Preston Brook 7th October 1994 94742228 A1 Not Given Miscellaneous/Other Pollution Type Category 3 - Minor Incident Located by supplier to within 100m	SE	472	2	316000 391900
Pollution Incidents to Controlled Waters						
14	Property Type Location Authority Pollutant Note Incident Date Incident Reference Catchment Area Receiving Water Cause of Incident Severity of Incident Positional Accuracy	Not Given Location Description Not Available Environment Agency - North West Region Fuel/Oil/Lub Oil Solids Preston Brook Solid Waste Tyres 2nd June 1992 92410771 Cotton Drain Not Given Unknown Category 2 - Significant Incident Located by supplier to within 100m	SE	515	2	346500 392400

Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NGR
Pollution Incidents to Controlled Waters					
15	Property Type: Private Sewage (Non-PLC) Sewerage Systems Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Unknown Sewage Note: Prescot Brook Incident Date: 19th March 1993 Incident Reference: 93440603 Catchment Area: Cotton Brook Receiving Water: Not Given Cause of Incident: Unknown Severity of Incident: Category 3 - Minor Incident Position: Located by supplier to within 100m Accuracy:	E	549	2	346200 392300
Pollution Incidents to Controlled Waters					
16	Property Type: Spillage/Accident - Solid Sub Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Oil - Unknown Note: Prescot Brook Incident Date: 27th August 1991 Incident Reference: 91440603 Catchment Area: Dillon Brook Receiving Water: Not Given Cause of Incident: Unknown Severity of Incident: Category 3 - Minor Incident Position: Located by supplier to within 100m Accuracy:	F	549	2	346200 392300
Pollution Incidents to Controlled Waters					
16	Property Type: Private Sewage (Non-PLC) Sewerage Systems Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Unknown Sewage Note: Prescot Brook Incident Date: 09th January 1992 Incident Reference: 92440603 Catchment Area: Dillon Brook Receiving Water: Not Given Cause of Incident: Unknown Severity of Incident: Category 3 - Minor Incident Position: Located by supplier to within 100m Accuracy:	G	565	2	346400 391900
Pollution Incidents to Controlled Waters					
17	Property Type: Not Given Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Sewage/Wastewater - Unknown Note: Prescot Brook Incident Date: 8th February 1993 Incident Reference: 93440604 Catchment Area: Cotton Brook Receiving Water: Not Given Cause of Incident: Unknown Severity of Incident: Category 3 - Minor Incident Position: Located by supplier to within 100m Accuracy:	E	572	2	346200 392200
Pollution Incidents to Controlled Waters					
18	Property Type: Not Given Location: Mossydale Authority: Environment Agency, North West Region Pollutant: Oil - Diesel (Including Agricultural) Note: Prescot Brook, Dred And Schwa Incident Date: 21st November 1996 Incident Reference: 96740401 Catchment Area: Mearby - Trout Receiving Water: Not Given Cause of Incident: Motorbikes and Other Pollution Type Severity of Incident: Category 2 - Significant Incident Position: Located by supplier to within 100m Accuracy:	SE	619	2	345600 391700

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Pollution Incidents to Controlled Waters						
19	Property Type	Subsided Accident - Drain 50m	F	641	2	348705 392402
	Location	Location Description Not Available				
	Authority	Environment Agency - North West Region				
	Pollutant	Chemicals - Coloured/Suspended				
	Note	Prescol Brook				
	Incident Date	8th September 1994				
	Incident Reference	94/46246				
	Catchment Area	Dillon Brook				
	Receiving Water	Not Given				
	Cause of Incident	Deliberate Disposal To Drain				
	Severity of Incident	Category 3 - Major Incident				
	Positional Accuracy	Located by supplier to within 100m				
Pollution Incidents to Controlled Waters						
20	Property Type	Not Given	E	840	2	346143 392350
	Location	Manseygale				
	Authority	Environment Agency - North West Region				
	Pollutant	Microbiological - Other				
	Note	Prescol Brook, Keweenaw Creek/Dow				
	Incident Date	17th January 1996				
	Incident Reference	96/40112				
	Catchment Area	Mansey - Total				
	Receiving Water	Not Given				
	Cause of Incident	Microbiological/Other Pollution Type				
	Severity of Incident	Category 3 - Minor Incident				
	Positional Accuracy	Located by supplier to within 100m				
Pollution Incidents to Controlled Waters						
21	Property Type	Tip Storage	S	740	2	345800 391500
	Location	Location Description Not Available				
	Authority	Environment Agency - North West Region				
	Pollutant	Waste Materials - Colour				
	Note	Prescol Brook				
	Incident Date	13th January 1994				
	Incident Reference	94/46247				
	Catchment Area	Dillon Brook				
	Receiving Water	Not Given				
	Cause of Incident	Other Incident/Unknown				
	Severity of Incident	Category 3 - Significant Incident				
	Positional Accuracy	Located by supplier to within 100m				
Pollution Incidents to Controlled Waters						
19	Property Type	Not Given	S	926	2	345700 391300
	Location	Chapel Brook/Hayden Industrial Estate/HUYTON, Cheshire				
	Authority	Environment Agency - North West Region				
	Pollutant	Chemicals - Unknown				
	Note	Not Specified				
	Incident Date	28th June 1998				
	Incident Reference	98/241145				
	Catchment Area	Dillon Brook				
	Receiving Water	Freshwater Stream/river				
	Cause of Incident	Unknown				
	Severity of Incident	Category 3 - Minor Incident				
	Positional Accuracy	Located by supplier to within 100m				
River Quality						
	Name	Dillon Brook	E	987	2	348200 392210
	GOA Grade	From Grade E				
	Reach	Cs At Keweenaw Park To Prescol Slu				
	Estimated Distance of Reach (km)	1.8				
	Flow Code	Flow less than 0.31 m³/sec				
	Flow Type	None				
	Year	2000				

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Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NGR
Groundwater Vulnerability					
Geological Classification:	Minor Aquifer (Weakly permeable) - These can be composed of potentially fractured rocks, which do not have a high primary permeability, or other formations of variable permeability including unconsolidated deposits. Although not producing large quantities of water for abstraction, they are important for local supplies and in supplying base flow to rivers.	-	0	2	345480 387390
Drill Classification:	Class of High Leaching Potential (H) - An indication for reduced mineral workings and management based on leach characteristics for instance. A neutral leach vulnerability classification (H) shows no real ground difference.				
Map Sheet Scale:	Sheet 10 West Cheshire 1:100,000				
Drift Deposits					
Drift Deposit:	Low permeability drift deposits occurring at the surface and overlying Major and Minor Aquifers are head, gravelly fine to medium sized deposits and some	-	0	2	345480 387390
Map Sheet Scale:	Sheet 10 West Cheshire 1:100,000				
Extreme Flooding from Rivers or Sea without Defences					
Description:	None	-	-	-	-
Flooding from Rivers or Sea without Defences					
Description:	None	-	-	-	-
Areas Benefiting from Flood Defences					
Description:	None	-	-	-	-
Flood Water Storage Areas					
Description:	None	-	-	-	-
Flood Defences					
Description:	None	-	-	-	-
River Flood Data (Scotland)					
Description:	None	-	-	-	-

Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NGR
BGS Recorded Landfill Sites					
25	Site Name: Whiston Tip Location: Pothey Lane, PRR, SOUTH Merseyside Authority: British Geological Survey, National Geodetic Information Service Ground Water: Information not available Surface Water: Information not available Category: N/A Provisional: Provisioned by the supplier Accuracy: Boundary Accuracy: Good	SE	964	-	546379 361469
Licensed Waste Management Facilities (Locations)					
26	Licensing Number: 54024 Location: Rye Hill Car Lane, Farnost, Merseyside, L34 1B7 Operator Name: Alexon Ltd Operator Location: 25 Hazel Street Warrington Cheshire WA1 1PF Authority: Environment Agency - North West Region - South Area Site Category: Household, Commercial And Industrial Transfer Station Licensing Status: Issued Issued: 30th July 1999 Last Modified: Not Supplied Expires: Not Supplied Successful: Not Supplied Revoked: Not Supplied Suspended: Not Supplied IPPC Reference: Not Supplied Provision: Located by supplier Landfill ID# Accuracy:	F	130	2	546340 360170
Local Authority Landfill Coverage					
	Name: Knowsley Metropolitan Borough Council Location: - For supplier landfill data	-	0	3	545480 361320
Local Authority Landfill Coverage					
	Name: Merseyside Waste Disposal Authority Location: - For supplier landfill data	-	0	4	545490 362320
Local Authority Recorded Landfill Sites					
27	Location: Pothey Waste Knowsley Reference: KO10 Authority: Merseyside Waste Disposal Authority Last Reported Status: Unknown Type of Waste: Not Supplied Date of Closure: Not Supplied Provisional location: Located by supplier to within 10 m Boundary Quality: Not Applicable	E	520	4	545130 362130
Local Authority Recorded Landfill Sites					
28	Location: Whiston Tip, Knowsley Reference: SD0050 Authority: Knowsley Metropolitan Borough Council Last Reported Status: Closed Type of Waste: Refuseable Date of Closure: 31/12/17 Provisional location: Provisioned by the supplier Boundary Quality: Good	SE	976	0	546000 361400

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
	Registered Waste Transfer Sites					
40	Licence Holder	A/leas Ltd	E	752	2	345190 302150
	Licence Reference	BWWMUS022				
	Site Location	Carr Lane, Prestat, Merseyside				
	Operator Location	25 Hazel Street, WARRINGTON, Cheshire, WA1 3PY				
	Authority	Environment Agency - North West Region - South Area				
	Site Category	Storage				
	Maximum Tonnage	5000 (Equal to or greater than 10,000 or at less than 25,000 tonnes per year)				
	Waste Source	No known restriction on source of waste				
	Restrictions					
	Licence Status	Operational as far as is known				
	Validated	30th July 1994				
	Proposed By	Not Given				
	Licensed By	Not Given				
	Not operated By	Not Given				
	Prohibited	Manually processed to the address or location				
	Authority					
	Boundary Quality	Not Supplied				
	Authorized Waste	Maximum Storage In Licence				
		Maximum Waste Permitted By Licence				
		Metal & Bone Meal				
	Prohibited Waste	Other Waste/Waste Not Otherwise Specified				

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
	Control of Major Accident Hazards Sites (COMAH)					
30	Name	Bio Neals (Plymouth) Limited	E	432	E	548210
	Location	PRESCO [®] Merseygate, 1.34 SuR				392180
	Reference	Not Supplied				
	Type	Lower Tier				
	Status	Record Ceased To Be Supplied Under COMAH Regulations				
	Position	Manually positioned to the road when the address is known				
	ASST 5389					

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
BGS Boreholes						
31	BGS Reference: Drilled Length (m): Borehole Name:	S495e174 2.3 The Hazels Prescol Tp 22	N	0	6	345473 362773
BGS Boreholes						
31	BGS Reference: Drilled Length (m): Borehole Name:	S495e187 2.2 The Hazels Prescol Tp 8	NW	0	6	345433 362560
BGS Boreholes						
31	BGS Reference: Drilled Length (m): Borehole Name:	S495e188 2.15 The Hazels Prescol Tp 5	NW	0	6	345410 362570
BGS Boreholes						
31	BGS Reference: Drilled Length (m): Borehole Name:	S495e149 1.5 The Hazels Prescol Tp 11	NE	0	6	345510 362540
BGS Boreholes						
31	BGS Reference: Drilled Length (m): Borehole Name:	S495e200 27 The Hazels Prescol 3	N	0	6	345510 362790
BGS Boreholes						
32	BGS Reference: Drilled Length (m): Borehole Name:	S495e170 2.05 The Hazels Prescol Tp 23	NE	0	6	345530 362430
BGS Boreholes						
32	BGS Reference: Drilled Length (m): Borehole Name:	S495e192 1.5 The Hazels Prescol Tp 9	NE	0	6	345500 362410
BGS Boreholes						
31	BGS Reference: Drilled Length (m): Borehole Name:	S495e180 1.55 The Hazels Prescol Tp 26	N	0	6	345480 362490
BGS Boreholes						
31	BGS Reference: Drilled Length (m): Borehole Name:	S495e185 1 The Hazels Prescol Tp 15	SW	0	6	345430 362250
BGS Boreholes						
34	BGS Reference: Drilled Length (m): Borehole Name:	S495e186 2.4 The Hazels Prescol Tp 1	SW	0	6	345410 362270
BGS Boreholes						
34	BGS Reference: Drilled Length (m): Borehole Name:	S495e186 1.3 The Hazels Prescol Tp 7	SW	0	6	345430 362300
BGS Boreholes						
34	BGS Reference: Drilled Length (m): Borehole Name:	S495e196 1 The Hazels Prescol Tp 13	SW	0	6	345410 362230
BGS Boreholes						
34	BGS Reference: Drilled Length (m): Borehole Name:	S495e197 2.1 The Hazels Prescol Tp 14	SW	0	6	345380 362250
BGS Boreholes						
34	BGS Reference: Drilled Length (m): Borehole Name:	S495e188 25 The Hazels Prescol 1	W	0	6	345410 362740
BGS Boreholes						
34	BGS Reference: Drilled Length (m): Borehole Name:	S495e173 3.62 The Hazels Prescol Tp 21	W	4	6	345400 362310

Map ID	Details		Compass Direction	Estimated Distance From S14a	Contact	NGR
BGS Boreholes						
15	BGS Reference Drilled Length (m) Borehole Name	S445a140 2.7 The Hazels Prescot Tp 7	E	0	6	345560 392540
BGS Boreholes						
32	BGS Reference Drilled Length (m) Borehole Name	S445a101 1.6 The Hazels Prescot Tp 10	NE	0	6	345540 392530
BGS Boreholes						
35	BGS Reference Drilled Length (m) Borehole Name	S445a181 2.5 The Hazels Prescot Tp 29	E	0	6	345550 392535
BGS Boreholes						
36	BGS Reference Drilled Length (m) Borehole Name	S445a120 2 The Hazels Prescot Tp 19	NE	0	6	345590 392550
BGS Boreholes						
38	BGS Reference Drilled Length (m) Borehole Name	S445a182 2.4 The Hazels Prescot Tp 30	E	1	6	345620 392550
BGS Boreholes						
37	BGS Reference Drilled Length (m) Borehole Name	S445a184 1.2 The Hazels Prescot Tp 11	NE	0	6	345640 392530
BGS Boreholes						
37	BGS Reference Drilled Length (m) Borehole Name	S445a103 1.2 The Hazels Prescot Tp 31	NE	0	6	345650 392430
BGS Boreholes						
39	BGS Reference Drilled Length (m) Borehole Name	S445a196 19.5 The Hazels Prescot 2	SE	0	6	345670 392300
BGS Boreholes						
37	BGS Reference Drilled Length (m) Borehole Name	S445a185 2.1 The Hazels Prescot Tp 2	E	1	6	345450 392590
BGS Boreholes						
39	BGS Reference Drilled Length (m) Borehole Name	S445a170 2.05 The Hazels Prescot Tp 27	SW	0	6	345370 392560
BGS Boreholes						
40	BGS Reference Drilled Length (m) Borehole Name	S445a172 3.45 The Hazels Prescot Tp 20	SW	14	6	345320 392530
BGS Boreholes						
41	BGS Reference Drilled Length (m) Borehole Name	S445a176 2.9 The Hazels Prescot Tp 34	E	17	6	345540 392540
BGS Boreholes						
41	BGS Reference Drilled Length (m) Borehole Name	S445a165 2.55 The Hazels Prescot Tp 16	N	75	6	345610 392530
BGS Boreholes						
42	BGS Reference Drilled Length (m) Borehole Name	S445a166 3.95 The Hazels Prescot Tp 14	N	12	6	345590 392570
BGS Boreholes						
43	BGS Reference Drilled Length (m) Borehole Name	S445a167 3.75 The Hazels Prescot Tp 15	NE	95	6	345470 392490

Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NDR
BGS Boreholes					
43	BGS Reference: S495e160 Drilled Length (m): 24 Borehole Name: The Hazels Prescol A	NW	117	G	345370 392510
BGS Boreholes					
44	BGS Reference: S495e171 Drilled Length (m): 3 Borehole Name: The Hazels Prescol Tp 19	SW	109	G	345310 392540
BGS Boreholes					
43	BGS Reference: S495e208 Drilled Length (m): Not Supplied Borehole Name: Kings Business Park Knowsley Tp 2	W	113	G	345290 392590
BGS Boreholes					
45	BGS Reference: S495e178 Drilled Length (m): Not Supplied Borehole Name: Kings Business Park Knowsley Tp 12	W	115	G	345210 392570
BGS Boreholes					
45	BGS Reference: S495e220 Drilled Length (m): Not Supplied Borehole Name: Kings Business Park Knowsley Tp 14	W	138	G	345200 392390
BGS Boreholes					
45	BGS Reference: S495e207 Drilled Length (m): Not Supplied Borehole Name: Kings Business Park Knowsley Tp 3	W	143	G	345190 392380
BGS Boreholes					
45	BGS Reference: S495e206 Drilled Length (m): Not Supplied Borehole Name: Kings Business Park Knowsley Tp 2	W	146	G	345220 392300
BGS Boreholes					
46	BGS Reference: S495e319 Drilled Length (m): Not Supplied Borehole Name: Kings Business Park Knowsley Tp 13	W	155	H	345190 392310
BGS Boreholes					
41	BGS Reference: S495e205 Drilled Length (m): Not Supplied Borehole Name: Kings Business Park Knowsley Tp 3	W	167	G	345200 392330
BGS Boreholes					
40	BGS Reference: S495e165 Drilled Length (m): 4.2 Borehole Name: The Hazels Prescol Tp 10	W	122	G	345270 392350
BGS Boreholes					
46	BGS Reference: S495e310 Drilled Length (m): Not Supplied Borehole Name: Kings Business Park Knowsley Tp 4	W	143	G	345240 392390
BGS Boreholes					
47	BGS Reference: S495e175 Drilled Length (m): 21 Borehole Name: The Hazels Prescol 7	SW	137	G	345240 392090
BGS Boreholes					
48	BGS Reference: S495e162 Drilled Length (m): 2.65 Borehole Name: The Hazels Prescol Tp 9	N	149	G	345430 392580
BGS Boreholes					
48	BGS Reference: S495e151 Drilled Length (m): 21 Borehole Name: The Hazels Prescol 5	N	190	G	345490 392590
BGS Boreholes					
49	BGS Reference: S495e164 Drilled Length (m): 3.8 Borehole Name: The Hazels Prescol Tp 12	W	147	G	345170 392740

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
BGS Boreholes						
49	BGS Reference: United Length (m): Borehole Name:	Sy455a315 Not Supplied Kings Business Park, Knowsley Tp 4	W	182	H	345143 392383
BGS Boreholes						
50	BGS Reference: Drilled Length (m): Borehole Name:	Sy495a201 Not Supplied Kings Business Park, Knowsley Tp 10	W	185	G	345223 392363
BGS Boreholes						
50	BGS Reference: Drilled Length (m): Borehole Name:	Sy495a305 Not Supplied Kings Business Park, Knowsley Tp 1	W	172	G	345223 392363
BGS Boreholes						
50	BGS Reference: Drilled Length (m): Borehole Name:	Sy495a311 Not Supplied Kings Business Park, Knowsley Tp 5	W	172	G	345230 392363
BGS Boreholes						
50	BGS Reference: United Length (m): Borehole Name:	Sy495a312 Not Supplied Kings Business Park, Knowsley Tp 6	W	141	G	345236 392391
BGS Boreholes						
50	BGS Reference: United Length (m): Borehole Name:	Sy495a428 20.5 The Hazels Prescot 2	W	214	G	345190 392320
BGS Boreholes						
51	BGS Reference: Drilled Length (m): Borehole Name:	Sy455a314 Not Supplied Kings Business Park, Knowsley Tp 3	W	185	G	345100 392320
BGS Boreholes						
51	BGS Reference: Drilled Length (m): Borehole Name:	Sy495a313 Not Supplied Kings Business Park, Knowsley Tp 7	W	140	G	345170 392340
BGS Boreholes						
52	BGS Reference: Drilled Length (m): Borehole Name:	Sy105a170 4.3 The Hazels Prescot Tp 13	SW	189	H	345100 392363
BGS Boreholes						
53	BGS Reference: Drilled Length (m): Borehole Name:	Sy195a161 1.45 The Hazels Prescot Tp 8	NW	201	H	345120 392390
BGS Boreholes						
54	BGS Reference: United Length (m): Borehole Name:	Sy455a317 Not Supplied Kings Business Park, Knowsley Tp 11	W	206	G	345210 392410
BGS Boreholes						
54	BGS Reference: Drilled Length (m): Borehole Name:	Sy455a316 Not Supplied Kings Business Park, Knowsley Tp 10	W	223	G	345170 392390
BGS Boreholes						
54	BGS Reference: Drilled Length (m): Borehole Name:	Sy455a150 1 The Hazels Prescot Tp 6	W	223	G	345170 392400
BGS Boreholes						
54	BGS Reference: Drilled Length (m): Borehole Name:	Sy495a158 3.6 The Hazels Prescot Tp 6a	W	229	G	345170 392400
BGS Boreholes						
55	BGS Reference: Drilled Length (m): Borehole Name:	Sy495a160 3.4 The Hazels Prescot Tp 7	NW	215	G	345250 392480

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
BGS Boreholes						
55	BGS Reference: Drilled Length (m): Borehole Name:	S4956116 18 The Hazels Prescol 1	NE	247	E	345209 342705
BGS Boreholes						
56	BGS Reference: Drilled Length (m): Borehole Name:	S4956178 3.35 The Hazels Prescol Tp 25	SW	246	E	345213 341580
BGS Boreholes						
57	BGS Reference: Drilled Length (m): Borehole Name:	S4956163 3.85 The Hazels Prescol Tp 11	W	255	E	345260 342171
BGS Boreholes						
58	BGS Reference: Drilled Length (m): Borehole Name:	S4956166 1.3 The Hazels Prescol Tp 5	W	263	E	345283 342143
BGS Boreholes						
59	BGS Reference: Drilled Length (m): Borehole Name:	S4956177 3.3 The Hazels Prescol Tp 5a	W	263	E	345283 342143
BGS Boreholes						
59	BGS Reference: Drilled Length (m): Borehole Name:	S4956175 4 The Hazels Prescol Tp 4	W	280	E	345273 342253
BGS Boreholes						
59	BGS Reference: Drilled Length (m): Borehole Name:	S4956297 Not Supplied Liverpool Road, Huxton	W	306	E	345310 342280
BGS Boreholes						
60	BGS Reference: Drilled Length (m): Borehole Name:	S4956160 4.5 The Hazels Prescol Tp 17	SW	296	E	345280 342260
BGS Boreholes						
61	BGS Reference: Drilled Length (m): Borehole Name:	S4956151 21 The Hazels Prescol 5	W	321	E	345310 342370
BGS Boreholes						
62	BGS Reference: Drilled Length (m): Borehole Name:	S4956172 0.2 The Hazels Prescol 3	SW	322	E	345170 341430
BGS Boreholes						
63	BGS Reference: Drilled Length (m): Borehole Name:	S4956177 3.55 The Hazels Prescol Tp 10	SW	343	E	344950 342020
BGS Boreholes						
64	BGS Reference: Drilled Length (m): Borehole Name:	S4956172 35 The Hazels Prescol 1	W	340	E	344950 342170
BGS Boreholes						
65	BGS Reference: Drilled Length (m): Borehole Name:	S4956173 3.5 The Hazels Prescol Tp 2	W	384	E	344930 342250
BGS Boreholes						
65	BGS Reference: Drilled Length (m): Borehole Name:	S4956173 4.4 The Hazels Prescol 5	W	411	E	344930 342260
BGS Boreholes						
66	BGS Reference: Drilled Length (m): Borehole Name:	S4956177 3.2 The Hazels Prescol Tp 25	SW	400	E	344950 341850

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
BGS Boreholes						
57	BGS Reference: S485w76		N	412	b	364910 392150
	Drilled Length (m): 163					
	Borehole Name: The Hazels Prescot Tp 3					
BGS Boreholes						
58	BGS Reference: S485w76		E	417	c	365020 392150
	Drilled Length (m): Not Supplied					
	Borehole Name: Prescot Brook Knowsley 1					
BGS Boreholes						
59	BGS Reference: S485w76		W	459	b	364850 392200
	Drilled Length (m): 4					
	Borehole Name: The Hazels Prescot Tp 1					
BGS Boreholes						
60	BGS Reference: S485w76		S	479	d	365040 391800
	Drilled Length (m): 102.72					
	Borehole Name: Mossall Farm					
BGS Boreholes						
71	BGS Reference: S485w216		E	479	c	364120 392250
	Drilled Length (m): Not Supplied					
	Borehole Name: Prescot Brook 2 Tp 1					
BGS Boreholes						
72	BGS Reference: S485w216		F	480	c	365030 392160
	Drilled Length (m): Not Supplied					
	Borehole Name: Prescot Brook 2 To 4					
BGS Boreholes						
73	BGS Reference: S485w216		NE	495	c	364910 391800
	Drilled Length (m): Not Supplied					
	Borehole Name: King George V Playing Fields, Haydock					
BGS Boreholes						
74	BGS Reference: S485w217		E	509	e	364160 392300
	Drilled Length (m): Not Supplied					
	Borehole Name: Prescot Brook 2 Tp 2					
BGS Boreholes						
75	BGS Reference: S485w334		SE	504	f	364040 392330
	Drilled Length (m): Not Supplied					
	Borehole Name: Former Prescot White Liverpool Tp 1					
BGS Boreholes						
76	BGS Reference: S485w336		NE	505	g	365270 392370
	Drilled Length (m): Not Supplied					
	Borehole Name: Prescot Brook Knowsley 2					
BGS Boreholes						
76	BGS Reference: S485w337		NE	526	g	365300 391970
	Drilled Length (m): Not Supplied					
	Borehole Name: Prescot Brook Knowsley P1					
BGS Boreholes						
77	BGS Reference: S485w337		E	564	g	365130 392080
	Drilled Length (m): Not Supplied					
	Borehole Name: Former Prescot White Liverpool Tp 2					
BGS Boreholes						
77	BGS Reference: S485w336		E	605	e	364180 392080
	Drilled Length (m): Not Supplied					
	Borehole Name: Former Prescot White Liverpool Tp 4					
BGS Boreholes						
78	BGS Reference: S485w212		E	670	d	365240 392290
	Drilled Length (m): Not Supplied					
	Borehole Name: Prescot Brook Knowsley P2					
BGS Boreholes						
79	BGS Reference: S485w74		NE	685	g	365080 392000
	Drilled Length (m): 2					
	Borehole Name: From Garsington To 1					

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e73 2 Prop Gardenstone, Tp 2	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e76 2 Prop Gardenstone, Tp 3	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e77 2 Prop Gardenstone, Tp 4	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e75 2 Prop Gardenstone, Tp 5	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e80 3 Prop Gardenstone, Tp 7	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e81 2 Prop Gardenstone, Tp 8	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e82 1 Prop Gardenstone, Tp 9	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e83 2 Prop Gardenstone, Tp 10	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e85 2 Prop Gardenstone, Tp 12	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e85 2 Prop Gardenstone, Tp 13	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e87 2 Prop Gardenstone, Tp 14	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e88 30 Prop Gardenstone, Bl 1	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e88 30 Prop Gardenstone, Bl 2	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e91 30 Prop Gardenstone, Bl 4	NE	585	6	346000 392500
BGS Boreholes						
79	BGS Reference: Drilled Length (m): Borehole Name:	S495e92 30 Prop Gardenstone, Bl 5	NE	585	6	346000 392500

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
74	BGS Boreholes					
	BGS Reference:	S495e30	NE	553	6	345000 392400
	Drilled Length (m):	12				
75	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 3r				
	BGS Reference:	S495e31	NE	565	6	345000 392500
	Drilled Length (m):	11				
76	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 7r				
	BGS Reference:	S495e36	NE	605	6	346000 392500
	Drilled Length (m):	10				
77	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 1r				
	BGS Reference:	S495e37	NE	585	6	346000 392300
	Drilled Length (m):	8				
78	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 10r				
	BGS Reference:	S495e35	NE	565	6	346000 392500
	Drilled Length (m):	10				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 12r				
	BGS Reference:	S495e39	NE	585	6	346000 392400
	Drilled Length (m):	12				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 13r				
	BGS Reference:	S495e100	NE	585	6	346000 392400
	Drilled Length (m):	12				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 14r				
	BGS Reference:	S495e101	NE	575	7	346000 392900
	Drilled Length (m):	10				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 15r				
	BGS Reference:	S495e102	NE	585	6	346000 392900
	Drilled Length (m):	12				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 16r				
	BGS Reference:	S495e103	NE	585	6	346000 392900
	Drilled Length (m):	12				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 17r				
	BGS Reference:	S495e104	NE	585	6	346000 392400
	Drilled Length (m):	12				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 18r				
	BGS Reference:	S495e105	NE	585	6	346000 392400
	Drilled Length (m):	2				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Tp 6				
	BGS Reference:	S495e54	NE	545	6	346000 392500
	Drilled Length (m):	3				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Tp 11				
	BGS Reference:	S495e55	NE	585	6	346000 392400
	Drilled Length (m):	12				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 3r				
	BGS Reference:	S495e56	NE	585	6	346000 392400
	Drilled Length (m):	12				
79	BGS Boreholes					
	Borehole Name:	Pipe Ganderstone, Bh 3r				
	BGS Reference:	S495e56	NE	585	6	346000 392400
	Drilled Length (m):	12				

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
BGS Boreholes						
50	BGS Reference: Drilled Length (m): Borehole Name:	S48sw132 Not Supplied Former Prescott Way, Liverpool Tp 9	SE	551	5	346010 351910
BGS Boreholes						
51	BGS Reference: Drilled Length (m): Borehole Name:	S48sw155 Not Supplied King George V Playing Fields, Huxton 4	SW	540	6	344770 351550
BGS Boreholes						
52	BGS Reference: Drilled Length (m): Borehole Name:	Sy19sw135 Not Supplied Former Prescott Way, Liverpool Tp 9	SE	631	6	345160 352030
BGS Boreholes						
53	BGS Reference: Drilled Length (m): Borehole Name:	S48sw146 Not Supplied King George V Playing Fields, Huxton 2	SW	650	6	344810 351750
BGS Boreholes						
54	BGS Reference: Drilled Length (m): Borehole Name:	S48sw245 9.5 Jacqueline Cross Huxton 1	SW	679	6	345020 351590
BGS Boreholes						
54	BGS Reference: Drilled Length (m): Borehole Name:	Sy19sw244 5 Jacqueline Cross Huxton 2	SW	681	6	345060 351570
BGS Boreholes						
54	BGS Reference: Drilled Length (m): Borehole Name:	Sy19sw215 3 Jacqueline Cross Huxton 3	SW	688	6	345060 351560
BGS Boreholes						
55	BGS Reference: Drilled Length (m): Borehole Name:	S48sw151 Not Supplied King George V Playing Fields, Huxton 3	SW	700	6	344870 352010
BGS Boreholes						
56	BGS Reference: Drilled Length (m): Borehole Name:	Sy45sw147 Not Supplied King George V Playing Fields, Huxton 1	SW	711	6	344840 351670
BGS Boreholes						
57	BGS Reference: Drilled Length (m): Borehole Name:	Sy45sw226 6.7 Hurst Park Drive Huxton 5	S	706	6	345170 351470
BGS Boreholes						
58	BGS Reference: Drilled Length (m): Borehole Name:	S48sw225 8 Hurst Park Drive Huxton 4	SW	707	6	345130 351470
BGS Boreholes						
59	BGS Reference: Drilled Length (m): Borehole Name:	S48sw137 4 Bosco Prescott Tp A15	E	874	6	346630 352470
BGS Boreholes						
60	BGS Reference: Drilled Length (m): Borehole Name:	S48sw125 4 Bosco Prescott Tp A1	E	875	6	346620 352530
BGS Boreholes						
61	BGS Reference: Drilled Length (m): Borehole Name:	Sy45sw115 15.00 Bosco Prescott Tp B12	E	890	6	346650 352370
BGS 1:625,000 Solid Geology						
Description:		Lower Walsoken (mainly Productive Grit Measures)		0	6	346480 352120

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NGR
Coal Mining Affected Areas						
Description	An area which may be affected by coal mining activity. It is recommended that a coal mining report is obtained from the Coal Authority. Contact details are included in the Useful Contacts section of this report.			0	7	345440 392320
Shallow Mining Hazards						
Risk	Low-Moderate			0	8	345440 392320
Source	British Geological Survey, National Geoscience Information Service					
Shallow Mining Hazards						
Risk	Low-Moderate		SE	32	6	345550 392350
Source	British Geological Survey, National Geoscience Information Service					
Shallow Mining Hazards						
Risk	Low-Moderate		NW	230	6	345350 392510
Source	British Geological Survey, National Geoscience Information Service					
Potential for Collapse/In Ground Stability Hazards						
Description	No Hazard		-	-	-	
Potential for Compressible Ground Stability Hazards						
Hazard Potential	No Hazard		-	0	6	345480 392320
Source	British Geological Survey, National Geoscience Information Service					
Potential for Ground Dissolution Stability Hazards						
Description	No Hazard		-	-	-	
Potential for Landslide Ground Stability Hazards						
Hazard Potential	Very Low		-	0	6	345480 392330
Source	British Geological Survey, National Geoscience Information Service					
Potential for Running Sand Ground Stability Hazards						
Hazard Potential	No Hazard		N	0	6	345480 392370
Source	British Geological Survey, National Geoscience Information Service					
Potential for Running Sand Ground Stability Hazards						
Hazard Potential	Very Low			0	6	345480 392380
Source	British Geological Survey, National Geoscience Information Service					
Potential for Shrinking or Swelling Clay Ground Stability Hazards						
Hazard Potential	Very Low		-	0	6	345490 392380
Source	British Geological Survey, National Geoscience Information Service					
Potential for Shrinking or Swelling Clay Ground Stability Hazards						
Hazard Potential	No Hazard		N	0	6	345490 392390
Source	British Geological Survey, National Geoscience Information Service					
Mining Instability						
Mining Features	Unknown vs Coal Mining			0	-	345490 392390
Source	On-Air & Pathways					
Boundary Detail	As Supplied					
Radon Affected Areas						
Description	Less than 1% of houses are above the Action Level		-	0	6	345490 392390
Source	Health Protection Agency					
Radon Protection Measures						
Type	No radon protective measures are necessary in the construction of new dwellings or extensions		-	0	6	345490 392390
Source	British Geological Survey, National Geoscience Information Service					

Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NGR
Contemporary Trade Directory Entries					
92	Name: Independent Post Centre Ltd Location: 3 Birch Meadows, Prescot, Merseyside, L34 1PB Classification: Post & Courier Centre Status: Active Positional Accuracy: Automatically positioned to the address	SW	250	-	346570 362120
Contemporary Trade Directory Entries					
93	Name: James Whicker & Sons (Nurserymen) Ltd Location: Nursery & Garden Centre, Liverpool Road, Prescot, Merseyside, L34 1LX Classification: Gas Suppliers Status: Active Positional Accuracy: Automatically positioned to the address	NE	279	-	346200 362520
Contemporary Trade Directory Entries					
94	Name: Air One Location: 9 Western Dock Road, L36 1TL Classification: Air Compressors Status: Inactive Positional Accuracy: Automatically positioned to the address	SW	691	-	344340 361520
Contemporary Trade Directory Entries					
95	Name: KFC Location: 7 Longview Drive, Liverpool, L30 6DY Classification: Bistros, Takeaways & Cafes Status: Inactive Positional Accuracy: Automatically positioned to the vicinity of the address	SW	741	-	344550 361500
Contemporary Trade Directory Entries					
96	Name: Kennedy Refrigeration & Freezing Co. Ltd Location: 11 West Street, Prescot, Merseyside, L34 1LJ Classification: Post & Courier Centre Status: Inactive Positional Accuracy: Automatically positioned to the address	NE	756	-	346510 362720
Contemporary Trade Directory Entries					
97	Name: H-Tec Deliveries Location: 43 Knowlsey Park Lane, Prescot, Merseyside, L34 3XA Classification: Road Haulage Services Status: Inactive Positional Accuracy: Automatically positioned to the address	NE	866	-	346380 363180
Contemporary Trade Directory Entries					
98	Name: West Street Garage Location: West Street, Prescot, Merseyside, L34 1LJ Classification: Garage Services Status: Inactive Positional Accuracy: Automatically positioned to the address	NE	890	-	346170 362170
Contemporary Trade Directory Entries					
99	Name: Lorraine Hardware Location: 64 Hilda Road, Huyton, Liverpool, L36 2BJ Classification: Hardware Status: Active Positional Accuracy: Automatically positioned to the address	W	896	-	344410 362270
Contemporary Trade Directory Entries					
100	Name: Longbow Service Station Location: Longbow Drive, Liverpool, L30 6EB Classification: Petrol Filling Stations Status: Active Positional Accuracy: Automatically positioned to the address	E	903	-	346280 361770

Map ID	Details		Compass Direction	Estimated Distance From Site	Contact	NCR
Contemporary Trade Directory Entries						
101	Name	Express Catch Remotely Servicing Centre	C	921	-	146170 392140
	Location	Unit Q118-32, Jewell Street, Prescot, Merseyside, L34 1MD				
	Classification	Roof & Clutch Service Centres				
	Status	Active				
	Positional Accuracy	Automatically positioned to the address				
Contemporary Trade Directory Entries						
102	Name	Kendal Thompson Ltd	NE	970	-	146720 392350
	Location	Forest House, 3 High Street, PRESCOT, Merseyside, L34 0LD				
	Classification	Road Working & Scaffolding Equipment & Material Hire, Tool hire				
	Status	Active				
	Positional Accuracy	Automatically positioned to the address or location				
Contemporary Trade Directory Entries						
103	Name	W. A. E. Motors Ltd	E	985	-	146620 392490
	Location	15, Seawall Street, Prescot, Merseyside, L34 1ND				
	Classification	Car Dealers				
	Status	Active				
	Positional Accuracy	Automatically positioned to the address				
Contemporary Trade Directory Entries						
104	Name	Stephenson Print	E	985	-	146700 392700
	Location	5 Mount Pleasant, Merseyside, L34 0SL				
	Classification	Printers				
	Status	Active				
	Positional Accuracy	Automatically positioned to the road within the address or location				
Fuel Station Entries						
105	Name	Supercheap	NE	274	-	146750 392490
	Location	Liverpool Road, PRESCOT Merseyside, L34 1NH				
	Brand	Obsolete				
	Premises Type	Not Applicable				
	Status	Obsolete				
	Positional Accuracy	Automatically positioned to the address or location				
Fuel Station Entries						
106	Name	Bluebell Service Station	W	891	-	146100 392090
	Location	Liverpool Road, L34 1NH, LIVERPOOL, Merseyside, L				
	Brand	Obsolete				
	Premises Type	Not Applicable				
	Status	Obsolete				
	Positional Accuracy	Approximate location provided by mapfile				
Fuel Station Entries						
107	Name	Longway Service Station	N	970	-	145200 391270
	Location	Longway Drive, York Road, HUYTON, LIVERPOOL, Merseyside, L32 6LE				
	Brand	Circle K				
	Premises Type	Petrol Station				
	Status	Open				
	Positional Accuracy	Automatically positioned to the address				

Map ID	Details	Compass Direction	Estimated Distance From Site	Contact	NGR
Areas of Adopted Green Belt					
Authority:	Knowsley Metropolitan Borough Council	-	0	3	345430
Plan Name:	Knowsley Metropolitan Borough Unitary Development Plan				352370
Status:	Adopted				
Plan Date:	20th June 1994				
Areas of Unadopted Green Belt					
Authority:	Knowsley Metropolitan Borough Council	-	0	3	345430
Plan Name:	Knowsley Unitary Development Plan Revised Draft Replacement Plan				352320
Status:	Revised Draft				
Plan Date:	31st December 2004				
Heritage Vulnerable Zones					
Name:	Not Supplied	NW	242	0	345030
Description:	Surface Water				351780
Source:	Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)				

Data Type	Version	Update Cycle
Agency & Hydrological		
Local Authority Pollution Prevention and Controls Knowsley Metropolitan Borough Council Environmental Health and Consumer Protection Division	January-2006	Annual Rolling Update
Local Authority Pollution Prevention and Control Enforcements Knowsley Metropolitan Borough Council Environmental Health and Consumer Protection Division	January-2006	Annual Rolling Update
Contaminated Land Register Entries and Notices Knowsley Metropolitan Borough Council Department of Planning and Development	April-2006	Annual Rolling Update
Discharge Consents Environment Agency North West Region	July-2005	Quarterly
Integrated Pollution Controls Environment Agency North West Region	July-2005	Quarterly
Integrated Pollution Prevention And Control Environment Agency North West Region	July-2005	Quarterly
Local Authority Integrated Pollution Prevention And Control Knowsley Metropolitan Borough Council Environmental Health and Consumer Protection Division	January-2006	Annual Rolling Update
Nearest Surface Water Feature Ordnance Survey	April-2006	Quarterly
Pollution Incidents to Controlled Waters Environment Agency North West Region	January-2006	Not Applicable
Substantiated Pollution Incident Register Environment Agency North West Region South Area	July-2005	Quarterly
Water Industry Act Referrals Environment Agency North West Region	July-2005	Quarterly
Registered Radioactive Substances Environment Agency North West Region	July-2005	Quarterly
River Quality Environment Agency Head Office	November-2005	Not Applicable
River Quality Biology Sampling Points Environment Agency Head Office	February-2006	Annually
River Quality Chemistry Sampling Points Environment Agency Head Office	January-2006	Annually
Water Abstractions Environment Agency North West Region	July-2005	Quarterly
Groundwater Vulnerability Environment Agency Head Office	January-1999	Not Applicable

Data Type	Version	Update Cycle
Agency & Hydrological		
Drift Deposits		
Environment Agency Head Office	January-1998	Not Applicable
Source Protection Zones		
Environment Agency Head Office	April 2005	Variable
Extreme Flooding from Rivers or Sea without Defences		
Environment Agency Head Office	September-2006	Quarterly
Flooding from Rivers or Sea without Defences		
Environment Agency Head Office	September-2006	Quarterly
Areas Benefiting from Flood Defences		
Environment Agency Head Office	September-2006	Quarterly
Flood Water Storage Areas		
Environment Agency Head Office	July-2005	Quarterly
Flood Defences		
Environment Agency Head Office	September-2006	Quarterly
River Flood Data (Scotland)		
Centre for Ecology and Hydrology	September-1999	Not Applicable

Data Type	Version	Update Cycle
Waste		
BGS Recorded Landfill Sites		
British Geological Survey National Geoscience Information Service	June-1996	Not Applicable
Integrated Pollution Control Registered Waste Sites		
Environment Agency North West Region	July-2006	Quarterly
Licensed Waste Management Facilities (Landfill Boundaries)		
Environment Agency - North West Region South Area	May-2006	Quarterly
Licensed Waste Management Facilities (Locations)		
Environment Agency - North West Region South Area	August-2006	Quarterly
Local Authority Landfill Coverage		
Knowsley Metropolitan Borough Council	May-2000	Not Applicable
Merseyside Waste Disposal Authority	May-2000	Not Applicable
Local Authority Recorded Landfill Sites		
Knowsley Metropolitan Borough Council	May-2000	Not Applicable
Merseyside Waste Disposal Authority	May-2000	Not Applicable
Registered Landfill Sites		
Environment Agency - North West Region South Area	March-2000	Not Applicable
Registered Waste Transfer Sites		
Environment Agency - North West Region South Area	March-2000	Not Applicable
Registered Waste Treatment or Disposal Sites		
Environment Agency - North West Region South Area	March-2000	Not Applicable

Data Type	Version	Update Cycle
Hazardous Substances		
Control of Major Accident Hazards Sites (COMAH)		
Health and Safety Executive	May-2006	Bi-Annually
Explosive Sites		
Health and Safety Executive	September-2006	Bi-Annually
Notification of Installations Handling Hazardous Substances (NIHHS)		
Health and Safety Executive	November-2000	Not Applicable
Planning Hazardous Substance Consents		
Knowsley Metropolitan Borough Council	September-2006	Annual Rolling Update
Planning Hazardous Substance Enforcements		
Knowsley Metropolitan Borough Council	September-2006	Annual Rolling Update

Data Type	Version	Update Cycle
Geological		
BGS Boreholes		
British Geological Survey National Geoscience Information Service	October-2006	Quarterly
BGS Recorded Mineral Sites		
British Geological Survey National Geoscience Information Service	October-2006	3-Annually
BGS 1:825,000 Solid Geology		
British Geological Survey National Geoscience Information Service	August-1996	Not Applicable
Brine Compensation Areas		
Cheshire Brine Subsidence Compensation Board	November-2002	As notified
Coal Mining Affected Areas		
The Coal Authority Mining Report Service	January-2006	As notified
Shallow Mining Hazards		
British Geological Survey National Geoscience Information Service	August-2002	Not Applicable
Potential for Collapsible Ground Stability Hazards		
British Geological Survey National Geoscience Information Service	May-2006	Annually
Potential for Compressible Ground Stability Hazards		
British Geological Survey National Geoscience Information Service	November-2005	Annually
Potential for Ground Dissolution Stability Hazards		
British Geological Survey National Geoscience Information Service	May-2006	Annually
Potential for Landfill Ground Stability Hazards		
British Geological Survey National Geoscience Information Service	May-2006	Annually
Potential for Running Sand Ground Stability Hazards		
British Geological Survey National Geoscience Information Service	May-2006	Annually
Potential for Shrinking or Swelling Clay Ground Stability Hazards		
British Geological Survey National Geoscience Information Service	May-2006	Annually
Mining Instability		
One Group & Partners	October-2006	Not Applicable
Natural and Mining Cavities		
Deer Broth Associates	December-2005	Variable
Radon Affected Areas		
Health Protection Agency	January-2003	Not Applicable
Radon Protection Measures		
British Geological Survey National Geoscience Information Service	August-2002	Variable

Data Type	Version	Update Cycle
Industrial Land Use		
Contemporary Trade Directory Entries	August-2006	Quarterly
Thomson Directories		
Fuel Station Entries	September-2006	Quarterly
Celtek LVI (Fuel Station Data)		

Data Type	Version	Update Cycle
Sensitive Land Uses		
Areas of Adopted Green Belt		
St Helens Metropolitan Borough Council	July-1998	As notified
Knowsley Metropolitan Borough Council	June-1999	As notified
Liverpool City Council	November-2002	As notified
Areas of Unadopted Green Belt		
Knowsley Metropolitan Borough Council	December-2014	As notified
St Helens Metropolitan Borough Council	July-1998	As notified
Liverpool City Council	November-2002	As notified
Areas of Outstanding Natural Beauty		
The Countryside Agency	October-2004	Annually
Environmentally Sensitive Areas		
Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	June-2005	Annually
Forest Parks		
Forestry Commission	April-1997	Not Applicable
Local Nature Reserves		
Liverpool City Council	September-1999	Variable
Marine Nature Reserves		
English Nature	May-2006	Bi-Annually
National Nature Reserves		
English Nature	May-2006	Bi-Annually
National Parks		
The Countryside Agency	October-2006	Annually
Nitrate Sensitive Areas		
Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	December-2005	Not Applicable
Nitrate Vulnerable Zones		
Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	May-2006	Annually
Ramsar Sites		
English Nature	May-2006	Bi-Annually
Sites of Special Scientific Interest		
English Nature	May-2006	Bi-Annually
Special Areas of Conservation		
English Nature	May-2006	Bi-Annually
Special Protection Areas		
English Nature	May-2006	Bi-Annually

Some of the organisations who provide data which is used within the report

Ordnance Survey



Environment Agency



Scottish Environment Protection Agency



The Coal Authority



British Geological Survey



**British
Geological Survey**

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

Centre for Ecology and Hydrology



**Centre for
Ecology & Hydrology**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Countryside Council for Wales



CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES

Scottish Natural Heritage



English Nature

Site of Special Scientific Interest, National Nature Reserve, Ramsar, Special Protection Area, Special Conservation Area, Marine Nature Reserve data licensed from Countryside Survey 1990/2000 copyright provided by, and used with the permission of, English Nature who retain the copyright and Intellectual Property Rights for the data



Health Protection Agency



Ove Arup

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Peter Brett Associates

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Health and Consumer Protection Division**

Municipal Buildings
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Kirkby
Knowsley
Merseyside
L32 1TX

Telephone 0151 443 4721
Fax 0151 289 7428

www.knowsley.gov.uk

**2 Environment Agency National Customer Contact Centre
(NCCC)**

PO Box 544
Templeborough
Rotherham
S60 1BW

Telephone 08706 506 506

enquiries@environment-agency.gov.uk

3 Knowsley Metropolitan Borough Council

Archway Road
Huyton
Liverpool
Merseyside
L35 9YU

Telephone 0151 489 6000
Fax 0151 443 2298

www.knowsley.gov.uk

4 Merseyside Waste Disposal Authority

2nd Floor
North House
17 North John Street
Liverpool
Merseyside
L2 5QY

Telephone 0151 2551444
Fax 0151 2271848

enquiries@merseysidewda.gov.uk

Contact Name and Address
5 Health and Safety Executive

HSE Infoline
 Caerphilly Business Park
 Caerphilly
 CF83 3CG

hseinformationservices@natbrit.com
www.hse.gov.uk

Telephone 087011 545500
 Fax 02920 869260

6 British Geological Survey Enquiry Service

British Geological Survey
 Kingsley Dunham Centre
 Keyworth
 Nottingham
 Nottinghamshire
 NG12 5GG

enquiries@bgs.ac.uk
www.bgs.ac.uk

Telephone 0115 936 3145
 Fax 0115 936 3270

7 The Coal Authority Mining Report Service

200 Lichfield Lane
 Mansfield
 Nottinghamshire
 NG18 4RG

thecoalauthority@coal.gov.uk

Telephone 0845 7620848
 DX 716176 Mansfield 5

8 Health Protection Agency

Chilton
 Didcot
 Oxfordshire
 OX11 0RQ

Telephone 01235 831600
 Fax 01235 233891

9 Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)

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 Olley Road
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 LS16 5QT

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 Fax 0113 230 0879

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22 Richmond Hill

Clifton

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Landmark Information Group Limited

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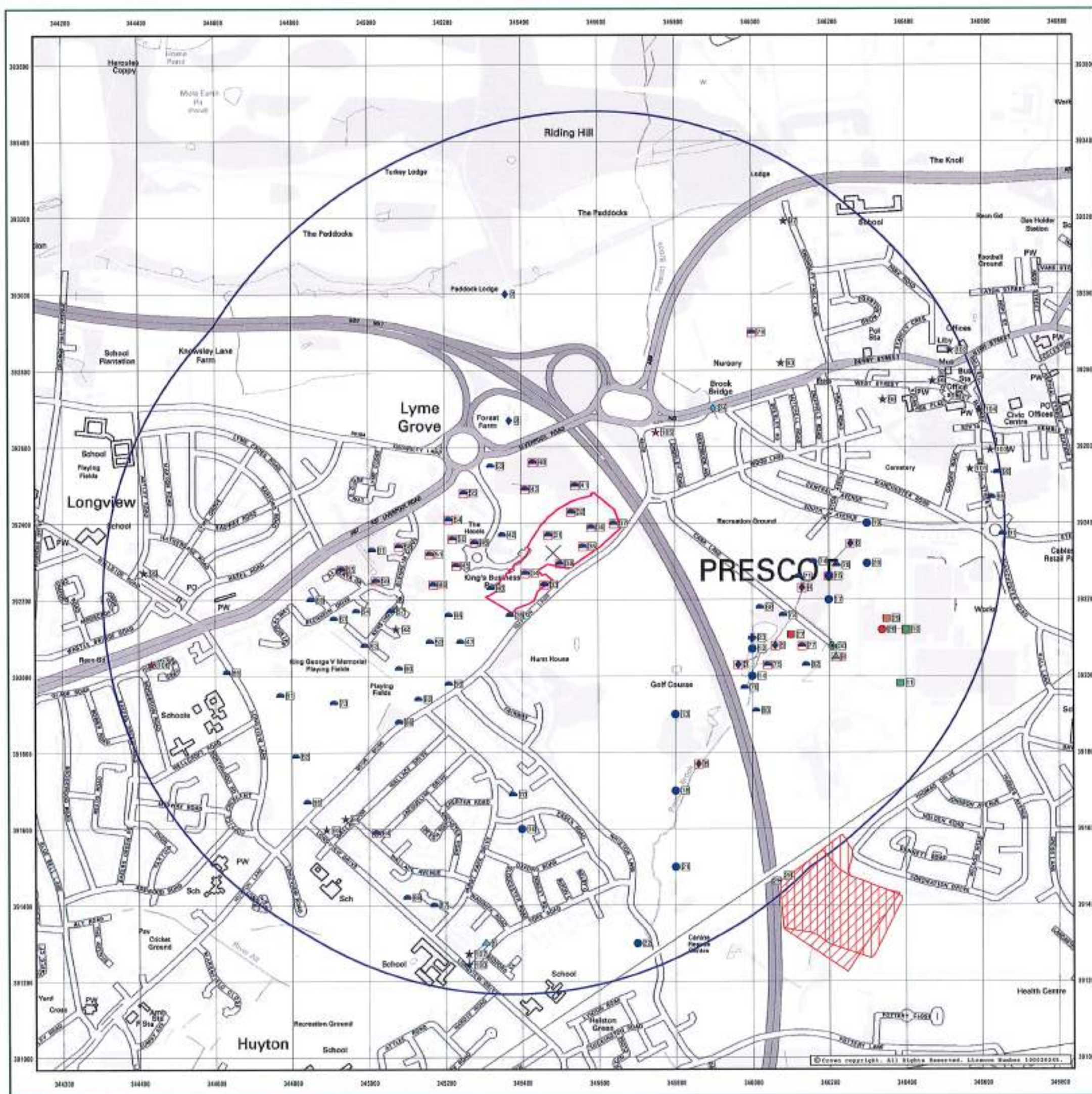
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Please note that the Environment Agency/SEPA have a charging policy in place for enquiries.



CLIENT DETAILS Envirocheck Order No. EC20523531_1_1

Customer Ref: 6 Underwood, 1128
FWS Consultants Ltd
Merrington House, Po Box 11 Merrington Lane Trading Estate
Spennymoor
Durham DL16 7UU

SITE DETAILS Grid Reference 345480 392320

Area A and B
Kings Business Park
Knowsley

KEY TO THE LEGEND DATABASE

General	Waste
Specified Site	Point Location of BGS Recorded Landfill Site
Bearing Reference Point	BGS Recorded Landfill Site
Buffer (1000m)	Integrated Pollution Control Registered Waste Site
Reference Number	Licensed Waste Management Facilities (Landfill Boundary)
Several of Type at Location	Licensed Waste Management Facility (Location)
	Point Location of Local Authority Recorded Landfill Site
	Local Authority Recorded Landfill Site
	Registered Landfill Site (Polygon)
Agency and Hydrological	
Local Authority Pollution Prevention and Control	Point Location of Registered Landfill Site
Local Authority Pollution Prevention and Control Enforcement	Registered Landfill Site (Point Buffered to 100m)
Point Location of Contaminated Land Register Entry or Notice	Registered Landfill Site (Point Buffered to 250m)
Contaminated Land Register Entry or Notice	Point Location of Registered Waste Transfer Site
Discharge Consent	Registered Waste Transfer Site
Enforcement Or Prohibition Notice	Point Location of Registered Waste Treatment or Disposal Site
Integrated Pollution Control	Registered Waste Treatment or Disposal Site
Integrated Pollution Prevention Control	
Local Authority Integrated Pollution Prevention and Control	
Pollution Incident to Controlled Waters	
Substantiated Pollution Incident Register	
Prosecution Relating to Authorised Processes	
Prosecution Relating to Controlled Waters	
Registered Radioactive Substance	
River Quality Sampling Point	
Water Abstraction	
Water Industry Act Referral	
Hazardous Substances	
COMAH Site	
Explosive Site	
NIHHS Site	
Planning Hazardous Substance Consent	
Planning Hazardous Substance Enforcement	
Geological	
BGS Borehole	
BGS Recorded Mineral Site	
Industrial Land Use	
Contemporary Trade Directory Entry	
Fuel Station Entry	



CLIENT DETAILS Envirocheck Order No. EC20523531_1_1

Customer Ref: S Underwood, 1129
FWS Consultants Ltd
Merrington House, Po Box 11 Merrington Lane Trading Estate
Spennymoor
Durham DL16 7UU

SITE DETAILS Grid Reference 345480 392320

Areas A and B
Kings Business Park
Knowsley

KEY TO THE LEGEND DATABASE

General	Waste
Specified Site	Point Location of BGS Recorded Landfill Site
Bearing Reference Point	BGS Recorded Landfill Site
Buffer (250m)	Integrated Pollution Control Registered Waste Site
Reference Number	Licensed Waste Management Facilities (Landfill Boundary)
Several of Type at Location	Licensed Waste Management Facility (Location)
Pylon	Point Location of Local Authority Recorded Landfill Site
Overhead Transmission Line	Local Authority Recorded Landfill Site
	Registered Landfill Site (Polygon)
Agency and Hydrological	
Local Authority Pollution Prevention and Control	Point Location of Registered Landfill Site
Local Authority Pollution Prevention and Control Enforcement	Registered Landfill Site (Point Buffered to 100m)
Point Location of Contaminated Land Register Entry or Notice	Registered Landfill Site (Point Buffered to 250m)
Contaminated Land Register Entry or Notice	Point Location of Registered Waste Transfer Site
Discharge Consent	Registered Waste Transfer Site
Enforcement Or Prohibition Notice	Point Location of Registered Waste Treatment or Disposal Site
Integrated Pollution Control	Registered Waste Treatment or Disposal Site
Integrated Pollution Prevention Control	
Local Authority Integrated Pollution Prevention and Control	
Pollution Incident to Controlled Waters	
Substantiated Pollution Incident Register	
Prosecution Relating to Authorised Processes	
Prosecution Relating to Controlled Waters	
Registered Radioactive Substance	
River Network or Water Feature	
River Quality Sampling Point	
Water Abstraction	
Water Industry Act Referral	
Hazardous Substances	
COMAH Site	
Explosive Site	
NIHHS Site	
Planning Hazardous Substance Consent	
Planning Hazardous Substance Enforcement	
Geological	
BGS Borehole	
BGS Recorded Mineral Site	
Industrial Land Use	
Contemporary Trade Directory Entry	
Fuel Station Entry	

APPENDIX E

Exploratory Hole Records

TerraConsult		Borehole Log				Borehole no: BH101		Sheet 1 of 1					
Personnel: Drilled by: ACE Logged by: LM Checked by: DD		Equipment & methods: Plant: Beretta T41 Method: Hand dug inspection pit to 0.70m bgl. Rotary coring to depth. Flush: Air/Mist SPT Hammer details: N/A		Hole diameter & casing depths: Dia (mm): to: Casing depth: 0.50 92 7.50 0.50		Coordinates & level: UK National Grid 345589.93mE 392435.30mN -		Dates: Start: 15/12/2014 End: 16/12/2014 Backfilled: 16/12/2014					
Backfill/ Well Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Progress, Casing & Water Data		Samples & In Situ Testing						
					Date Casing	Time Water	Depth Core run	Type & No.	Results				
			(0.20)	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.	15/12/2014	1600	0.50 - 1.50	56 0 0	NI NI 70				
			(0.30)	Light orangish brown slightly silty gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of sandstone.	16/12/2014	0800							
			(1.20)	Very weak light brownish grey finely laminated fine grained SANDSTONE. Joints are horizontal to 10 degrees, extremely closely spaced, planar and smooth.			1.50 - 3.00	77 9 0	NI NI 180				
			(0.35)	Completely weathered SANDSTONE recovered as firm slightly sandy gravelly CLAY. Gravel is angular fine to medium of sandstone.									
			(2.08)	Extremely weak to very weak brownish grey mottled dark greyish brown SILTSTONE. Joints are horizontal and vertical, extremely closely to very closely spaced, planar and rough.			3.00 - 4.50	94 32 19	NI NI NI				
			(0.37)	Extremely weak brownish grey mottled orangish brown SILTSTONE. Joints are horizontal and vertical, extremely closely spaced, planar and smooth.									
			(2.26)	Very weak light brownish grey finely laminated fine grained SANDSTONE. Joints are horizontal and vertical, extremely closely to closely spaced, planar and smooth. Penetrative orangish brown staining to 3mm.			4.50 - 6.00	100 26 7	NI 80 240				
			(0.44)	Weak light brownish grey finely laminated fine SANDSTONE. Joints are horizontal and vertical, extremely closely to closely spaced, planar and smooth. Penetrative orangish brown staining to 3mm.									
			(0.30)	Extremely weak dark grey thinly bedded MUDSTONE. Joints are horizontal to vertical, extremely closely spaced, planar and smooth.			6.00 - 7.50	97 58 33	NI NI 50				
			(0.44)	Weak light brownish grey finely laminated fine SANDSTONE. Joints are horizontal and vertical, extremely closely to closely spaced, planar and smooth. Penetrative orangish brown staining to 3mm.									
				Exploratory hole ends at 7.50 m									
					Casing Date	Water Time	Core run Depth	TCR SCR ROD	If	Results			
Instrumentation details: ID: Type: Diam: Remarks:					General remarks:					Groundwater entries: Struck: Rose to: Rate of Depth (20 mins) inflow: sealed: No Groundwater Encountered		Chiselling: From: to: Duration (min): Tool:	
Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres. Log issue: Draft Scale: 1:50 (c) TerraConsult. www.terraconsult.co.uk					Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd								

TerraConsult		Borehole Log				Borehole no: BH102		Sheet 1 of 1		
Personnel: Drilled by: ACE Logged by: LM Checked by: DD		Equipment & methods: Plant: Beretta T41 Method: Hand dug inspection pit to 1.20m bgl. Rotary open hole drilling to 1.80m bgl. Rotary coring to depth. Flush: Air/Mist SPT Hammer details: N/A		Hole diameter & casing depths: Dia (mm): 92 to: 8.20 Casing depth: 1.20		Coordinates & level: UK National Grid 345611.27mE 392400.20mN		Dates: Start: 16/12/2014 End: 16/12/2014 Backfilled: 16/12/2014		
Backfill/ Well Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Progress, Casing & Water Data		Samples & In Situ Testing			
					Date Casing	Time Water	Depth Core run	Type & No.	Results	
			(0.30)	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.			1.80 - 3.10	98 9 0	NI NI 120	
			0.30	Firm becoming stiff light orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of siltstone.						
			(1.50)							
			1.80	Completely weathered SILTSTONE recovered as firm light greyish brown slightly sandy gravelly CLAY. Gravel is angular fine to coarse of siltstone.						
			(0.42)							
			2.22	Extremely weak light greyish brown laminated SILTSTONE. Joints are horizontal to 10 degrees extremely closely to closely spaced with orangish brown penetrative staining to 1mm, planar and smooth.						
			(1.30)							
			3.52	Extremely weak to very weak light brownish grey thinly laminated fine grained SANDSTONE. Joints are horizontal to 10 degrees very closely to closely spaced, planar and smooth.						
			(0.61)							
			4.13	Extremely weak light greyish brown laminated SILTSTONE. Joints are horizontal and vertical extremely closely spaced, planar and smooth.						
(0.19)										
4.32	Extremely weak to very weak light brownish grey thinly laminated fine grained SANDSTONE. Joints are horizontal to 10 degrees very closely to closely spaced, planar and smooth.									
(0.68)										
5.00	Extremely weak light greyish brown laminated SILTSTONE. Joints are horizontal and vertical extremely closely spaced with dark reddish orange penetrative staining to 1mm, planar and smooth.									
(0.47)										
5.47	Very weak light brownish grey thinly laminated fine grained SANDSTONE. Joints are horizontal to 10 degrees very closely to closely spaced, planar and smooth.									
(1.51)										
6.98	Extremely weak dark grey thinly bedded MUDSTONE. Joints are horizontal to vertical, extremely closely spaced with orangish brown penetrative staining to 1mm, planar and smooth.									
(0.62)										
7.60	Very weak light orangish brown fine SANDSTONE. Joints are horizontal and vertical extremely closely to closely spaced, planar and rough.									
(0.60)										
8.20	Exploratory hole ends at 8.20 m									
					Casing Date	Water Time	Core run Depth	TCR SCR ROD	If	Results
Instrumentation details: ID: Type: Diam: Remarks: 1 SP 51 RC 150 GV				General remarks:		Groundwater entries: Struck: Rose to: Rate of Depth: (20 mins) inflow: sealed: No Groundwater Encountered		Chiselling: From: to: Duration (min): Tool:		
Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres. Log issue: Draft Scale: 1:50 (c) TerraConsult. www.terraconsult.co.uk				Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd						

Dates:	
Start:	17/12/2014
End:	17/12/2014
Backfilled:	17/12/2014

 Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres. Log issue: Draft Scale: 1:50 (c) TerraConsult. www.terraconsult.co.uk	Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd
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TerraConsult		Borehole Log				Borehole no: BH104		Sheet 1 of 1		
Personnel: Drilled by: ACE Logged by: LM Checked by: DD		Equipment & methods: Plant: Beretta T41 Method: Hand dug inspection pit to 0.30m bgl. Rotary coring to depth. Flush: Air/Mist SPT Hammer details: N/A		Hole diameter & casing depths: Dia (mm): 92 to: 7.00 Casing depth: 0.80		Coordinates & level: UK National Grid 345573.96mE 392379.29mN - - -		Dates: Start: 17/12/2014 End: 17/12/2014 Backfilled: 18/12/2014		
Backfill/ Well Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Progress, Casing & Water Data		Samples & In Situ Testing			
					Date Casing	Time Water	Depth Core run	Type & No.	Results	
			(0.30)	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.		1600 Dry	0.30 - 0.80	94 0 0	NI NI NI	
			0.30							
			(1.10)	Extremely weak dark brownish grey laminated SILTSTONE. Joints are horizontal and vertical, extremely closely to closely spaced with orange and bluish brown penetrative staining to 1mm, planar and smooth. 0.30m - 0.80m: Non intact, possibly due to drilling induced fractures. 0.80m - 1.40m: No recovery.		0800 Dry	0.80 - 1.40	0 0 0	NI NI NI	
			1.10							
			(0.16)	Completely weathered SILTSTONE recovered as firm slightly sandy gravelly CLAY.			1.40 - 1.90	98 24 0		
			1.40							
			(2.34)	Very weak brownish grey thinly laminated SILTSTONE. Joints are horizontal to 5 degrees, extremely closely to closely spaced with orangish brown penetrative staining to 2mm, planar and smooth. 2.30m - 2.72m: Non intact. 2.90m - 3.15m: Vertical joint.			1.90 - 2.90	100 41 0	NI NI 120	
			2.34							
			(0.10)	Completely weathered SILTSTONE recovered as firm slightly sandy gravelly CLAY.			2.90 - 3.70	100 24 15		
			3.90							
(1.45)	Very weak dark greyish brown thinly laminated SILTSTONE. Joints are horizontal and vertical to 45 degrees, extremely closely to closely spaced with dark orangish brown penetrative staining to 2mm, planar and rough.			3.70 - 4.00	100 0 0					
4.00										
			(5.45)	Extremely weak brownish grey mottled light grey SILTSTONE. Joints are horizontal and vertical, extremely closely spaced, planar and smooth.			4.00 - 5.50	100 11 0	NI NI 60	
			5.45							
			(1.55)				5.50 - 7.00	95 10 0	NI NI 90	
7.00										
				Exploratory hole ends at 7.00 m						
					Casing Date	Water Time	Core run Depth	TCR SCR ROD	If	Results
Instrumentation details: ID: Type: Diam: Remarks: 1 SP 51 RC 150 GV				General remarks:		Groundwater entries: Struck: Rose to: Rate of Depth: sealed: (20 mins) inflow: No Groundwater Encountered		Chiselling: From: to: Duration (min): Tool:		
Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres. Log issue: Draft Scale: 1:50 (c) TerraConsult. www.terraconsult.co.uk				Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd						

TerraConsult		Borehole Log				Borehole no: BH105		Sheet 1 of 1											
Personnel: Drilled by: ACE Logged by: LM Checked by: DD		Equipment & methods: Plant: Beretta T41 Method: Hand dug inspection pit to 0.50m bgl. Rotary coring to depth. Flush: Air/Mist SPT Hammer details: N/A		Hole diameter & casing depths: Dia (mm): to: Casing depth: 92 7.00 0.50		Coordinates & level: UK National Grid 345499.10mE 392380.15mN -		Dates: Start: 18/12/2014 End: 18/12/2014 Backfilled: 18/12/2014											
Backfill/ Well Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Progress, Casing & Water Data		Samples & In Situ Testing												
					Date Casing	Time Water	Depth Core run	Type & No.	Results										
			(0.40)	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.			0.50 - 1.50	87 0 0	NI NI 120										
			(0.10) 0.40 0.50	Completely weathered siltstone recovered as light greyish brown slightly clayey gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of siltstone.															
			(2.94)	Extremely weak to very weak light greyish brown thinly laminated SILTSTONE. Joints are horizontal and vertical, extremely closely to very closely spaced occasionally closely spaced with orangish brown penetrative staining to 2mm, planar and smooth. 0.70m - 0.83m: Recovered as very sandy angular to subangular GRAVEL. 1.26m: Joints become closely spaced.															
			(0.11) 3.44 3.55	Completely weathered SILTSTONE recovered as stiff slightly sandy gravelly CLAY.															
			(2.15)	Very weak light greyish brown thinly laminated SILTSTONE. Joints are horizontal to 10 degrees, closely spaced with orangish brown penetrative staining to 1mm, planar and smooth. 4.00m: Joints become very closely to closely spaced. Becomes light brownish grey. 4.10m - 4.36m: Non intact															
			5.70	Weak light greyish brown thinly laminated SILTSTONE. Joints are horizontal to 5 degrees, closely spaced, planar and smooth.															
			(1.30)																
			7.00	Exploratory hole ends at 7.00 m															
											Casing Date	Water Time	Core run Depth	TCR SCR ROD	If	Results			
			Instrumentation details: ID: Type: Diam: Remarks: 1 SP 51 RC 150 GV								General remarks:					Groundwater entries: Struck: Rose to: Rate of Depth: (20 mins) inflow: sealed: No Groundwater Encountered		Chiselling: From: to: Duration (min): Tool:	
 Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres. Log issue: Draft Scale: 1:50 (c) TerraConsult. www.terraconsult.co.uk					Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd														

TerraConsult		Borehole Log				Borehole no: BH106		Sheet 1 of 1					
Personnel: Drilled by: ACE Logged by: LM Checked by: DD		Equipment & methods: Plant: Beretta T41 Method: Hand dug inspection pit to 0.40m bgl. Rotary coring to depth. Flush: Air/Mist SPT Hammer details: N/A		Hole diameter & casing depths: Dia (mm): 92 to: 6.80 Casing depth: 0.40		Coordinates & level: UK National Grid 345520.48mE 392348.25mN -		Dates: Start: 18/12/2014 End: 18/12/2014 Backfilled: 18/12/2014					
Backfill/ Well Inst.	Water- strikes	Legend	Level (Thickness)	Depth	Stratum Description	Progress, Casing & Water Data		Samples & In Situ Testing					
						Date Casing	Time Water	Depth Core run	Type & No.	Results			
			(0.40)	0.40	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.			0.40 - 1.40	27 0 0	NI NI NI			
			(1.27)	1.67	Completely weathered SILTSTONE recovered as light brownish grey slightly clayey sandy angular to subrounded fine to coarse GRAVEL of siltstone.								
			(0.83)	2.50	Very weak light brownish grey thinly laminated fine SANDSTONE. Joints are horizontal to 10 degrees and vertical, extremely closely to very closely spaced, planar and rough.								
			(0.40)	2.90	Completely weathered SILTSTONE recovered as sandy very clayey angular to subrounded fine to coarse GRAVEL of siltstone.								
			(1.87)	4.77	Very weak to weak light greyish brown fine grained SANDSTONE. Joints are horizontal, very closely to closely spaced with dark orangish brown penetrative staining to 2mm, planar and smooth.								
			(1.03)	5.80	Weak light greyish brown thinly laminated SILTSTONE. Joints are horizontal to 5 degrees, very closely to closely spaced with dark brown penetrative staining to 1mm, planar and smooth.								
			(1.00)	6.80	4.77m - 5.07m: Non intact.								
					Very weak light grey MUDSTONE. Joints are horizontal occasionally vertical, extremely closely to closely spaced, planar and smooth.								
					Exploratory hole ends at 6.80 m								
					Casing Date		Water Time	Core run Depth	TCR SCR ROD	If	Results		
Instrumentation details: ID: Type: Diam: Remarks:					General remarks:					Groundwater entries: Struck: Rose to: Rate of Depth (20 mins) inflow: sealed: No Groundwater Encountered		Chiselling: From: to: Duration (min): Tool:	
Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres. Log issue: Draft Scale: 1:50 (c) TerraConsult. www.terraconsult.co.uk					Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd								

TerraConsult		Borehole Log				Borehole no: BH107		Sheet 1 of 1		
Personnel: Drilled by: ACE Logged by: LM Checked by: DD		Equipment & methods: Plant: Beretta T41 Method: Hand dug inspection pit to 0.50m bgl. Rotary coring to depth. Flush: Air/Mist SPT Hammer details: N/A		Hole diameter & casing depths: Dia (mm): 92 to: 6.50 Casing depth: 0.50		Coordinates & level: UK National Grid 345448.90mE 392355.48mN -		Dates: Start: 19/12/2014 End: 19/12/2014 Backfilled: 19/12/2014		
Backfill/ Well Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Progress, Casing & Water Data		Samples & In Situ Testing			
					Date Casing	Time Water	Depth Core run	Type & No.	Results	
			(0.30)	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.			0.50 - 1.50	49 0 0	NI NI NI	
			(0.20)	Completely weathered SANDSTONE recovered as firm slightly sandy gravelly CLAY. Gravel is angular fine to coarse of sandstone.						
			(1.60)	Extremely weak light greyish brown fine grained SANDSTONE. Joints are horizontal and vertical, extremely closely spaced with orangish brown penetrative staining to 1mm, planar and rough.						
				1.60m - 2.10m: Recovered as very sandy angular to subangular GRAVEL.						
			(1.70)	Very weak light brownish grey fine grained SANDSTONE. Joints are horizontal to 5 degrees and occasionally vertical, very closely to closely spaced with orangish brown penetrative staining to 1mm, planar and rough.						
			(0.90)	Extremely weak to very weak light greyish brown thinly laminated fine grained SANDSTONE. Joints are horizontal and vertical, extremely closely to closely spaced, planar and rough.						
			(0.45)	Weak light grey mottled brownish grey thinly laminated SILTSTONE. Joints are horizontal to five degrees, very closely spaced with orangish brown penetrative staining to 1mm, planar and smooth.						
			(1.35)	Extremely weak to very weak light grey MUDSTONE. Joints are horizontal and occasionally vertical, extremely closely to very closely spaced with reddish brown penetrative staining to 1mm, planar and smooth.						
				6.10m - 6.50m: Becomes very weak to weak.						
				Casing Date	Water Time	Core run Depth	TCR SCR ROD	If	Results	
Instrumentation details: ID: Type: Diam: Remarks: 1 SP 51 RC 150 GV				General remarks:		Groundwater entries: Struck: Rose to: Rate of Depth (20 mins) inflow: sealed: No Groundwater Encountered		Chiselling: From: to: Duration (min): Tool:		
 Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres. Log issue: Draft Scale: 1:50 (c) TerraConsult. www.terraconsult.co.uk				Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd						

Personnel:	Equipment & methods:	Hole diameter & casing depths:	Coordinates & level:	Dates:
Drilled by: ACE	Plant: Beretta T41	Dia (mm): to: Casing depth:	UK National Grid	Start: 19/12/2014
Logged by: LM	Method: Hand dug inspection pit to 0.50m bgl. Rotary coring to depth.	92 7.10 0.40	345482.40mE 392307.97mN	End: 19/12/2014
Checked by: DD	Flush: Air/Mist SPT Hammer details: N/A		-	Backfilled: 19/12/2014

Backfill/ Well Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Progress, Casing & Water Data		Samples & In Situ Testing						
					Date Casing	Time Water	Depth Core run	Type & No.	Results				
			(0.40)	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.			0.40 - 1.40	42 0 0					
			0.40	Completely weathered SANDSTONE recovered as clayey sandy angular to subrounded fine to coarse GRAVEL of sandstone.									
			(0.95)					1.35		Extremely weak light greyish brown fine grained SANDSTONE. Joints are horizontal and vertical, extremely closely spaced with orangish brown penetrative staining to 1mm, planar and rough. 1.45m - 2.15m: Recovered as clayey sandy angular to subrounded GRAVEL.	1.40 - 2.90	97 0 0	NI NI NI
			(0.80)	2.15				Extremely weak light greyish brown thinly laminated SILTSTONE. Joints are horizontal to vertical, extremely closely to closely spaced with dark brown mottled black penetrative staining to 1mm, planar and smooth.					
				3.00m: Becomes very weak.				2.90 - 4.40		100 23 0	NI 40 160		
			(2.66)	4.00m: Becomes weak.									
				4.81				4.40 - 5.90		91 23 11	NI NI NI		
			(0.45)	5.26								Weak light brownish grey thinly laminated SILTSTONE. Joints are horizontal to 5 degrees, closely spaced with dark orangish brown penetrative staining to 2mm, planar and smooth.	
			(1.84)					5.90 - 7.10		98 93 77	NI 110 250		
				6.85m: Becomes light grey.									
	7.10	Exploratory hole ends at 7.10 m											
					Casing Date	Water Time	Core run Depth	TCR SCR ROD	If	Results			
Instrumentation details: ID: Type: Diam: Remarks: 1 SP 51 RC 150 GV					General remarks:					Groundwater entries: Struck: Rose to: Rate of Depth (20 mins) inflow: sealed: No Groundwater Encountered		Chiselling: From: to: Duration (min): Tool:	



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

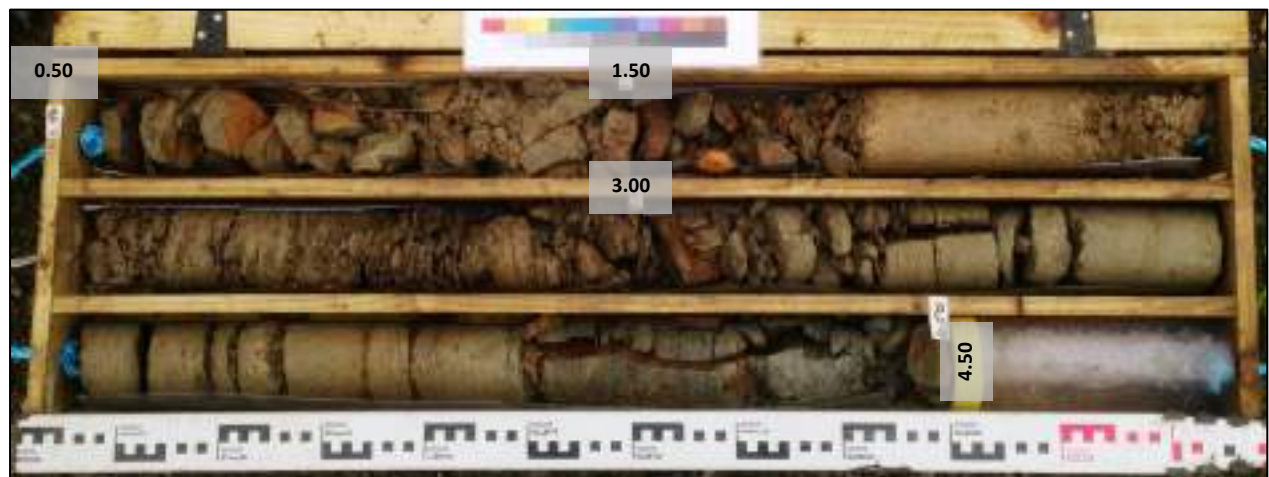
Scale: 1:50 (c) TerraConsult. www.terraconsult.co.uk

Project: **Kings Business Park**

Project No: 2173

Client: **Alfred H Knight International Ltd**

Location: BH101



Depth: 0.50 to 4.50m bgl



Depth: 4.50 to 7.50m bgl

Location: BH102



Depth: 1.80 to 5.05m bgl

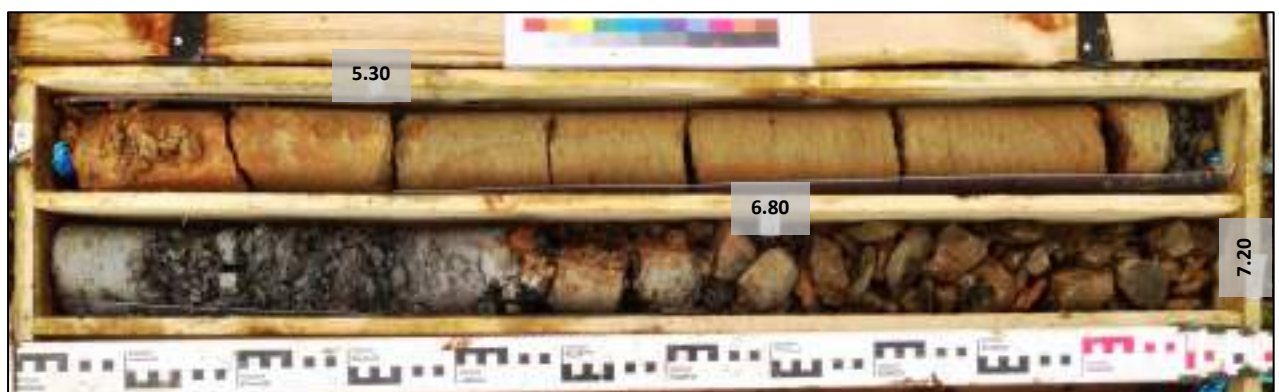


Depth: 5.05 to 8.20m bgl

Location: BH103



Depth: 1.20 to 5.00 m bgl



Depth: 5.00 to 7.20m bgl

Location: BH104



Depth: 0.30 to 4.00m bgl

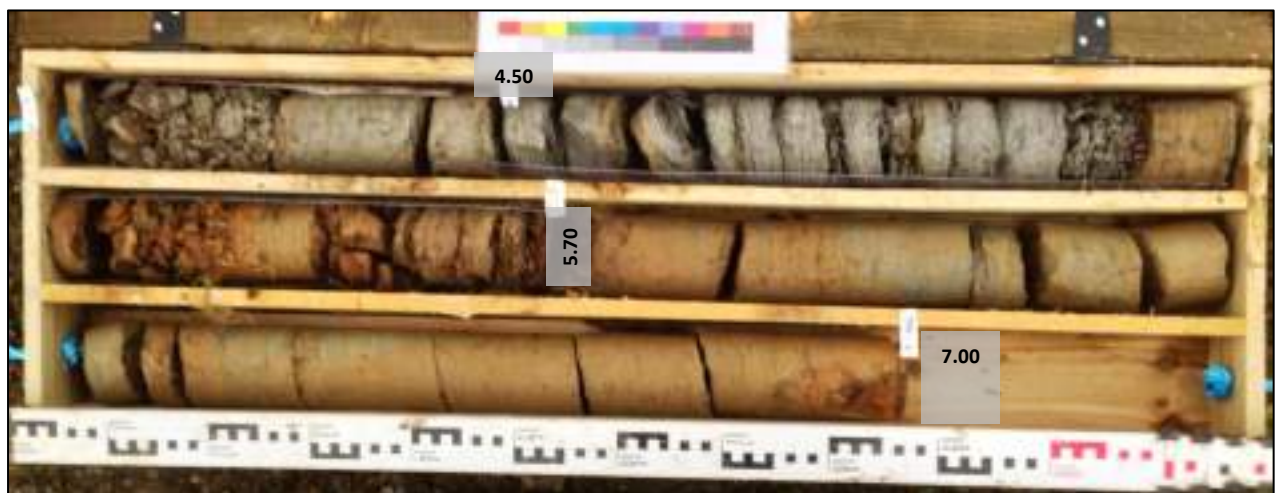


Depth: 4.00 to 7.00m bgl

Location: BH105



Depth: 0.50 to 4.10 m bgl

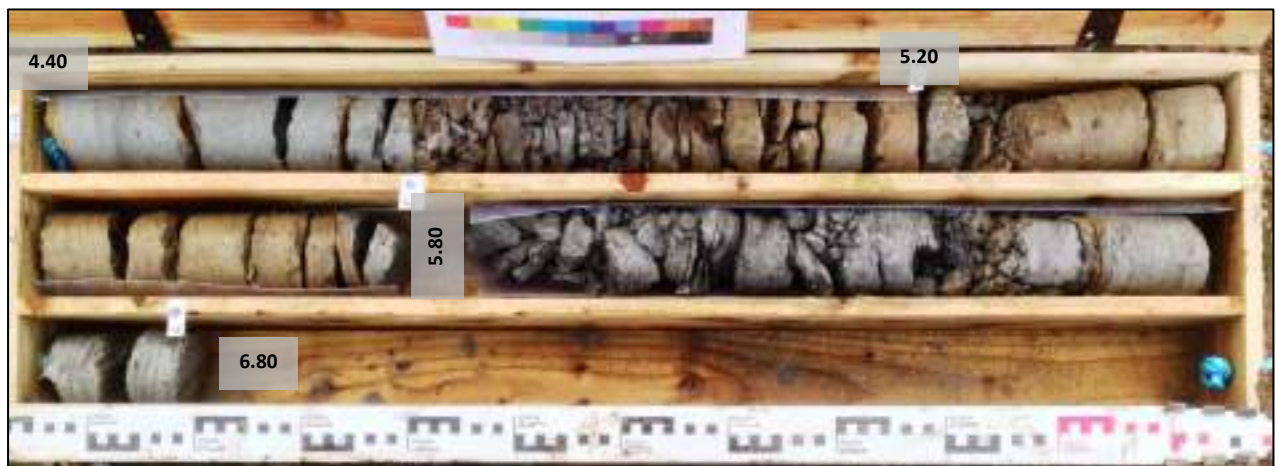


Depth: 4.10 to 7.00 m bgl

Location: BH106



Depth: 0.40 to 4.40 m bgl



Depth: 4.40 to 6.80 m bgl

Location: BH107

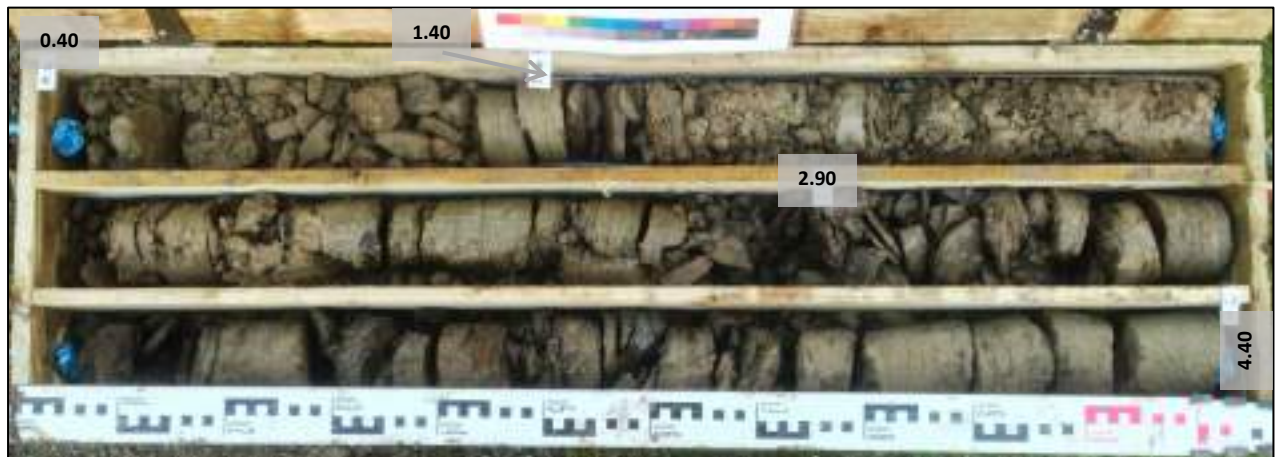


Depth: 0.50 to 4.30 m bgl

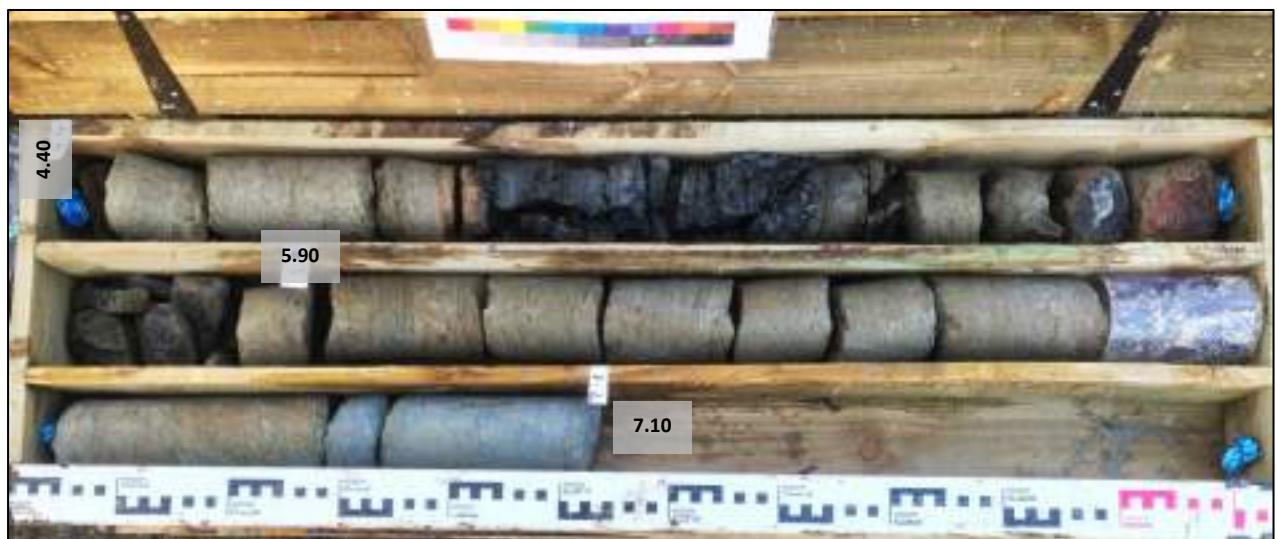


Depth: 4.30 to 6.50 m bgl

Location: BH108



Depth: 0.40 to 4.40 m bgl



Depth: 4.40 to 7.10 m bgl



Trial Pit Log

Trial pit no:

HP1

Personnel:

Logged by: LM

Date: 19/12/2014

Checked by: DD

Equipment & methods:

Method: Hand dug pit.

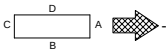
Plant: N/A

Shoring: None

Dimensions & orientation:

Width: -

Length: -



Coordinates & level:

UK National Grid

Dates:

Start: 19/12/2014

End: 19/12/2014

Backfilled: 19/12/2014

Sheet 1 of 1

Backfill/ Inst.	Water- strikes	Legend	Level	Depth (Thickness)	Stratum Description	Samples & In Situ Testing			
						Depth (m)	Type & No.	Results	
				(0.15) 0.15 (0.85) 1.00	MADE GROUND: Light grey slightly silty very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of limestone and concrete. Stiff light orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium of sandstone. Exploratory hole ends at 1.00 m	1.00	ES		
						Depth (m)	Type & No.	Results	
Groundwater entries: Struck: Rose to: Rate of inflow: No Groundwater Encountered					Depth related remarks: From: To:			General remarks: Weather: Rain Stability: Stable Remarks:	
 Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres. Log issue: Draft Scale: 1:25 <td colspan="4"> Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd </td>					Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd				

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Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345415.43mE 392327.77mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

[illegible]

Groundwater entries:

Struck: Rose to: Rate of inflow:

 No Groundwater Encountered

Depth related remarks:	
From:	To:

General remarks:	
Weather:	Rain
Stability:	Spalling from 0.20m bgl to base.
Remarks:	Abandoned due to constant spalling.

Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345391.16mE 392294.26mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

Backfill/ Inst.	Water- strikes	Legend	Level	Depth (Thickness)	Stratum Description	Samples & In Situ Testing		
						Depth (m)	Type & No.	Results
			(0.10)	0.10	MADE GROUND: Grey slightly clayey slightly sandy fine to coarse angular to subangular GRAVEL of limestone.	0.20 - 0.30 0.20	B ES	
					MADE GROUND: Brown slightly sandy slightly gravelly CLAY with a medium cobble content of brick and paving slabs. Gravel is fine to coarse angular to subrounded of brick, metal, concrete, sandstone, mudstone, tile and ceramic. Rare rootlets.			
			(1.35)					
			1.45		Reddish brown clayey fine SAND.			
			(0.90)					
								</

Struck:	Rose to:	Rate of inflow:
2.75	-	M

From: To:

Weather:	Rain
Stability:	Stable

Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Personnel:

Logged by: CB
Date: 16/12/2014
Checked by: DD

Equipment & methods:

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Dimensions & orientation:

Width: - Length: -

C D A 

Coordinates & level:

UK National Grid
345430.06mE 392236.55mN
-

Dates:

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

Backfill/ Inst.		Water- strikes	Legend	Level	Depth	Stratum Description	Samples & In Situ Testing		
				(Thickness)			Depth (m)	Type & No.	Results
				(0.90)	MADE GROUND: Brownish grey clayey very sandy fine to coarse angular to subrounded GRAVEL of brick, concrete and sandstone.	0.30	ES		
					0.50 - 0.70	B			
					0.90	Reddish brown clayey fine SAND.			
					(0.70)				
				1.60	Completely weathered thinly bedded SILTSTONE recovered as brownish grey slightly sandy fine to coarse angular GRAVEL of siltstone.				
					(1.10)				
					2.70	Exploratory hole ends at 2.70 m			
						Depth (m)	Type & No.	Results	

Groundwater entries:

Struck: Rose to: Rate of inflow:

No Groundwater Encountered

Depth related remarks:

From: To:

[illegible]

Weather:	Rain
Stability:	Stable

Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  B

UK National Grid
345424.40mE 392286.41mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

Stratum Description								Samples & In Situ Testing		
Backfill/ Inst.	Water- strikes	Legend	Level Depth (Thickness)					Depth (m)	Type & No.	Results
			(0.12)	MADE GROUND: Grey slightly sandy slightly clayey fine to coarse angular to subangular GRAVEL of limestone.				0.75 - 0.90	B	
			0.12	MADE GROUND: Brown slightly sandy slightly gravelly CLAY with a medium cobble content of brick and paving slabs. Gravel is fine to coarse angular to subrounded of brick, metal, concrete, sandstone, mudstone, tile and ceramic. Rare rootlets.						
			(0.58)							
			0.70	Completely weathered thinly bedded SILTSTONE recovered as brownish grey slightly sandy fine to coarse angular GRAVEL of siltstone.						
			(1.50)							
			2.20	Exploratory hole ends at 2.20 m						
								Depth (m)	Type & No.	Results

Groundwater entries:

Struck: Rose to: Rate of inflow:

 No Groundwater Encountered

Depth related remarks:	
From:	To:

General remarks:

Weather: Rain

Stability: Stable

Remarks:

Logged by: LM
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: 0.70m Length: 1.90m

C  146 deg

UK National Grid
345436.15mE 392316.15mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

[illegible]

Struck: Rose to: Rate of inflow:

No Groundwater Encountered

From:	To:	
1.75	1.95	Soakaway test 2 attempted.

Weather:	Rain
Stability:	Stable
Remarks:	



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Logged by: CB
Date: 15/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345454.44mE 392294.60mN
-

Start:	15/12/2014
End:	15/12/2014
Backfilled:	15/12/2014

[illegible]

Struck: Rose to: Rate of inflow:

No Groundwater Encountered

From: To:

Weather: Rain
Stability: Stable

Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345480.82mE 392294.65mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

[illegible]

Groundwater entries:

Struck: Rose to: Rate of inflow:

 No Groundwater Encountered

Depth related remarks:	
From:	To:

General remarks:	
Weather:	Rain
Stability:	Stable
Remarks:	

Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345516.76mE 392319.13mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

Backfill/ Inst.	Water- strikes	Legend	Level/ Depth (Thickness)	Stratum Description	Samples & In Situ Testing		
					Depth (m)	Type & No.	Results
			0.05	Brown clayey fine and medium SAND. Frequent rootlets.	0.20	ES	
			(0.60)	Brown clayey slightly gravelly fine to coarse SAND. Gravel is fine to coarse angular to subangular of sandstone.			
			0.65	Completely weathered SANDSTONE recovered as brownish grey sandy fine to coarse angular to subangular GRAVEL of sandstone.	0.80 - 0.90	B	
			(1.65)				
			2.30	Exploratory hole ends at 2.30 m			
					Depth (m)	Type & No.	Results

Groundwater entries:

Struck: Rose to: Rate of inflow:

 No Groundwater Encountered

Depth related remarks:	
From:	To:

General remarks:	
Weather:	Rain
Stability:	Stable
Remarks:	

Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345553.12mE 392350.01mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

[illegible]

Groundwater entries:

Struck: Rose to: Rate of inflow:

 No Groundwater Encountered

Depth related remarks:	
From:	To:

General remarks:	
Weather:	Rain
Stability:	Stable
Remarks:	

Logged by: CB
 Date: 16/12/2014
 Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  B

UK National Grid
345548.15mE 392383.15mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

Backfill/ Inst.	Water- strikes	Legend	Level	Depth	Stratum Description	Samples & In Situ Testing		
						Depth (m)	Type & No.	Results
			(0.10)	0.10	TOPSOIL: Brown slightly sandy slightly gravelly CLAY. Gravel is fine subangular to rounded of mudstone and sandstone. Frequent rootlets. Rare timber fragments.	0.35	ES	
			(1.00)	1.10	Orangish brown clayey slightly gravelly fine to coarse SAND. Gravel is fine to coarse angular of sandstone. 0.35m: Becomes gravelly.			
			(1.00)	2.10	Completely weathered SILTSTONE recovered as greyish brown slightly sandy fine to coarse angular GRAVEL of laminated siltstone.			
					Exploratory hole ends at 2.10 m			

Groundwater entries:

Struck: Rose to: Rate of inflow:

 No Groundwater Encountered

Depth related remarks:	
From:	To:

General remarks:	
Weather:	Rain
Stability:	Stable
Remarks:	

Sheet 1 of 1

Start:	19/12/2014
End:	19/12/2014
Backfilled:	19/12/2014

Groundwater entries: Struck: Rose to: Rate of inflow: No Groundwater Encountered	Depth related remarks: From: To:	General remarks: Weather: Rain Stability: Stable Remarks:
--	--	--

Personnel:

Logged by: LM
Date: 19/12/2014
Checked by: DD

Equipment & methods:

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Dimensions & orientation:

Width: 0.70m Length: 2.50m

C  220 deg

Coordinates & level:

UK National Grid
345635.54mE 392386.76mN
-

Dates:

Start:	19/12/2014
End:	19/12/2014
Backfilled:	19/12/2014

[illegible]

Groundwater entries:

Struck:	Rose to:	Rate of inflow:
2.10	-	M

Depth related remarks:

From:	To:	
1.40	2.00	Soakaway test 3 attempted.

[illegible]

Weather:	Rain
Stability:	Stable

Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345566.58mE 392435.22mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

[illegible]

Struck: Rose to: Rate of inflow:
No Groundwater Encountered

From: To:

Weather:	Rain
Stability:	Stable

Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Logged by: LM
 Date: 15/12/2014
 Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: 0.55m Length: 1.40m

C  57 deg

D
A
B

UK National Grid
345530.80mE 392423.89mN
-

Start:	15/12/2014
End:	15/12/2014
Backfilled:	15/12/2014

[illegible]

Struck: Rose to: Rate of inflow:
No Groundwater Encountered

From:	To:	
1.00	1.60	Soakaway test 1 completed.

Weather: Rain
Stability: Stable
Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345515.90mE 392399.52mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

Backfill/ Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Samples & In Situ Testing		
					Depth (m)	Type & No.	Results
			(0.10) 0.10	TOPSOIL: Brown slightly sandy slightly gravelly CLAY. Gravel is fine subangular to rounded of mudstone and sandstone. Frequent rootlets. Rare timber fragments.	0.45 0.50	ES B	
			(0.40)	Reddish brown clayey slightly gravelly fine to coarse SAND with a medium cobble content of sandstone. Gravel is fine to coarse subangular to subrounded of sandstone and siltstone.			
			0.50	Completely weathered SILTSTONE recovered as brownish grey slightly sandy fine to coarse angular GRAVEL of laminated siltstone.			
			(1.90)				
			2.40	Exploratory hole ends at 2.40 m			

Groundwater entries:

Struck: Rose to: Rate of inflow:

 No Groundwater Encountered

Depth related remarks:	
From:	To:

General remarks:	
Weather:	Rain
Stability:	Stable
Remarks:	

Logged by: CB
Date: 16/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345472.23mE 392384.38mN
-

Start:	16/12/2014
End:	16/12/2014
Backfilled:	16/12/2014

Backfill/ Inst.	Water- strikes	Legend	Level	Depth (Thickness)	Stratum Description	Samples & In Situ Testing		
						Depth (m)	Type & No.	Results
					TOPSOIL: Brown clayey slightly gravelly fine SAND. Gravel is subrounded fine and medium of sandstone. Frequent rootlets.	0.25	ES	
			(0.50)					
			0.50	Reddish brown clayey gravelly fine to coarse SAND. Gravel is fine to coarse subangular of sandstone.	0.60 - 0.80	B		
			(1.05)					
			1.55	Completely weathered SILTSTONE recovered as brownish grey slightly sandy fine to coarse angular GRAVEL of siltstone with a low cobble content.				
			(0.50)					
			2.05	Exploratory hole ends at 2.05 m				
					Depth (m)	Type & No.	Results	

Groundwater entries:

Struck: Rose to: Rate of inflow:

 No Groundwater Encountered

Depth related remarks:	
From:	To:

General remarks:	
Weather:	Rain
Stability:	Stable
Remarks:	

Logged by: CB
Date: 15/12/2014
Checked by: DD

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Width: - Length: -

C  D A  -

UK National Grid
345499.00mE 392356.33mN
-

Start:	15/12/2014
End:	15/12/2014
Backfilled:	15/12/2014

[illegible]

Struck: Rose to: Rate of inflow:
No Groundwater Encountered

From: To:

Weather: Rain
Stability: Stable

Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Personnel:

Logged by: LM
Date: 19/12/2014
Checked by: DD

Equipment & methods:

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Dimensions & orientation:

Width: 0.65m Length: 1.70m



Coordinates & level:

UK National Grid
345601.27mE 392435.30mN
-

Dates:

Start: 19/12/2014
End: 19/12/2014
Backfilled: 19/12/2014

				B				
Backfill/ Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Samples & In Situ Testing			
					Depth (m)	Type & No.	Results	
			(0.20)	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.				
			0.20 (0.25)	Light greyish brown clayey gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of siltstone.				
			0.45	Completely weathered SILTSTONE recovered as light greyish brown clayey gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of siltstone.				
		(0.95)						
			1.40	Exploratory hole ends at 1.40 m				

Groundwater entries:

Struck: Rose to: Rate of inflow:

No Groundwater Encountered

Depth related remarks:

From:	To:	
1.00	1.40	Soakaway test 4 attempted.

[illegible]

Weather:	Rain
Stability:	Stable

Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Client: **Alfred H Knight International Ltd**

 Trial Pit Log						Trial pit no: TP119		
Personnel: Logged by: LM Date: 19/12/2014 Checked by: DD		Equipment & methods: Method: Machine excavated trial pit. Plant: JCB-3CX Shoring: None		Dimensions & orientation: Width: 0.75m Length: 2.60m 		Coordinates & level: UK National Grid 345515.48mE 392398.56mN -		Dates: Start: 19/12/2014 End: 19/12/2014 Backfilled: 19/12/2014
Sheet 1 of 1								
Backfill/ Inst.	Water- strikes	Legend	Level Depth (Thickness)	Stratum Description	Samples & In Situ Testing			
					Depth (m)	Type & No.	Results	
			0.35	TOPSOIL: Dark brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of sandstone. Frequent rootlets.	0.30	ES		
			0.35	Light greyish brown slightly clayey very gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of siltstone.				
			1.35					
			1.70	Completely weathered SILTSTONE recovered as light greyish brown clayey gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of siltstone.				
			2.00	Exploratory hole ends at 2.00 m				
					Depth (m)	Type & No.	Results	
Groundwater entries: Struck: Rose to: Rate of inflow: No Groundwater Encountered				Depth related remarks: From: To:			General remarks: Weather: Rain Stability: Stable Remarks:	
 Notes: For explanation of symbols and abbreviations see key sheet. All depths are reduced levels in metres.				Project: Kings Business Park Project No: 2173 Client: Alfred H Knight International Ltd				
Log issue: Draft Scale: 1:25				(c) TerraConsult www.terraconsult.co.uk				

Personnel:

Logged by: LM
Date: 19/12/2014
Checked by: DD

Equipment & methods:

Method: Machine excavated trial pit.
Plant: JCB-3CX
Shoring: None

Dimensions & orientation:

Width: 0.75m Length: 2.00m

C  323 deg

Coordinates & level:

UK National Grid
345445.51mE 392215.92mN
-

Dates:

Start:	19/12/2014
End:	19/12/2014
Backfilled:	19/12/2014

[illegible]

Groundwater entries:

Struck:	Rose to:	Rate of inflow:
2.35	-	\$

Depth related remarks:

From: To:

[illegible]

Weather:	Rain
Stability:	Stable

Remarks:



Notes: For explanation of symbols and abbreviations see key sheet.
All depths are reduced levels in metres.

Log issue: **Draft**

Scale: 1:25

Project:	Kings Business Park
Project No:	2173
Client:	Alfred H Knight International Ltd

Client: **Alfred H Knight International Ltd**

Key To Exploratory Hole Records

SAMPLES

Undisturbed

U	Driven tube sample	} nominally 100 mm diameter and full recovery unless otherwise stated
TW	Pushed thin wall tube sample	
P	Pushed piston sample	
L	Liner sample (from windowless or similar sampler), full recovery unless otherwise stated	
CBR	CBR mould sample	
BLK	Block sample	
CS	Core sample (from rotary core) taken for laboratory testing	
AMAL	Amalgamated sample	

Disturbed

D	Small sample
B	Bulk sample

Other

W	Water sample
G	Gas sample

	Environmental chemistry samples (in more than one container where appropriate)
ES	Soil sample
EW	Water sample

Comments Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that attempt was made to take a tube sample; however, there was no recovery.

Monitoring samples taken after completion of hole construction are not shown on the exploratory hole logs.

TESTS

SPT S or SPT C	Standard Penetration Test, open shoe (S) or solid cone (C)
	The Standard Penetration Test is defined in BS EN ISO 22476-3 (2005). The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self-weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 (either in total or for a single increment) the total blow count beyond the seating drive is given (without the N = prefix).
IV	<i>in situ</i> Vane shear strength, peak (p) and remoulded (r), kPa
HV	Hand vane shear strength, peak (p) and remoulded (r), kPa
PP	Pocket penetrometer test, converted to shear strength, kPa
KFH, KRH, KPI	Variable head permeability tests (KFH = falling head test, KRH = rising head test, KPI = packer test), permeability value
	Test results provided in Field Records column

DRILLING RECORDS

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930 (1999) and BS EN ISO 22575-1 (2006)

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented.
NI	Non-intact is used where the core is fragmented.

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss
NR	Not recovered

GROUNDWATER

▼	Groundwater strike
▽	Groundwater level after standing period

INSTALLATION

Standpipe/ piezometer

Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill.

SP
SPIE
PPIE
EPIE



The type of instrument installed is indicated by a code in the Legend column at the depth of the response zone:
Standpipe
Standpipe piezometer
Pneumatic piezometer
Electronic piezometer

Inclinometer or Slip Indicator

The installation of vertical profiling instruments is indicated on the Record. The base of tubing is shown in the Legend column.

ICE
ICM
SLIP



The type of instrument installed is indicated by a code in the Legend column at the base of the tubing:
Biaxial inclinometer
Inclinometer tubing for use with probe
Slip indicator

Settlement Points or Pressure Cells

The installation of single point instruments is indicated on the Record. The location of the measuring device is shown in the Legend column.

ESET
ETM
EPCE
PPCE

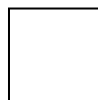


The type of instrument installed is indicated by a code in the Legend column:
Electronic settlement cell/gauge
Magnetic extensometer settlement point
Electronic embedment pressure cell
Electronic push in pressure cell

INSTALLATION LEGENDS

A legend describing the installation is shown in the rightmost column. Legends additional to BS5930 are used to describe the backfill materials as indicated below.

Arisings



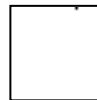
Concrete



Grout



Bentonite



Sand



Gravel



Tarmac



NOTES

- 1 Soils and rocks are described in accordance with BS EN ISO 14688-1 (2002), 14688-2 (2004), 14689-1 (2003) and BS 5930 (1999) as clarified by Baldwin et al (2007).
- 2 Strata legends are in accordance with BS 5930 (1999).
- 3 Water level observations of discernible entries during the advancing of the exploratory hole are given at the foot of the log and in the Legend column. The term "none observed" is used where no discrete entries are identified although this does not necessarily indicate that the hole has not been advanced below groundwater level. Under certain conditions groundwater cannot be observed, for instance, drilling with water flush or overwater, or boring at a rate much faster than water can make its way into the borehole (ref BS5930: 1999, Clause 47.2.7). In addition, where appropriate, water levels in the hole at the time of recovering individual samples or carrying out in situ tests and at shift changes are given in the Records column.
- 4 Evidence of the occurrence of very coarse particles (cobbles and boulders) is presented on the logs, however, because of their size in relation to the exploratory hole these records may not be fully representative of their size and frequency in the ground mass.
- 5 The borehole logs present the results of Standard Penetration Tests recorded in the field without correction or interpretation. However, in certain ground conditions (e.g. high hydraulic head or where very coarse particles are present) some judgement may be necessary in considering whether the results are representative of in situ mass conditions.
- 6 The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.
- 7 The assessment of SCR, RQD and Fracture Spacing excludes artificial (non in situ) fractures.

NOTE

Where “tarmac” is referred to in descriptions, this refers to bound bituminous paving materials which could be blacktop, asphalt, mastic asphalt, tarmac or other type of materials. The word “tarmac” is not intended to convey that tar has been used in the material.

REFERENCES

- Baldwin M, Gosling R C and Brownlie N: 2007: Soil and rock descriptions - a practical guide to the implementation of BS EN ISO 14688 and 14689. Ground Engineering, July 2007.
- BS EN ISO 14688-1: 2002: Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description. British Standards Institution.
- BS EN ISO 14688-2: 2004: Geotechnical investigation and testing - Identification and classification of soil - Part 2 Principles for a classification. British Standards Institution.
- BS EN ISO 14689-1: 2003: Geotechnical investigation and testing - Identification and classification of rock - Part 1 Identification and description. British Standards Institution.
- BS EN ISO 22476-3: 2005: Geotechnical investigation and testing - Field testing - Part 3: Standard penetration test. British Standards Institution.
- BS EN ISO 22475-1: 2007: Geotechnical investigation and testing – Sampling methods and groundwater measurements - Part 1: Technical principles for execution (reproduced 2007). British Standards Institution.
- BS 5930: 1999: Code of Practice for site investigations (amendment number 2, 2010). British Standards Institution

APPENDIX F

In Situ Testing

TerraConsult

TerraConsult

TerraConsult

TerraConsult

TerraConsult

TerraConsult Limited
CBR Test Report - LWD Test Method

See Start Spreadsheet for Importing data
Do not alter formulas in Foundation class or Contact Pressure
Do not alter any cell below row 11 on this Spreadsheet

Table with 2 columns: Contact Pressure Check, Values (100, 90, <90) and Units (KPa).

Summary tables for Deflection Check (µm), Temperature Check C, Deflection Change During Testing, and Foundation Classes to IAN 73/06.

This spreadsheet is Copyright Grontmij 2010
This Spreadsheet is provided without any warranty or guarantee from Grontmij

Main data table with columns: Client, Client reference, Project No., Date, Point No., Chainage, Latitude, Longitude, Drop No., Force (kN), Plate Radius (mm), Stress (kPa), Sensor1 Central Deflection Raw (µm), Sensor1 Central Deflection Normalised (µm), Poisson's Ratio, Pulse time (ms), Sensor1 Central Surface Modulus (Raw) (MPa), Temp (°C), Pavement Description, Remarks, Deflection Change from First Measurement Normalised, Coefficient of Variation, Characteristic Surface Modulus (Design) (MPa), Sensor1 AVE Central Surface Modulus (Raw) (MPa), CBR VALUE.

APPENDIX G

Gas and Groundwater Monitoring

No: 2173

GROUNDWATER AND GROUND GAS MONITORING

TerraConsult

Site: Kings Business Park

Location	Date	Monitored by	Well Details			Groundwater				Gas												Weather		
			Standpipe diameter (mm)	Response Zone (m bgl)	Depth to Base (m bgl)	Water Depth (m bgl)	Groundwater Level (mOD)	Purged (Y/N - litres)	Water Sample Taken?	Atmospheric Pressure (mbar)	Atmospheric Pressure Comment	Relative Pressure	Steady Flow (l/h)	Peak Flow (l/h)	CH ₄ (% v/v)	GSV CH ₄ (l/hr)	CO ₂ (% v/v)	GSV CO ₂ (l/hr)	O ₂ (% v/v)	CO (ppm)	H ₂ S (ppm)	VOC (ppm)	Conditions	Ambient Temp °C
BH102	06/01/15	CB	50	2.00-7.97	7.97	7.25	56.12	Y	Y	1005	Falling	123	13.1	40.0	0.1	0.0131	0.7	0.0917	15.6	1	1	-	Raining	8
	20/01/15	AC	50	2.00-7.97	7.97	7.26	56.11	-	-	994	Steady	0.01	13.1	1.8	0.1	0.0131	1.2	0.1572	9.6	1	1	-	Clear	2
	26/01/15	AC	50	2.00-7.97	7.97	7.42	55.95	-	-	1018	Rising	0.1	0.1	0.1	0.1	0.0001	0.6	0.0006	16.9	1	1	-	Clear	6
BH103	06/01/15	CB	50	1.50-2.99	2.99	2.52	63.18	Y	Y	1004	Falling	0.1	0.1	2.0	0.1	0.0001	3.6	0.0036	17.1	1	1	-	Raining	8
	20/01/15	AC	50	1.50-2.99	2.99	2.40	63.30	-	-	994	Steady	0.1	0.1	0.1	0.1	0.0001	4.3	0.0043	15.2	1	1	-	Clear	2
	26/01/15	AC	50	1.50-2.99	2.99	2.60	63.10	-	-	1018	Rising	0.1	0.1	0.1	0.1	0.0001	2.3	0.0023	18.4	1	1	-	Clear	6
BH104	06/01/15	CB	50	1.00-2.30	2.26	2.11	61.70	Y	Y	1004	Falling	0.1	0.1	0.1	0.1	0.0001	1.6	0.0016	18.0	1	1	-	Raining	8
	20/01/15	AC	50	1.00-2.30	2.23	1.82	61.99	-	-	994	Steady	0.1	0.1	0.1	0.1	0.0001	1.0	0.0010	19.2	1	1	-	Clear	2
	26/01/15	AC	50	1.00-2.30	2.23	1.76	62.05	-	-	1018	Rising	0.1	0.1	0.1	0.1	0.0001	2.4	0.0024	17.6	1	1	-	Clear	6
BH105	06/01/15	CB	50	1.00-3.10	3.10	2.98	60.74	Y	Y	1004	Falling	0.1	0.1	0.1	0.1	0.0001	3.1	0.0031	15.1	1	1	-	Raining	8
	20/01/15	AC	50	1.00-3.10	3.10	2.99	60.73	-	-	993	Steady	0.1	0.1	0.1	0.1	0.0001	3.1	0.0031	16.2	1	1	-	Clear	2
	26/01/15	AC	50	1.00-3.10	3.10	2.92	60.80	-	-	1018	Rising	0.1	0.1	0.1	0.1	0.0001	1.7	0.0017	20.1	1	1	-	Clear	6
BH107	06/01/15	CB	50	2.00-6.06	6.06	4.29	57.10	Y	Y	1005	Falling	0.1	0.1	0.1	0.1	0.0001	2.1	0.0021	18.4	1	1	-	Raining	8
	20/01/15	AC	50	2.00-6.06	6.06	4.05	57.34	-	-	994	Steady	0.1	0.1	0.1	0.1	0.0001	0.4	0.0004	19.7	1	1	-	Clear	2
	26/01/15	AC	50	2.00-6.06	6.06	4.11	57.28	-	-	1018	Rising	0.1	0.1	0.1	0.1	0.0001	1.8	0.0018	19.7	1	1	-	Clear	6
BH108	06/01/15	CB	50	1.00-3.27	3.27	2.85	60.40	Y	Y	1004	Falling	0.1	0.1	0.1	0.1	0.0001	2.8	0.0028	16.0	1	1	-	Raining	8
	20/01/15	AC	50	1.00-3.27	3.27	2.89	60.36	-	-	994	Steady	0.1	0.1	0.1	0.1	0.0001	2.7	0.0027	16.4	1	1	-	Clear	2
	26/01/15	AC	50	1.00-3.27	3.27	3.08	60.17	-	-	1018	Rising	0.1	0.1	0.1	0.1	0.0001	0.2	0.0002	20.2	1	1	-	Clear	6
Note: * = flow rate maximum indicate, flow rate reduced down to less than detection limit of 0.1 l/hr within 10 to 60 seconds of opening gas tap.															Indicates reading less than the detection limit indicated									
TCL = TerraConsult Ltd																								

NOTES:

NM = Not Measured.

(x) = Peak value recorded.

[grey] = Below detection limit.

$$\text{GSV (l/HR)} = [\text{gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]$$

100

Instrumentation Specifications

Gas Monitoring – Permanent Gases

Gas monitoring for permanent gases (e.g. methane, carbon dioxide, oxygen etc) at TerraConsult is carried out using a GasData GFM 400 series gas analyser with flow meter which measures borehole flow rates, bulk gas concentrations (methane, carbon dioxide and oxygen), barometric and differential pressure.

The specification range of the GFM 400 series is as follows:

Feature	Method/Type	Range	Resolution
Methane	Infrared	0 - 100%v/v	0.1%
Lower Detection Limit (LEL)	Infrared	0 - 100%v/v	0.1%
Carbon Dioxide	Infrared	0 - 100%v/v	0.1%
Oxygen	Electrochemical	0 - 25%v/v	0.1%
Hydrogen Sulphide	Electrochemical	0 - 5,000ppm	1ppm
Carbon monoxide	Electrochemical	0 – 2,000ppm	1ppm
Atmospheric Pressure	Absolute Pressure Sensor	800 – 1,200mb	1mb
Differential Pressure	Thermal Dissipation	±1,250Pa	0.1Pa
Temperature	Bi-metal	-10°C to +100°C	1°C
Flow	Thermal Dissipation	-60 – 100 l/hr	0.1 l/hr

Volatile Organic Compounds

TerraConsult uses a PhoCheck Tiger Photo Ionisation Detector (PID) to detect a large range of Volatile Organic Compounds (VOCs) which are potentially dangerous from both a poisoning and/or an explosive perspective.

The sensor specification is as follows:

Feature	Method/Type	Range	Resolution
Total VOCs	PID	1ppb – 10,000ppm & 1ppb to 20,000ppm for specific gases	+/- 5% displayed reading +/- one digit

Calibration

Measuring equipment owned by TerraConsult is maintained in good condition and regularly inspected to ensure that it is capable of accurate and effective operation and is calibrated in line with the manufacturer's recommendations. When equipment is hired for use, the hirer will be required to provide a calibration certificate with the equipment.

In accordance with TerraConsult's ISO 9001:2008 accreditation, the process of calibrating and maintenance of TerraConsult's own measuring equipment is carried out in accordance with our quality system procedures and a register of all measuring equipment is maintained and calibration certificates collated and stored accordingly.

Prior to the use of any measuring equipment, the user will undertake suitable checks to ensure that it is fit for use and within the calibration tolerances specified.

Should a copy of the relevant calibration certificate be required, please contact TerraConsult directly to request a copy.

APPENDIX H

Laboratory Chemical Test Results



Chris Eccles
TerraConsult Ltd
Bold Business Centre
Bold Lane
Sutton
St Helens
Merseyside
WA9 4TX

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 14-27457

Site Reference: Kings Business Park

Project / Job Ref: 2178

Order No: None Supplied

Sample Receipt Date: 19/12/2014

Sample Scheduled Date: 19/12/2014

Report Issue Number: 1

Reporting Date: 02/01/2015

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
QTS Environmental Report No: 14-27457	Date Sampled	15/12/14	16/12/14	16/12/14	16/12/14	16/12/14
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Kings Business Park	TP / BH No	TP106	TP102	TP108	TP101	TP116
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.10	0.20	0.30	0.80	0.25
Reporting Date: 02/01/2015	QTSE Sample No	130032	130033	130034	130035	130036

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025		Not Detected	Not Detected	Detected	
Sample Matrix	Material Type	N/a	NONE				Loose fibres	
Asbestos Type	PLM Result	N/a	ISO17025				Chrysotile	
pH	pH Units	N/a	MCERTS	6.9		7.0	7.3	6.2
Total Cyanide	mg/kg	< 2	NONE	< 2		< 2	< 2	< 2
Total Sulphate as SO ₄	mg/kg	< 200	NONE				1876	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.10		0.45	0.37	0.07
Organic Matter	%	< 0.1	MCERTS				2.8	
Total Organic Carbon (TOC)	%	< 0.1	MCERTS				1.6	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS				67	
Arsenic (As)	mg/kg	< 2	MCERTS	25		6	9	16
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	2.2		0.6	1	1.2
Chromium (Cr)	mg/kg	< 2	MCERTS	23		19	25	22
Copper (Cu)	mg/kg	< 4	MCERTS	220		29	89	129
Lead (Pb)	mg/kg	< 3	MCERTS	135		72	458	84
Mercury (Hg)	mg/kg	< 1	NONE	< 1		< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	19		16	23	15
Selenium (Se)	mg/kg	< 3	NONE	< 3		< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	111		204	632	62
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2		< 2	< 2	< 2
DRO (C10 - C24)	mg/kg	< 6	MCERTS				10	
Oil (C25 - C40)	mg/kg	< 6	MCERTS				67	
Mineral Oil (C10 - C40)	mg/kg	< 10	MCERTS				54	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)
This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.
The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.
Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.
Asbestos Analyst: Graham Revell
RL: Reporting Limit
Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).
Subcontracted analysis ⁽⁵⁾



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
QTS Environmental Report No: 14-27457	Date Sampled	16/12/14	16/12/14	16/12/14	16/12/14	16/12/14
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Kings Business Park	TP / BH No	TP107	TP108	TP109	TP110	TP115
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.20	0.20	0.45	0.35	0.45
Reporting Date: 02/01/2015	QTSE Sample No	130037	130038	130039	130040	130041

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025					
Sample Matrix	Material Type	N/a	NONE					
Asbestos Type	PLM Result	N/a	ISO17025					
pH	pH Units	N/a	MCERTS	5.9	6.2	6.3	6.2	6.2
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	2	3
Total Sulphate as SO ₄	mg/kg	< 200	NONE		420			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.01	< 0.01	0.01	0.01
Organic Matter	%	< 0.1	MCERTS		1.5			
Total Organic Carbon (TOC)	%	< 0.1	MCERTS		0.9			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS		8			
Arsenic (As)	mg/kg	< 2	MCERTS	12	3	4	3	< 2
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	0.5	< 0.5	< 0.5	1.1	< 0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	25	18	16	20	20
Copper (Cu)	mg/kg	< 4	MCERTS	75	18	15	20	10
Lead (Pb)	mg/kg	< 3	MCERTS	45	11	15	24	9
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	19	14	11	17	16
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	77	44	39	58	55
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
DRO (C10 - C24)	mg/kg	< 6	MCERTS		< 6			
Oil (C25 - C40)	mg/kg	< 6	MCERTS		< 6			
Mineral Oil (C10 - C40)	mg/kg	< 10	MCERTS		< 10			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)
This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.
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Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.
Asbestos Analyst: Graham Revell
RL: Reporting Limit
Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).
Subcontracted analysis ⁽⁵⁾



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
QTS Environmental Report No: 14-27457	Date Sampled	15/12/14	15/12/14			
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Kings Business Park	TP / BH No	TP114	TP113			
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.25	0.15			
Reporting Date: 02/01/2015	QTSE Sample No	130042	130043			

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025					
Sample Matrix	Material Type	N/a	NONE					
Asbestos Type	PLM Result	N/a	ISO17025					
pH	pH Units	N/a	MCERTS	5.8	5.5			
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2			
Total Sulphate as SO ₄	mg/kg	< 200	NONE		609			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	< 0.01			
Organic Matter	%	< 0.1	MCERTS		4.8			
Total Organic Carbon (TOC)	%	< 0.1	MCERTS		2.8			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS		24			
Arsenic (As)	mg/kg	< 2	MCERTS	7	9			
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	1.4	1.8			
Chromium (Cr)	mg/kg	< 2	MCERTS	20	25			
Copper (Cu)	mg/kg	< 4	MCERTS	46	75			
Lead (Pb)	mg/kg	< 3	MCERTS	35	64			
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	17	18			
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3			
Zinc (Zn)	mg/kg	< 3	MCERTS	67	77			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2			
DRO (C10 - C24)	mg/kg	< 6	MCERTS		< 6			
Oil (C25 - C40)	mg/kg	< 6	MCERTS		9			
Mineral Oil (C10 - C40)	mg/kg	< 10	MCERTS		< 10			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)
This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.
The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.
Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.
Asbestos Analyst: Graham Revell
RL: Reporting Limit
Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).
Subcontracted analysis ⁽⁵⁾



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Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 14-27457	Date Sampled	15/12/14	16/12/14	16/12/14	16/12/14	16/12/14
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Kings Business Park	TP / BH No	TP106	TP108	TP101	TP116	TP107
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.10	0.30	0.80	0.25	0.20
Reporting Date: 02/01/2015	QTSE Sample No	130032	130034	130035	130036	130037

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	0.15	0.20	0.24	0.12	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.27	0.46	0.58	0.25	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.23	0.44	0.52	0.23	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.26	0.29	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.27	0.30	0.13	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.41	0.38	0.14	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.14	0.15	0.13	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.32	0.26	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.23	0.21	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	0.21	0.18	< 0.1	< 0.1
Coronene	mg/kg	< 0.1	NONE	< 0.1	0.36	0.38	< 0.1	< 0.1
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1	1.6	1.6	< 1	< 1
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1	2.1	2.2	< 1	< 1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	2.9	3.1	< 1.6	< 1.6
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7	3.3	3.5	< 1.7	< 1.7

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 14-27457	Date Sampled	16/12/14	16/12/14	16/12/14	16/12/14	15/12/14
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Kings Business Park	TP / BH No	TP108	TP109	TP110	TP115	TP114
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.20	0.45	0.35	0.45	0.25
Reporting Date: 02/01/2015	QTSE Sample No	130038	130039	130040	130041	130042

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 14-27457	Date Sampled	15/12/14				
TerraConsult Ltd	Time Sampled	None Supplied				
Site Reference: Kings Business Park	TP / BH No	TP113				
Project / Job Ref: 2178	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.15				
Reporting Date: 02/01/2015	QTSE Sample No	130043				

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1			
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1			
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1			
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1			
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1			
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	0.18			
Pyrene	mg/kg	< 0.1	MCERTS	0.17			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.11			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1			
Coronene	mg/kg	< 0.1	NONE	< 0.1			
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1			
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6			
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 14-27457	Date Sampled	16/12/14	16/12/14	15/12/14		
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Kings Business Park	TP / BH No	TP101	TP108	TP113		
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.80	0.20	0.15		
Reporting Date: 02/01/2015	QTSE Sample No	130035	130038	130043		

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	43	< 10	< 10		
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	43	< 21	< 21		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	5	< 3	< 3		
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	56	< 10	< 10		
Aromatic (C5 - C35)	mg/kg	< 21	NONE	61	< 21	< 21		
Total >C5 - C35	mg/kg	< 42	NONE	104	< 42	< 42		

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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 14-27457	Date Sampled	16/12/14	16/12/14	15/12/14		
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Kings Business Park	TP / BH No	TP101	TP108	TP113		
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.80	0.20	0.15		
Reporting Date: 02/01/2015	QTSE Sample No	130035	130038	130043		

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5		
Ethylbenzene	ug/kg	< 10	MCERTS	< 10	< 10	< 10		
p & m-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10		
o-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10		
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5		

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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2

QTS Environmental Report No: 14-27457		Date Sampled	16/12/14			Landfill Waste Acceptance Criteria Limits		
TerraConsult Ltd		Time Sampled	None Supplied			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Site Reference: Kings Business Park		TP / BH No	TP102					
Project / Job Ref: 2178		Additional Refs	None Supplied					
Order No: None Supplied		Depth (m)	0.20					
Reporting Date: 02/01/2015		QTSE Sample No	130033					
Determinand	Unit	MDL						
TOC ^{MU}	%	< 0.1	1.6		3%	5%	6%	
Loss on Ignition	%	< 0.01	2.60		--	--	10%	
BTEX ^{MU}	mg/kg	< 0.05	< 0.05		6	--	--	
Sum of PCBs	mg/kg	< 0.7	< 0.7		1	--	--	
Mineral Oil ^{MU}	mg/kg	< 10	< 10		500	--	--	
Total PAH ^{MU}	mg/kg	< 1.7	4.1		100	--	--	
pH ^{MU}	pH Units	N/a	7.1		--	>6	--	
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	2.1		--	To be evaluated	To be evaluated	
Eluate Analysis			10:1 mg/l		Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic ^U		< 0.01			< 0.1	0.5	2	25
Barium ^U		0.03			0.3	20	100	300
Cadmium ^U		< 0.0005			< 0.005	0.04	1	5
Chromium ^U		< 0.005			< 0.05	0.5	10	70
Copper ^U		< 0.01			< 0.1	2	50	100
Mercury ^U		< 0.0005			< 0.01	0.01	0.2	2
Molybdenum ^U		0.002			0.02	0.5	10	30
Nickel ^U		< 0.007			< 0.07	0.4	10	40
Lead ^U		< 0.005			< 0.05	0.5	10	50
Antimony ^U		< 0.005			< 0.05	0.06	0.7	5
Selenium ^U		< 0.005			< 0.05	0.1	0.5	7
Zinc ^U		< 0.005			< 0.05	4	50	200
Chloride ^U		2			23	800	15000	25000
Fluoride ^U		0.5			5	10	150	500
Sulphate ^U		8			84	1000	20000	50000
TDS		100			1000	4000	60000	100000
Phenol Index		< 0.01			< 0.1	1	-	-
DOC		22.9			229	500	800	1000
Leach Test Information								
Sample Mass (kg)		0.10						
Dry Matter (%)		91.6						
Moisture (%)		9.2						
Stage 1								
Volume Eluate L10 (litres)		0.89						
Results are expressed on a dry weight basis, after correction for moisture content where applicable								
Stated limits are for guidance only and QTS Environmental cannot be held responsible for any discrepancies with current legislation								
M Denotes MCERTS accredited test								
U Denotes ISO17025 accredited test								



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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 14-27457	
TerraConsult Ltd	
Site Reference: Kings Business Park	
Project / Job Ref: 2178	
Order No: None Supplied	
Reporting Date: 02/01/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
130032	TP106	None Supplied	0.10	33.1	Black clayey loam with vegetation
130033	TP102	None Supplied	0.20	8.3	Brown gravelly clay with rubble
130034	TP108	None Supplied	0.30	11.2	Light brown loamy clay with rubble and vegetation
130035	TP101	None Supplied	0.80	14.7	Light brown loamy clay with rubble and vegetation
130036	TP116	None Supplied	0.25	20.8	Brown sandy loam with vegetation
130037	TP107	None Supplied	0.20	14.6	Light brown sandy loam with vegetation
130038	TP108	None Supplied	0.20	14.7	Light brown sandy loam with vegetation
130039	TP109	None Supplied	0.45	14.5	Light brown sandy loam
130040	TP110	None Supplied	0.35	13.1	Light brown sandy loam with vegetation
130041	TP115	None Supplied	0.45	10.1	Light brown sandy loam with stones
130042	TP114	None Supplied	0.25	12.2	Brown sandy loam with vegetation
130043	TP113	None Supplied	0.15	14.7	Brown sandy loam with vegetation

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information				
QTS Environmental Report No: 14-27457				
TerraConsult Ltd				
Site Reference: Kings Business Park				
Project / Job Ref: 2178				
Order No: None Supplied				
Reporting Date: 02/01/2015				

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried
AR As Received



Chris Eccles
TerraConsult Ltd
Bold Business Centre
Bold Lane
Sutton
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QTS Environmental Report No: 14-27517

Site Reference: Kings Business Park

Project / Job Ref: 2173

Order No: PO1

Sample Receipt Date: 22/12/2014

Sample Scheduled Date: 22/12/2014

Report Issue Number: 1

Reporting Date: 05/01/2015

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd



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Soil Analysis Certificate						
QTS Environmental Report No: 14-27517	Date Sampled	19/12/14	19/12/14	19/12/14	19/12/14	19/12/14
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Kings Business Park	TP / BH No	TP111	TP112	TP112	TP119	TP120
Project / Job Ref: 2173	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: PO1	Depth (m)	0.50	0.30	0.10	0.30	0.45
Reporting Date: 05/01/2015	QTSE Sample No	130335	130336	130337	130338	130339

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025			Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	6.0	6.1			5.9
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2			< 2
Total Sulphate as SO ₄	mg/kg	< 200	NONE					< 200
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.03	0.01			0.02
Total Sulphur	mg/kg	< 200	NONE					
Organic Matter	%	< 0.1	MCERTS					1.5
Total Organic Carbon (TOC)	%	< 0.1	MCERTS					0.9
Ammonium as NH ₄	mg/kg	< 0.5	NONE					
W/S Chloride (2:1)	mg/kg	< 1	MCERTS					11
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS					
Arsenic (As)	mg/kg	< 2	MCERTS	3	4			5
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5			< 0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	18	25			26
Copper (Cu)	mg/kg	< 4	MCERTS	16	19			30
Lead (Pb)	mg/kg	< 3	MCERTS	16	16			14
W/S Magnesium	g/l	< 0.0001	NONE					
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1			< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	18	22			30
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3			< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	43	43			62
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2			< 2
DRO (C10 - C24)	mg/kg	< 6	MCERTS					< 6
Oil (C25 - C40)	mg/kg	< 6	MCERTS					< 6
Mineral Oil (C10 - C40)	mg/kg	< 10	MCERTS					< 10

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)
This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.
The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.
Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.
Asbestos Analyst: Piotr Lipski
RL: Reporting Limit
Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).
Subcontracted analysis ^(S)



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Soil Analysis Certificate						
QTS Environmental Report No: 14-27517	Date Sampled	19/12/14	19/12/14			
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Kings Business Park	TP / BH No	TP120	HP1			
Project / Job Ref: 2173	Additional Refs	None Supplied	None Supplied			
Order No: PO1	Depth (m)	0.20	1.00			
Reporting Date: 05/01/2015	QTSE Sample No	130340	130341			

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected				
pH	pH Units	N/a	MCERTS		7.1			
Total Cyanide	mg/kg	< 2	NONE					
Total Sulphate as SO ₄	mg/kg	< 200	NONE		771			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS		0.02			
Total Sulphur	mg/kg	< 200	NONE		266			
Organic Matter	%	< 0.1	MCERTS					
Total Organic Carbon (TOC)	%	< 0.1	MCERTS					
Ammonium as NH ₄	mg/kg	< 0.5	NONE		1.9			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS		7			
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS		5			
Arsenic (As)	mg/kg	< 2	MCERTS					
Cadmium (Cd)	mg/kg	< 0.5	MCERTS					
Chromium (Cr)	mg/kg	< 2	MCERTS					
Copper (Cu)	mg/kg	< 4	MCERTS					
Lead (Pb)	mg/kg	< 3	MCERTS					
W/S Magnesium	g/l	< 0.0001	NONE		0.0015			
Mercury (Hg)	mg/kg	< 1	NONE					
Nickel (Ni)	mg/kg	< 3	MCERTS					
Selenium (Se)	mg/kg	< 3	NONE					
Zinc (Zn)	mg/kg	< 3	MCERTS					
Total Phenols (monohydric)	mg/kg	< 2	NONE					
DRO (C10 - C24)	mg/kg	< 6	MCERTS					
Oil (C25 - C40)	mg/kg	< 6	MCERTS					
Mineral Oil (C10 - C40)	mg/kg	< 10	MCERTS					

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)
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Asbestos Analyst: Piotr Lipski
RL: Reporting Limit
Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).
Subcontracted analysis ^(S)



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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 14-27517	Date Sampled	19/12/14	19/12/14	19/12/14		
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Kings Business Park	TP / BH No	TP111	TP112	TP120		
Project / Job Ref: 2173	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: PO1	Depth (m)	0.50	0.30	0.45		
Reporting Date: 05/01/2015	QTSE Sample No	130335	130336	130339		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Coronene	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6		
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7	< 1.7	< 1.7		

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 14-27517	Date Sampled	19/12/14				
TerraConsult Ltd	Time Sampled	None Supplied				
Site Reference: Kings Business Park	TP / BH No	TP120				
Project / Job Ref: 2173	Additional Refs	None Supplied				
Order No: PO1	Depth (m)	0.45				
Reporting Date: 05/01/2015	QTSE Sample No	130339				

Determinand	Unit	RL	Accreditation				
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01			
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05			
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3			
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3			
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10			
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21			
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01			
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05			
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2			
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2			
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2			
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3			
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10			
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21			
Total >C5 - C35	mg/kg	< 42	NONE	< 42			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 14-27517	Date Sampled	19/12/14				
TerraConsult Ltd	Time Sampled	None Supplied				
Site Reference: Kings Business Park	TP / BH No	TP120				
Project / Job Ref: 2173	Additional Refs	None Supplied				
Order No: PO1	Depth (m)	0.45				
Reporting Date: 05/01/2015	QTSE Sample No	130339				

Determinand	Unit	RL	Accreditation				
Benzene	ug/kg	< 2	MCERTS	< 2			
Toluene	ug/kg	< 5	MCERTS	< 5			
Ethylbenzene	ug/kg	< 10	MCERTS	< 10			
p & m-xylene	ug/kg	< 10	MCERTS	< 10			
o-xylene	ug/kg	< 10	MCERTS	< 10			
MTBE	ug/kg	< 5	MCERTS	< 5			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2

QTS Environmental Report No: 14-27517		Date Sampled	19/12/14				Landfill Waste Acceptance Criteria Limits		
TerraConsult Ltd		Time Sampled	None Supplied				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Site Reference: Kings Business Park		TP / BH No	TP111						
Project / Job Ref: 2173		Additional Refs	None Supplied						
Order No: PO1		Depth (m)	0.50						
Reporting Date: 05/01/2015		QTSE Sample No	130335						
Determinand	Unit	MDL							
TOC ^{MU}	%	< 0.1	0.7		3%	5%	6%		
Loss on Ignition	%	< 0.01	1.80		--	--	10%		
BTEX ^{MU}	mg/kg	< 0.05	< 0.05		6	--	--		
Sum of PCBs	mg/kg	< 0.7	< 0.7		1	--	--		
Mineral Oil ^{MU}	mg/kg	< 10	< 10		500	--	--		
Total PAH ^{MU}	mg/kg	< 1.7	< 1.7		100	--	--		
pH ^{MU}	pH Units	N/a	6.0		--	>6	--		
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1		--	To be evaluated	To be evaluated		
Eluate Analysis			10:1 mg/l		Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)			
Arsenic ^U		< 0.01			< 0.1	0.5	2	25	
Barium ^U		< 0.02			< 0.2	20	100	300	
Cadmium ^U		< 0.0005			< 0.005	0.04	1	5	
Chromium ^U		< 0.005			< 0.05	0.5	10	70	
Copper ^U		< 0.01			< 0.1	2	50	100	
Mercury ^U		< 0.0005			< 0.01	0.01	0.2	2	
Molybdenum ^U		< 0.001			< 0.01	0.5	10	30	
Nickel ^U		< 0.007			< 0.07	0.4	10	40	
Lead ^U		< 0.005			< 0.05	0.5	10	50	
Antimony ^U		< 0.005			< 0.05	0.06	0.7	5	
Selenium ^U		< 0.005			< 0.05	0.1	0.5	7	
Zinc ^U		0.006			0.06	4	50	200	
Chloride ^U		< 1			< 10	800	15000	25000	
Fluoride ^U		< 0.5			< 5	10	150	500	
Sulphate ^U		< 1			< 10	1000	20000	50000	
TDS		6			60	4000	60000	100000	
Phenol Index		< 0.01			< 0.1	1	-	-	
DOC		10.8			108	500	800	1000	
Leach Test Information									
Sample Mass (kg)		0.10							
Dry Matter (%)		85.9							
Moisture (%)		16.4							
Stage 1									
Volume Eluate L10 (litres)		0.89							
Results are expressed on a dry weight basis, after correction for moisture content where applicable									
Stated limits are for guidance only and QTS Environmental cannot be held responsible for any discrepancies with current legislation									
M Denotes MCERTS accredited test									
U Denotes ISO17025 accredited test									



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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 14-27517	
TerraConsult Ltd	
Site Reference: Kings Business Park	
Project / Job Ref: 2173	
Order No: PO1	
Reporting Date: 05/01/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
130335	TP111	None Supplied	0.50	14.1	Brown loamy clay
130336	TP112	None Supplied	0.30	17.5	Light brown loamy clay
130339	TP120	None Supplied	0.45	7.8	Brown sand with rubble
130341	HP1	None Supplied	1.00	12.7	Red loamy clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information				
QTS Environmental Report No: 14-27517				
TerraConsult Ltd				
Site Reference: Kings Business Park				
Project / Job Ref: 2173				
Order No: PO1				
Reporting Date: 05/01/2015				

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried
AR As Received



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QTS Environmental Report No: 15-27609

Site Reference: Kings Business Park

Project / Job Ref: 2178

Order No: None Supplied

Sample Receipt Date: 19/12/2014

Sample Scheduled Date: 05/01/2015

Report Issue Number: 1

Reporting Date: 08/01/2015

Authorised by:

Russell Jarvis
Director

On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd



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Soil Analysis Certificate						
QTS Environmental Report No: 15-27609	Date Sampled	15/12/14	16/12/14	16/12/14	16/12/14	16/12/14
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Kings Business Park	TP / BH No	TP106	TP116	TP107	TP108	TP109
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.10	0.25	0.20	0.20	0.45
Reporting Date: 08/01/2015	QTSE Sample No	130718	130719	130720	130721	130722

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Quantification	%	< 0.001	NONE					

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)
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The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.
Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.
Asbestos Analyst: Piotr Lipski
RL: Reporting Limit
Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).
Subcontracted analysis ^(S)



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Soil Analysis Certificate						
QTS Environmental Report No: 15-27609	Date Sampled	16/12/14	16/12/14	15/12/14	15/12/14	16/12/14
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Kings Business Park	TP / BH No	TP110	TP115	TP114	TP113	TP101
Project / Job Ref: 2178	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.35	0.45	0.25	0.15	0.80
Reporting Date: 08/01/2015	QTSE Sample No	130723	130724	130725	130726	130727

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	
Asbestos Quantification	%	< 0.001	NONE					0.003

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)
This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.
The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.
Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.
Asbestos Analyst: Piotr Lipski
RL: Reporting Limit
Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).
Subcontracted analysis ^(S)



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - Methodology & Miscellaneous Information				
QTS Environmental Report No: 15-27609				
TerraConsult Ltd				
Site Reference: Kings Business Park				
Project / Job Ref: 2178				
Order No: None Supplied				
Reporting Date: 08/01/2015				

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried
AR As Received



Scientific Analysis Laboratories Ltd

Certificate of Analysis

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

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

Report Number: 446861-1

Date of Report: 12-Jan-2015

Customer: TerraConsult Limited
Unit 34
Bold Business Centre
Bold Lane
Sutton
St Helens
WA9 4TX

Customer Contact: Ms Cassie Bailey

Customer Job Reference: 2173

Customer Purchase Order: PO13699

Customer Site Reference: Kings Business Park

Date Job Received at SAL: 06-Jan-2015

Date Analysis Started: 07-Jan-2015

Date Analysis Completed: 12-Jan-2015

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22



1549

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

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

SAL Reference: 446861							
Project Site: Kings Business Park							
Customer Reference: 2173							
Water		Analysed as Water					
Heavy Metals(9)							
SAL Reference					446861 001	446861 003	446861 004
Customer Sample Reference					BH2	BH7	BH8
Date Sampled					06-JAN-2015	06-JAN-2015	06-JAN-2015
Determinand	Method	Test Sample	LOD	Units			
As (Dissolved)	T281	AR	0.2	µg/l	2.3	1.2	0.8
Boron	T6	AR	0.01	mg/l	0.05	0.02	0.02
Cd (Dissolved)	T281	AR	0.02	µg/l	0.07	0.04	0.03
Cr (Dissolved)	T281	AR	1	µg/l	6	6	6
Cu (Dissolved)	T281	AR	0.5	µg/l	<0.5	<0.5	1.0
Pb (Dissolved)	T281	AR	0.3	µg/l	<0.3	<0.3	<0.3
Hg (Dissolved)	T281	AR	0.05	µg/l	<0.05	<0.05	<0.05
Ni (Dissolved)	T281	AR	1	µg/l	3	5	4
Se (Dissolved)	T281	AR	0.5	µg/l	<0.5	1.9	4.8
Zn (Dissolved)	T281	AR	2	µg/l	<2	<2	<2

SAL Reference: 446861

Project Site: Kings Business Park

Customer Reference: 2173

Water

TerraConsult 3

Analysed as Water

SAL Reference					446861 001	446861 002	446861 003	446861 004
Customer Sample Reference					BH2	BH4	BH7	BH8
Date Sampled					06-JAN-2015	06-JAN-2015	06-JAN-2015	06-JAN-2015
Determinand	Method	Test Sample	LOD	Units				
Alkalinity expressed as CaCO3	T22	AR	10	mg/l	230	-	210	240
Ammoniacal nitrogen	T686	AR	0.05	mg/l	<0.05	-	<0.05	0.05
Chloride	T686	AR	1	mg/l	8	-	15	12
Cyanide(Total)	T4	AR	0.05	mg/l	<0.05	-	<0.05	<0.05
Electrical Conductivity	T7	AR	10	µS/cm	540	-	600	570
Hardness expressed as CaCO3	T6	AR	10	mg/l	250	-	280	280
Nitrate	T686	AR	0.5	mg/l	<0.5	-	6.7	3.5
pH	T7	AR			7.5	8.1	7.3	7.3
Sulphate	T686	AR	0.5	mg/l	31	6800	66	52
Total Phenols	T16	AR	0.5	µg/l	1.7	-	1.3	<0.5

Value	Description
AR	As Received
13	Results have been blank corrected.
100	LOD determined by sample aliquot used for analysis
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T54	GC/MS (Headspace)
T686	Discrete Analyser
T149	GC/MS (SIR)
T215	GC/MS (Headspace)(LV)
T6	ICP/OES
T85	Calc
T281	ICP/MS (Filtered)
T16	GC/MS
T7	Probe
T4	Colorimetry
T22	Titration
T81	GC/FID (LV)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Alkalinity expressed as CaCO ₃	T22	AR	10	mg/l	N	001,003-004
Ammoniacal nitrogen	T686	AR	0.05	mg/l	U	001,003-004
Chloride	T686	AR	1	mg/l	U	001,003-004
Cyanide(Total)	T4	AR	0.05	mg/l	U	001,003-004
Electrical Conductivity	T7	AR	10	µS/cm	N	001,003-004
Hardness expressed as CaCO ₃	T6	AR	10	mg/l	N	001,003-004
Nitrate	T686	AR	0.5	mg/l	U	001,003-004
pH	T7	AR			U	001-004
Sulphate	T686	AR	0.5	mg/l	U	001-004
Total Phenols	T16	AR	0.5	µg/l	U	001,003-004
As (Dissolved)	T281	AR	0.2	µg/l	U	001,003-004
Boron	T6	AR	0.01	mg/l	N	001,003-004
Cd (Dissolved)	T281	AR	0.02	µg/l	U	001,003-004
Cr (Dissolved)	T281	AR	1	µg/l	U	001,003-004
Cu (Dissolved)	T281	AR	0.5	µg/l	U	001,003-004
Pb (Dissolved)	T281	AR	0.3	µg/l	U	001,003-004
Hg (Dissolved)	T281	AR	0.05	µg/l	U	001,003-004
Ni (Dissolved)	T281	AR	1	µg/l	U	001,003-004
Se (Dissolved)	T281	AR	0.5	µg/l	U	001,003-004
Zn (Dissolved)	T281	AR	2	µg/l	U	001,003-004
Naphthalene	T149	AR	0.01	µg/l	U	001,003-004
Acenaphthylene	T149	AR	0.01	µg/l	U	001,003-004
Acenaphthene	T149	AR	0.01	µg/l	U	001,003-004
Fluorene	T149	AR	0.01	µg/l	U	001,003-004
Phenanthrene	T149	AR	0.01	µg/l	U	001,003-004
Anthracene	T149	AR	0.01	µg/l	U	001,003-004
Fluoranthene	T149	AR	0.01	µg/l	U	001,003-004
Pyrene	T149	AR	0.01	µg/l	U	001,003-004
Benzo(a)Anthracene	T149	AR	0.01	µg/l	U	001,003-004
Chrysene	T149	AR	0.01	µg/l	U	001,003-004
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	U	001,003-004
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	U	001,003-004
Benzo(a)Pyrene	T149	AR	0.01	µg/l	U	001,003-004
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	U	001,003-004
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	U	001,003-004
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	U	001,003-004
PAH(total)	T149	AR	0.01	µg/l	U	001,003-004
Benzene	T54	AR	1	µg/l	U	001-004
EthylBenzene	T54	AR	1	µg/l	U	001-004
m/P Xylene	T54	AR	1	µg/l	U	001-004
Methyl tert-Butyl Ether	T54	AR	1	µg/l	U	001-004
O Xylene	T54	AR	1	µg/l	U	001-004
Toluene	T54	AR	1	µg/l	U	001-004

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
TPH (C5-C6 aliphatic)	T215	AR	0.010	mg/l	N	001-004
TPH (C6-C8 aliphatic)	T215	AR	0.010	mg/l	N	001-004
TPH (C8-C10 aliphatic)	T215	AR	0.010	mg/l	N	001-004
TPH DW(C10-C12 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C12-C16 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C16-C21 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C21-C35 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH (C35-C40 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH (C6-C7 aromatic)	T215	AR	0.010	mg/l	N	001-004
TPH (C7-C8 aromatic)	T215	AR	0.010	mg/l	N	001-004
TPH (C8-C10 aromatic)	T215	AR	0.010	mg/l	N	001-004
TPH DW(C10-C12 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C12-C16 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C16-C21 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C21-C35 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH (C35-C40 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH (Aliphatic+Aromatic) C10-C40 (Sum)	T85	AR	0.01	mg/l	N	001-004



APPENDIX I

Laboratory Geotechnical Test Results



LABORATORY REPORT



4043

Contract Number: PSL15/0145

Client's Reference:

Report Date: 22 January 2015

Client Name: Terra consult
Bold Business Centre
Bold Lane, Sutton
St Helens
Merseyside
WA9 4TX

For the attention of: Chris Eccles

Contract Title: Kings Business Park, Prescot

Date Received: 12/1/2015

Date Commenced: 12/1/2015

Date Completed: 22/1/2015

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

M Beastall
(Laboratory Manager)

D Lambe
(Senior Technician)

S Royle
(Senior Technician)

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

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	22/01/15		22/01/15		22/01/15
KINGS BUSINESS PARK, PRESCOT.				Contract No:	PSL15/0145
				Client Ref:	2173

SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**

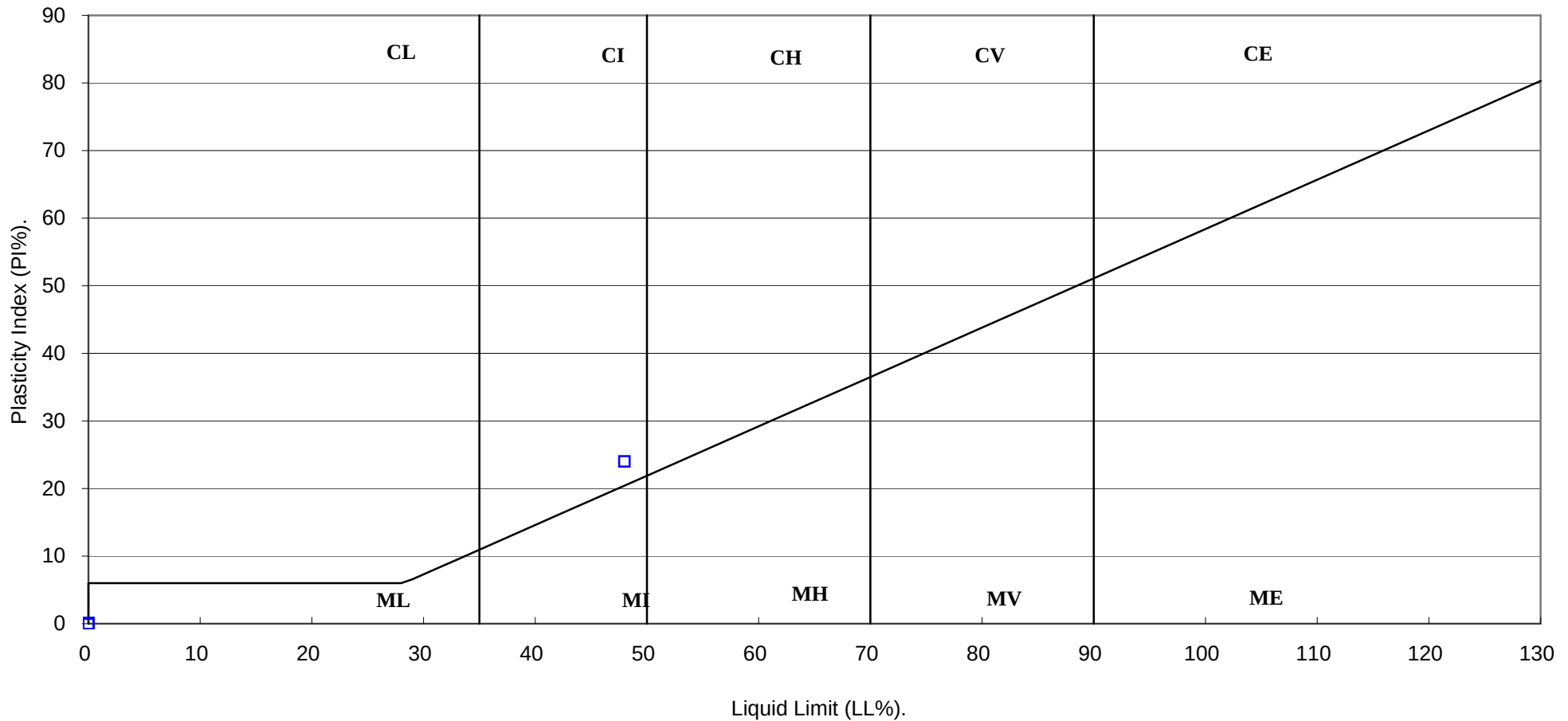


Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	22/01/15		22/01/15		22/01/15
KINGS BUSINESS PARK, PRESCOT.				Contract No:	PSL15/0145
				Client Ref:	2173

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL

Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	22/01/15		22/01/15		22/01/15
KINGS BUSINESS PARK, PRESCOT.				Contract No:	PSL15/0145
				Client Ref:	2173

Particle Size Distribution Test

BS1377 : Part 2 : 1990

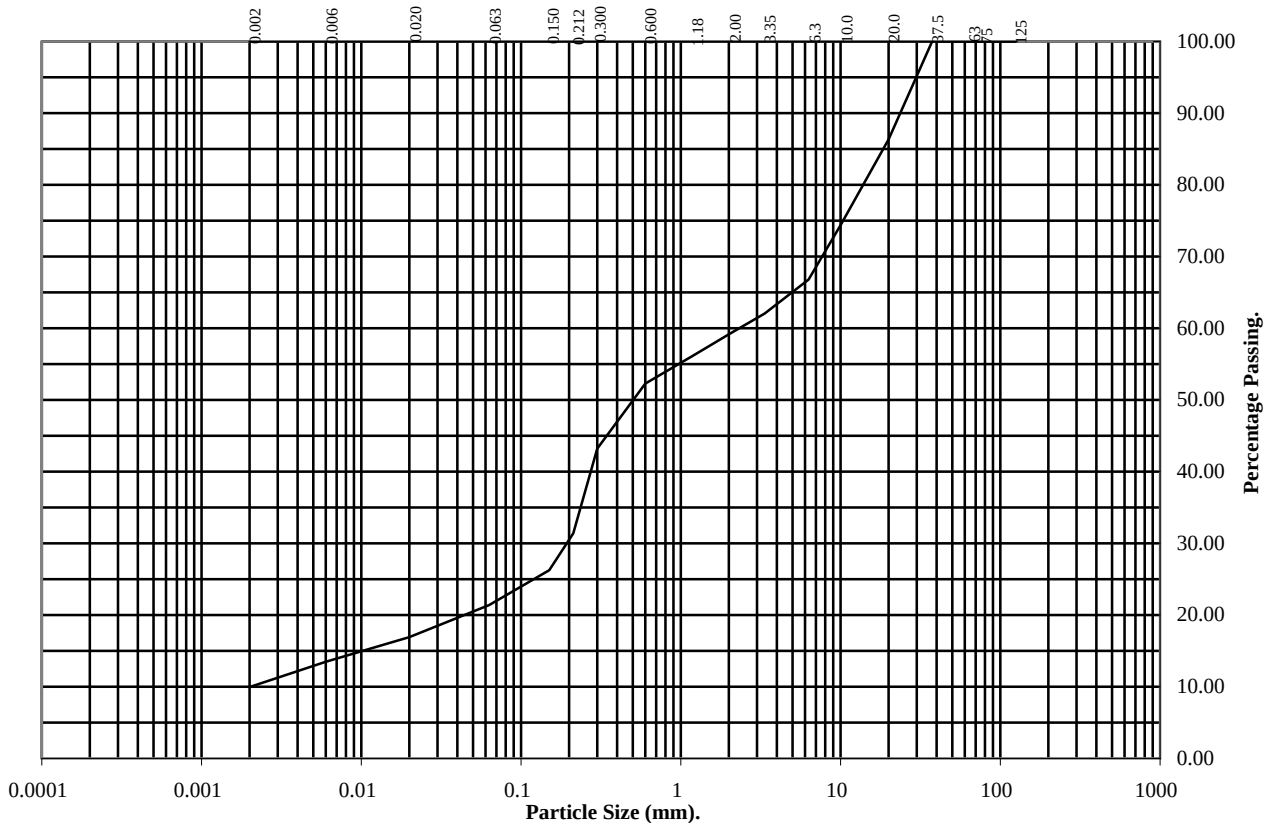
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP102

Depth (m): 0.20-0.30

Sample Number:

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	86
10	74
6.3	67
3.35	62
2	59
1.18	56
0.6	52
0.3	43
0.212	31
0.15	26
0.063	21

Particle Diameter	Percentage Passing
0.02	17
0.006	14
0.002	10

Soil Fraction	Total Percentage
Cobbles	0
Gravel	41
Sand	38
Silt	11
Clay	10

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	22/01/15		22/01/15

Particle Size Distribution Test

BS1377 : Part 2 : 1990

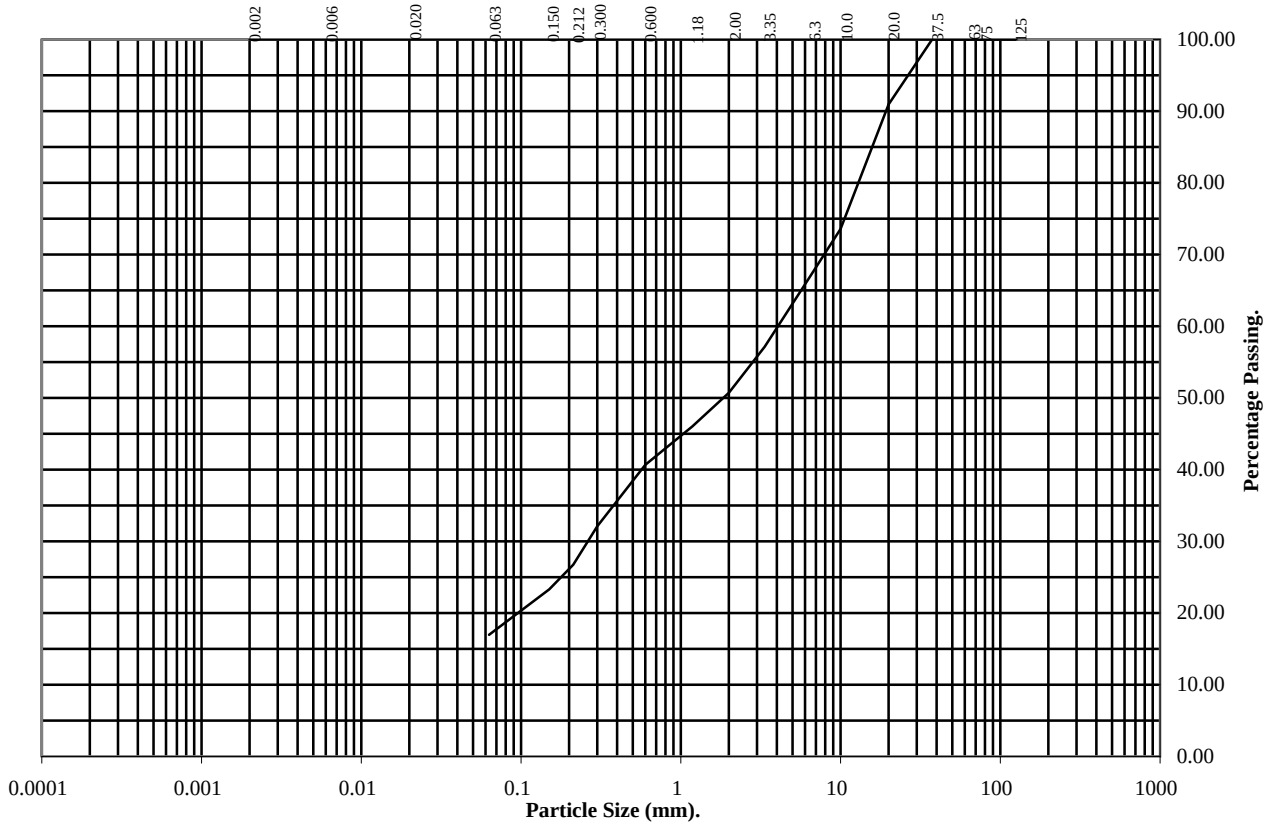
Wet Sieve, Clause 9.2

Hole Number: TP103

Depth (m): 0.50-0.70

Sample Number:

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	91
10	74
6.3	67
3.35	57
2	51
1.18	46
0.6	41
0.3	32
0.212	27
0.15	23
0.063	17

Soil Fraction	Total Percentage
Cobbles	0
Gravel	49
Sand	34
Silt / Clay	17

Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	22/01/15		22/01/15

PSL

Professional Soils Laboratory

KINGS BUSINESS OARK, PRESCOT.

Contract No.:
PSL15/0145

Particle Size Distribution Test

BS1377 : Part 2 : 1990

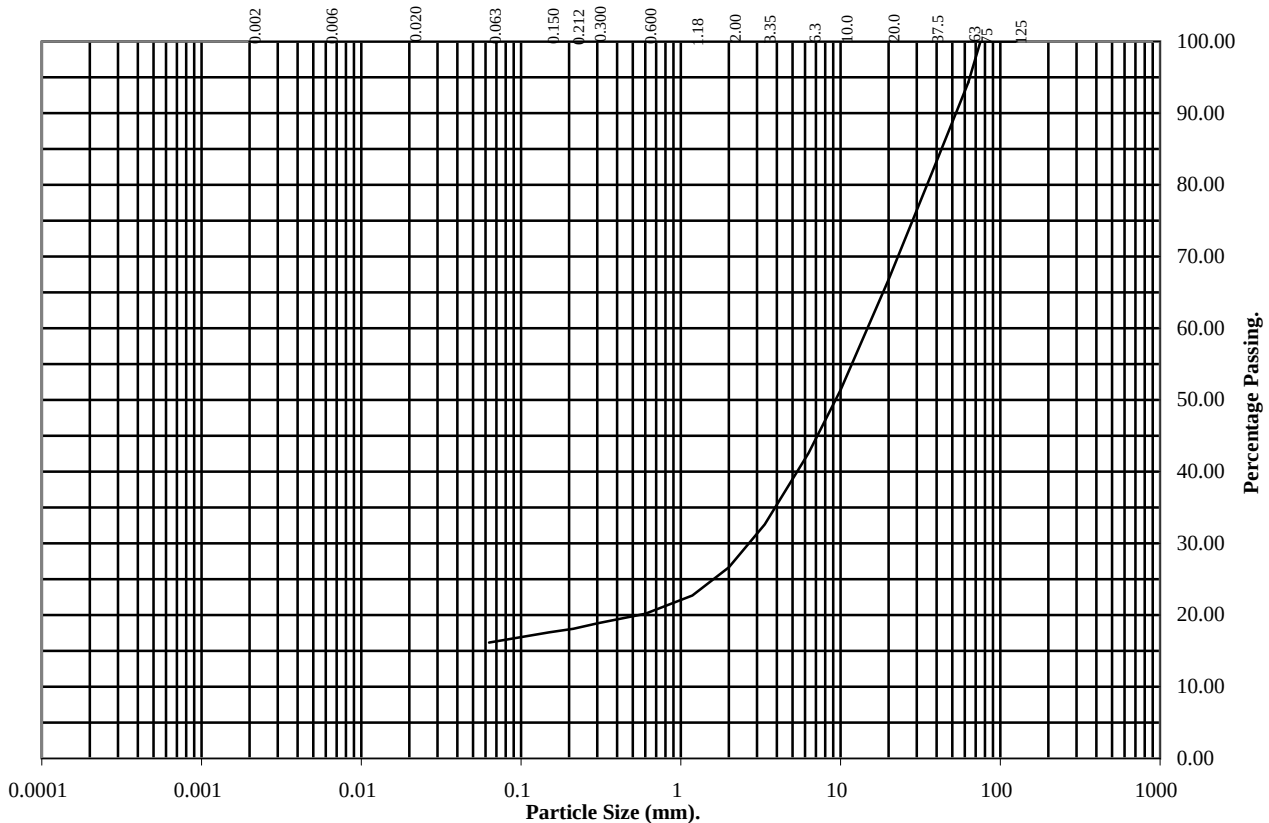
Wet Sieve, Clause 9.2

Hole Number: TP108

Depth (m): 0.80-0.90

Sample Number:

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	94
37.5	82
20	67
10	51
6.3	43
3.35	33
2	27
1.18	23
0.6	20
0.3	19
0.212	18
0.15	18
0.063	16

Soil Fraction	Total Percentage
Cobbles	6
Gravel	67
Sand	11
Silt / Clay	16

Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	22/01/15		22/01/15

PSL

Professional Soils Laboratory

KINGS BUSINESS OARK, PRESCOT.

Contract No.:
PSL15/0145

Particle Size Distribution Test

BS1377 : Part 2 : 1990

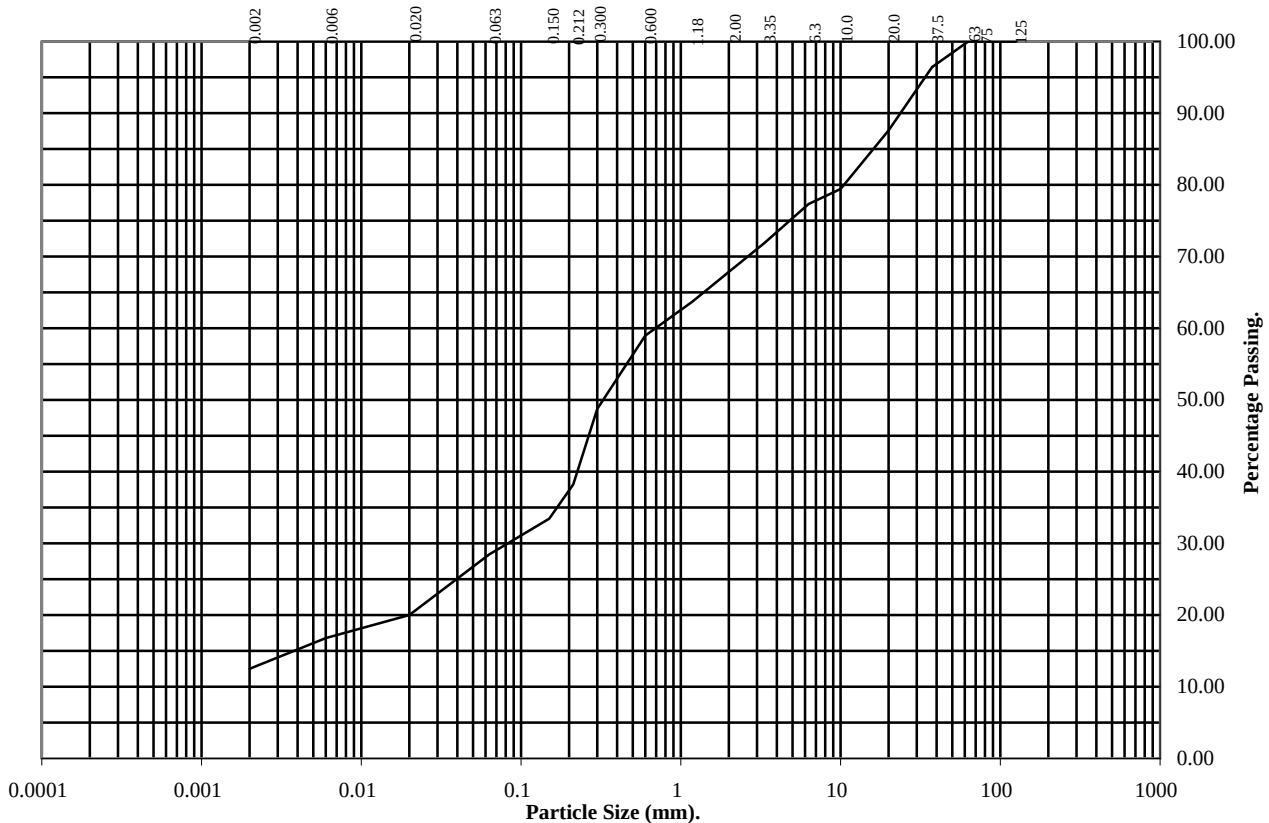
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP109

Depth (m): 0.50-0.60

Sample Number:

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	96
20	88
10	79
6.3	77
3.35	72
2	68
1.18	64
0.6	59
0.3	49
0.212	38
0.15	33
0.063	28

Particle Diameter	Percentage Passing
0.02	20
0.006	17
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	32
Sand	40
Silt	15
Clay	13

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	22/01/15		22/01/15

Particle Size Distribution Test

BS1377 : Part 2 : 1990

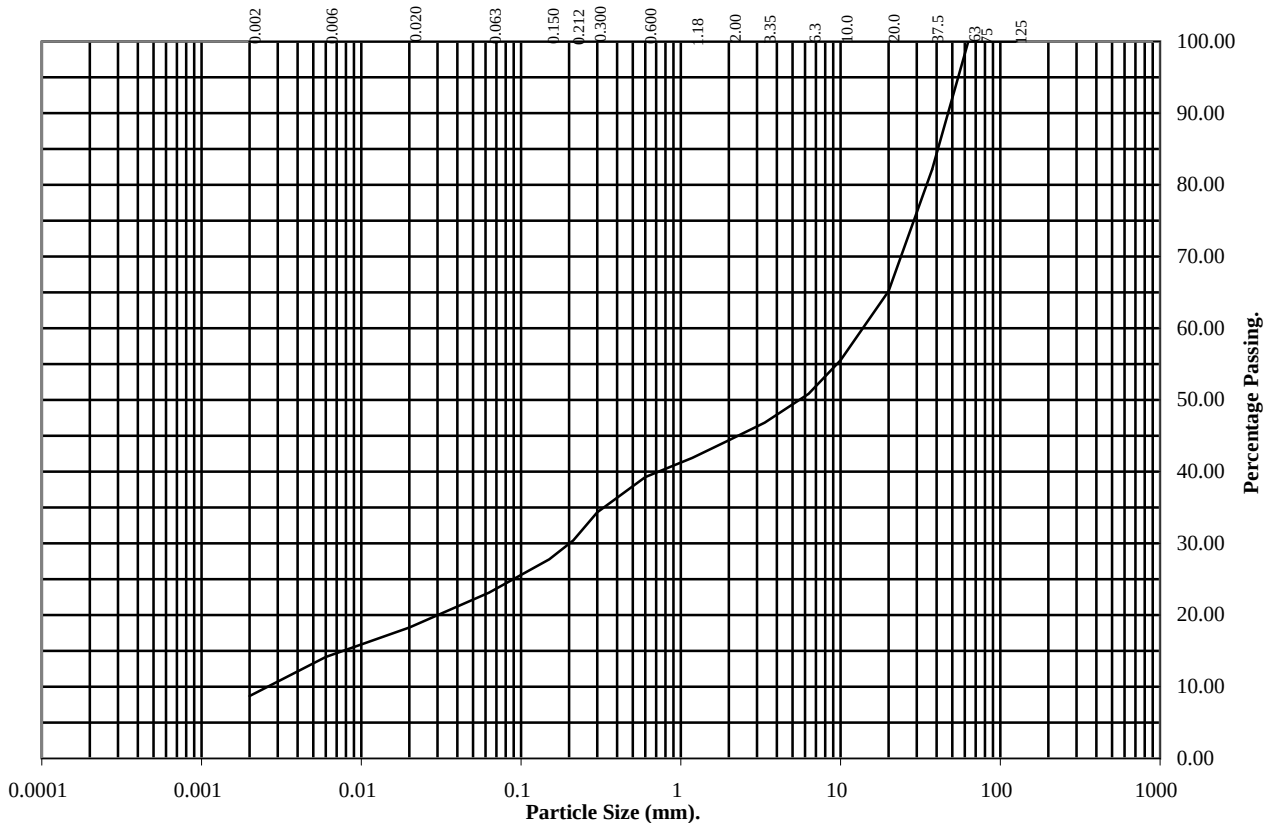
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP116

Depth (m): 0.60-0.80

Sample Number:

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	82
20	65
10	56
6.3	51
3.35	47
2	44
1.18	42
0.6	39
0.3	34
0.212	30
0.15	28
0.063	23

Particle Diameter	Percentage Passing
0.02	18
0.006	14
0.002	9

Soil Fraction	Total Percentage
Cobbles	0
Gravel	56
Sand	21
Silt	14
Clay	9

Remarks:

See summary of soil descriptions.

Checked By	Date	Approved By	Date
	22/01/15		22/01/15

PSL

Professional Soils Laboratory

KINGS BUSINESS OARK, PRESCOT.

Contract No.:
PSL15/0145

Client: Terraconsult

Job No.: SRL171

Site Name: Kings Buisness Park



Laboratory Test Result Summary

				Description	Classification					Triaxial Compression								Chemical					Additional				
Location Number	Sample Type No.	Sample Depth Top m	Sample Depth Bottom m		LL	PL	PI	% Retained 425µm	Moisture Content %	Bulk Density Mg/m³	Dry Density Mg/m³	Test Type	Specimen Diameter mm	Specimen Length mm	Lateral Pressure {Deviator Stress} kPa	Cohesion Intercept kPa	Friction Angle	Cu kPa	pH	SO₄ % Total	SO₄ mg/l 2:1 Extract	SO₄ mg/l in Water	Cl₂ %	Point Load	Oedometer	Hand Pene. kgf/cm²	Others
BH101		2.50	2.53	Grey SANDSTONE					4.3	2.134	2.046																
BH101		2.56	2.64	Grey SANDSTONE					5.0															✓			
BH101		4.03	4.13	Grey SANDSTONE					5.1															✓			
BH101		5.42	5.52	Grey SANDSTONE					5.2															✓			
BH101		6.25	6.37	Grey SANDSTONE					7.9															✓			
BH101		6.90	6.94	Grey MUDSTONE					6.0	2.106	1.987																
BH101		7.20	7.27	Grey SANDSTONE					4.2	2.271	2.178																
BH101		7.27	7.36	Grey SANDSTONE					4.3															✓			
BH102		3.02	3.10	Grey MUDSTONE					6.7	2.100	1.968																
BH102		3.82	3.92	Grey SANDSTONE					4.7															✓			
BH102		3.92	4.04	Grey SANDSTONE					4.6															✓			
BH102		6.05	6.09	Grey SANDSTONE					4.1	2.315	2.224																
BH102		6.10	6.18	Grey SANDSTONE					4.3															✓			
BH102		6.84	6.93	Grey SANDSTONE					3.9															✓			
BH103		3.00	3.10	Grey SANDSTONE					4.5															✓			
BH103		3.56	3.66	Grey SANDSTONE					4.6															✓			
BH103		4.80	4.86	Grey SANDSTONE					5.7	2.446	2.314																
BH103		5.10	5.22	Grey SANDSTONE					5.3															✓			
BH103		5.47	5.58	Grey SANDSTONE					5.2															✓			
BH103		6.15	6.22	Grey MUDSTONE					5.1	2.400	2.283																
BH104		2.43	2.48	Grey SANDSTONE					5.4	2.194	2.082																
BH104		3.13	3.24	Grey SANDSTONE					4.5															✓			
BH104		4.20	4.26	Grey SANDSTONE					6.4	2.542	2.389																
BH104		5.45	5.50	Grey SANDSTONE					5.8	2.130	2.012																
BH104		6.95	7.00	Grey SANDSTONE					5.6	2.129	2.016																
BH105		2.75	2.82	Grey SANDSTONE					5.5	1.729	1.639																

Client: Terraconsult

Job No.: SRL171

Site Name: Kings Buisness Park



Laboratory Test Result Summary

					Classification					Triaxial Compression								Chemical					Additional				
Location Number	Sample Type No.	Sample Depth Top m	Sample Depth Bottom m	Description	LL	PL	PI	% Retained 425µm	Moisture Content %	Bulk Density Mg/m³	Dry Density Mg/m³	Test Type	Specimen Diameter mm	Specimen Length mm	Lateral Pressure {Deviator Stress} kPa	Cohesion Intercept kPa	Friction Angle	Cu kPa	pH	SO₄ % Total	SO₄ mg/l 2:1 Extract	SO₄ mg/l in Water	Cl₂ %	Point Load	Oedometer	Hand Pene. kgf/cm²	Others
BH105		3.87	3.95	Grey SANDSTONE					5.5															✓			
BH105		4.35	4.44	Grey SANDSTONE					4.6															✓			
BH105		5.85	5.97	Grey SANDSTONE					4.5															✓			
BH105		6.69	6.81	Grey SANDSTONE					4.1															✓			
BH106		2.98	3.05	Grey SANDSTONE					5.0	2.258	2.151																
BH106		3.37	3.47	Grey SANDSTONE					4.5															✓			
BH106		3.65	3.77	Grey SANDSTONE					4.7															✓			
BH106		4.34	4.40	Grey SANDSTONE					5.3	2.136	2.029																
BH106		5.28	5.40	Grey SANDSTONE					4.1															✓			
BH106		5.51	5.56	Grey SANDSTONE					4.7	2.207	2.109																
BH106		6.44	6.54	Grey SANDSTONE					4.0															✓			
BH106		6.74	6.80	Grey SILTSTONE					4.1	2.225	2.138																
BH107		2.56	2.64	Grey SANDSTONE					6.3	2.125	1.998																
BH107		2.64	2.75	Grey SANDSTONE					6.5															✓			
BH107		4.14	4.17	Grey SILTSTONE					5.5	2.205	2.089																
BH107		4.74	4.84	Grey SILTSTONE					4.2															✓			
BH107		4.84	4.88	Grey SILTSTONE					4.3	2.377	2.279																
BH107		6.46	6.50	Grey SILTSTONE					4.1	2.393	2.299																
BH108		3.21	3.25	Grey SILTSTONE					4.7	2.218	2.118																
BH108		3.37	3.47	Grey SILTSTONE					4.6															✓			
BH108		4.04	4.15	Grey SILTSTONE					4.4															✓			
BH108		5.14	5.18	Grey SILTSTONE					7.1	2.266	2.116																
BH108		6.07	6.18	Grey SILTSTONE					4.7															✓			
BH108		6.85	6.89	Grey SILTSTONE					4.3	2.171	2.082																

Client: Terraconsult

Job No.: SRL171

Site Name: Kings Business Park



Point Load Strength Index

Borehole No	Depth (m)	Description	Type	Orientation	W (mm)	D (mm)	P (kN)	De ² (mm ²)	De (mm)	I _s	ƒ	I _{sg} MN/m ²
101	2.56	1	d	II	35	86	0.10	7396.00	86.00	0.014	1.28	0.02
101	2.56	1	a	⊥	86	53	5.60	5803.43	76.18	0.965	1.21	1.17
101	4.03	1	d	II	55	86	6.00	7396.00	86.00	0.811	1.28	1.04
101	4.03	1	a	⊥	86	67	9.00	7336.41	85.65	1.227	1.27	1.56
101	5.42	2	d	II	58	86	4.90	7396.00	86.00	0.663	1.28	0.85
101	5.42	2	a	⊥	86	84	5.60	9197.88	95.91	0.609	1.34	0.82
101	6.25	2	d	II	62	86	5.00	7396.00	86.00	0.676	1.28	0.86
101	6.25	2	a	⊥	86	54	12.00	5912.92	76.90	2.029	1.21	2.46
101	7.27	2	d	II	44	86	1.50	7396.00	86.00	0.203	1.28	0.26
101	7.27	2	a	⊥	86	56	5.60	6131.92	78.31	0.913	1.22	1.12
102	3.82	2	d	II	50	86	4.30	7396.00	86.00	0.581	1.28	0.74
102	3.82	2	a	⊥	86	49	7.50	5365.43	73.25	1.398	1.19	1.66
102	3.92	2	d	II	58	86	5.60	7396.00	86.00	0.757	1.28	0.97
102	3.92	2	a	⊥	86	59	8.00	6460.42	80.38	1.238	1.24	1.53
102	6.10	2	d	II	50	86	3.30	7396.00	86.00	0.446	1.28	0.57
102	6.10	2	a	⊥	86	41	8.00	4489.44	67.00	1.782	1.14	2.03
102	6.84	2	d	II	37	86	2.10	7396.00	86.00	0.284	1.28	0.36
102	6.84	2	a	⊥	86	51	6.50	5584.43	74.73	1.164	1.20	1.39
103	3.00	1	d	II	61	86	2.80	7396.00	86.00	0.379	1.28	0.48
103	3.00	1	a	⊥	86	53	14.50	5803.43	76.18	2.499	1.21	3.02
103	3.56	1	d	II	42	86	2.75	7396.00	86.00	0.372	1.28	0.47
103	3.56	1	a	⊥	86	67	7.00	7336.41	85.65	0.954	1.27	1.22
103	5.10	1	d	II	60	86	5.40	7396.00	86.00	0.730	1.28	0.93
103	5.10	1	a	⊥	86	84	5.60	9197.88	95.91	0.609	1.34	0.82
103	5.47	1	d	II	57	86	6.50	7396.00	86.00	0.879	1.28	1.12
103	5.47	1	a	⊥	86	54	10.50	5912.92	76.90	1.776	1.21	2.16
104	3.13	1	d	II	63	86	1.50	7396.00	86.00	0.203	1.28	0.26
104	3.13	1	a	⊥	86	56	7.00	6131.92	78.31	1.142	1.22	1.40
105	3.87	1	d	II	42	86	0.30	7396.00	86.00	0.041	1.28	0.05
105	3.87	1	a	⊥	86	49	7.50	5365.43	73.25	1.398	1.19	1.66
105	4.35	1	d	II	48	86	2.30	7396.00	86.00	0.311	1.28	0.40
105	4.35	1	a	⊥	86	59	7.00	6460.42	80.38	1.084	1.24	1.34
105	5.85	1	d	II	43	86	2.60	7396.00	86.00	0.352	1.28	0.45
105	5.85	1	a	⊥	86	41	5.60	4489.44	67.00	1.247	1.14	1.42
105	6.69	1	d	II	67	86	2.60	7396.00	86.00	0.352	1.28	0.45
105	6.69	1	a	⊥	86	51	8.50	5584.43	74.73	1.522	1.20	1.82
106	3.37	2	d	II	62	86	5.60	7396.00	86.00	0.757	1.28	0.97
106	3.37	2	a	⊥	86	48	13.00	5255.93	72.50	2.473	1.18	2.92
106	3.65	2	d	II	64	86	4.00	7396.00	86.00	0.541	1.28	0.69
106	3.65	2	a	⊥	86	46	11.00	5036.94	70.97	2.184	1.17	2.56
106	5.28	1	d	II	57	86	2.30	7396.00	86.00	0.311	1.28	0.40
106	5.28	1	a	⊥	86	62	5.60	6788.91	82.39	0.825	1.25	1.03
106	6.44	3	d	II	50	86	3.60	7396.00	86.00	0.487	1.28	0.62
106	6.44	3	a	⊥	86	60	5.60	6569.92	81.06	0.852	1.24	1.06
107	2.64	2	d	II	62	86	7.00	7396.00	86.00	0.946	1.28	1.21
107	2.64	2	a	⊥	86	73	11.50	7993.40	89.41	1.439	1.30	1.87
107	4.74	1	d	II	53	86	3.80	7396.00	86.00	0.514	1.28	0.66
107	4.74	1	a	⊥	86	56	6.50	6131.92	78.31	1.060	1.22	1.30
108	3.37	3	d	II	50	86	0.60	7396.00	86.00	0.081	1.28	0.10
108	3.37	3	a	⊥	86	43	2.60	4708.44	68.62	0.552	1.15	0.64
108	4.04	3	d	II	60	86	1.95	7396.00	86.00	0.264	1.28	0.34
108	4.04	3	a	⊥	86	51	9.50	5584.43	74.73	1.701	1.20	2.04
108	6.07	3	d	II	55	86	9.50	7396.00	86.00	1.284	1.28	1.64
108	6.07	3	a	⊥	86	48	13.00	5255.93	72.50	2.473	1.18	2.92

Client: Terraconsult

Job No.: SRL171

Site Name: Kings Business Park



Description 1: Grey SILTSTONE
Description 2: Grey fine grained SANDSTONE
Description 3: Grey fine grained SANDSTONE

Summary of Axial Tests		Siltstone	Sandstone	Mudstone
$I_{s(50)}$ MN/m ² for Stratum 1-3	Min	0.82	0.82	0.64
	Mean	1.53	1.84	1.66
	Max	3.02	2.92	2.92
Approx. Compressive Strength (correction factor of 20)	Min	16.32	16.32	12.73
	Mean	31	37	33
	Max	60	58	58
EN ISO 14689-1 Term	Min	Weak	Weak	Weak
	Mean	Medium Strong	Medium Strong	Medium Strong
	Max	Strong	Strong	Strong

		Diametrical	Axial
$I_{s(50)}$ MN/m ² for Diametrical/Axial	Min	0.02	0.64
	Mean	0.63	1.66
	Max	1.64	3.02
Approx. Compressive Strength (correction factor of 20)	Min	0.35	12.73
	Mean	13	33
	Max	33	60

Test

A = axial

D = diametrical

IL = irregular lump

Relationship to planes of weakness

|| = parallel

⊥ = perpendicular

Extremely Weak

Very Weak

Weak

Medium Strong

Strong

Very Strong

Extremely Strong

U.C.S.

MN/m²

0.6-1.0

1.0-5.0

5.0-25.0

25-50

50-100

100-250

>250

APPENDIX J

Current Guidance on Interpretation of Chemical Analysis of Soils for Human Health Assessment

Current Guidance on Interpretation of Chemical Analysis of Soils

Contaminated land is defined under law through Part IIA of the Environmental Protection Act 1990, implemented through Section 57 of the Environment Act 1995. This supports a 'suitable for use' based approach to the risk assessment of contaminated land. The site specific risk assessment is based upon an assessment of plausible contaminant linkages, referred to as the contaminant-pathway- receptor model, based upon the current or proposed use of the site.

Before undertaking a risk assessment a conceptual site model is devised in order to identify the potential contaminants, pathways and receptors. The individual contaminants, pathways and receptors then need to be further investigated in order to refine the initial assessment and risk assessment undertaken.

In March 2002, the Department for Environment, Food and Rural Affairs (DEFRA) and the EA published the Contaminated Land Exposure Assessment (CLEA) Model and a series of related reports. These were designed to provide a scientifically based framework for the assessment of chronic risks to human health from contaminated land. These reports (CLR7-10) together with associated "SGV" documents were withdrawn and the following documents have been published as revised guidance to the CLEA assessment:

- Environment Agency : 2008: Using Soil Guideline Values SC050021/SGV Introduction, March 2008.
- Environment Agency : 2008: Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
- Environment Agency : 2008: Science Report SC050021/SR3: Updated technical background to the CLEA model.
- Environment Agency : 2008 :Compilation of Data for Priority Organic Contaminants for Derivation of Soil Guideline Values Science report SC050021/SR7
- Science Report SC050021/SR4: CLEA Software (Version) Handbook.

Additional guidance on statistical assessment replacing CLR 7 is partly provided in:

- CL:AIRE :2009: Guidance on Comparing Data With a Critical Concentration

A different approach to the statistical appraisal of data is required depending on whether the assessment of risk is to assess whether land is Contaminated Land in accordance with regulations, or whether the assessment is to assess whether the site is suitable for new development in according with Planning guidance. This is discussed further in CL:AIRE :2009 "Guidance on Comparing Data With a Critical Concentration".

The introduction of the Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) reassessed the CLEA Model and the derived SGVs (and associated GACs calculated using the model). This re-assessment concluded that the SGVs/GACs were conservative screening criteria for determining the suitability of soil with regard to the risk to human health under the planning regime and defined a new upper limit for planning purposes which is the boundary between the new Category 3 and 4. In March 2014 Defra issued preliminary guidance on these new Category 4 Screening Levels (C4SL) and these are discussed further below.

Soil Guideline Values

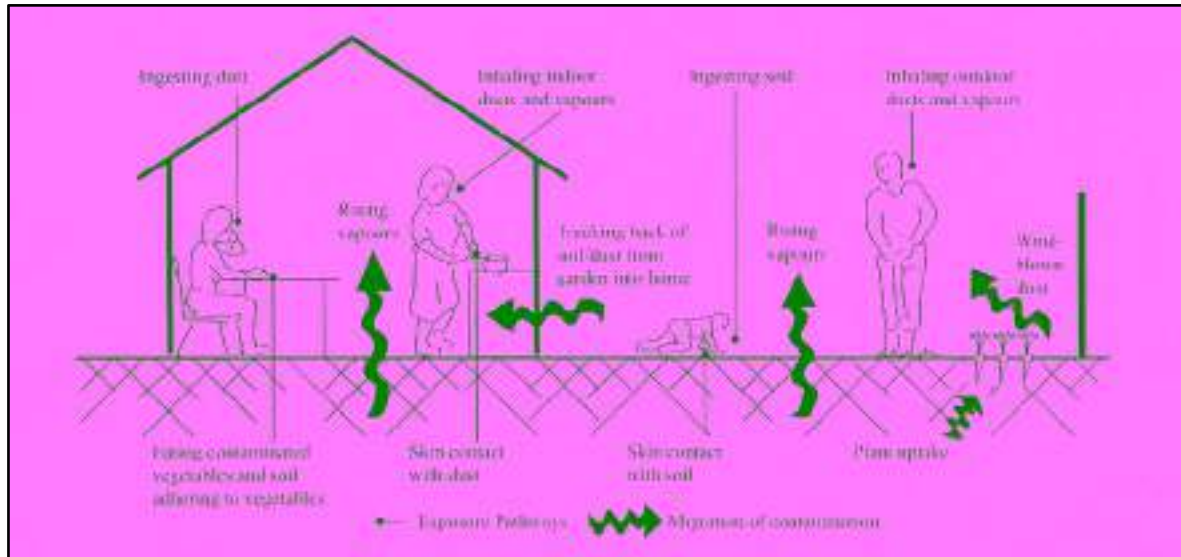
A program for the derivation of SGVs based on the above guidance is provided by the Environment Agency and is entitled "CLEA Software Version 1.06". These reports, together with supporting toxicology reviews ("Tox" or Supplementary Information Reports) for individual substances (which will be gradually updated), Soil Guideline Value Reports and other guidance referred to in the above documents, provide guidance and the scientific basis for assessing the risk to human health from potential contaminants. Soil Guideline Value Reports (SGV Reports) have been published for a number of contaminants and these are published on the Environment Agency website. Eventually the reports will include SGVs for:

- heavy metals and other inorganic compounds: arsenic, cadmium, chromium, cyanide, lead (now withdrawn), mercury nickel, and selenium;
- benzene, ethylbenzene, toluene and xylenes;

- phenol;
- dioxins and dioxin-like polychlorinated biphenyls (PCBs);
- polycyclic aromatic hydrocarbons (PAHs) – 11 substances.

In addition CIEH through LQM and the EIC have published generic assessment criteria (GACs) for a wide variety of other parameters including metals, hydrocarbons, solvents, PAHs and explosive substances for three standard land uses. These have been produced to supplement the Environment Agency guidance. These GACs will be replaced by SGVs when or if the EA publishes any more SGVs.

The CLEA model has been developed to calculate an estimated tolerable daily soil intake (TDSI) for site users given a set 'default' exposure pathways. Ten human exposure pathways are covered in the CLEA model as presented below:



- **Ingestion**
 - ingestion of outdoor soil;
 - ingestion of indoor dust;
 - ingestion of home grown vegetables;
 - ingestion of soil attached to home grown vegetables.
- **Dermal Contact**
 - dermal contact with outdoor soil;
 - dermal contact with indoor dust.
- **Inhalation**
 - inhalation of outdoor dust;
 - inhalation of indoor dust;
 - inhalation of outdoor soil vapour;
 - inhalation of indoor soil vapour.

It should be noted that there are other potential exposure pathways on some sites not included in the CLEA model e.g. certain organic compounds can pass through plastic water pipes into drinking water supply.

The presence and/or significance of each of the above exposure pathways are dependent on the type of land use being considered and the nature of the contaminant under scrutiny. Accordingly, the CLEA model considers for principle 'default' land use types and makes a series of 'default' assumptions with regard to human exposure frequency, duration and critical human target groups for each land use considered:

- residential land use;
- allotments;
- commercial and industrial land use.

The land use categories defined in the CLEA are detailed below.

Residential: This land use category assumes that people live in a variety of dwellings including terraced, detached and semi-detached houses up to two storeys high. The structure of buildings varies. Default parameters for building materials and building design are included in CLEA documents to calculate the relevant multi-layer diffusion coefficients for vapour intrusion and to model indoor vapour intrusion. The CLEA model assumes that regardless of the style of housing the residents will have access to either a private garden or community open space nearby, and that soil tracked into the home will form indoor dust. It allows for the ingestion pathways from home grown vegetables.

Allotments: The CLEA model incorporates an assessment of land provided by local authorities specifically for people to grow fruit and vegetables for their own consumption. Consumption of such fruit and vegetables present several exposure pathways; plants absorb contaminants mainly via water uptake through roots, the contaminants move to edible portions of plants via translocation and contaminated soil particles become trapped in the skin and between leaves. At present the model fails to account for exposure through the consumption of animals, and their products (e.g. eggs), which have been reared on contaminated land.

Commercial/Industrial: Although there are a wide variety of workplaces and work-related activities, the CLEA assessment of this land-use assumes that work occurs in a permanent, three-storey structure, where employees spend most time indoors, conducting office-based or light physical work. The model assumes employees sit outside during breaks for most of the year. Limitations in applying this land-use to different industries is detailed in EA publication “Updated technical background to the CLEA model” (2011). The generic model assumes that the site would not be covered by hard standing. Risk of exposure to contaminants would be clearly less where commercial land is essentially all buildings and hard standing.

Based on the assumptions of each land use and the associated applicable exposure pathways, a ‘Soil Guideline Value’ (SGV) may be calculated for each contaminant under consideration for a particular land use in order to determine whether certain contaminant soil concentrations pose a significant risk to human health. The primary purpose of the CLEA SGVs are as ‘trigger values’ – indicators to a risk assessor that soil concentrations below this level require no further assessment as it can be assumed that the soil is suitable for the proposed use. Where soil concentrations occur above the SGV then further assessment of the results is required. The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012 provides new clarity on the assessment of risk where soil concentrations exceed the SGV. The guidance introduces a four stage classification system relating to concentration of contaminants and the assessed risk which indicates appropriate actions. Category 1 and 2 sites are classified as “Contaminated Land” as defined in Part IIA of The Environmental Protection Act (1990). Category 3 and 4 sites are not considered as “Contaminated Land” in accordance with the Act. This can be explained using the figure on the following page.

There are also difficulties in establishing soil concentrations of contaminants beyond which risks from exposure to these contaminants would be ‘unacceptable’ and that they would lead to “significant possibility of significant harm” as defined in Part IIA of The Environmental Protection Act (1990) and determine that the land is “contaminated.” This ultimately requires detailed ‘toxicological’ information of the health effects of individual contaminants and also a scientific judgement on what constitutes an ‘unacceptable’ risk. It is for local authorities or the Environment Agency to determine whether a particular site is contaminated land and it is for local Planning Authorities to determine whether land affected by contamination can be redeveloped.

Given the SGVs have been derived only for a limited number of contaminants and there was little prospect of further SGVs being published, two professional groupings have produced Generic Assessment Criteria (GACs) in accordance with the CLEA model for a large number of additional contaminants. These GACs were recognised in the new Contaminated Land Statutory Guidance (DEFRA, 2012) and have been produced as follows:

LQM/CIEH : 2009 Nathaniel CP, McCaffrey C, Ashmore MH, Cheng NPS GROUP, Gillett A, Ogden R & Scott D : 2009 . The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd edition). Land Quality Press, Nottingham.

CL:AIRE/EIC/AGS: 2009 : Soil Generic Assessment Criteria (GAC) for Human Health Risk Assessment. Contaminated Land: Applications in Real Environments, Environment Industries Commission & Association of Geotechnical and Environmental Specialists. December 2009.

Category 4 Screening Levels

For new developments progressing through the planning regime, it is desirable that the soil concentrations are within Category 4 where there is a valid contaminant linkage. The upper boundary between Category 4 and 3 is not defined in the guidance. This boundary can also be better defined by carrying out a Detailed Quantified Risk Assessment (DQRA) and this is discussed later in this appendix.

In December 2013 Defra issued the findings of a research project undertaken by CL:AIRE to set out the framework by which potential Category 4 Screening Levels (pC4SL) may be derived. The report was not designed to produce 'final' C4SL as the steering group producing the report believes that final C4SL should be set by a 'relevant authority' (e.g. Defra), the toxicological framework proposed has not been reviewed by the Committee on Toxicity and the document has yet to be subject to peer review.

In March 2014, appendices to the main Defra report were published detailing the derivation of pC4SL for 6 contaminants and other appendices regarding a review of the CIEH/CL:AIRE statistics guidance and sensitivity analysis. For each contaminant, a range of pC4SL have been produced relating to modifying toxicological parameters only, modifying exposure parameters only or by modifying both. It should be noted that the pC4SL produced for lead (the SGV was withdrawn in 2011) has undertaken a relatively large toxicological review in relation to modelling blood lead concentrations. pC4SL have been produced for:

- Arsenic;
- Benzene;
- Benzo(a)pyrene (as a surrogate marker for PAHs);
- Cadmium;
- Chromium (VI); and
- Lead

As previously discussed the values published are 'potential' C4SL. At the present time, it is not known if the pC4SL will be issued as 'final' C4SL. It is considered that the pC4SL provide a simple test for deciding whether land is suitable for use without any remediation. The pC4SL represent a new set of screening levels that are more pragmatic (but strongly precautionary) compared to the existing soil guideline values (SGVs and the other GACs calculate in accordance with the existing CLEA methodology). The pC4SL provide cautious estimates of contaminant concentrations in soil that are still considered to present an acceptable level of risk, within the context of Part 2A, by combining information on toxicology, exposure assessment and normal levels of exposure to these contaminants. pC4SL values should not be seen as 'SPOH values'. If, or when, 'final' C4SL are issued, these shall supersede the current 'potential' C4SL.

A DEFRA letter published on the 3rd September 2014 from Lord de Mauley, Parliamentary Under Secretary, has confirmed the following with regard to the use of C4SLs:

- The impact assessment agreed during the revision of the Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime, as well as with Part 2A;
- The DCLG's Planning Practice Guidance on Land Affected by Contamination was revised on 12 June and now includes reference to the use of C4SLs in risk assessment under planning;
- C4SLs are considered a simple test for deciding when land is suitable for use and definitely not contaminated;
- Exceeding a C4SL means that further investigation is required, not that the land is necessarily contaminated.

Lead

The SGV for lead was withdrawn in 2011 and is not used in this report. The pC4SL for lead provides a technically robust and conservative assessment tool using significantly updated toxicological modelling in line with current scientific understanding of lead toxicology.

Public Open Space

The Defra report (December 2013) has also introduced exposure scenarios for two other commonly occurring land uses which require assessment (under the planning and Part 2A regimes) on a relatively frequent basis. These exposure scenarios are:

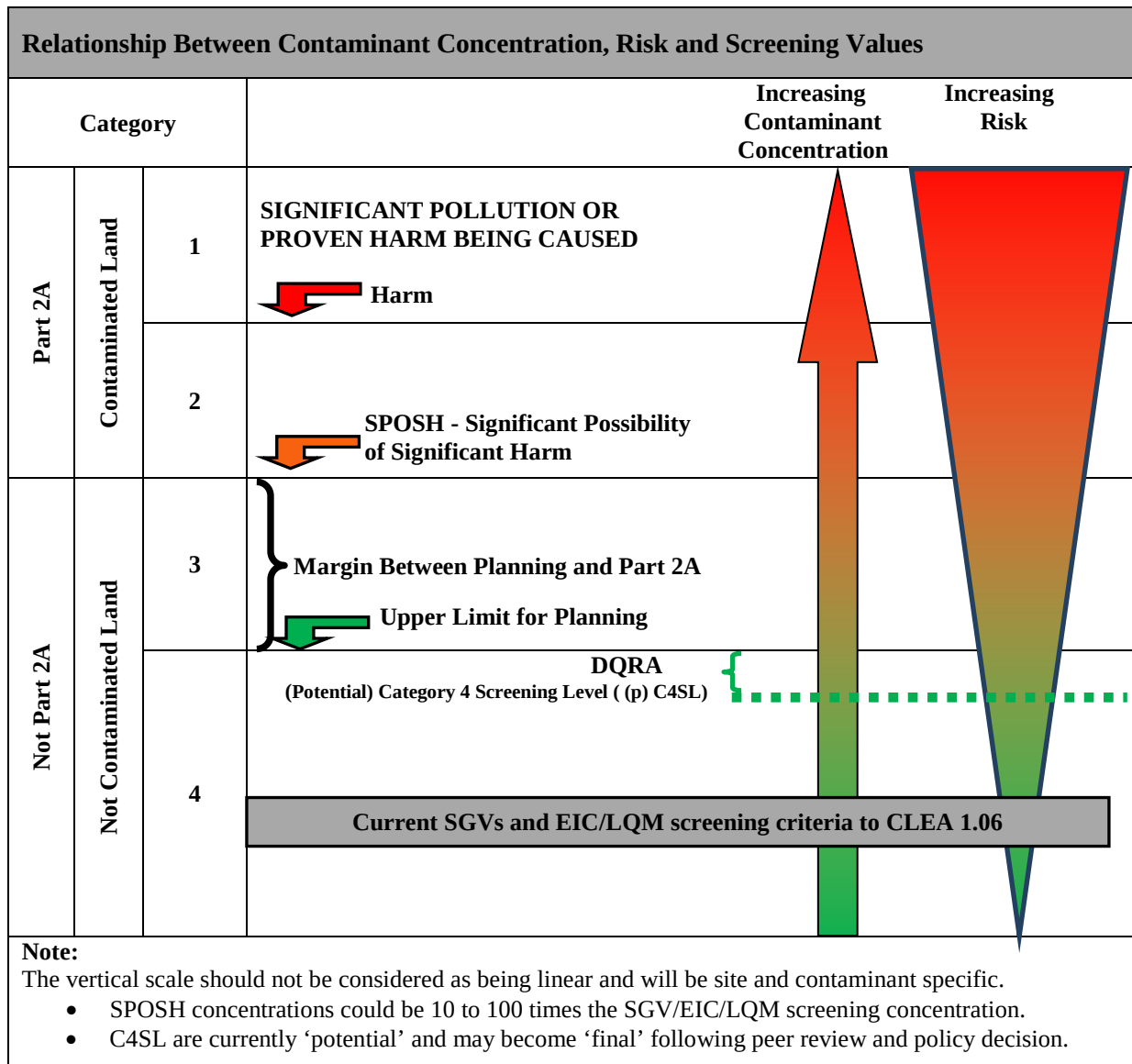
- Public Open Space – Space Near Residential Housing (POS_{resi}); and
- Public Open Space – Public Park (POS_{park}).

Potential use of pC4SL relating to Public Open Space (POS) require care due to the significant variability in exposure characteristics. For example, POS may include:

- Children's play areas, public parks where children practise sport several times a week and teenagers only once a week;
- Grassed areas adjacent to residential properties which are rarely used;
- Dedicated sports grounds where exposure is only to players and groundworkers; and
- Nature reserves or open ground with low level activity (for example, dog walking).

Within the Defra report (December 2013) the following exposure scenarios have been modelled as these are considered the most important for potential exposure for the critical receptor i.e. young children:

- Green open space close to housing, including tracking back of soil (POS_{resi}); and
- Park-type scenario where distance is considered sufficient to discount tracking back of soil (POS_{park}).



Detailed Quantified Risk Assessment (DQRA)

SGVs, GACs and pC4SL are based on a number of basic assumptions. There are two main options for developing Site Specific Assessment Criteria (SSAC) by adjusting the CLEA model so that they have greater relevance to the site:

- Simple adjustment of the generic SGV / C4SL model.** Such adjustment is restricted to the choice of exposure routes selected for the generic land use, building type, soil type and soil organic matter content within the CLEA software.
- Detailed adjustment.** It may be relevant to make greater modifications to the model due to the specific use of the land in question. This can include modification to any parameter value, including exposure assumptions, building parameters, and the choice and application of fate and transport models. This is equally relevant to site-specific modifications of existing generic land uses, the development of new land uses, and the inclusion of additional exposure pathways. Much of this can be undertaken using the CLEA software. Depending on the complexity of the detailed adjustments required, it may be necessary to use other tools either alone or in conjunction with the CLEA software. Both options should follow established protocols for DQRA and require

sufficient justification and supporting information for the adjustments made. Detailed adjustments are likely to require substantially greater technical justification and supporting documentation, especially if modifications are based on information not contained within the SGV framework documents.

The two choices present the risk assessor with three options/decisions:

- (1) Use a published SGV/GAC/C4SL if it can be demonstrated that the assumptions inherent in the value are appropriate to the site in question. If they are not, proceed to either option 2 or 3 below.
- (2) Make simple site-specific adjustments to the generic exposure model used to derive the SSAC. Three examples of when this could be appropriate are:
 - a. High density residential development with no exposed contaminated soil at surface. It is appropriate in this case to consider the relevance of direct contact pathways and consumption of homegrown produce.
 - b. Soil type is significantly different (specifically when soil type is likely to be less protective e.g. made ground) to that assumed in the SGV/GAC/C4SL.
 - c. Soil organic matter content is significantly different to that assumed in the derivation of the SGV/GAC/C4SL.
- (3) If simple adjustments are not sufficient to reflect site conditions, undertake a DQRA. This may be undertaken using the CLEA software or by using an alternative risk assessment methodology that is relevant, appropriate, authoritative and scientifically based. Changes to toxicological end points may also be considered, although this should only be undertaken by a toxicology expert. In the context of this guidance, simple adjustments of a generic land use scenario for soil type or SOM content for example are not considered sufficient to be classed as a DQRA.

DQRAs should be conducted with the agreement of the local authority (or the Environment Agency) since it is the authority that determines whether land is Contaminated Land or whether Planning Permission for a new development may be granted.

Representative Data

The type, quantity and quality of the available soil data influence the method chosen to obtain a site representative soil concentration that is compared with a SGV / GAC / C4SL in the screening process. The soil data should be representative of the exposure scenario being considered. This can include factors such as:

- averaging area over which exposure occurs;
- sample depth;
- heterogeneity of soil

where the 'averaging area' is defined as:

That area (together with a consideration of depth) of soil to which a receptor is exposed or which otherwise contributes to the creation of hazardous conditions'.

Site investigations take discrete samples from a given area (and to a certain depth). It has to be assumed that these samples are to some degree representative of the contaminant concentration throughout that volume of soil. The critical soil volume (taking into account area and depth) which might be usefully compared with a SGV / GAC / C4SL is a site-specific decision, but a starting point is the generic land use scenarios used in the derivation of the SGV / GAC / C4SL. The critical soil volume depends on two factors:

- Contaminant distribution and vertical profile (bands of highly contaminated material or lateral hot spots should not necessarily be averaged out with more extensive cleaner areas of soil without justification)

- Contribution to average exposure underpinning the SGV. Direct contact exposure pathways depend on the adult or child coming into contact with near-surface soils and the area over which that exposure occurs is usually important (i.e. the averaging area). Vapour pathways are less dependent on surface area, for example vapour intrusion may result from a highly concentrated hot spot beneath a building leading to elevated average indoor air concentrations. For the three standard land uses for which SGVs are derived, relevant considerations are:
- For the standard **residential or allotment land use**, the critical soil volume is the area of an individual garden, communal play area or working plot from the surface to a depth of between 0.5m and 1.0m. This is the ground over which children are most likely to come into contact with soil or from which vegetable and fruit produce will be harvested. In the case of volatile contaminants, it may also be appropriate to consider the volume of soil underneath the footprint of the building although vapour intrusion may be driven by a soil volume much smaller than this if the contaminant source is highly concentrated.
- For the standard **commercial land use**, the critical soil volume has to be decided on a case-by-case basis due to the wide range of possible site layouts. However, for non-volatile contaminants, landscaped and recreational areas around the perimeter of office buildings are likely to be most important. For volatile contaminants, the footprint occupied by the building itself should also be considered.
- For **most exposure pathways**, the contamination is assumed to be at or within one metre of the surface.

The use of averaging areas must be justified on the basis of relevance to the exposure scenario. SGVs are relevant only when the exposure assumptions inherent in them are appropriate for the identified exposure averaging area. Further guidance on critical soil volumes and the consideration of averaging exposure areas can be found in:

- *Secondary model procedure for the development of appropriate soil sampling strategies for land contamination* (Environment Agency, 2000);
- *Guidance on comparing soil contamination data with a critical concentration* (CIEH/CL:AIRE, 2009); and
- *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Appendix I* (Defra December 2013, March 2014)

It is the mean soil concentration for the individual contaminant within an individual averaging area, which is compared to the SGV. However, as contaminant concentrations vary across a site, and sampling and analysis will introduce measurement errors, the comparison between measured mean concentration and the SGV must take this uncertainty into account.

There are two principal options available to obtain site representative soil concentrations from a site investigation dataset; statistical and non-statistical methods. Data objectives, quality and quantity are likely to determine which approach is most appropriate. If statistical methods such as those presented in CIEH/CL:AIRE (2011) are to be used, sufficient data need to be available or obtained. No one single statistical approach is applicable to all sites and circumstances. The wider range of robust statistical techniques developed by organisations including the US Environmental Protection Agency (USEPA) are also important tools. Risk assessors should choose an appropriate statistical approach on the basis of the specific site and the decision that is being made. For further guidance on the appropriate use of statistical approaches, refer to USEPA 2006 or good environmental monitoring statistics textbooks.

When statistical approaches are inappropriate (this will depend on the objectives of the site investigation), individual or composite samples should be compared directly to the SGV. Guidance on use of alternative data handling approaches such as the use of composite sampling can be found in documents such as:

- *Verification of remediation of land contamination* (Environment Agency, 2010);
- *Sampling and testing of wastes to meet landfill Waste Acceptance Criteria* (Environment Agency, 2005);
- *Guidance on choosing a sampling design for environmental data collection* (USEPA, 2002);
- *Soil Quality – Sampling, ISO 10381 series* (ISO, 2002–2007).

The statistical tests should not be used as arbiters for decisions under Part 2A. They are an additional, useful line of evidence to assist in decision-making. The implications of the basis for the derivation of the site representative soil concentration must be taken into account in any decision-making process and clearly documented.

Where the statistical tests are conducted in accordance with the method described in CL:AIRE 2009:

- For the Planning situation, the regulator needs to check whether the concentration of contaminants is low compared to the SGV/SSTL. This decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is lower than the SGV/SSTL.
- For the Part 2A scenario the regulator needs to determine whether the concentration of contaminants is greater than the SGV/SSTL. This decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is higher than the SGV/SSTL. However, the regulator may proceed with determination if there is just a 51% probability, “on the balance of probabilities”.

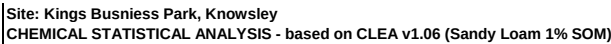
If the screening levels are exceeded then more sophisticated quantitative risk assessment can be undertaken or remedial action may be taken to break the contaminant linkages. The benefits of undertaking a quantitative risk assessment must be weighed against the likelihood that it will bring about cost savings in the proposed remediation. Further information about the use of soil guideline values is provided in Environment Agency : 2008: Using Soil Guideline Values SC050021/SGV Introduction, March 2008.

APPENDIX K

Summary of Chemical Test Results of Soil Samples

	Below Detection Limits.
	Exceeded GAC/SGV
	Exceeded pC4SL
	Assessment criteria for pH, Sulphide and Sulphate are not based on human health. Sulphate criteria assumes DS-1 ACCEC classification for concrete.

1. Generic Qualitative Assessment Criteria have been used where appropriate based on the current CLEA v1.06 Model (default values, sandy loam 1% SOM). Where no CLEA generic guideline value has been calculated no assessment has been made. The results presented show maximum and mean concentrations. This is to provide a reasonable prediction of the range of data rather than to provide any detailed statistical appraisal.
2. Results lower than detection limit are shaded in grey.
3. When the test result is recorded as being less than the detection limit, the result used for the analysis is the detection limit.
4. Cyanide (total)¹, in the absence of a GQAC based on current CLEA v1.06 Model, the Ahrk Soil Value for Cyanide (free) has been used.
5. For metals, where an SGV has been published, this value has been used. Note that the published SGVs do not include the residential without plant uptake scenario. CLEA v1.06 has therefore been used to derive GACs for this scenario. For organics, CLEA v1.06 has been used (as the SGV assumes 6% SOM).
6. pCASL based on adjusted toxicology and exposure assumptions
7. pCASL for benzene assumes 6% SOM



JOB: 2173

08122:Jobs\2173-AHK Group-Kings Bus Pk17 - Technical\Geo-environmental Testing\1%_DEFAULT_pC4SL_March_2014_Chem Statistical Analysis of soils-Residential_Commercial

APPENDIX L

Current Guidance for Controlled Waters Risk Assessment

CURRENT GUIDANCE FOR CONTROLLED WATERS RISK ASSESSMENT

Summary of Regulatory Context

Government policy is based upon a “suitable for use approach,” which is relevant to both the current use of land and also to any proposed future use. When considering the current use of land, Part IIA of the Environment Protection Act 1990^[4] (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995^[5], which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, controlled waters or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

“any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

- (a) Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- (b) Pollution of controlled waters is being, or is likely to be, caused.”*

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

*“the entry into controlled waters of **any** poisonous, noxious or polluting matter or **any** solid waste matter”*

Part IIA is supported by a substantial quantity of guidance and other Regulations, especially for England, The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012. The document re-confirms the duties of Enforcing Authorities in dealing with contamination including the role of the Environment Agency which has powers under Part 7 of The Water Resources Act (1991) to take action to prevent or remedy the pollution of controlled waters, including circumstances where the pollution arises from contamination in the land.

Part IIA introduces the concept of a contaminant linkage; where for potential harm to exist there must be a connection between the source of the hazard and the receptor via a pathway. Risk assessment in contaminated land is therefore directed towards identifying the contaminants, pathways and receptors that can provide contaminant linkages. This is known as the contaminant-pathway-receptor link (CPR or contaminant linkage).

Part IIA places contaminated land responsibility as a part of the planning and redevelopment process rather than Local Authority or Environment Agency taking direct action except in situations of very high pollution risk or where harm is occurring. In the planning process guidance is provided by National Planning Policy Framework (NPPF) of March 2012. This requires that a site which has been developed shall not be capable of being determined “contaminated land” under Part IIA. Therefore, appropriate risk-based investigation is required to identify the contaminant linkages that can then be assessed, and then mitigated using methods that can be readily agreed with the planners.

Environment Agency Guidance

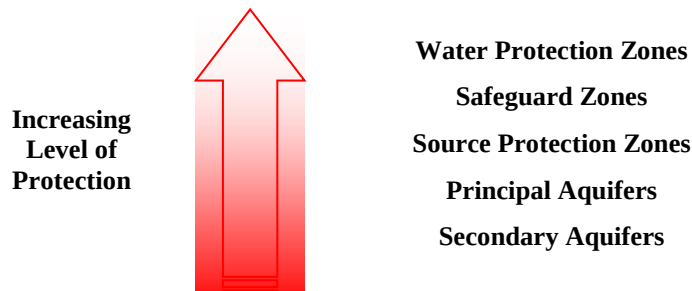
Legislation and guidance surrounding the protection of controlled waters in the UK is numerous and can be complex. The Environment Agency’s overall position on groundwater is “*To protect and manage groundwater resources for present and future generation in ways that are appropriate for the risks that we identify*” (Groundwater Protection : Policy and Practice GP3, 2012). In brief, the core objectives of the existing legislation serve to enforce this position.

In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document was influential as it provided a focus for key developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was then revised in 1998, since which there have been substantial changes in legislation, driven by Europe. Key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled by primary UK legislation such as the Water Resources Act 1991 as amended by the Water Act 2003. Further to

legislative changes, gaps identified in the 1998 PPPG required addressing. These changes are reflected in the Environment Agency Policy document *Groundwater Protection: Policy and Practice (GP3)*, Version 1 of November 2012. The following diagram indicates the three main parts of GP3:



The Environment Agency follows a tiered, risk based approach to drinking water protection and this should be taken into account when carrying out controlled waters risk assessment:



Tools available for Risk Assessment of Controlled Waters

In order for a developer of a potentially contaminated site to fulfil their obligations under the legislation, a site assessment would be required to be undertaken in order to identify any potential risks to controlled waters and to derive suitable clean-up criteria if necessary to ensure the protection of controlled waters. A number of tools are available for this purpose and the general approach is detailed further in Part 3 of GP3.

Three main stages apply to any risk assessment of controlled waters, these are:

- i) Risk Screening (devise Conceptual Site Model, making reference to groundwater vulnerability maps, site setting etc)
- ii) Generic Risk Assessment (EA Remedial Targets Methodology Tier 1 / Comparison of groundwater data with relevant standards)
- iii) Detailed Quantitative Risk Assessment (Consideration of aquifer properties and site specific parameters, EA Remedial Targets Methodology Tiers 2 & 3)

The process is summarised below (Taken from the Environment Agency GP3 draft consultation document, 2006):

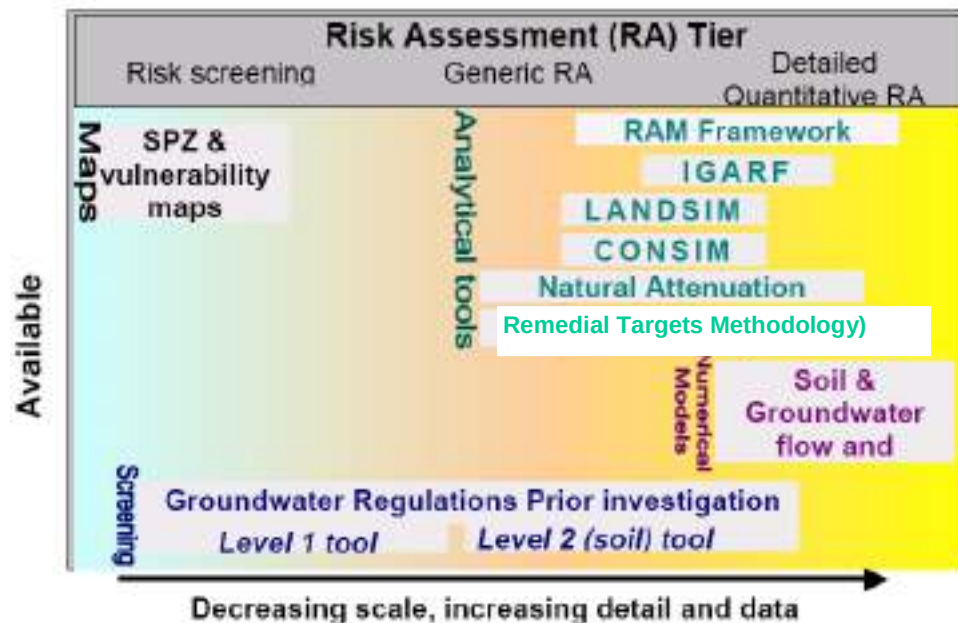


Figure 1-1 Environment Agency groundwater assessment tools, mapped against the different levels of risk assessment.

When assessing groundwater impact the Environment Agency advocate the application of their framework methodology “Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination” Environment Agency (2006). The methodology has four tiers of assessment:

Tier 1 utilises either a soil concentration (calculation of pore water concentrations based on partitioning calculations), leaching test or pore-water concentration of perched water as a source concentration input and these are contrasted directly to water quality standards. No dilution or attenuation is considered at Level 1.

Tier 2 (groundwater) considers dilution of the contaminant within the underlying receiving groundwater or surface water body. To determine a dilution factor the infiltration rate of pore water and the discharge of groundwater beneath the source must be determined. Level 2 Assessment is comprises a comparison between measured groundwater concentrations with to water quality standards.

Tier 3 considers natural attenuation in the form of dispersion, retardation and degradation of the contaminant. As the levels are progressed, the assessment becomes increasingly more detailed and less conservative as the data requirements are increased with each successive tier. The Environment Agency has released Excel Worksheets to carry out basic calculations using a conservative approach up to Tier 3. However, in this case the conceptual model is a simple one and assumes there is a simple migration of contaminants from the source zone into the aquifer receptor. Using these worksheets requires a sensitivity analysis showing how by varying each parameter, what effect it might have on the outcome of the assessment. Groundwater conceptual models are not always this simple.

Tier 4 is for more complex conceptual models where multiple sources, multiple pathways, multiple receptors and complex water balances can be assessed. The Tier 4 assessment is not supported by the RTM software.

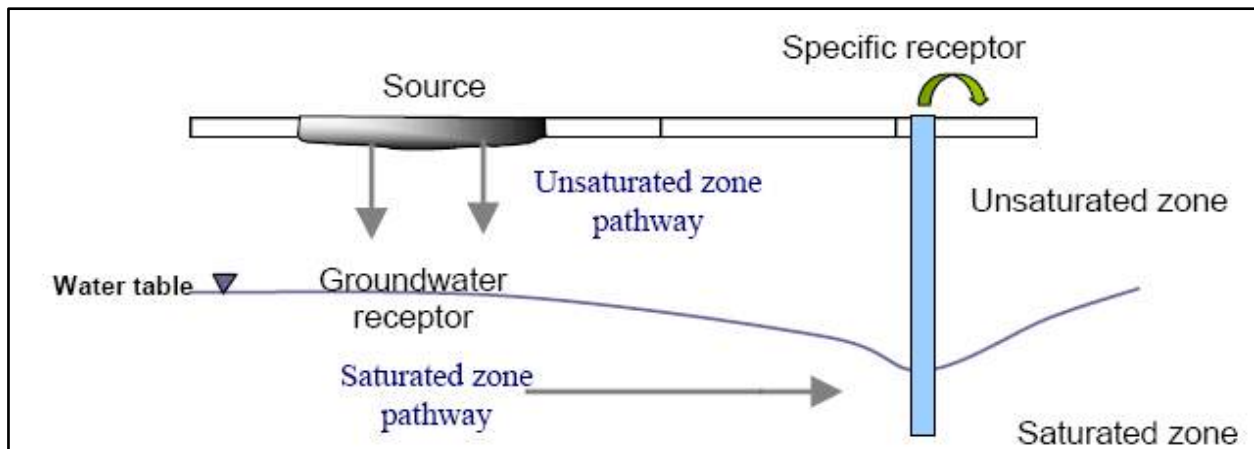
A slightly more advanced program, ConSim 2, developed on behalf of the Environment Agency, allows for the introduction of additional geological horizons and is used mainly to determine whether soil contaminants will reach their target within a specified timeframe. This model as inbuilt sensitivity, however, due to its greater complexity requires more time to run. The overall approach and basic calculations required within the Remedial Targets

Methodology framework are incorporated within ConSim 2. These models assess only the dissolved phase contaminants. There are many further models commercially available for use in controlled waters risk assessment, particularly for more complex situations, however, these should be used with caution and only once agreement has been obtained from the Environment Agency. All have the overall aim of the protection of controlled waters.

General notes on each stage of the controlled waters risk assessment process

Risk Screening

The understanding of the Conceptual Site Model (CSM) is the key to assessing any site. Using a robust CSM, potential pathways or receptors may be screened out from any further assessment at an early stage. For example if the pathway through the unsaturated zone is blocked by the presence of a significant thickness of low permeability clay. A greater understanding of the CSM is achieved with each tier of risk assessment. An example of a basic Source-Pathway-Receptor concept is given below (taken from the Environment Agency GP3, 2012):



Generic Risk Assessment

When undertaking the Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Tier 1), comparison of chemical analytical results is made with screening criteria. Published values of screening criteria with which chemical test results can be compared are published in the following guidance:

- Updated Recommendations on Environmental Technical Standards, River Basin Management (2015-21), April 2012 by the UK Technical Advisory Group on the Water Framework Directive;
- Environmental Quality Standards (EQS) for freshwaters based on The EC Dangerous Substances Directive (76/464/EEC and Daughter Directives);
- Surface Waters (Abstraction for Drinking Water)(Classification) Regulations (1996)
- Surface Waters (Fishlife) (Classification) Regulations (1997)
- UK Drinking Water Standards (DWS) (Water Supply (Water Quality) Regulations 2000);
- Dutch Ministry of Housing, Spatial Planning and Environment (2001) Intervention Values and Target Values – soil quality standards;
- World Health Organisation Guidelines for Drinking Water (2004)

Should the Level 1 or 2 assessments indicate threshold levels to be exceeded, then there are three alternative ways in which to proceed:

- To devise suitable remedial solutions;
- To carry out more investigation, sampling and analysis;
- To conduct a site-specific Detailed Quantitative Risk Assessment (DQRA) to whether or not the soil materials are suitable for their site-specific intended use or to devise a site-specific clean-up level.

Detailed Quantitative Risk Assessment (DQRA)

The decision to carry out a DQRA will be dependent on the extent and implications of the initial qualitative and generic assessment. The scope of any such assessment will be accurately defined by the outcomes of the former two stages. The CSM will be sufficiently refined by this stage that only certain contaminants of concern, certain pathways and certain receptors will require further assessment, the remainder having been screened out.

Additional site specific data is normally required for this stage of assessment, as explained above, more processes that are capable of affecting contaminant concentrations are considered (such as dilution and attenuation).

Remediation criteria derived will therefore be specific to each site and will be based on a detailed assessment of the potential impact at the identified receptor or *compliance point*. A greater level of confidence can be placed on the predicted impact on the compliance point following a DQRA.

Definition of Controlled Waters

The term ‘controlled waters’ is defined in Section 104 of the Water Resources Act 1991 as:

“Territorial Waters...which extend seawards for three miles..., coastal waters..., inland freshwaters, waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and ground waters, that is to say, any waters contained in underground strata.”

Note that the definition of groundwater under the Water Resources Act 1991 includes all water within underground strata (including soil / pore water in the unsaturated zone). The definition of groundwater under the Groundwater Directive however is limited to water in the saturated zone. For the purposes of Part IIA of the Environmental Protection Act 1990, the Environment Agency recommends that the groundwater within the saturated zone only is considered as the receptor (rather than soil / pore water).

Environment Agency’s Aquifer Designations

The Environment Agency have classified different types of aquifer from which groundwater can be extracted. The aquifer designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey.

The maps are split into two different types of aquifer designation:

- **Superficial (Drift)** – permeable unconsolidated (loose) deposits.
- **Bedrock (Solid)**– solid permeable formations e.g. sandstone, chalk, limestone.

The aquifer designations displayed on the Environment Agency maps are as follows:

- **Principal Aquifers (formerly termed Major Aquifers)** – These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as a major aquifer.
- **Secondary Aquifers (formerly termed Minor Aquifers)** – These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:
 - **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;
 - **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
 - **Secondary Undifferentiated** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
- **Unproductive Strata (formerly termed Non-Aquifer)** – These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Hazardous and Non Hazardous Substances

The Groundwater (England and Wales) Regulations 2009 control the disposal to the hydrogeological environment of potentially polluting substances which are divided into Hazardous Substances and Non-hazardous Contaminants (this roughly approximates to the former List 1 and List 2 substances).

Hazardous Substances are the most damaging and toxic and must be prevented from directly or indirectly entering the groundwater environment. Hazardous Substances include mineral oils and hydrocarbons, pesticides, biocides, herbicides, solvents and some metals. Discharge of Hazardous Substances to Controlled Waters must be prevented.

Non-hazardous Pollutants are any contaminants other than Hazardous Substances. Non-hazardous Pollutants are potentially toxic but are less harmful than Hazardous Substances, but their direct discharge to groundwater is generally not permitted and any indirect discharge to groundwater must be limited and be controlled by technical precautions in order to prevent pollution. Non-hazardous Pollutants include ammonia and nitrites, many metals and fluorides.

APPENDIX M

Summary of Chemical Test Results of Water & Leachate Samples

Job No: 2173

Site: Kings Business Park

Summary of Groundwater Data - Tier I Screening

TerraConsult

Sample Location	Units	Drinking Water Standard	EQS Freshwater	Other	CDP Ltd Site Investigation Data			TerraConsult Ltd Site Investigation Data					
					11/12/06	11/12/06	11/12/06	16/12/14	19/12/14	06/01/15	06/01/15	06/01/15	06/01/15
					TP2/2	TP19/1	BH 18/B1	TP102	TP111	BH102	BH104	BH107	BH108
							Leachate	Leachate	Water	Water	Water	Water	
Water Quality													
pH	pH units	-	-	-	7.6	6.1	7.0	7.1	6.0	7.5	8.1	7.3	7.3
Electrical Conductivity	uS/cm	-	-	-	-	-	-	-	-	540	-	600	570
Total Dissolved Solids	mg/l	-	-	-	-	-	-	100	6	-	-	-	-
Metals													
Arsenic	ug/l	10	50	50	0.00068	0.00490	0.00110	10	10	2.3	-	1.2	0.8
Barium	ug/l	700	-	100	-	-	-	30	20	-	-	-	-
Boron	ug/l	1000	2000	-	-	-	-	-	-	50	-	20	20
Cadmium	ug/l	5	5	5	-	-	-	0.5	0.5	0.07	-	0.04	0.03
Chromium (Total)	ug/l	50	200*	-	-	-	-	5	5	6	-	6	6
Copper	ug/l	2000	28*	28	-	-	-	10	10	0.5	-	0.5	1
Iron	ug/l	200	1000	-	-	-	-	-	-	-	-	-	-
Lead	ug/l	25	125*	-	-	-	-	5	5	0.3	-	0.3	0.3
Mercury	ug/l	1	1	-	0.00008	0.00008	0.00008	0.5	0.5	0.05	-	0.05	0.05
Molybdenum	ug/l	70	-	-	-	-	-	2	1	-	-	-	-
Nickel	ug/l	20	150*	200	-	-	-	7	7	3	-	5	4
Antimony	ug/l	-	-	-	-	-	-	5	5	-	-	-	-
Selenium	ug/l	10	-	10	-	-	-	5	5	0.5	-	1.9	4.8
Zinc	ug/l	5000	250*	500	-	-	-	5	6	2	-	2	2
Inorganic													
Alkalinity (as CaCO3)	mg/l	-	-	-	-	-	-	-	-	230	-	210	240
Hardness (as CaCO3)	mg/l	-	-	-	-	-	-	-	-	250	-	280	280
Chloride	mg/l	250	250	250	0.5	1.6	1.5	2	1	8	-	15	12
Fluoride	mg/l	1.5	-	1.5	-	-	-	0.5	0.5	-	-	-	-
Nitrate as N	mg/l	-	50.0	-	-	-	-	-	-	0.5	-	6.7	3.5
Sulphate (as SO4)	mg/l	250	400	250	15	6	12	8	1	31	6800	66	52
Ammoniacal Nitrogen as N	mg/l	-	-	-	-	-	-	-	-	0.05	-	0.05	0.05
Total Cyanide	ug/l	50	-	70	0.02	0.02	0.022	-	-	50	-	50	50
Organics													
Phenol	ug/l	0.5	30	30	0.02	0.02	0.02	10	10	1.7	-	1.3	0.5
Dissolved Organic Carbon	mg/l	-	-	-	-	-	-	22.9	10.8	-	-	-	-
PAH													
Naphthalene	ug/l	10 ²¹	10	10	-	-	-	-	-	0.65	-	0.80	1.70
Acenaphthylene	ug/l	-	-	-	-	-	-	-	-	0.04	-	0.01	0.16
Acenaphthene	ug/l	-	-	-	-	-	-	-	-	0.07	-	0.02	0.36
Fluorene	ug/l	-	-	-	-	-	-	-	-	0.10	-	0.02	0.42
Phenanthrene	ug/l	-	-	-	-	-	-	-	-	0.35	-	0.06	2.30
Anthracene	ug/l	-	0.40	-	-	-	-	-	-	0.10	-	0.01	0.64
Fluoranthene	ug/l	-	0.10	-	-	-	-	-	-	0.31	-	0.03	3.10
Pyrene	ug/l	-	-	-	-	-	-	-	-	0.27	-	0.03	2.90
Benzo[a]anthracene	ug/l	-	-	-	-	-	-	-	-	0.16	-	0.01	0.81
Chrysene	ug/l	-	-	-	-	-	-	-	-	0.16	-	0.01	0.79
Benzo[b]fluoranthene	ug/l	-	0.03	-	-	-	-	-	-	0.15	-	0.01	0.65
Benzo[k]fluoranthene	ug/l	-	0.03	-	-	-	-	-	-	0.12	-	0.01	0.50
Benzo[a]pyrene	ug/l	0.01	-	0.01	-	-	-	-	-	0.15	-	0.01	0.66
indeno[1,2,3-cd]pyrene	ug/l	-	-	-	-	-	-	-	-	0.05	-	0.01	0.35
dBenzo[a,h]anthracene	ug/l	-	-	-	-	-	-	-	-	0.01	-	0.01	0.19
Benzo[ghi]perylene	ug/l	-	0.002	-	-	-	-	-	-	0.05	-	0.01	0.38
Total EPA-16 PAHs	ug/l	-	-	-	-	-	-	-	-	2.70	-	0.98	16.00
TPH													
Aliphatic >C5 - C6	ug/l	-	-	-	-	-	-	-	-	10	10	10	10
Aliphatic >C6 - C8	ug/l	-	-	-	-	-	-	-	-	10	10	10	10
Aliphatic >C8 - C10	ug/l	-	-	-	-	-	-	-	-	10	10	10	10
Aliphatic >C10 - C12	ug/l	-	-	-	-	-	-	-	-	10	0.24	10	10
Aliphatic >C12 - C16	ug/l	-	-	-	-	-	-	-	-	20	0.56	10	10
Aliphatic >C16 - C21	ug/l	-	-	-	-	-	-	-	-	30	100	10	20
Aliphatic >C21 - C35	ug/l	-	-	-	-	-	-	-	-	200	100	20	20
Aliphatic >C35 - C40	ug/l	-	-	-	-	-	-	-	-	10	100	10	10
Aliphatic (C5 - C40)	ug/l	10	-	-	-	-	-	-	-	260	0.8	30	40
Aromatic >C5 - C7	ug/l	-	-	-	-	-	-	-	-	10	10	10	10
Aromatic >C7 - C8	ug/l	-	-	-	-	-	-	-	-	10	10	10	10
Aromatic >C8 - C10	ug/l	-	-	-	-	-	-	-	-	10	10	10	10
Aromatic >C10 - C12	ug/l	-	-	-	-	-	-	-	-	20	100	10	10
Aromatic >C12 - C16	ug/l	-	-	-	-	-	-	-	-	50	100	30	10
Aromatic >C16 - C21	ug/l	-	-	-	-	-	-	-	-	50	100	30	10
Aromatic >C21 - C35	ug/l	-	-	-	-	-	-	-	-	250	100	10	10
Aromatic >C35 - C40	ug/l	-	-	-	-	-	-	-	-	10	100	10	10
Aromatic (C5 - C35)	ug/l	10	-	-	-	-	-	-	-	370	100	80	10
Total TPH (C10 - C40)	ug/l	10	-	-	-	-	-	-	-	640	800	110	40
BTEX													
Benzene	ug/l	1	30	10	-	-	-	-	-	1	1	1	1
Toluene	ug/l	-	50	700	-	-	-	-	-	1	1	1	1
Ethylbenzene	ug/l	-	20	300	-	-	-	-	-	1	1	1	1
p & m-xylene	ug/l	-	30	500	-	-	-	-	-	1	1	1	1
o-xylene	ug/l	-	30	500	-	-	-	-	-	1	1	1	1
Methyl tert-Butyl Ether	ug/l	-	-	-	-	-	-	-	-	1	1	1	1

Note:

Fail: Above UK EQS

Fail: Above UK DWS

Result below Detection Limit

* EQS for substances based on >100-150 mg/l CaCO3 Hardness band and Cyprinid designation for receiving water

** Calculated from ammoniacal nitrogen and pH results using an assumed water temperature of 10 degrees.

Total of 4 Drinking Water Standard PAHs: Benzo[b]fluoranthene, Benzo[k]fluoranthene, Indeno[1,2,3-cd]pyrene, Benzo[ghi]perylene

APPENDIX N

Current Guidance for Ground Gas Risk Assessment

Current Guidance for Ground Gas Risk Assessment

Origin of Ground and Landfill Gases

When carrying out a ground gas risk assessment, the origin or source of the gases is important as potential risks will vary depending on the source. This Appendix relates to the risk of the two main ground gases of concern: methane and carbon dioxide, and does not apply to other ground gases (e.g. radon or vapours from hydrocarbon spills). Methane and carbon dioxide are major constituents of landfill gas but can also occur from a variety of anthropogenic and natural sources, as summarised in Table G1 below:

Table G1. Potential Sources of Ground Gases		
Gas	Source	Comments
Landfill Gas	Anaerobic decomposition of degradable waste within landfill sites. Typically 60% methane and 40% carbon dioxide during methanogenic phase.	Composition varies over time, particularly in early stages. Contains a range of minor constituents (particularly carbon monoxide and hydrogen sulphide).
Landfill Associated Gases	- Anaerobic degradation of leachate external to the site; - Degassing of dissolved gases in groundwater; - Evolution of gases following interaction between leachate and groundwater	Can result in secondary (external) production of methane or carbon dioxide.
Made Ground	Anaerobic degradation of organic components	Very variable depending on source
Sewer Gas, Cess Pits	Anaerobic degradation of organic components of sewage producing methane and carbon dioxide.	Often characterised by hydrogen sulphide odour.
Mains Gas	Leakage from underground pipework or storage tanks. Mainly methane but often contains higher alkanes.	An odouriser is added to permit detection of leaks. Typically 90% CH ₄ , but 1 to 27% C ₂ -C ₄ alkanes, May also contain other trace gases e.g. CO, helium and CO ₂ (from degradation of CH ₄ in the ground).
Other Anthropogenic Sources	- Degradation of leaked or spilled hydrocarbons or other industrial chemicals; - Anaerobic degradation of organic contaminants in groundwaters (e.g. silage liquor); - Reactions between monitoring well construction components and environment; - Burial grounds/cemeteries.	Hydrocarbon spillages often have an 'oily' odour. Fuel spillages common – Petrol or Diesel and can contain a wide range of VOC's. Can degrade to produce methane / carbon dioxide.
Alluvium / Marsh / Peat Gas	Anaerobic microbial degradation of organic material (usually waterlogged vegetation / peat). Often associated with the presence of alluvial deposits or dredgings.	
Geogenic Gas	Natural seepages of carbon dioxide and hydrocarbon gases derived from geologic sources such as coal seams and deep oil / gas source formations. Can be present in solution in groundwaters.	Methane most common but can contain carbon dioxide and higher alkanes.
Mine Gases	Various types. Most common is "fire damp" with high methane, produced by the desorption of gas trapped in coal. "Black damp" (Stythe gas) with high carbon dioxide and denser than air. "White damp" is high in carbon monoxide.	Methane most common. Can contain higher alkanes, carbon dioxide and carbon monoxide. Often low in oxygen.
Natural Shallow Ground Gas	Various types - high carbon dioxide formed by subsurface aerobic activity leading to depleted oxygen and elevated carbon dioxide; - chemical degradation of rocks (e.g. carbonates) producing carbon dioxide; - carbon dioxide production in root zone of soils by plants.	Gases can be emitted from ground under falling barometric pressure conditions.

This Appendix concentrates on the assessment of risk from methane and carbon dioxide. This Appendix does not provide guidance for the assessment of risk when other gases are present due to 'Other Sources' from the above table (particularly organic compounds such as BTEX and VOC's or for the risk from radon or hydrogen sulphide).

To determine the origin of the gas a range of factors must be considered together, including;

1. Proximity of likely sources;
2. Ground conditions (geology, hydrogeology, anthropogenic pathways etc);
3. Properties of gases present including:
 - Chemical composition;
 - Physical properties;
 - Ratios of components e.g. methane : carbon dioxide.
4. Timeframe of activities such as infilling periods, capping works, installation of gas control systems etc.

Identification of the originating source may be problematic given that there may be more than one source present and trace gas analysis may be required. Identification of the sources of the gases encountered during monitoring is usually carried out through a process of eliminating the most unlikely potential sources (given the site setting) and selecting those which are the more likely candidates.

Hazards Associated with Presence of Ground Gases

Methane gas is combustible and potentially explosive. When the concentration of methane in air is between the limits of 5.0%v/v and 15.0%v/v an explosive mixture is formed. The Lower Explosive Limit (LEL) of methane is 5.0%v/v, which is equivalent to 100% LEL. The 15.0%v/v limit is known as the Upper Explosive Limit (UEL), but concentrations above this level cannot be assumed to represent safe concentrations. Further, the LEL and UEL will vary (up and down) depending upon the proportion of other gases (including oxygen). However, the fact that methane is a colourless, odourless gas means that there is no simple indicator of the presence of the gas until such a time as explosive limits are reached and an incident occurs. Methane is lighter than air and has a low toxicity. However, at high concentrations it can result in asphyxiation due to oxygen displacement.

Carbon dioxide is a colourless, odourless gas, which, although non-flammable, is both toxic and an asphyxiant. As carbon dioxide is denser than air, it will collect in low points and depressions. The UK Health & Safety Executive (HSE) has published information relating to concentrations of carbon dioxide that humans may be exposed to, which uses concentrations contained in the Control of Substances Hazardous to Health Regulations 2002 (as amended). These are the Long Term Occupational Exposure Limit (LTOEL, 8 hour period) and the Short Term Occupational Exposure Limit (STOEL, 15 minute period), which are 0.5% and 1.5% carbon dioxide, respectively.

Parameters Influencing the Rate of Ground Gas Production

Figure G2 is taken from EA guidance document LFTGN 03 illustrates typical ground gas generation curves from biodegradable materials:

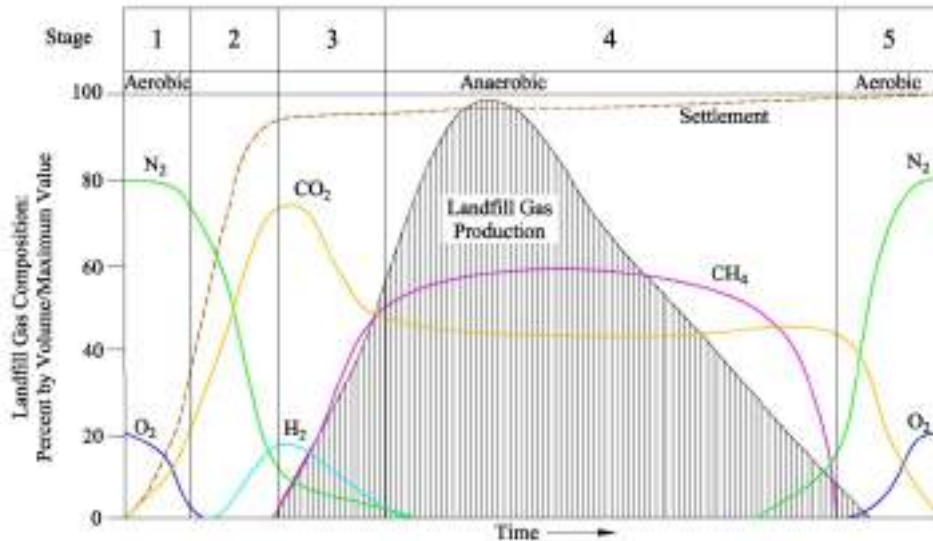


Figure G2. Idealised Representation of Landfill Gas Generation.

The production of methane and carbon dioxide at a landfill site may be expected to be considerable and ongoing. Concentrations of methane will eventually decrease, followed by concentrations of carbon dioxide, but the duration and rate of gas production can vary markedly between sites. Five distinct phases of gas production occur during the process which are, in order of event (as marked on Figure G2), as follows:

1. An aerobic phase involving oxygen depletion and temperature increase through aerobic respiration;
2. The establishment of anaerobic conditions and the evolution of carbon dioxide and hydrogen through acidogenic activity;
3. Commencement of methanogenic activity; the establishment of populations of methanogenic bacteria;
4. A phase of stable methanogenic activity, which may go on for many tens of years;
5. A phase of decreasing methanogenic activity, representing depletion of the organic material and a return to aerobic conditions.

The time scale for the return to the normal ground gas concentrations will be highly variable, depending upon the types and quantities of materials present. In addition, the optimum parameters influencing the rate of decomposition and ground gas production within the ground at a site are as follows:

- High water content with adequate rainfall and water infiltration to provide moisture content between approximately 20 to 26%;
- Conditions that either are or are very close to anaerobic;
- High proportion of biodegradable materials;
- A pH between 6.5 and 8.5, ideally verging slightly on the acidic between pH 6 to 7;
- Temperature between 25°C and 55°C;
- The ratio of the biochemical and chemical oxygen demands (BOD:COD);
- High permeability;
- Small particle size, as finer subsurface materials possess a greater surface area to provide a growing 'face' for the micro-organisms but high fines levels reduces permeability and reduces decomposition rate.

For this reason, it is vital that sources of methane and carbon dioxide are identified prior to the commencement of any work on a construction site, and that the ground gas regime is characterised at the worst temporal conditions a site may experience. From this, a risk assessment is carried out to identify the risk at the site from ground gases so that suitable protection measures can be designed and incorporated into a development to prevent a dangerous build-up of gas occurring.

Factors Influencing the Migration and Behaviour of Ground Gases

There are many factors that influence the migration of ground gases which can affect the risk from a gassing source:

- driving force – pressure differential along a pathway, diffusion and dissolved in solution;
- meteorological conditions – short term and seasonal conditions including atmospheric pressure changes (e.g. rapidly falling pressure causes gas to expand increasing emission rates), rainfall, frozen ground and thawing, temperature;
- geological and groundwater conditions – these can have the over-riding influence on the direction/pathways and quantity of migrating gas;
- anthropogenic influences – man-made pathways include mine shafts, service runs/drains, foundation piles, underground voids/pits/basements, foundation/building design/construction

Guidance Documents

Currently in the UK, there are no statutory threshold limits for hazardous gases in the ground as site specific variables mean that standard threshold values cannot be applied. The published guidance relating to development of sites where methane and carbon dioxide are present has been produced in response to building projects on or close to landfill sites, as both gases are principal constituents of landfill gas. Much of the historic guidance that has been produced on gas risk assessment focused on landfill sites and as a result there has previously been a lack of clarity when relating the process to gas conditions on non-landfill sites.

Statutory guidance regarding methane in the ground has previously taken a limiting concentration of 1.0 % by volume methane (equal to 20% of the lower explosive limit of methane in air) above which necessary actions will be appropriate. For carbon dioxide the limiting recommended trigger was 1.5 % by volume (the Long Term Exposure Limit for carbon dioxide). Above these concentrations the Building Regulations Approved Document C (1992) stated that consideration should be given to whether actions may be appropriate, whilst more specific solutions would be likely to be necessary at concentrations greater than 5% by volume of carbon dioxide (Building Regulations Approved Document C, 1992). However, the latest fully revised version of Approved Document C (DoE, 2004) no longer endorses this approach and instead requires the use of a risk-based approach in interpreting the findings of a gas monitoring survey. Further, the latest EA documentation on landfill gas (LFTGN 03, 2004) continues to sanction the use of a risk-based approach through a structured approach to the assessment of ground gases and links with the risk assessment process outlined within CLR 11 for soil contaminants.

With the above in mind, recent guidance has been produced in 2006 and 2007 with the aim of providing up to date advice in relation to residential and commercial development. The guidance does not address issues associated with gas derived from landfills, for this refer to “*Guidance on the Management of Landfill Gas*” (Environment Agency 2004) for an overview.

Recent guidance relevant to gas assessments for residential and commercial development includes:

- **Wilson *et al.* (CIRIA C665, December 2007) “Assessing Risks Posed by Hazardous Ground Gases for Buildings.”**

This document provides up to date advice on all aspects of ground gas risk assessment such as investigation, monitoring programmes, data collection and interpretation. The guidance presents separate methodologies for the characterisation of:

- **All development types except low rise housing with gardens and for Low Rise Buildings without a 150mm void (Situation A) (Table 8.5 CIRIA C665)**
and;
- **Low rise housing with gardens with a 150mm ventilated sub-floor void (Situation B) (Table 8.7 CIRIA C665)**
(See below for further explanation of the methods of characterisation)

- **Boyle and Witherington (NHBC / RSK Group, Report 10627-R01(04) January 2007) “Guidance on the Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present.”**

This document presents the “Traffic Lights System” detailed below and is relevant only for low rise properties (e.g. bungalows and town houses) that have a ventilated sub-floor void (i.e. Situation B as described in CIRIA C665).

- **Wilson and Card (CIEH, expected 2011) “Ground Gas Handbook for Designers and Regulators”**

This document is expected to provide practical guidance on ground gas assessments and the design and evaluation of protection measures.

- **British Standard (BS 8485, December 2007) “Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments”**

This document provides an overview of gas characterisation and assessment. The Standard is intended to be used by designers of gas protection measures and regulators involved in the assessment of design solutions. The Standard provides a framework in line with CLR11 allowing designers to judge the adequacy of ground gas and related site investigation data. The document provides an approach to determine appropriate ground gas parameters that can be used to identify a range of possible construction solutions mitigating against the presence of ground gas on a development site.

Each of these documents continues to highlight the importance of, and give further guidance towards, carrying out a tiered risk-based decision-making process in accord with government policy on dealing with contamination from historic or natural sources and highlight the importance of the Conceptual Model in site characterisation. These documents also stress the importance that the assessor should be confident that the ground gas monitoring results are representative of the likely worse case ground gas regime on a site and that the data collected from the site is sufficient. With this in mind, CIRIA C665 sets out ideal monitoring periods as below.

Idealised Frequency and Period of Monitoring (after Table 5.5a and 5.5b, CIRIA C665)						
		Generation Potential of Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4/1	6/2	6/3	12/6	12/12
	Moderate (Flats)	6/2	6/3	9/6	12/12	24/24
	High (Residential with Gardens)	6/3	9/6	12/6	24/12	24/24
Notes 1. First number is the number of readings and the second is the minimum period in months (e.g. 6/2 – six sets of readings over two months). 2. At least two sets of readings must be at low (preferably under 1,000 mb) and falling pressure. 3. High sensitivity end use on high or very high hazard site will not normally be acceptable unless the source is treated to reduce gassing potential.						

Before the latest guidance, good practice for site characterisation had been based upon the method proposed by Wilson and Card (1999). CIRIA C665 (2007) effectively supersedes Wilson and Card (1999) and includes a modified version of the Wilson and Card method (Tables 8.5, 8.6 and Box 8.1). Gas concentrations and flow rates for either methane and/or carbon dioxide measured at a site to ‘Characteristic Situations.’ Appropriate protection measures are selected from Table 8.6 (if using modified Wilson & Card method) and from Box 8.4 from CIRIA C665 (if using the NHBC traffic lights method). Throughout the risk assessment process, strong regard must be given to the nature of the gassing source, the flow rates and the estimated surface emissions. Note that certain protection measures are stated in CIRIA Report 149 that are now considered wholly inappropriate to certain developments and consequently should not be used without modification. Throughout the process, it is important to remember that these tables are not intended to be used as a definitive design tool and have been prepared to show the typical scope of measures for gas control.

Both the NHBC (2007) and CIRIA (2007) guidance documents and BS 8485 (2007) propose that both ground gas concentrations and flow rates are used to calculate the limiting gas well gas volume flow rates for methane and carbon dioxide, based on the ground gas conditions monitored for during the worse-case temporal conditions. This limiting gas well volume flow rate is termed the Gas Screening Value (GSV, note that this was termed borehole gas volume flow), and is calculated as follows:

$$\text{GSV (l/hr)} = \frac{[\text{gas well gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]}{100}$$

These GSVs are then compared to generic ‘Traffic Lights’ contained within the NHBC guidance, which present typical maximum gas concentrations and limiting GSV’s, for ‘Situation B Development’ (Low rise housing with gardens).

Table 8.7 NHBC Traffic light system for 150 mm void				
Traffic Light	Methane ¹		Carbon Dioxide ²	
	Typical max concentration ³ (% by volume)	Gas Screening Value ^{2,4} (litres/hour)	Typical max concentration ³ (% by volume)	Gas Screening Value ^{2,4} (litres/hour)
Green				
	1	0.13	5	0.78
Amber 1				
	5	0.63	10	1.6
Amber 2				
	20	1.60	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. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), 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.				

Box 8.4 of CIRIA C665 Gas protection measures for low-rise housing development based upon allocated NHBC Traffic light (Boyle and Withrington, 2007)	
Traffic Light Classification	Protection Measures Required
Green	Negligible gas regime identified and gas protection measures are not considered necessary.
Amber 1	Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.
Amber 2	Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Membranes should always be fitted by a specialist Contractor. As with Amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided.
Red	High gas regime identified. It is considered that standard residential housing would not normally be acceptable without a further Gas Risk Assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.

For a ‘Situation A Development’ (All development except low rise housing with gardens), the GSV value is used to derive the appropriate Characteristic Situation from Table 8.5 of CIRIA C665 (below):

Table 8.5 from CIRIA C665 Modified Wilson and Card Classification					
Characteristic Situation (CIRIA R149)	Comparable Partners in Technology gas Regime (see Box 8.2)	Risk Classification	Gas Screening Value (CH₄ or CO₂) (l/hr)¹	Additional Factors	Typical Source of Generation
1	A	Very low risk	<0.07	Typically methane ≤ 1% and/or carbon dioxide ≤ 5%. Otherwise consider increase to Situation 2	Natural soils with low organic content “Typical” made ground
2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3	Natural soil, high peat/organic content. “Typical” made ground
3	C	Moderate risk	<3.5		Old landfill, inert waste, mine working flooded
4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mine working susceptible to flooding, completed landfill (WMP 26B criteria)
5	E	High risk	<70		Mine working unflooded inactive with shallow workings near surface
6	F	Very high risk	>70		Recent landfill site

It was intended in CIRIA C665 that the characteristic situation allocated to the development from the table above would then be used in Table 8.6 of CIRIA C665 in order to determine the level of gas protection the development requires. However, BS8485:2007 superseded this document and a different set of mitigation standards were put forward.

The recommended gas protection measures should be selected based on the building type. For the majority of development situations the gas protection measures can be based on Tables 2 and 3 of BS8485:2007 (see below).

The first step in the decision making process is to obtain the level of gas protection necessary in the range 0 to 7 from Table 2. Then a combination of ventilation and /or barrier systems should be chosen from Table 3 to meet that requirement. The guidance value is allocated to reflect the risk associated with the characteristic gas situation and the combined effectiveness of the elements in Table 3. The level of gas protection necessary should take into account the characteristic gas situation and a number of other factors. The whole decision making process should be made transparent, where all parties can see the approach being taken, can understand the various steps and decisions made and be confident that a risk-assessed solution has been designed and installed commensurate with the construction and site constraints.

Where the gas situation is 4 or more (and for NHBC Red situations according to CIRIA C665), the site requires a comprehensive risk assessment to confirm the scope of protection measures. These are higher risk sites and reliance on Table 2 and 3 alone is not sufficient.

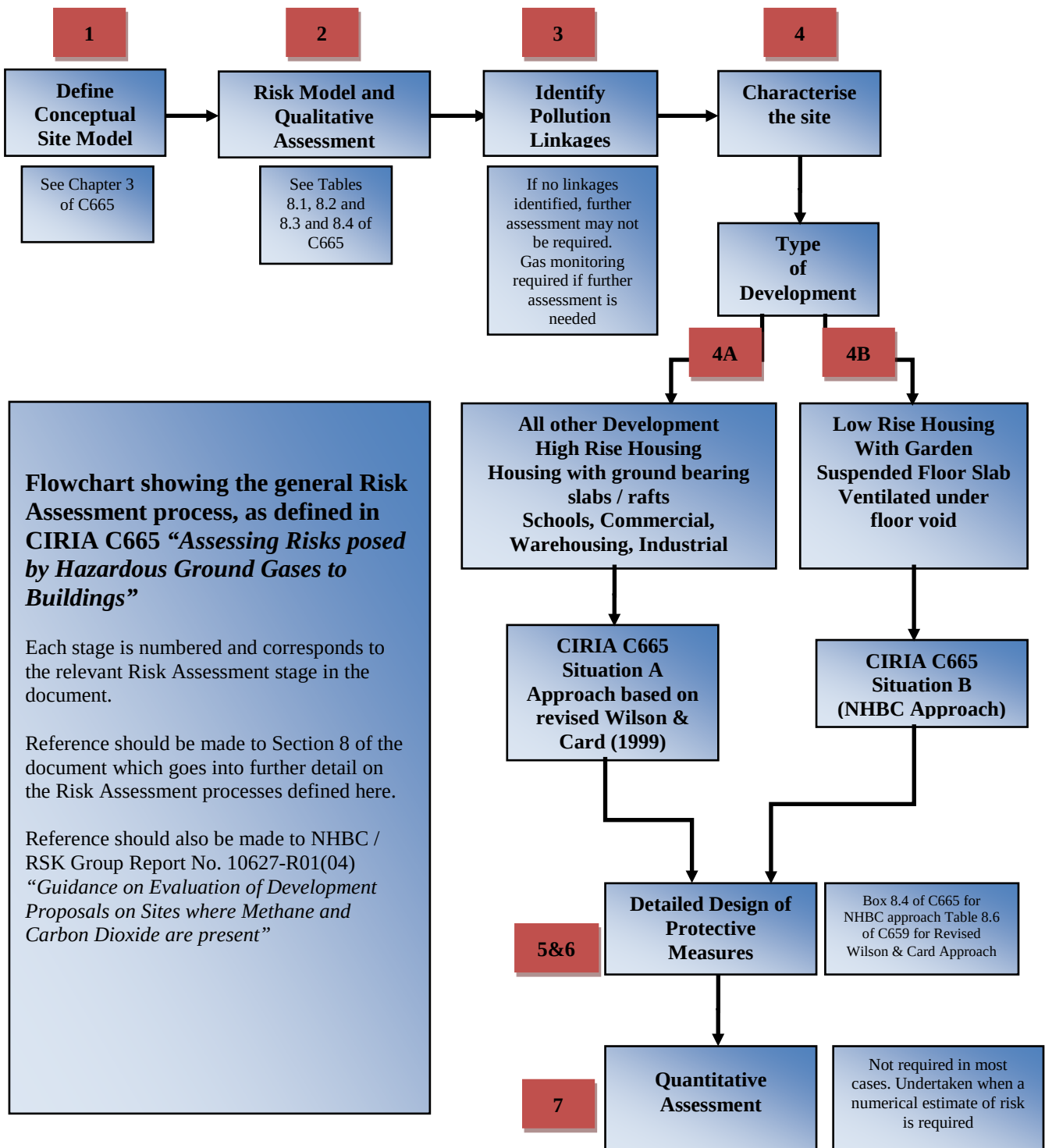
BS8485:2007 Table 2 Required gas protection by characteristic gas situation and type of building					
Characteristic Gas Situation, CS	NHBC traffic light	Required gas protection			
		Non-managed property e.g. private housing	Public building (a)	Commercial buildings	Industrial buildings (b)
1	Green	0	0	0	0
2	Amber 1	3	3	2	1 (c)
3	Amber 2	4	3	2	2
4	Red	6 (d)	5(d)	4	3
5			6(e)	5	4
6				7	6
<i>NOTE Traffic light indications are taken from NHBC Report no.:10627-RO1 (04) and are mainly applicable to low-rise residential housing¹. These are for comparative purposes but the boundaries between the traffic light indications and CS values do not coincide.</i> a) Public buildings include, for example, managed apartments, schools and hospitals. b) Industrial buildings are generally open and well ventilated. However, areas such as office pods might require a separate assessment and may be classified as commercial buildings and require a different scope of gas protection to the main building. c) Maximum methane concentration 20% otherwise consider and increase to CS3, d) Residential building on higher traffic light/CS sites is not recommended unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations. e) Consideration of issues such as ease of evacuation and how false alarms will be handled are needed when completing the design specification of any gas protection scheme.					
¹ The NHBC guidance and CIRIA C665 guidance refers to low rise housing (which is up to three storeys without lifts) that is constructed with a 150mm ventilated sub-floor void.					

For a site which is impacted by migratory gases from an off-source, the development may be protected by imposing pathway intervention methods, which if successfully validated, could also remove the need for further analysis. It is essential that the gas regime in these circumstances has been fully characterised and that the only source impacting the site is located off site and that the pathway is clearly defined and its interception equally proven before construction commences. Pathway intervention methods may include vertical membrane installations, venting trenches, rows of stone columns, activated trenches and various proprietary systems. These systems are particularly relevant to domestic housing where there is limited scope for foundation type solutions.

Having selected the appropriate gas protection for the building from Table 2, an element, or combination of elements should be chosen from Table 3a, Table 3b, Table 3c and Table 3d, and combined to achieve the required gas protection. A combination of elements should be chosen where high gas protection is required, unless professional judgement and risk assessment show otherwise. The scores are not proportionate and are not to be taken as an indication of relative quantitative performance. This method relies upon the method developed in CIRIA C665 and is intended to be consistent with the CIRIA approach while developing the principle. As such, minor inconsistencies in result might be observed between the two methods.

BS8485:2007 Table 3 Solution Scores			
PROTECTION ELEMENT/SYSTEM		SCORE	COMMENTS
a) Venting/dilution (See Annex A BS8485)			
Passive sub floor ventilation (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^A Subfloor ventilation with active abstraction/pressurization (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^A Ventilated car park (basement or undercroft)	Very good performance	2.5	Ventilation performance in accordance with Annex A (BS8485) If passive ventilation is poor this is generally unacceptable and some form of active system will be required. There have to be robust management systems in place to ensure the continued maintenance of any ventilation system. Active ventilation can always be designed to meet good performance. Mechanically assisted systems come in two forms: extraction and positive pressurization.
	Good performance	1	
		2.5	
		4	
b) Barriers			
Floor slabs			
Block and beam floor slab		0	It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum. Breaches in floor slabs such as joints have to be effectively sealed against gas ingress in order to maintain these performances.
Reinforced concrete ground bearing slab		0.5	
Reinforced concrete ground bearing foundation raft with limited service penetrations that are cast into slab		1.5	
Reinforced concrete cast in situ suspended floor slab with minimal service penetrations and water bars around all slab penetrations and at joints		1.5	
Fully tanked basement		2	
c) Membranes			
Taped and sealed membrane to reasonable levels of workmanship/in line with current good practice with validation ^{B,C}		0.5	The performance of membranes is heavily dependent on the quality of design of the installation, resistance to damage after installation, and the integrity of joints.
Proprietary gas resistant membrane to reasonable levels of workmanship /in line with good practice under independent inspection (CQA) ^{B,C}		1	
Proprietary gas resistant membrane installed to reasonable levels of workmanship/in line with current good practice under CQA with integrity testing and independent validation		2	
d) Monitoring and detection (not applicable to non-managed property, or in isolation)			
Intermittent monitoring using hand held equipment		0.5	Where fitted, permanent monitoring systems ought to be installed in the underfloor venting/dilution system in the first instance but can also be provided within the occupied space as a fail-safe.
Permanent monitoring and alarm system ^A	Installed in the underfloor venting/dilution system	2	
	Installed in the building	1	
e) Pathway Intervention			
Pathway intervention		-	This can consist of site protection measures for off-site or on-site sources (see Annex A, BS8485)
NOTE In practice the choice of materials might well rely on factors such as construction method and the risk of damage after installation. It is important to ensure that the chosen combination gives an appropriate level of protection			
A)	It is possible to test ventilation systems by installing monitoring probes for post installation validation.		
B)	If a 1 200g DPM material is to function as a gas barrier it should be installed according to BRE 212 /BRE 414 being taped and sealed to all penetrations		
C)	Polymeric Materials> 1200 g (proportional to thickness) but their physical properties mean that they are more robust and resistant to damage.		

To summarise the main stages in the risk assessment process set out in CIRIA C665 and followed by TerraConsult are as follows:



APPENDIX O

Summary of Guidance for Classification of Soil as a Waste Material

Guidance for Classification of Soil for Off Site Disposal at a Landfill Site

Many site developments create a portion of excess soils and Made Ground which if not re-usable, are required to be disposed off-site at a suitably licensed landfill site. The regulations and associated guidance published by the Environment Agency is relatively complex and lengthy. This guidance provides a summary of the following documents which should be referred to when assessing soil (and common constituents found within Made Ground on remediation sites) for off-site disposal:

- Guidance for Waste destined for disposal in landfills: Interpretation of the Waste Acceptance Requirements of the Landfill (England and Wales) Regulations 2002 (as amended) (EA, 2004);
- Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance Procedures (EA, April 2005);
- WM2 - Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Wastes Version 3 (EA, May 2013 and October 2013 errata);
- Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (CHIP4);
- Guidance on Waste Destined for Disposal in Landfill (EA, June 2006);
- Treatment of Non-hazardous wastes for Landfill (EA, February 2007).

It is important to distinguish between the waste classification system and the designation of materials as “suitable for use” on site. A material may be retained on site for an appropriate end use if that end-use is clearly designated and that a site-specific risk assessment ensures that it does not pose a risk to human health or controlled waters. However, if this material is excavated and sent for disposal, the material is then subject to waste management regulations and the two systems cannot be directly correlated. It is therefore important to note that classifying a material as hazardous (should it be excavated and become a waste) does not necessarily indicate that it might not be suitable to be kept on site for re-use. Separate guidance in the form of a Code of Practice (CL:AIRE Version 2, 2011) has been developed jointly between the development industry and the Environment Agency to provide best practice when assessing whether materials are wastes or not, and for determining when waste can cease to be waste for a particular use.

In accordance with the current waste regulations (or Landfill Directive, as they are more commonly known), from 30th October 2007 all waste materials produced from construction sites have to be pre-treated prior to disposal. Pre-treatment includes waste minimisation, recovery (e.g. separation of demolition waste to be used as hardcore) and separation of materials into different waste categories (e.g. separate inert waste from hazardous waste etc). Mixing of different waste types shall be avoided and intentional mixing of inert materials with hazardous waste to ‘dilute it’ and hence change its waste classification, is illegal.

The current waste regulations (based on the EU landfill directive) introduced a two tier classification system for waste materials, defining them as either being hazardous or non-hazardous. Landfills are licensed to take wastes based on a three tier classification system with the non-hazardous waste divided into two sub-categories:

- Non-Hazardous - inert;
- Non-Hazardous - non-hazardous;
- Hazardous.

Waste materials are categorised with a six figure numeric code in the European Waste Catalogue. Commonly found construction and demolition wastes including excavated soil from contaminated sites and Made Ground with their waste codes are summarised below (this is not a comprehensive list):

Waste Code	What is it?	Likely Waste Category–		
		Inert Waste	Non-Hazardous	Hazardous Waste
17 01 01 Concrete	Concrete, possibly with reinforcement (from Construction & Demolition)	✓		
17 01 02 Bricks		✓		
17 01 06* Mixtures of concrete, bricks, tiles & ceramics containing dangerous substances	These are not normally considered hazardous but if they are contaminated (e.g. by asbestos) then could be hazardous – see comment above			✓
17 01 07 Mixtures of concrete, bricks, tiles & ceramics other than those in 17 01 06	This is mixed inerts c.f. 17 09 04	✓		
17 05 03* soils and stones containing dangerous substances				✓
17 05 04 soils and stones other than those mentioned in 17 05 03	Soil and stones only (excluding top soil, peat, soil and stones from contaminated sites)	✓		
17 06 05* Construction materials containing asbestos	e.g. corrugated asbestos sheeting			✓
17 08 02 Gypsum-based construction materials other than those mentioned in 17 08 01	Plaster & plasterboard (although specific disposal requirements are required for high sulphate waste – see EA guidance ‘Understanding the Landfill Directive’ version 1.0 March 2010.		✓	
17 09 01* Construction & demolition wastes containing mercury				✓
17 09 02* Construction & demolition wastes containing PCBs	Waste with more than 50 mg/kg of PCB’s are hazardous			✓
17 09 03* Other mixed construction & demolition wastes containing dangerous substances	Broad range of potentially (see notes below – if asterix the waste is hazardous) hazardous wastes			✓
17 09 04 Mixed construction & demolition wastes other than those mentioned in 17 09 01, 17 09 02 & 17 09 03	Mixed inerts with soil, tarmac, cables, vegetation, plaster, etc. (this waste can only be considered inert if it passes the waste acceptance criteria identified in the regulations).	✓	✓	

Note: all wastes with an asterix code are hazardous regardless of whether they are mirror or absolute entries in the EWC list the decision to with regard to composition must come before applying the code for mirror entries.

Some materials are classified as Inert Waste based in its origin (e.g. 17 01 01 Concrete, or glass) without any requirement for laboratory chemical analysis.

However, most soils will require laboratory testing to confirm whether they are classified as Hazardous Waste. The protocol for assessing these materials and the appropriate threshold values is complicated and are set out in the Environment Agency's "Technical Guidance WM2 Hazardous Waste – Interpretation of the Definition and Classification of Hazardous Waste" Version 3 (2013). If the test results for the waste indicates that it is not hazardous then further analysis of the waste is required to determine whether it is Inert Waste. If the waste does not meet the criteria for either Hazardous or Inert, then it is by default classified as Non-hazardous Waste.

As an alternative location to landfills for off-site disposal of inert and non-hazardous waste, there are a number of sites which have Waste Permit Exemptions that can accept certain categories of inert and non-hazardous wastes. Additionally some quarries can accept certain types of wastes to be used for quarry restoration material. For both alternatives to disposal at landfill sites the material still requires chemical testing as these sites have site specific acceptance criteria for wastes. It should also be noted that these types of site do not incur landfill tax which in the 2014/15 tax year is £2.50 for inactive waste (inert and some types of non-hazardous waste) and £80.00/Tonne for active waste (some types of non-hazardous waste and hazardous waste. Note that the Inland Revenue uses a different classification scheme for waste for tax purposes to the European Waste Classification scheme.

Waste Categorisation

The process of determining the category of wastes is a three stage process:

- Stage 1 – is the waste either Hazardous or Inert by definition without the requirement for chemical analysis (if it is then Stages 2 and 3 are not required);
- Stage 2 - Waste characterisation;
- Stage 3 - WAC classification.

Waste characterisation determines if a waste is hazardous or not. Excavated soil is characterised using a system based on the contaminants present and their hazardous properties. The system uses total concentrations of the contaminants. Thresholds (as a percentage of the waste) have been set for the various hazardous properties.

Fourteen hazardous properties together with other scenarios where material could cause a hazard have been defined:

- Hazardous properties: explosive, oxidising, highly flammable/flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic and ecotoxic;
- Substances which can release toxic/very toxic gases in contact with water, acid or air;
- Substances which, after disposal, can yield another substance, e.g. a leachate, which possesses any of the above hazardous properties.

Some of the hazardous properties are sub-divided e.g. there are three categories of carcinogenic, mutagenic and toxic for reproduction substances. The hazardous properties were originally defined in the European Hazardous Waste Directive 91/689/EC. Should a waste contain a contaminant with one or more of the listed hazardous properties at a concentration equal to or above the threshold value for the particular

property, then the waste is hazardous. The hazardous properties of a wide range of chemicals are sourced from CHIP4 (2009).

There are many reasons why waste soil is classified as being hazardous but the majority of reasons can be divided into the following four groups:

- Hydrocarbons – this is probably the most common reason for the hazardous classification of soils. For most soils hydrocarbon analysis will be required for both Polycyclic Aromatic Hydrocarbons (PAH) and speciated Petroleum Hydrocarbons (PHCs) but depending on the site's history other groups of organic contaminants may also be included in any analysis suite for soil samples;
- Metals – Particularly sites from former metal processing or mining sites and also some types of ash have metal concentrations that are sufficiently high to characterise materials requiring disposal as hazardous waste.
- Asbestos;
- Anions – e.g. sulphate in plasterboard (there are special disposal requirements for high sulphate waste and specific WAC requirements); it is possible that sulphate salts of metals and semi-metals could make the waste hazardous – the sulphate concentration could possibly be significant under H12, H13 and H14.

The characterisation of wastes with significant metal concentrations involves some processing of the analysis data. The chemical analysis results for inorganic substances are generally reported as total concentrations e.g. total lead, total arsenic, total sulphate etc. However, CHIP4 (2009) deals with the hazardous properties of actual compounds e.g. lead sulphate, arsenic pentoxide, nickel carbonate. Therefore, the total metal results have to be converted into assessed chemical analysis results for the compound most likely to be present in the soil samples. For example, if the sample contains high total lead concentrations and high sulphate concentrations, then the lead is likely to be present in the soil as lead sulphate. The most likely compounds can often be determined from a desk study or previous site uses. If the site has been derelict for a number of years, consideration should be given as to whether water soluble compounds should or should not be chosen, as rainfall could have removed them from the soil (this does not apply if the soil has been taken from below under a concrete slab etc). Chemical knowledge and common sense needs to be used in choosing a suitable compound.

If no data is available, then a worst case scenario has to be assumed and the most hazardous compound likely to be present has to be chosen. For example, metal chromates (lead chromate, nickel chromate) are often the most hazardous compounds formed by many metals, but if the chromium concentrations in the soil are low, chromates are unlikely to be present. It should also be noted that for many of the hazard categories, the cumulative hazard from different compounds is added (e.g. add the concentrations of the copper, lead and zinc compounds together to assess the Hazard Category H14 Ecotoxicity).

If the results of the above assessment determine that the waste is hazardous, it must then be analysed for the Waste Acceptance Criteria (WAC) analysis contained within appropriate Environmental Permitting Regulations (this comprises mainly leachate but also analysis for TOC and Loss on ignition). WAC limit values have been set for the listed determinands. If any of the determinands exceed their limit value, the waste must be pre-treated to reduce concentrations to below the limit values before the waste may be disposed of at a landfill site licensed to take hazardous waste.

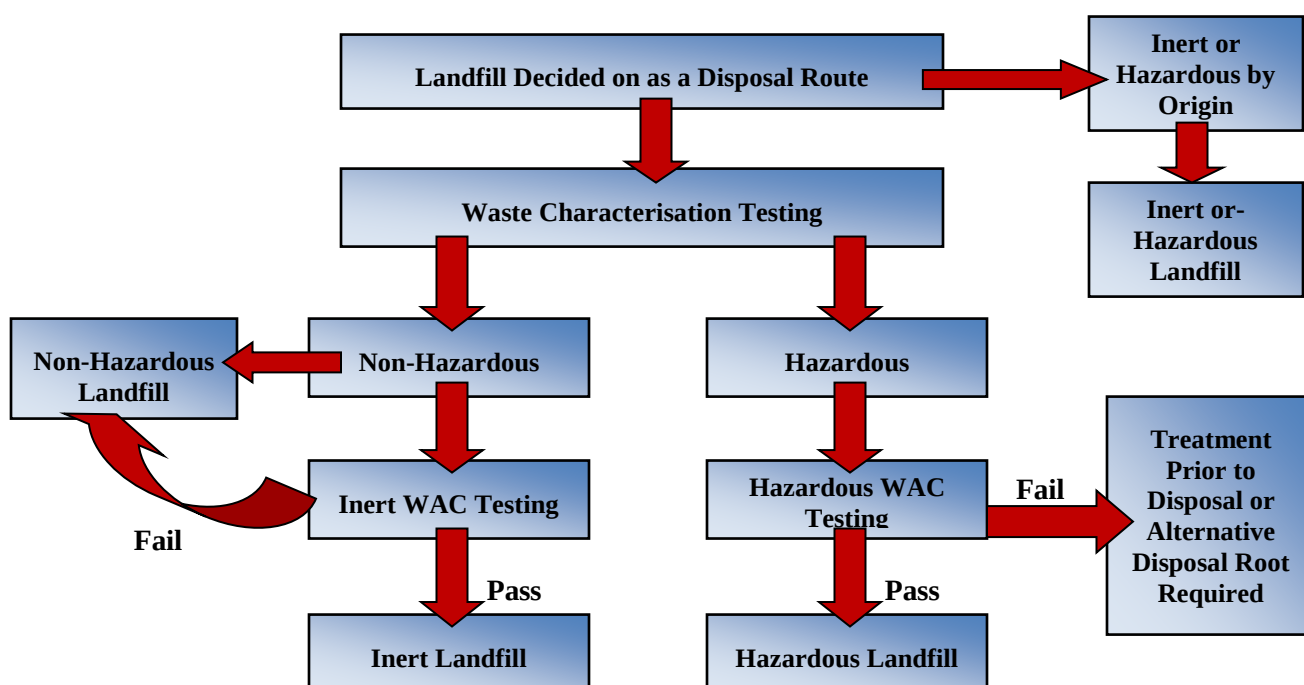
For waste classified as not being hazardous, then there are two options available. Currently, waste correctly characterised as not being hazardous may be disposed of without WAC testing to a non-hazardous landfill. Alternatively WAC testing for Inert Waste can be carried out (this is similar to the list for hazardous waste with the addition of PAH's, BTEX and Mineral Oil). If the results pass the Inert WAC criteria it can be

disposed of at an Inert Waste Landfill. If any of the WAC test results exceed the Inert WAC criteria the waste has to be disposed at a non-hazardous landfill. There are WAC limits for non-hazardous waste set for pH and TOC. If these two criteria are not met then the waste must be pre-treated to so that it meets the criteria before it can be disposed.

If materials fail the WAC criteria they can be pre-treated on site or taken to a soil treatment centre for pre-treatment (such as at the facility run by Biffa at Risley near Warrington). Here the soil's hazardous properties may be reduced (e.g. by bioremediation of hydrocarbons).

It should be noted that in order to dispose of Hazardous Waste, the site must register as a producer of Hazardous Waste with the Environment Agency. When disposing of waste materials to landfill sites the appropriate Duty of Care Waste Transfer procedures must be followed.

Landfilled Waste Decision Tree



Landfill Tax

It should be noted that HM Revenue and Customs (HMRC) classify wastes for tax purposes using a different scheme to the three fold landfill EU Landfill Directive scheme (i.e. the hazardous, non-hazardous and inert). HMRC have a two-fold system for landfill tax. The Standard Landfill Tax is currently £80/T (rising by £8/T per year) and applies to all wastes unless they qualify for the reduced rate of landfill tax of £2.50/T. The wastes that qualify for the reduced rate of Landfill Tax are set out in The Landfill Tax (Qualifying Material) Order 2011 with supplementary information on the interpretation of these regulations in HMRS "Notice LFT1 – A General Guide to Landfill Tax" (May 2012) and HMRC Briefing Notes 15/12 and 18/12.

APPENDIX P
Requirements For Excavation and Re-Use Of
Soils Containing Asbestos

APPENDIX P

REQUIREMENTS FOR EXCAVATION AND RE-USE OF SOILS CONTAINING ASBESTOS

1 INTRODUCTION

This Appendix provides information for the requirements to excavate and re-use soils containing asbestos and will be referred to as the Asbestos Strategy. This is required due to the potential widespread presence of asbestos within Made Ground deposits. It is understood that the “Principal Contractor” is yet to be appointed by the Client but the Principal Contractor must be made fully aware of their requirements for dealing with these soils.

This Appendix will be referred to herein as the “Asbestos Strategy”.

1.1 Proven Presence of Asbestos Plus Aims and Objectives

Asbestos can be present in soil as fragments of bulk Asbestos Containing Materials (ACMs) (e.g. asbestos cement sheeting) and also as discrete asbestos fibres within the soil matrix. The investigation carried out assessments to determine whether both bulk fragments of asbestos and discrete fibres are present in the soil at the site. The asbestos assessment commenced on site with inspection of the Made Ground by our site staff for the presence of bulk ACMs. During the fieldwork no suspected ACMs were identified. Laboratory assessments of fifteen soil samples indicated that:

- No asbestos present in fourteen samples (note that the laboratory detection limit for these samples is 0.001%);
- In one sample of Made Ground (demolition material) was found to have asbestos fibres of chrysotile at 0.003% by weight.

Finding asbestos at such concentrations is very common in Made Ground. Made Ground was only encountered in TP101 to TP105 (plus TP4, TP5, BH4, BH17 and BH18 by FWS) in the southwest of the site within the car park area with the single positive test for asbestos being in this area in TP101. It should be noted that the Made Ground in TP101 was the only location where demolition material was found. Therefore it can be concluded that there is only a risk from asbestos where there is demolition material in the Made Ground. This demolition material could be located locally anywhere within the Made Ground which is likely to be found in the area indicated in Figure 7 below.



Figure 7: Likely Presence of Made Ground and Hence Asbestos

Where Made Ground is present it is likely that there will be a variable asbestos content and it could be present at higher concentrations than measured in this investigation and ACMs could also be present.

The presence of asbestos does not signify that any remediation is required for a commercial development. This is because the surface hard standing will seal the asbestos into the ground breaking any pathway to receptors although soft landscaping has to be considered. However, it does highlight there is an elevated risk which could be present to construction staff from localised “hotspots” of asbestos during the groundworks phase of the project.

It is the intention is to limit the amount of intrusive works within the area with Made Ground present. Once the initial layer of topsoil or gravel has been removed the formation will be trimmed to level and compacted so there will be minimal amounts of excavation and no crushing of Made Ground materials is proposed. There will be excavations for service trenches and a lagoon and this material will be re-used or disposed of off-site. The material will be re-engineered on site to create

a development platform. If any Made Ground does not achieve the correct grade or cannot be reused will be sent off site for disposal and fresh material imported.

This Asbestos Strategy will clarify the conditions and restraints on the re-use of the excavated materials containing asbestos, whilst ensuring that safe systems of work are implemented by the principal contractor in line with The Control of Asbestos Regulations 2012 (CAR) and the HSE's Asbestos ACoP published in December 2013.

In addition, this Asbestos Strategy also presents mitigation measures that must be implemented to protect future site users, and also outlines the records that should be maintained within the CDM Health and Safety File to inform future land owners / developers of the locations of the re-engineered materials.

This Asbestos Strategy addresses the safe use and placement of Made Ground with respect to asbestos risk only. Information on all non-asbestos contaminants and geotechnical suitability are addressed in the main body of this report.

2 HEALTH AND SAFETY

2.1 General

It is anticipated that the following tasks will all involve, or potentially involve, working with ACMs. These tasks are included in the preparation of the Risk Assessment and Plan of Work in accordance with CAR as detailed in 2.2 & 2.3

- Site mobilisation;
- Excavation of earthworks;
- Handling, movement and storage on site of excavation arisings from Made Ground
- Any processing of excavation arisings containing ACMs (if encountered);
- Movement and placement of Made Ground and other arisings to final destination;
- Off-site disposal of ACMs.

2.2 Risk Assessment - Compliance with Regulation 6 of CAR

Prior to the commencement of any works where there is a potential for ACMs to be disturbed or exposed at the ground surface or Made Ground to be placed in stockpiles, an assessment of risk is required (i.e. prior to any excavations into Made Ground across the site). This Risk Assessment will be carried out by the Principal Contractor and confirm that the proposals in this Appendix are sufficient to control the risks from ACMs. This Risk Assessment will also be reviewed for sufficiency at regular stages during the works. The person undertaking the Risk Assessment and reviews must be competent to do so in line with Regulation 10 of CAR and Risk Assessment review shall ensure that it is in line with Regulation 6 of CAR.

2.3 Quantity of Asbestos

The only asbestos encountered in the investigations was in buried demolition material which had free fibres of Chrysotile at concentrations of up to 0.003%. The total quantity of asbestos present in Made Ground is difficult to assess and will be very low unless ACMs are encountered.

2.4 Information, Instruction and Training - Compliance with Regulation 10 of CAR

It will be ensured that the following information, instruction and training are provided to all persons involved in the excavation and re-placement of material containing, or potentially containing ACMs:

- Significant findings of risk assessment;
- The risks to health from asbestos;
- Precautions that should be observed;
- Method of work; and,
- The relevant control limit.

All personnel who will be involved with working on Made Ground will have attended a suitable Asbestos Awareness training course. Personnel involved in handling asbestos will have received training in the removal of asbestos. If handling fibrous asbestos which is notifiable is required once site works commence then personnel undertaking these activities will only be from a specialist subcontractor and these personnel will have a higher level of training appropriate for this notifiable work.

2.5 Preliminaries

When any works are to take place where Made Ground is to be exposed or excavated the Principal Contractor will set up an Asbestos Control Zone (ACZ). It is envisaged that the contractor will set up a series of ACZs as the work progresses on a sequential basis with each ACZ being fenced off as work progresses in order to form a series of secure areas delineating where asbestos could be encountered. This fencing will be present for the duration of the groundworks in each of the ACZs (i.e. until the Made Ground is covered or encapsulated).

Prior to commencing any works within the fenced off area a suitable decontamination unit will be established outside the perimeter of this area. This decontamination unit will have separate clean and dirty entrances and exits. Personnel will enter via the clean entrance, get changed into their PPE and then exit by the dirty door. At the end of each period of work they will enter via the dirty door and exit by the clean door. An external boot wash will also be provided adjacent to the dirty door.

All excavation plant used to excavate ground which could potentially contain ACMs will remain within the fenced area and will only exit it when it has been cleaned to remove any ACMs from the tracks, bucket and superstructure. The excavators will only be operated with all doors and windows closed and will have a suitable dust filter on the air conditioning unit. The excavator operator will track to the edge of fenced area to leave or enter the cab so as to avoid tacking ACMs into the cab.

2.6 Plans of Work - Compliance with Regulation 7 of CAR

The Principal Contractor will set out the programme of groundworks and appropriate risk assessments plus methodologies in the Construction Phase Plan. The relevant parts will comply with Regulation 7 of CAR. This plan will also set out the numbers of personnel and plant working in ground potentially containing asbestos.

It is understood that the proposed method of work is likely to use a hydraulic excavator to excavate Made Ground and any underlying natural soils as required. Soils will be continually inspected for the presence of ACMs. If there are no ACMs then excavation can continue in stages with the face inspected as fresh materials are exposed.

Where any exposed ACMs are encountered these will be excavated from the Made Ground. The larger readily separable ACMs and pockets of soils with ACMs will be removed and placed in a designated quarantine area for off-site disposal. Smaller individual fragments of ACMs and fines containing asbestos will be excavated and placed in the required final destination.

Any larger pieces of observed fibrous asbestos (that possibly includes amosite) that are encountered will be initially sampled then covered with a plastic sheet. The fibrous material will then be inspected by a licensed asbestos removal contractor. Note that fibrous asbestos is likely to be of a higher risk and covered by additional regulations than cement bound asbestos will be handled and stored separately from the other lower risk types of asbestos.

The Principal Contractor will have a system for spraying the ground to dampen it down. This will generally be used when excavating the soils which could contain asbestos (i.e. Made Ground) to suppress fibres from becoming airborne.

Any open faces of the Made Ground shall be inspected at the end of each day or end of a phase of work during the day to ensure that no asbestos is left exposed in the face where it could release fibres. The face will be sealed up by the excavator and if asbestos is present in the face then it will either be removed prior to the end of the work, or the area will be covered with 2000 gauge Visqueen sheeting to prevent release of fibres.

During the above activities the above methodology and risk assessments will be reviewed by the Principal Contractor's Health and Safety Adviser to assess the nature of the risk(s) based on work activities/monitoring activities. This review will be carried out pre-commencement, one week after commencing earthworks and then monthly during all earthworks.

2.7 Prevention or Reduction of Exposure to Asbestos - Compliance with Regulation 11 of CAR

The exposure of employees to asbestos will be prevented so far as is reasonably practicable. Measures that will be taken will include:

- Asbestos Control Zones (ACZs) will be set up. All works within the ACZs will be under the control of the Principal Contractor;
- All personnel to have appropriate training;
- A site specific induction will be held with all personnel who are to work in the ACZs prior to commencement. This briefing will include:
 - Overview of the works required.
 - Risks associated with asbestos
 - Establishing control zones, and decontamination facilities
 - Using Personal Protective Equipment
 - Air monitoring
 - Responsibilities of technical support and monitoring
 - Standard operations and procedures including control zones, decontamination etc.
- Tool Box talks will be carried out during the works;
- If licensable asbestos is present then an asbestos analyst will be on site who is certified with P406 Supervision and Management of the Safe Removal and Disposal of Asbestos certificate and can carry out asbestos analysis on site and can carry out the asbestos fibre monitoring. This will ensure the works are being carried out in accordance with the remediation method statement and that all risks of exposure to asbestos and kept to a minimum at all times;
- Trained personnel will be on site to act as a watching brief/banks person to visually assess materials/stockpile for ACMs;
- All persons to operating plant are to work in closed cabin excavators;
- Excavation area to be fenced off from the rest of the site and warning signs where required;
- All excavation and separation of soils containing asbestos will be by machine;
- Provision of a system for wetting down materials to suppress fibres;
- Decontamination unit;
- Adoption of suitable PPE/RPE.

All personnel working in the ACZs will wear the following:

- hard hat;

- disposable hooded overalls suitable for use with asbestos i.e. resistant to penetration by dust and fibres such as a Type 5 coverall;
- washable safety boots (Wellingtons) – suit legs must be over the outside of the Wellingtons and taped down to the boots);
- inner (Nitrile type) and outer gloves;
- safety goggles;
- Hi Vi long sleeve jacket/vest; and
- Respiratory Protective Equipment (RPE) during work with ACMs (FF P3 high efficiency particulate filtered masks in accordance with HSE guidance note HS(G)53). These will have been face fit tested and required to be worn by the operatives who are not operating plant at the face and handling asbestos.

To add a further level of protection the following specific ACZ rules must be adhered to prevent site personnel exposing themselves further to contaminated materials or breaching the level of protection the PPE Provides:

- No smoking, eating or drinking with in the control zone;
- No use of mobile phones;
- No use of personal stereos etc.;
- Do not unzip the PPE within the control zone to gain access to pockets etc;
- All personnel must fully decontaminate before using the welfare facilities;
- Dispose of PPE appropriately in skips within the control zone;
- All tools and equipment required must be carried and decontaminated when returning it to the uncontaminated parts of the site;
- All plant, equipment or personnel must fully decontaminate prior to leaving the asbestos control zone.

When personnel require to leave the ACZ all PPE must be removed outside the decontamination unit, within the confines of the control zone in the following order:

- Protective suites should be removed so that the suit is turned inside out /peeled off so that any potential contaminated materials does not come into contact with the body or clothes;
- All PPE to be disposed of should be placed directly to red asbestos bags and sealed at the end of the shift;
- Boots and hard hat should be washed down if required and stored for use on the next shift;
- Gloves should be disposed of next into the asbestos bags and sealed;

- The mask should be the last piece of PPE removed, masks should be cleaned upon removal and stored safely for future use;
- Potentially contaminated PPE must not pass through to the uncontaminated parts of the site beyond the ACZ.

Decontamination of plant and equipment will be required before it is removed from the area of works controlled by the Remediation Contractor. Prior to plant and equipment being utilised outside of the control zone or be demobilised, it will be thoroughly washed down and inspected by the site supervisor.

Should an unknown quantity or type of asbestos and or other potentially harmful material be discovered on site that is not be appropriately risked assessed as deemed by the competent site supervision to require increased control measures and changes in working practices all personnel within the control zone must:

- Walk immediately away from the area to an upwind location without going through the affected area.
- Not attempt to recover machinery or plant until it is safe to do so.
- The affected area will wetted down if required under instruction and covered if required.
- The area will also be fenced off and clear signed for no entry.
- The affected area may only be entered once a competent and qualified person has undertaken an appropriate risk assessment for the control and handling of the material.

The primary risk for the spreading of asbestos materials is through fugitive dust emissions. To mitigate against this occurring the following mitigation measures shall be implemented:

- In all soils/areas that have the potential to contain exposed ACM the ground will if required be wetted using a fine spray jet wash over the potentially impacted area before works commence. When the supervisor is satisfied the areas have been sufficiently wetted works may commence. The supervisor may request the areas to be further wetted if materials become dry or new materials are exposed.
- When wetting down areas all plant and personnel must be removed from the area to prevent further spread of contaminated materials as the wetting process may cause low level air turbulence and once wet the contaminated materials may adhere to plant and personnel.
- All plant are to operate at a 10mph speed limit as not to generate dust within the ACZ;
- All plant must slowly lower materials and dump materials slowly, as materials dropped from height quickly has the potential to increase fugitive dust emission and the potential to release asbestos fibres to the atmosphere.

- During excavation of the soils only the required plant will be present in the ACZ.
- Following each load of material where ACM is present in excavated soils the materials must be sufficiently wetted to prevent dust arising when moved from either the plant to the ground or from plant to plant, i.e. loading a dump truck.
- At the end of each day all exposed materials with the potential to contain asbestos will be either wetted sufficiently to prevent it drying and dusting during the night, or covered with a liner type material (e.g. 2000 gauge Visqueen) to prevent dusting when the materials are not being worked.

2.8 Use/Maintenance of Control Measures - Compliance with Regulation 12 of CAR

All equipment used as documented in the Plan of Work should be properly used and maintained in a good working order. Every employee shall make full use of any equipment provided and report any defect in the equipment to their employer.

In addition to the use of Control Measures, CAR 2012 requires that the effectiveness of these Control Measures be assessed to ensure their suitability. This will be determined by:

- Site audits during the works. These audits will be carried out by the Principal Contractor's Safety Department and also possibly the CDM coordinator.
- Air monitoring - see Section 2.11 below.

2.9 Provision and Cleaning of Protective Clothing - Compliance with Regulation 14 of CAR

Any protective clothing provided will be disposed of as asbestos waste and removed from the site in a sealed container labelled as a product containing asbestos – See Section 3.7 of this appendix for further details.

2.10 Arrangements to Deal with Accidents & Incidents – Compliance with Regulation 15 of CAR

In the event of an incident involving the unplanned release of asbestos at the workplace, immediate steps should be taken to mitigate effects of event and inform any person(s) other than persons in designated area who may be affected.

Should site personnel be over exposed to asbestos fibres during the works, they must proceed immediately to the decontamination unit and undertake the following steps for a full decontamination procedure:

- Washing down of Wellingtons and overalls;

- Removal of all PPE within the first chamber (dirty side) in the following order:
 - o Protective suite, turn inside out
 - o Wellingtons/ boots once washed down
 - o Hard hat
 - o Gloves
 - o Face mask.
- Dispose of protective suits, gloves, contaminated PPE must not pass through to the uncontaminated parts of the site beyond the control zone.
- Personnel must remove all underclothes which may be required to be disposed of upon individual assessment. Personnel should shower thoroughly to wet and remove asbestos fibres, asbestos towels will be provided for drying.
- The personnel must then proceed through to the third chamber (clean side) of the decontamination unit where site personnel can change in to standard site PPE, Hard hat, hi-vis, boots etc. Standard site PPE must not have been used within the ACZ.

2.11 Air Monitoring - Compliance with Regulation 19 of CAR

CAR 2012 states that air monitoring should be undertaken to ensure that:

1. Control measures are working effectively;
2. Employee exposure to asbestos does not exceed the appropriate control limit;
3. Dust suppression techniques are monitored and working effectively

The method of working will be designed so as to minimise the potential for dust and fibres to be released into the atmosphere as this may increase risk of exposure to unacceptable levels and beyond the ACZ. In order to continually assess this risk and ensure onsite control measures and appropriately mitigate fugitive emissions from the works will be monitored throughout the groundworks by an on-site analyst provided by the Principal Contractor. The asbestos analyst will be contracted from an independent UKAS accredited laboratory to provide representative on-site analytical air monitoring during stages of the work that will involve disturbance of ACMs, such as excavation, handling, storage and relocation of any material identified or presumed to contain ACMs and air monitoring will be carried out until all Made Ground (other than in the landscaped area) is encapsulated.

The required competencies of the independent UKAS accredited laboratory and the analyst are as per the CAR Regs 2012 and associated HSE guidance on sampling and testing of asbestos. The findings of the Risk Assessment will determine when, where and how often the monitoring will be required.

It is proposed that four monitoring locations will be established on the boundary of the site to provide reassurance monitoring to local stakeholders. The monitoring at these locations will be carried out as follows:

- On 4 days prior to commencement of any stripping of topsoil or clearance works and before excavation works commence in the Made Ground;
- On every second working day during all groundworks in the area where Made Ground may be encountered (e.g. until all made ground has been covered with sub-base and then also on any days when there are excavations through the sub-base for services); and
- Continue on for a further one week after the groundworks have been completed.

The number of boundary monitoring locations and their locations will be reviewed prior to commencing the monitoring and if any additional monitoring should be required this will be justified.

In addition to this, pumped air samples will be collected to determine the concentration of fibres at the place of work. This personal (assessment) monitoring will be undertaken for persons within the immediate work area and adjacent to where disturbance works are being undertaken. This strategy may be changed at any time depending on results obtained from these tests and will be under continuing review by the independent monitoring specialist.

The initial proposed perimeter locations for air monitoring based on the usual prevailing wind conditions is shown on the following figure:



Initial Proposed Perimeter Locations for Air Monitoring

3 RE-USE CONTROLS AND VALIDATION

3.1 Placement of Materials

Taking account of the preceding sections of this document all larger ACMs (if encountered) that can readily be separated by the excavators from the Made Ground will be disposed of off-site at a suitably licensed landfill site. This will leave material with a residual asbestos content (nominally with asbestos at a concentration of <0.001%) which will enable safe excavation and re-location and not present a residual risk to human health. This material will be placed to provide a development platform. This Made Ground will all be covered by either a building or hard standing and this will prevent any long term exposure to asbestos once groundworks have been completed.

The locations of the receiving fill will be survey appropriately.

When excavating the Made Ground, material containing, or suspected of containing fragments of ACMs (if encountered) will be segregated at the point of excavation. On excavation materials will be segregated depending on its risk:

- any observed large fragments of asbestos (sheets, pipes, tiles etc) will be removed directly from the excavation and placed in a quarantine area ready for off-site disposal, this is anticipated to be the majority of the asbestos encountered by weight;
- smaller isolated pockets of fibrous asbestos is anticipated which is of a higher risk and covered by additional regulations than cement bound asbestos, this material will be handled and stored separately from the other lower risk types of asbestos;
- the majority of excavated material will be re-used on site directly from the excavation with only limited quantities stockpiled while it is being assessed (while testing and the assessment process is carried out);
- a site investigation has identified the location and quantities of asbestos which will be supplemented during the works with surveys of the stockpiles of granular material to check for the presence and quantity of asbestos materials with particular emphasis on the presence of fibrous materials.

3.2 Future Use of Areas With Buried Asbestos

Any future groundworkers or purchasers of the site must be made aware of the presence and location of the identified ACMs within the CDM Health and Safety File developed by the Principal Contractor upon completion of works, and further detailed in Section 3.4.

3.3 Excess Made Ground Surplus to Requirements

Any Made Ground that has not been intended for use as engineering fill and is not being used as restoration soils may be deemed a waste and may have to be discarded off site. With respect to asbestos, Made Ground with a concentration greater than of 0.1% by weight will be hazardous waste. Any soil that has pieces of ACMs larger than about 15 mm diameter will also be deemed hazardous waste.

3.4 Record Keeping

Daily work records will be maintained by the Principal Contractor and these will be incorporated into a Materials Management Plan Verification Report. The records will include:

- Accurately surveyed drawings showing location and volumes where materials containing trace ACMs is placed;
- Accurately surveyed drawings showing ACMs have been left in situ along the southern boundary;
- Records of testing of ACMs for the presence/absence of Asbestos;
- Records of air monitoring undertaken during the works.

A management plan should be developed and included in the post construction CDM Health and Safety File developed by the CDM-C for the project. This will detail the location where material containing trace ACMs has been placed, and will include all of the above documents. During any future redevelopment works, the records within this file will necessitate the requirement for project specific risk assessments for any works that may potentially disturb the ACMs remaining at the site and ensure compliance with statutory regulations.



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