

CCG-C-25-15523

**PHASE II GEOENVIRONMENTAL REPORT
FOR LAND AT ALFRED KNIGHT HOLDINGS LIMITED,
PEGASUS HOUSE
KINGS DRIVE
KINGS BUSINESS PARK
PRESCOT
KNOWSLEY
L34 1PJ
JULY 2025**

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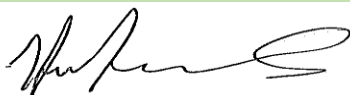
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1.0 INTRODUCTION

CC GEOTECHNICAL LIMITED (CCG) is providing consultancy services to ALFRED H KNIGHT INTERNATIONAL LIMITED (the *Client*) via MERSEY DESIGN GROUP LIMITED (MDG) (the *Consultant*) in connection with the proposed redevelopment of land located within the curtilage of Alfred Knight Holdings Limited, Pegasus House, Kings Drive, Kings Business Park, Prescot, Knowsley L34.

It is understood that the site is to be partially redeveloped by the construction of 2nr lightweight outbuildings (Blocks B and C) comprising:

Block B:

A 9.3m x 3.5m single storey outbuilding for the containment of 1nr x 5200 litre T1 store tank, 1nr x 10000 litre (T13) treated store tank, 1nr x 4000 litre (T3) treatment store tank, 1nr x 1000 litre (T9) store tanks, 1nr filter press, and associated works, with an adjoining carbon container and associated bund

Block C:

A 9.3m x 4.8m single storey outbuilding for the containment of 1nr x 10000 litre (T13) treated storage tank, 1nr x 5200 litre (T1) storage tank, 1nr (T3) treatment tank, 1nr x 1000 litre (T9) sludge tank, 1nr filter press, and associated works, with an adjoining carbon container and associated bund

It is further proposed that a waste compound and storage facility be repositioned within the eastern section of the site.

The proposed site layout and elevations are as illustrated on MDG architectural drawings contained within Appendix A.

The proposed development falls within the administrative jurisdiction of KNOWSLEY METROPOLITAN BOROUGH COUNCIL.

2.0 PREVIOUS STUDIES

The development site was the subject of a combined Phase I Desk Study / Coal Mine Risk Assessment Report, prepared by CCG under report Reference No. CCG-C-25-15364, dated May 2025 which concluded that a Phase II intrusive investigation was required, and made recommendations on the scope of the Phase II investigation.

This report documents the findings of the Phase II investigation.

This report should be read in conjunction with the aforementioned desk study report (CCG-C-25-15364), and with CCG Notes on Limitations, contained in Appendix J.

3.0 PURPOSE & AIMS OF THE PHASE II INTRUSIVE INVESTIGATION

The primary purpose of the Phase II intrusive investigation was to confirm the indications of the desk study with respect to:

- The collation of data on soil and groundwater contamination, as far as they may adversely impact on human and/or environmental receptors
- The collation of data on the properties of the substrata, as far as they relate to the design and construction of foundations, ground slabs, and development infrastructure

4.0 SITE DATA

The site is located within the curtilage of Kings Business Park. It comprises a parcel of commercially developed land located off Kings Drive, Prescot, Knowsley L34 1PJ, as illustrated on CCG Drawing No. CCG-C-25-15523-1 and Aerial Plate No. CCG-C-25-15523-2 contained within Appendix A.

The ORDNANCE SURVEY coordinates for the approximate site centre are 345491 392322.

The overall site is located within a commercial context. The sites for the 2nr proposed tank storage facilities described above are located adjacent to the northwestern and southeastern boundaries of the site for Buildings B and C respectively. The relocated waste compound will be sited adjacent to the northeastern boundary. The proposed layout is as shown on the MDG Location Plan in Appendix A.

The intended location for **Building B** comprises a rectangular shaped parcel of land which is contained within a low-level timber post and rail fence line. Its eastern boundary adjoins a current plant room facility, with a paved estate road extending along its southern boundary. Its

northern boundary adjoins a stand of mature / semi-mature woodland species. The surface topography was seen to be sensibly flat with surface cover comprising mixed perennial grasses. As discussed within the above referenced desk study, 1nr small, rectangular shaped, service cover was observed within the grass sward.

The proposed location for **Building C** comprises a rectangular shaped parcel of land. It is bound to the south and east by a shallow open drainage ditch (c. 1m depth). The site is currently occupied by a series a small outbuildings, one of which was being utilised for the storage of radioactive substances. The surface topography was seen to be sensibly flat with surface cover comprising full hard pavement cover incorporating a series of metal manhole covers within its construction.

The site for the proposed relocated waste compound and storage facility comprises a small, rectangular shaped, parcel of land. it is bound to the west by a hard paved estate road, its remaining boundaries having an open aspect. The surface topography across this site was seen to be generally flat with surface cover comprising mixed perennial grasses with occasional perennial herb species. As discussed within the above referenced desk study report, a series of square shaped service cover were identified within the grass sward.

There was no visual evidence of the presence of native and/or non-native plant species within, or adjoining, the site boundary.

Access to the site is currently proposed from the Kings Drive frontage to the northwest.

4.1 Published Geology

The geology of the site was researched by reference to the 1:50000 scale **BRITISH GEOLOGICAL SURVEY (BGS)** Sheet 097 Runcorn (Solid and Drift Editions: 1977 - 1980).

The **BGS** 1:10, 000 Scale Drift Geological map indicate that the site is underlain with impermeable diamictons (boulder clay) comprising poorly stratified gravel sand silt and clay deposits of glacial origin (Pleistocene Epoch - Late Quaternary - Devensian Sub Age).

The documented solid geology comprises the Pennine Lower Coal Measure Formations (*formerly the Lower Coal Measures Formation*) of the Pennine Coal Measures Group, comprising interbedded grey argillaceous mudstone, siltstone with subordinate pale grey sandstones, and numerous and thicker coal seams in the upper part of the Upper Carboniferous Period (*Westphalian CA: Langsettian Substage*).

The nearest geological line of weakness (i.e. faults, coal seams etc.) lies c. 225m east of the site. its downthrow is to the east.

The study site is located within an area where ancient earth movements have caused significant displacements and misalignments of the underlying and surrounding country rock. Hence, the general dip of the solid geology within the surrounding area varies between c.8° to the south, and c.50° to the west, northwest.

The above referenced desk study report, the 'Indicative Atlas of Radon in England and Wales' (Miles. J.C.H et.al, 2007) Map 13 'Northern Welsh Marches and Liverpool', and the freely available UK Radon Map (www.ukradon.org) shows the site to be situated within an area where less than 1% of the properties within the local area are affected by naturally occurring Radon. Hence, Radon Protection Measures are not required for new structures in contact with the ground.

4.2 Hydrogeology & Hydrology

Information pertaining to hydrogeological and hydrological features of the site may be summarised as follows:

- Artificial made ground deposits, if present, classify as being an Unproductive Aquifer
- The underlying diamictons classify as being an Secondary Undifferentiated Aquifer
- The solid geology (Pennine Lower Coal Measure Formations) is classified as a Secondary A Aquifer
- There are no records pertaining to historical and/or active Ground Water Abstraction Licences within, or within 1km of, the site
- There are records pertaining to the presence of historical an/or active Surface Water Abstraction points within 500m of the site, the nearest being associated with Licence No: 2569028003

- There are no records pertaining to the presence of historical and/or active Portable Water Abstraction points within, or within 1km of, the study site
- The site is not located within a designated Source Protection Zone
- The site is not located within an Environment Agency designated Zone II Flood Plain
- The site is not located within an Environment Agency designated Zone III Flood Plain

5.0 **PRELIMINARY CONCEPTUAL MODEL**

5.1 **Introduction**

The risk assessment methodologies adopted by **CCG** are based on current available guidance from several sources and are included in Appendix I.

A Tier 1 Risk Assessment and Preliminary Conceptual Model (PCM) were formulated using the information collated in the Phase I Desk Study (CCG-C-25-15177) and based on the following assumptions:

- The site is to be partially redeveloped by the construction of 2nr lightweight outbuildings (Blocks B and C) comprising:

Block B:

A 9.3m x 3.5m single storey outbuilding for the containment of 1nr x 5200 litre T1 store tank, 1nr x 10000 litre (T13) treated store tank, 1nr x 4000 litre (T3) treatment store tank, 1nr x 1000 litre (T9) store tanks, 1nr filter press, and associated works, with an adjoining carbon container and associated bund

Block C:

A 9.3m x 4.8m single storey outbuilding for the containment of 1nr x 10000 litre (T13) treated storage tank, 1nr x 5200 litre (T1) storage tank, 1nr (T3) treatment tank, 1nr x 1000 litre (T9) sludge tank, 1nr filter press, and associated works, with an adjoining carbon container and associated bund

It is further proposed that waste compound and storage facility be repositioned within the eastern section of the site.

- Drinking water will be from a mains supply.

In constructing the Preliminary Conceptual Model (PCM), **CCG** applied the guidance contained in Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D: 2008 Volume 1 (*Environment Agency and CIEH*). This recommends use of a Risk Matrix which classifies risk based on the product of Probability of a source being present, and the Consequence of receptors being exposed to the source. Guidance tables setting out the classifications of probability and consequence together with a risk matrix are given in Tables 1 - 3 hereunder. In using this approach **CCG** recommends intrusive investigation of any Risk Classification of “*Moderate*” or above although a precautionary approach is recommended for residential housing developments, irrespective of the Risk Classification.

Table 1: Matrix of consequences against probability to gain a risk classification [CIRIA C552, 2001]

		CONSEQUENCE			
		SEVERE	MEDIUM	MILD	MINOR
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table 2: Classification of Consequence

Classification	Definition	Examples
Severe	Highly elevated concentrations likely to result in “significant harm” to human health as defined by the EPA 1990, Part 2A, if exposure occurs.	Significant harm to humans is defined in circular 01.2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.
	Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a	Major fish kill in surface water from large spillage of contaminants from site.

	potable abstraction point; major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Catastrophic damage to crops, buildings or property.	Highly elevated concentrations of List I and II substances present in groundwater close to small potable abstraction (high sensitivity). Explosion, causing building collapse (can also equate to immediate human health risk of buildings are occupied).
Medium	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Significant damage to crops, buildings or property.	Significant harm to humans is defined in circular 01.2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Damage to buildings rendering it unsafe to occupy e.g. foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.
Mild	Exposure to human health unlikely to lead to "significant harm". Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality; marginal impact on amenity value, agriculture or commerce. Minor or short-lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Minor damage to crops, buildings or property.	Exposure could lead to slight short-term effects (e.g. mild skin rash). Surface spalling of concrete.
Minor	No measurable effect on humans. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	The loss of plants in a landscaping scheme. Discoloration of concrete.

Table 3: Classification of Probability Definitions (C552 CIRIA, 2001)

Classification	Definition	Examples
High Likelihood	There is potential contaminant linkage, and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.	a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden. b) Ground/groundwater contamination could be present from chemical works, containing a number of UST's, having been in operation on the same site for over 50 years.
Likely	There is potential contaminant linkage, and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.	a) Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden or the top 0.5m in a public open space. b) Ground/groundwater contamination could be present from an industrial site, containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.
Low Likelihood	There is potential contaminant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place and is less likely in the shorter term.	a) Elevated concentrations of toxic contaminants are present in soils at depths of >1m in a residential garden or 0.5-1.0m in a public open space. b) Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990's containing a UST in operation over the last 10 years. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.
Unlikely	There is potential contaminant linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.	a) Elevated concentrations of toxic contaminants are present below hardstanding. b) Light industrial units <10 yrs old containing a double-skinned UST with annual integrity testing results available.

Table 4 : Classification Définitions (C552 CIRIA, 2001)

CLASSIFICATION	DEFINITION
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard. Or there is evidence that server 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	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 longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that such harm would be server, or if any harm were to occur it is more likely that harm would be relatively mild. Investigation (if not undertaken already) is normally required to clarify the risk and to determine to potential liability. Some remedial works may be required in the longer term.
Moderate / Low	
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be server.

5.2 Preliminary Conceptual Model

By application of the risk assessment methodology outlined above, the following PCM was constructed.

Table 5: Preliminary Conceptual Model (PCM)

POLLUTANT LINKAGE	SOURCE	PATHWAY	RECEPTOR	PROBABILITY	CONSEQUENCE	RISK RATING
1	Broad spectrum of heavy metals, aggressive pH, hydrocarbons, PAH's in Made Ground associated with the development & redevelopment of the site & adjoining area & historical onsite demolition works etc.	Soil and / or soil dust ingestion Dermal contact	Construction workers Future worker occupants Offsite receptors	Likely	Medium	Moderate
2	Asbestos containing materials (ACM) in made ground soils associated with the development & redevelopment of the site & adjoining areas & historical onsite demolition works etc.	Fibre Inhalation	Construction workers Future worker occupants Offsite receptors	Unlikely	Severe (ACM)	Moderate / Low
3	Inhalation of vapours associated with on-site made ground deposits etc.	Inhalation	Construction workers Future worker occupants Offsite receptors	Unlikely	Medium	Moderate
4	Inhalation of ground gases from onsite or offsite sources i.e., made ground deposits etc.	Inhalation	Future worker occupants / residents	Unlikely	Medium	Moderate
5	pH & Sulphate attack on concrete	Future building	Future building	Likely	Mild	Moderate / Low
6	Organic contamination associated with historical on-site land uses	Direct contact with water mains	Potable water supply	Unlikely	Medium	Moderate
7	Radioactive substances associated with on site storage facilities	Soil and / or soil dust ingestion Dermal contact Inhalation Future building Direct contact with water mains	Construction workers Future worker occupants Offsite receptors Future building Potable water supply	Likely	Medium	Moderate

The contaminants of concern associated with those risks which require intrusive investigation were researched by reference to published industry profiles, and are summarised hereunder:

Table 6: Summary of Contaminants of Concern based on PCM

LINKAGE NO.	METALS	NON-METALS	ORGANICS	GASES	OTHERS
PL1, PL2, PL3, PL5-PL6	Cd, Cr (total & hexavalent), Ni, Cu, Zn, Pb, Hg, Se, Mo, Sb	As, sulphates, sulphides, boron, free cyanide	TPHCWG, PAH's, BTEX, Volatiles (by PID), SOM	-	pH Asbestos
PL4	-	-	-	CH ₄ , CO ₂ , CO, H ₂ S	-
PL1, PL6	-	-	TPHCWG, PAH's, BTEX,	-	-
PL7					
PL1-PL7	Cd, Cr (total), Ni, Cu, Zn, Pb, Hg, Se, Mo, Sb	As, sulphates, sulphides, boron, free cyanide	TPHCWG, BTEX PAH's, Volatiles (by PID), SOM	CH ₄ , CO ₂ , CO, H ₂ S	pH Asbestos

5.3 Summary of Risks

The foregoing analysis identified a 'Low' potential risk to end users, and if present, these could adversely impact on human or environmental receptors. Given the sensitivity of the proposed end use, an intrusive phase of investigation was undertaken to determine whether the postulated pollutant linkages are present on site.

6.0 FIELDWORK

6.1 Introduction

A programme of fieldwork investigation was undertaken in June 2025. The programme comprised:

- The manual excavation and CAT scanning of 4nr borehole service avoidance pits, each extending to 1.2mbngl
- The subsampling of borehole starter pit arisings for soil contamination analyses
- The advancement from the base of the service avoidance pits using light dynamic boring methods with associated *in-situ* testing
- The logging and sampling of borehole arisings for laboratory testing
- Installation of 50mm HDPE plain and slotted well-tube and associated headworks, complete with non-lime pea gravel surround and bentonite seals at each borehole position
- The instigation of a programme of groundwater / gas monitoring comprising 4nr rounds distributed over a 1-month period

The fieldwork was planned in accordance with BSEN 1997-1 (2007) Eurocode 7, BS10175: 2011, BS5930: 1999, and the sampling and monitoring methodologies employed by CCG as presented in Appendix B, as far as they related to the scope of the investigation.

The layout of the proposed intrusive investigation is as annotated on CCG Drawing No. CCG-C-25-15523-3 '*Site Investigation Plan*' contained within Appendix A.

6.2 Borehole Drilling & Monitoring Installations

6.2.1 Light Dynamic Sampling / Cable Percussive Boring

In accordance with the ground investigation plan, 4nr boreholes were sunk using light dynamic sampling methods using a Dando Terrier 2000 rig deploying 100mm casings and associated tools.

Each borehole location was positioned clear of all overhead services and scanned for buried electrical services using CAT cable avoidance scanner before and during hand excavation of a starter pit extending to 1.2mbngl.

Boring tools were decontaminated prior to commencement.

In this method of investigation samples of subsoils are recovered by driving and extracting a series of reducing diameter 1m long steel tubes. Standard penetration test's (SPT's) were undertaken at regular depth increments.

This method of sampling recovers relatively "undisturbed" soil profiles in Perspex tubes, which are used to line the steel tubes. The Perspex tubes were split and carefully logged and subsampled. Subsamples for potential chemical analysis were removed at appropriate positions from the profile and transferred to chilled amber glass jars and vials for laboratory analysis.

The logs of the light dynamic sampling boreholes, annotated with sampling details, and details of standpipe construction, are presented in Appendix C.

6.2.2 Monitoring Installations

Standpipes comprising 50mm diameter HDPE plain and slotted well tube set in bentonite and non-limestone pea gravel surround were installed at 4nr borehole positions. Each standpipe was fitted with a gas valve connector and was protected by a flush cover set in concrete. Details of standpipe installations are provided on the relevant borehole logs in Appendix C and summarised in the tabulation hereunder:

Table 5: Borehole Installation Details

BOREHOLE	DEPTH OF BOREHOLE (mbgl)	DEPTH OF STANDPIPE [mbgl]	RESPONSE ZONE (mbgl)	
			FROM	TO
WS01	1.6	1.6	0.5	1.6
WS02	1.7	1.5	0.5	1.5
WS03	2.0	2.0	0.5	2.0
WS04	1.8	1.8	0.5	1.8

The standpipe installations were periodically monitored for flow rate and composition of ground gas using a Geotechnical Instruments GA 2000 infra-red analyser. The installations were also monitored for standing water levels with an electronic dip meter.

The results of the gas and groundwater monitoring, together with calibration certificates of the instruments used are given in Appendix D.

7.0 OBSERVED STRATIGRAPHY

The stratigraphy of the boreholes was consistent with the documented geology. The succession may be generalised as tabulated hereunder:

Table 6: Observed Stratigraphy

Location	STRATIGRAPHY
WS01	Grassed topsoil overlying made ground deposits comprising grey / brown clayey sands and gravel extending to 1.2mbgl. The sequence thereafter continued in natural drift deposits comprising dense grey / brown sand and gravel, proven to 1.6mbgl. Borehole reported to be dry on completion
WS02	Grassed topsoil overlying made ground deposits comprising grey / brown sands and gravel, locally interbedded with thin reworked clay deposits to 1.55mbgl. The sequence thereafter continued in natural drift deposits comprising dense grey / brown sand and gravel, proven to 1.7mbgl. Borehole reported to be dry on completion
WS03	Made ground deposits comprising grey / brown sand and gravel extending to 1.2mbgl. The sequence thereafter continues in grey / brown weathered mudstone, proven to 2mbgl. Borehole reported to be dry on completion
WS04	Made ground deposits comprising grey, brown reworked clay deposits to 0.8mbgl, overlying grey, brown locally clayey sands and gravel extending to 1.3mbgl. The sequence thereafter continued in grey / brown weathered mudstone, proven to 1.8mbgl. Borehole reported to be dry on completion

There was no visual and/or olfactory evidence of contamination and/or biodegradable materials affecting the underlying deposits at any sampling position.

8.0 GROUNDWATER REGIME

All borehole positions were reported to be dry on completion of works, with all standpipes being reported as dry during the initial round of monitoring.

9.0 LABORATORY TESTING

9.1 Soil Engineering Test

A programme of soil engineering testing was undertaken at a UKAS / MCERTS accredited laboratory associated with **CCG**. The programme comprised:

- Determination of soil moisture content in accordance with BS: 1377: Part 2: 1990
- Determination of Atterberg Limits in accordance with BS: 1377: Part 2: 1990
- Determination of Particle Size Distribution by wet sieve analysis in accordance with BS 1377: Part 2: 1990

The soil classification test results are presented in Appendix E.

9.2 Contamination Analyses

A programme of soil chemical analyses was undertaken at a UKAS / MCERTS accredited laboratory:

- 4nr subsamples of soils were analysed to a broad range of contaminants including metals, non-metals, and speciated PAH's
- 4nr subsamples of soil were analysed for hydrocarbons to the TPHCWG methodology
- 4nr subsamples of were screened for asbestos containing materials (ACM's)
- 4nr subsamples of soil were analysed for the presence of Benzene, Toluene, Ethylbenzene and Xylene (BTEX) compounds
- 4nr subsamples of soil were analysed for the presence of Methyl Tert-Butyl Ether (MBTE) compounds

- In the absence of adequate quantities of perched water, a leachate prepared on soil recovered from 2nr borehole positions were analysed for a broad range of contaminants including metals, non-metals, and speciated PAH's
- Leachates prepared on soil recovered from 2nr borehole positions were analysed for the presence of hydrocarbons to the TPHCWG methodology
- Determination of soil pH and water-soluble sulphate content (4nr)

The soil / soil leachate contamination test results and certificates are presented in Appendix F.

10.0 **ASSESSMENT OF RISKS TO THE BUILT ENVIRONMENT**

10.1 **Specification of Buried Concrete**

The data obtained in the investigations was assessed against the guidance given in BRE Special Digest 1: 2005, as summarised hereunder:

Table 7: Design Chemical Class Based on Soil Data

CONCRETE SPECIFICATION DATA SHEET		
Is the site Brownfield or Greenfield?	Brownfield	
Is the water table static or mobile?	Static	
Highest water-soluble Sulphate results	203mg/l	Design Sulphate Class of
Lowest pH result	7.1	DS-2 Class of AC-1s
Intended Working Life	50 years	Adopt Design Chemical Classification of DC-1

Based on the foregoing assessments, concrete in the ground should be specified to conform to the compositional requirements of Design Chemical Class **DC 1**, as defined in BRE Special Digest 1: 2005.

10.2 **New Water Mains Supply**

The assessment of requirements for new potable water mains within the investigation area was based on the criteria specified in Paper 10/WM/03/21 'Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites' published by UK Water Industry Research (UKWIR) January 2011.

The preliminary findings indicate that the soil concentrations of pertinent hydrocarbon contaminant species are below the permitted threshold concentrations as specified by the UKWIR for the adoption of normal PE water mains and therefore new water mains may be specified as PE type construction. Good practice requires that mains be laid in a remediated alignment comprising of clean granular fill extending to 600mm + pipe diameter and to 300mm below pipe underside.

Pipes should be laid in accordance with BS EN 12201-2 'Plastic piping systems for water supply and for drainage and sewerage under pressure' as stated in UKWIR guidance.

It should be noted that this recommendation is subject to the opinion of the water supplier, and in this instance the local water authority (**UNITED UTILITIES**) must be consulted to confirm that the proposals above accord with their interpretation of current guidance.

10.3 **Assessment of Risk from Ground Gases**

Using the data gathered in the monitoring programme, a gas risk assessment was undertaken in accordance with the ground gas risk assessment methodology (See Appendix I) employed by **CCG**. The ground gas risk assessment methodology conforms to current UK guidance on the assessment of risks posed by ground gases.

The potential sources of gas identified in the desk study were considered as sources of "Low" generation potential, but since the development is of high sensitivity, a programme of monitoring comprising of 4nr rounds distributed over a 1-month period was adopted.

A gas risk assessment was undertaken in accordance with current UK guidelines set out in CIRCA C665 2007 "Assessing Risk Posed by Hazardous Gases to Buildings". The CIRIA risk assessment methodology uses typical maximum soil gas concentrations and worse case borehole flow rates to define a "Characteristic Situation" for the shallow gas regime.

The volumetric gas flow rate used by the risk assessment is termed "Gas Screening Value (GSV)" in the guidance and is defined below.

Table 8: Gas Monitoring Data

Position	WS01	WS02	WS03	WS04
No Monitoring Visits	4	4	4	4
CH ₄ (%)	Nil	Nil	Nil	Nil
CO ₂ (%)	2.0	1.6	0.7	0.6
O ₂ (%)	19.1	19.5	19.9	20.0
H ₂ S (ppm)	Nil	Nil	Nil	Nil
CO (ppm)	Nil	Nil	Nil	Nil
Flow (l/hr)	<0.1	<0.1	<0.1	<0.1
Water Levels (m)	Dry	Dry	Dry	Dry
PID response	0.0	0.0	0.0	0.0
Pressure Range (mb)	1000 - 1007mbar			

After 4nr rounds of monitoring, a Gas Screening Value (GSV) of 0.00020l/hrs is calculated for CO₂, and <0.00001l/hr for CH₄.

Using these GSV values and taking into account the absence of putrescible material and taking into account the underlying low permeability clay soils, the data obtained from 4nr borehole installations are considered a reliable basis of assessment, and the risk to the proposed development may be assessed in line with Situation A as defined in CIRIA C665. On this basis the site complies with Characteristic Situation 1 (CS1), and based on this classification, gas protection measures are not required.

11.0 HUMAN HEALTH RISK ASSESSMENT

11.1 Legislative Background to Contaminated Land Assessment

Current approaches (CLR11- 'Model Procedures for the Management of Land Contamination' and Part IIA of the Environmental Protection Act 1990) to risk assessment of contaminated land suggest the construction of a Preliminary Conceptual Model. The purpose of this model is to define all possible complete pollution linkages, where the requisite source – pathway – target elements are present; these elements being defined as:

- A contaminant (source) is a hazardous substance or agent, present at levels that have the potential to cause harm or damage a receptor
- A pathway is the means by or through which a contaminant meets, or otherwise affects, the receptor
- A receptor (target) is an entity (human being, aquatic environment, flora, and fauna etc) that is vulnerable to the adverse effects of the contaminant

This relationship is termed a “pollution linkage.” It should be recognised that for a health or environmental risk to exist, all three elements of the relationship or linkage must be present, *i.e.*

- If there is no contaminant, or contaminant present at levels below those considered to be harmful or damaging to a receptor, then there can be no adverse effect on a receptor
- If there is no receptor present that can be adversely affected by a contaminant, no harm or damage can arise
- Even where both a contaminant and a receptor are present, no harm or damage will occur if there is no pathway by or through which a linkage between the two can be established

11.2 Risk Assessment Methodologies

The risk assessment methodologies employed by CCG are based on the use of CLEA 1.06 and are detailed in Appendix I.

11.3 Basis of Assessment of Risk to Human Health

The Human Health Risk Assessment was carried out in accordance with the CCG methodology for assessing soil contamination data as contained in Appendix I, and since it is proposed that the site be partially redeveloped for continued commercial land use, the assessment was based on criteria contained in publication LQM/CIEH S4UL's for Human Health Risk Assessment (2015) (CCG Licence No. S4UL3233), applicable to the “Commercial” land use scenario. This document does not provide criteria for Lead, for which the results were compared to the C4SL (2300mg/kg) published by DEFRA SP1010 Development of Category 4 Screening Levels.

11.4 Assessment of Contamination Data

Based on a Soil Organic Matter content of an average 1%, an assessment of the soil data was undertaken as summarised in the tabulations hereunder, and presented on the worksheets in Appendix G.

11.4.1 Assessment of Metal Data

The assessment of the metal data is presented hereunder:

Table 9: Assessment of Metal Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Cadmium	190	<0.2		
Chromium	8600	32		
Copper	68000	26		
Lead	2300	26		
Mercury	58	<0.03		
Nickel	980	33		
Zinc	730000	76		

The above assessment confirms that no contaminant exceeds its respective guideline criterion. Hence, no risk to human health is indicated.

11.4.2 Assessment of Non-Metal Data

The assessment of the non-metal data is presented hereunder:

Table 10: Assessment of Non-Metal Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Arsenic	640	9.8		
Selenium	12000	1.6		
Cyanide	120	<1.0		

The above assessment confirms that no contaminant exceeds its respective guideline criterion. Hence, no risk to human health is indicated.

11.4.3 Assessment of PAH Data

The assessment of the non-metal data is presented hereunder:

Table 11: Assessment of PAH Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Naphthalene	190	0.08		
Acenaphthylene	83000	<0.05		
Acenaphthene	84000	0.07		
Fluorene	63000	<0.05		
Phenanthrene	22000	0.39		
Anthracene	520000	0.06		
Fluoranthene	23000	0.59		
Pyrene	54000	0.59		
Benz(a)anthracene	170	0.26		
Chrysene	350	0.3		
Benzo(b)fluoranthene	44	0.39		
Benzo(k)fluoranthene	1200	0.16		
Benzo(a)pyrene	35	0.35		
Indeno(123-cd)pyrene	500	0.17		
Dibenz(ah)anthracene	3.5	<0.05		
Benzo(ghi)perylene	3900	0.24		

The above assessment confirms that no contaminant exceeds its respective guideline criterion. Hence, no risk to human health is indicated.

11.4.4 Assessment of Petroleum Hydrocarbon Data

The assessment of the Petroleum Hydrocarbon (TPH) data is presented hereunder:

Table 12: Assessment of Hydrocarbon Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Aromatic EC5-EC7	26000	<0.010		
Aromatic EC7-EC8	56000	<0.010		
Aromatic EC8-EC10	3500	<0.020		
Aromatic EC10-EC12	16000	<1.0		
Aromatic EC12-EC16	36000	<2.0		
Aromatic EC16-EC21	28000	<10		
Aromatic EC21-EC35	28000	21		
Aliphatic EC5-EC6	3200	<0.010		
Aliphatic EC6-EC8	7800	<0.010		
Aliphatic EC8-EC10	2000	<0.010		
Aliphatic EC10-EC12	9700	<1.0		
Aliphatic EC12-EC16	59000	<2.0		
Aliphatic EC16-EC35	1600000	<8.0		

The above assessment confirms that no contaminant exceeds its respective guideline criterion. Hence, no risk to human health is indicated.

11.4.5 Assessment of Asbestos Data

Asbestos containing materials were not detected in any sample analysed. Hence no risk to human health is indicated.

11.4.6 Assessment of BTEX / MTBE Data

The appended laboratory contamination results confirm that all BTEX / MTBE compounds are below their respective soil guideline criteria and therefore no risk to human health is indicated.

11.4.7 Summary of Human Health Assessment

The above human health risk assessment confirms that no soil contaminant exceeds its respective soil guideline criteria for commercial land use. Hence no risk to human health is indicated.

Notwithstanding the above assessment, it is recommended that all new areas of soft landscaping receive as a minimum 300mm of clean imported topsoil to assist plant establishment. It is further recommended that all imported topsoil be placed under a strict validation regime comprising 1nr analyses per 50m³, with a minimum of 4nr analyses per material source.

In addition to the above, contractors are advised that disturbance of the ground may uncover unanticipated features which may give rise to considerations of contamination as far as the exposed conditions may have the potential to impact on receptors including *inter alia* humans, animals, controlled waters, and/or the fabric of buildings. Any such encounters will require the contractor to halt work, isolate the risk area, and summon **CCG** to site to determine the nature of the exposure and to determine an appropriate course of action. Any such incidents will be fully documented in a detailed site Remediation Report.

12.0 CONTROLLED WATERS RISK ASSESSMENT

12.1 Assessment of Soil Leachate Metals, Non-Metals & Polycyclic Aromatic Hydrocarbon (PAH) Data

In the absence of adequate quantities of perched water, leachates prepared on soils recovered from 1nr borehole position were analysed for a broad range of contaminants including metals, non-metals, speciated PAH and TPH concentrations. The results were assessed against Environmental Quality Standards (AA-EQS) for freshwater as shown hereunder.

Table 13: Assessment of Soil Leachate Data

Contaminant	WS01 Result (ug/l)	WS04 Result (ug/l)	AA-EQS (ug/l)
Naphthalene	<0.01	<0.01	2.4
Acenaphthylene	<0.01	<0.01	-
Fluorene	<0.01	<0.01	-
Phenanthrene	<0.01	<0.01	-
Anthracene	<0.01	<0.01	-
Fluoranthene	<0.01	<0.01	0.1
Pyrene	<0.01	<0.01	-
Benzo[a]anthracene	<0.01	<0.01	0.05
Chrysene	<0.01	<0.01	-

Benzo[b]fluoranthene	<0.01	<0.01	0.03
Benzo[k]fluoranthene	<0.01	<0.01	0.03
Benzo[a]pyrene	<0.01	<0.01	0.05
Indeno(123-cd)pyrene	<0.01	<0.01	0.02
Benzo(ghi)perylene	<0.01	<0.01	0.02
Arsenic	4.4	<1.0	25
Boron	23	21	1000
Cadmium	<0.08	<0.08	5
Copper	15	4.2	40
Lead	8.8	3.6	20
Mercury	<0.5	<0.5	1
Nickel	2.7	0.9	150
Selenium	<4.0	<4.0	-
Cyanide	<1	<1	-
pH	8	7.6	-
Sulphate	4.17	4.47	400000

The above assessment confirms that no contaminant exceeds its respective AA-EQS guideline criteria. Hence no risk to controlled waters is indicated.

12.2 Assessment of Soil Leachate Hydrocarbon Data

Speciated hydrocarbon results were assessed by comparison with AA-EQS values for inland waters. In case of determinants not covered by AA-EQS values, results were compared to EQS Freshwater Criteria values or where no EQS Freshwater Criterion is available, then WHO guidelines for Drinking Water are adopted.

Table 14: Assessment of Soil Leachate Hydrocarbon Data

Contaminant	WS01 Result (ug/l)	WS04 Result (ug/l)	AA-EQS (ug/l)	WHO ug/l
Aromatic EC5-EC7 (benzene)	<1.0	<1.0	-	10
Aromatic EC7-EC8 (toluene)	<1.0	<1.0	-	700
Aromatic EC8-EC10 (ethyl benzene)	<1.0	<1.0	-	300
Aromatic EC10-EC12	<10	<10	-	100
Aromatic EC12-EC16	<10	<10	-	100
Aromatic EC16-EC21	<10	<10	-	90
Aromatic EC21-EC35	<10	<10	-	90
Aliphatic EC5-EC6	<1.0	<1.0	-	15000
Aliphatic EC6-EC8	<1.0	<1.0	-	15000
Aliphatic EC8-EC10	<1.0	<1.0	-	300
Aliphatic EC10-EC12	<10	<10	-	300
Aliphatic EC12-EC16	<10	<10	-	300
Aliphatic EC16-EC21	<10	<10	-	(300)*
Aliphatic EC21-EC35	<10	<10	-	(300)*

The above assessment confirms that all contaminants are below their respective AA-EQS – WHO acceptance criteria. Hence no risk to controlled waters and/or human health is indicated.

12.3 Assessment of Soil Leachate BTEX / MBTE Data

All BTEX / MTBE compounds are reported to be below their respective limit of detection. Hence no risk to controlled waters and/or human health is indicated.

12.4 Summary of Controlled Waters Risk Assessment

The above controlled waters assessment confirms that no contaminant exceeds its respective AA-EQS and/or WHO guideline criteria. Hence no risk to controlled waters and/or human health is indicated.

13.0 POST INVESTIGATION CONCEPTUAL MODEL

Based on the findings of the investigation, a post investigation conceptual model may be constructed illustrating proven pollution linkages and summarising the conceptual remediation recommendations discussed above, as tabulated hereunder.

Table 15: Post Investigation Conceptual Model

Source	Pathway	Receptor	Remedial Options
No contaminant exceeds its respective soil guideline criteria. Hence no risk to human health is indicated.	-	-	Notwithstanding the above assessment, it is recommended that all new areas of soft landscaping receive as a minimum 300mm of clean imported topsoil to assist plant establishment. It is further recommended that all imported topsoil be placed under a strict validation regime comprising 1nr analyses per 50m³, with a minimum of 4nr analyses per material source. In addition to the above, contractors are advised that disturbance of the ground may uncover unanticipated features which may give rise to considerations of contamination as far as the exposed conditions may have the potential to impact on receptors including inter alia humans, animals, controlled waters, and/or the fabric of buildings. Any such encounters will require the contractor to halt work, isolate the risk area, and summon CCG to site to determine the nature of the exposure and to determine an appropriate course of action. Any such incidents will be fully documented in a detailed site Remediation Report.

14.0 PRELIMINARY WASTE CLASSIFICATION

A waste classification exercise was undertaken in relation to potential offsite disposal of excavation arisings. The first stage entailed the assessment of the basic soil contamination data via the **HAZWASTE** online program. The output data from this basic assessment is provided in Appendix H. This program generates the baseline '*Hazardous / Non-Hazardous*' classification of soils.

The appended **HAZWASTE** Report classifies all soils analysed as being '*Non-Hazardous*' and therefore soils generated for off-site purposes may be disposed at a suitably licenced '*Non-Hazardous*' waste landfill facility.

It should be noted that the final decision on waste classification is at the discretion of the accepting landfill, and it is recommended that consultation with landfill operators be undertaken during the development of the waste management plan.

15.0 GEOTECHNICAL ASSESSMENT

15.1 Introduction

This site investigation confirms the ground conditions prevailing at Block B (boreholes WS01 – WS02) to comprise grassed topsoil overlying made ground deposits generally comprising locally clayey sands and gravel extending to depths varying between 1.2m > 1.55mbgl. The sequence thereafter continues in natural drift deposits comprising dense sands and gravel, proven to 1.7mbgl.

At Block C (boreholes WS03 – WS04), the ground conditions encountered comprised made ground deposits consisting of grey / brown sands and gravel, locally overlain with reworked clay deposits to 1.2m – 1.3mbgl before continuing in grey weathered mudstone, proven to 2mbgl.

All exploratory sampling positions were reported to be dry on completion of fieldworks.

There was no visual and/or olfactory evidence of contamination and/or biodegradable materials affecting the underlying deposits at any sampling position.

15.2 Foundations

Taking into account the above observations, and given the loads imposed, each of the proposed outbuildings (Blocks B / C) may be founded on pseudo-raft foundations which incorporate thickened reinforced edge beams and internal thickenings under loaded walls off which structural brick/block work may be constructed. Each raft slab should be designed to span a 2m void, and cantilever 1.5m at corners. Stress under edge beams and internal thickenings should be limited to 80kN/m².

The formation under each raft slab should be thoroughly prepared as follows:

- The reduction in site levels to at least 300mm below raft underside, ensuring all organic soils are removed
- Thorough compaction at reduced level under walking supervision, with all soft spots exhibiting excessive deflection under rolling being grubbed out and refilled in thoroughly compacted layers of DTp Type 1, not exceeding 150mm
- Placement of a suitable geotextile fabric such as '*Terram 1000*' or similar, or geogrid matting such as '*Tensar InterAx (NX)*', or similar, at reduced dig levels

- Placement of well graded durable hard-core formation placed and compacted in 150mm compacted layers to an overall minimum thickness of 300mm such that the formation level is at the underside of the raft

As an alternative to the above, strip (spread) foundations may be adopted, with foundations being constructed on the underlying natural drift deposits and weathered mudstone formations. Foundations set at a notional depth of 1.3mbgl may be designed on a Presumed Bearing Value of 120kN/m².

It is important that all foundation excavations be inspected by a competent ground engineer to ensure that the predicted ground conditions have been encountered.

Strip foundations should be not less than 300mm thick and be formed in C35 concrete.

Should strip foundations be the preferred foundation solution, then ground bearing slabs may be adopted with each slab being constructed on ground thoroughly prepared as discussed above.

15.4 Excavations

Excavations in the observed made ground and natural drift soils may be undertaken by light hydraulic excavators.

Excavations in excess of 1.2mbgl will require side support.

15.5 Groundwater Management

All exploratory sampling positions were reported to be dry on completion of fieldworks.

Notwithstanding the above observations a prudent contractor would allow for pumping to maintain dry working conditions during foundation construction and/or service installations, particularly during periods of heavy / prolonged periods of precipitation.

16.0 SUMMARY CONCLUSIONS

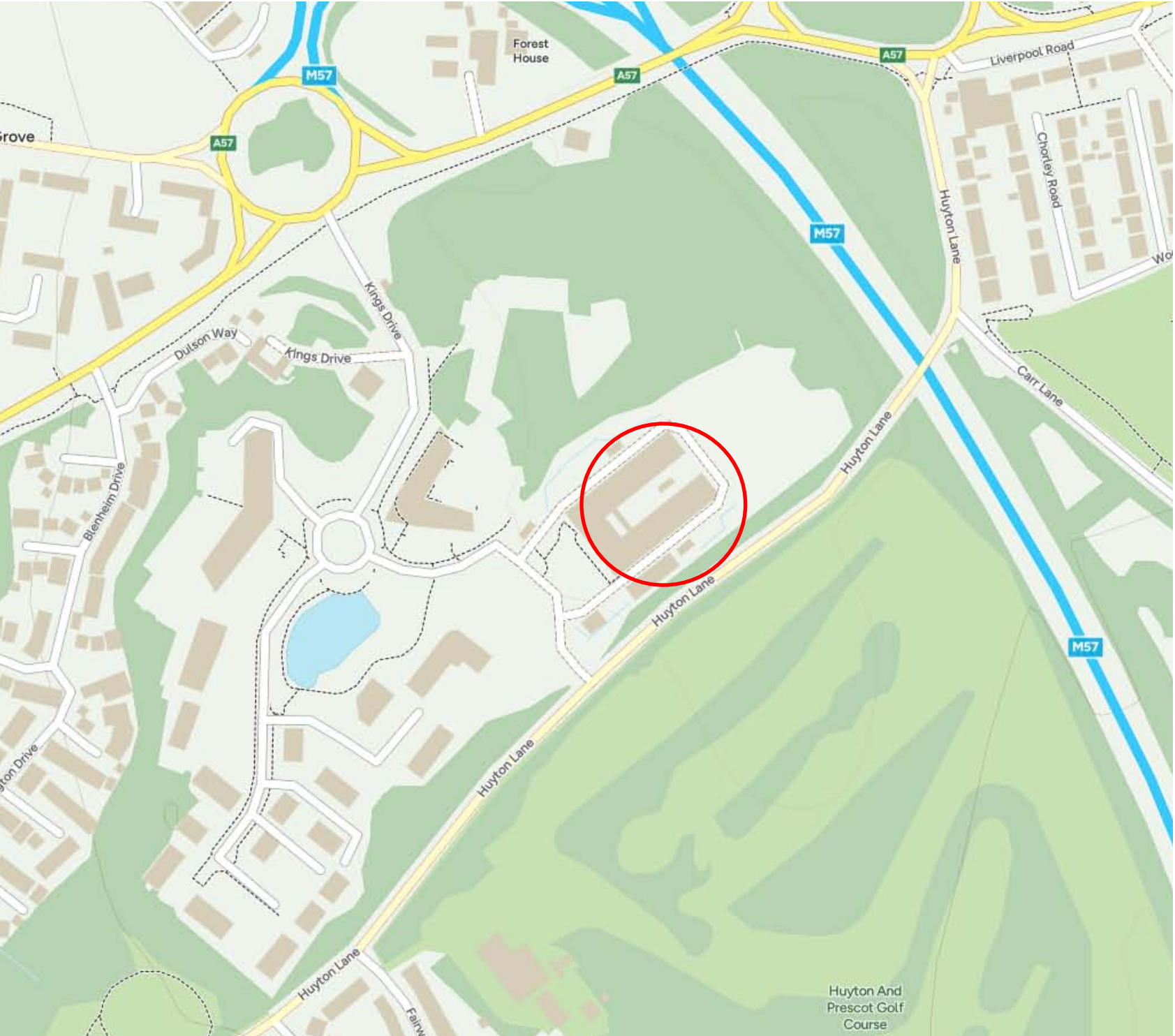
The recommendations hereunder are based on the salient sections of the report and should not be referred to in isolation of the relevant sections of the report. All recommendations are subject to Regulatory Local Authority review.

Table 17: Summary of Conclusions

Soil Contamination & Remediation	No contaminant exceeds its respective soil guideline criteria. Hence no risk to human health is indicated.
	Notwithstanding the above assessment, it is recommended that all new areas of soft landscaping receive as a minimum 300mm of clean imported topsoil to assist plant establishment. It is further recommended that all imported topsoil be placed under a strict validation regime comprising 1nr analyses per 50m ³ , with a minimum of 4nr analyses per material source.
	Where made ground deposits remain at the reduced dig level, then it is recommended that a suitable woven geotextile fabric, such as 'Terram 1000', or similar be placed at the interface of the imported topsoil / in-situ made ground deposits.
Controlled Waters	In addition to the above, contractors are advised that disturbance of the ground may uncover unanticipated features which may give rise to considerations of contamination as far as the exposed conditions may have the potential to impact on receptors including inter alia humans, animals, controlled waters, and/or the fabric of buildings. Any such encounters will require the contractor to halt work, isolate the risk area, and summon CCG to site to determine the nature of the exposure and to determine an appropriate course of action. Any such incidents will be fully documented in a detailed site Remediation Report.
	The above controlled waters assessment confirms that no contaminant exceeds its respective AA-EQS and/or WHO guideline criteria. Hence no risk to controlled water and/or human health is indicated.
Water Mains	The preliminary findings indicate that the soil concentrations of pertinent hydrocarbon contaminant species are below the permitted threshold concentrations as specified by the UKWIR for the adoption of normal PE water mains and therefore new water mains may be specified as PE type construction. Good practice requires that mains be laid in a remediated alignment comprising of clean granular fill extending to 600mm + pipe diameter and to 300mm below pipe underside.
	Pipes should be laid in accordance with BS EN 12201-2 'Plastic piping systems for water supply and for drainage and sewerage under pressure' as stated in UKWIR guidance.
Preliminary Waste Classification	It should be noted that this recommendation is subject to the opinion of the water supplier, and in this instance the local water authority (UNITED UTILITIES) must be consulted to confirm that the proposals above accord with their interpretation of current guidance.
	A waste classification exercise was undertaken in relation to potential offsite disposal of excavation arisings. The first stage entailed the assessment of the basic soil contamination data via the Hazwaste online program. The output data from this basic assessment is provided in Appendix H. This program generates the baseline 'Hazardous / Non-Hazardous' classification of soils.
	The appended Hazwaste Report classifies all soils analysed as being 'Non-Hazardous' and therefore soils generated for off-

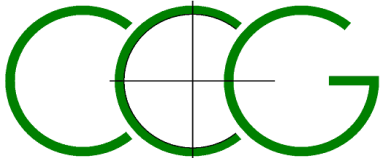
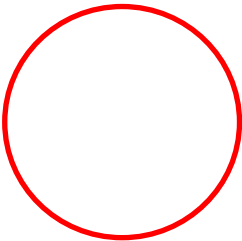
Concrete specification	site purposes may be disposed at a suitably licenced 'Non-Hazardous' waste landfill facility.
	It should be noted that the final decision on waste classification is at the discretion of the accepting landfill, and it is recommended that consultation with landfill operators be undertaken during the development of the waste management plan.
	Concrete in the ground should be specified to conform to the compositional requirements of DC-1 as defined in BRE Special Digest 1: 2005
Gas Risk Assessment	After 4nr rounds of monitoring, a Gas Screening Value (GSV) of 0.00020l/hrs is calculated for CO ₂ , and <0.00001/hr for CH ₄ .
	Using these GSV values and taking into account the absence of putrescible material and taking into account the underlying low permeability clay soils, the data obtained from 4nr borehole installations are considered a reliable basis of assessment, and the risk to the proposed development may be assessed in line with Situation A as defined in CIRIA C665. On this basis the site complies with Characteristic Situation 1 (CS1), and based on this classification, gas protection measures are not required.
Foundation Design	See Section 15.0 for fuller discussion
Floor Slabs	See Section 15.0 for fuller discussion
Groundwater Control	All exploratory sampling positions were reported to be dry on completion of fieldworks.
	Notwithstanding the above observations a prudent contractor would allow for pumping to maintain dry working conditions during foundation construction and/or service installations, particularly during periods of heavy / prolonged periods of precipitation.
Excavations	Excavations in the observed made ground and natural drift soils may be undertaken by light hydraulic excavators.
	Excavations in excess of 1.2mbgl will require side support.
Further work	• Complete the ongoing gas – groundwater monitoring programme • Update gas risk assessment • Prepare Phase III Remediation Strategy Report • Prepare Phase IV Validation Report

APPENDIX A: DRAWINGS



DO NOT SCALE

Notes: Study Site



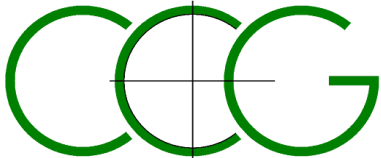
CC GEOTECHNICAL LIMITED
UNIT 1 DELTIC WAY
KNOWSLEY INDUSTRIAL ESTATE
LIVERPOOL
L33 7BA
0151 545 2750

Client: MDG	
Project: Kings Drive, Kings Business Park, Prescot, Knowsley L34	
Title: Site Location	
Scale: NTS	Issue: 01
Drawn by: DG	Date: June 2025
Project No. CCG-C-25-15523	Drawing No. 01



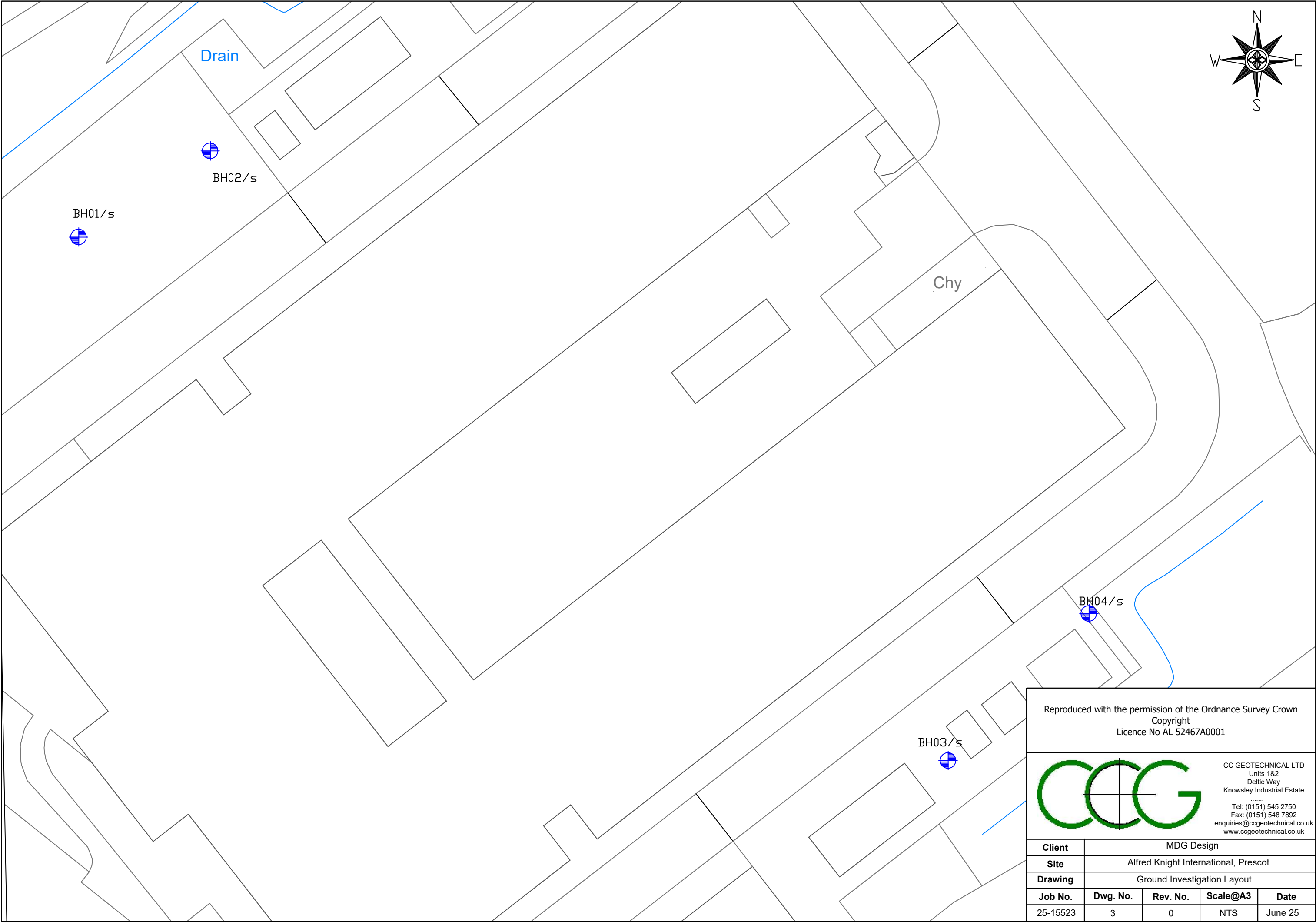
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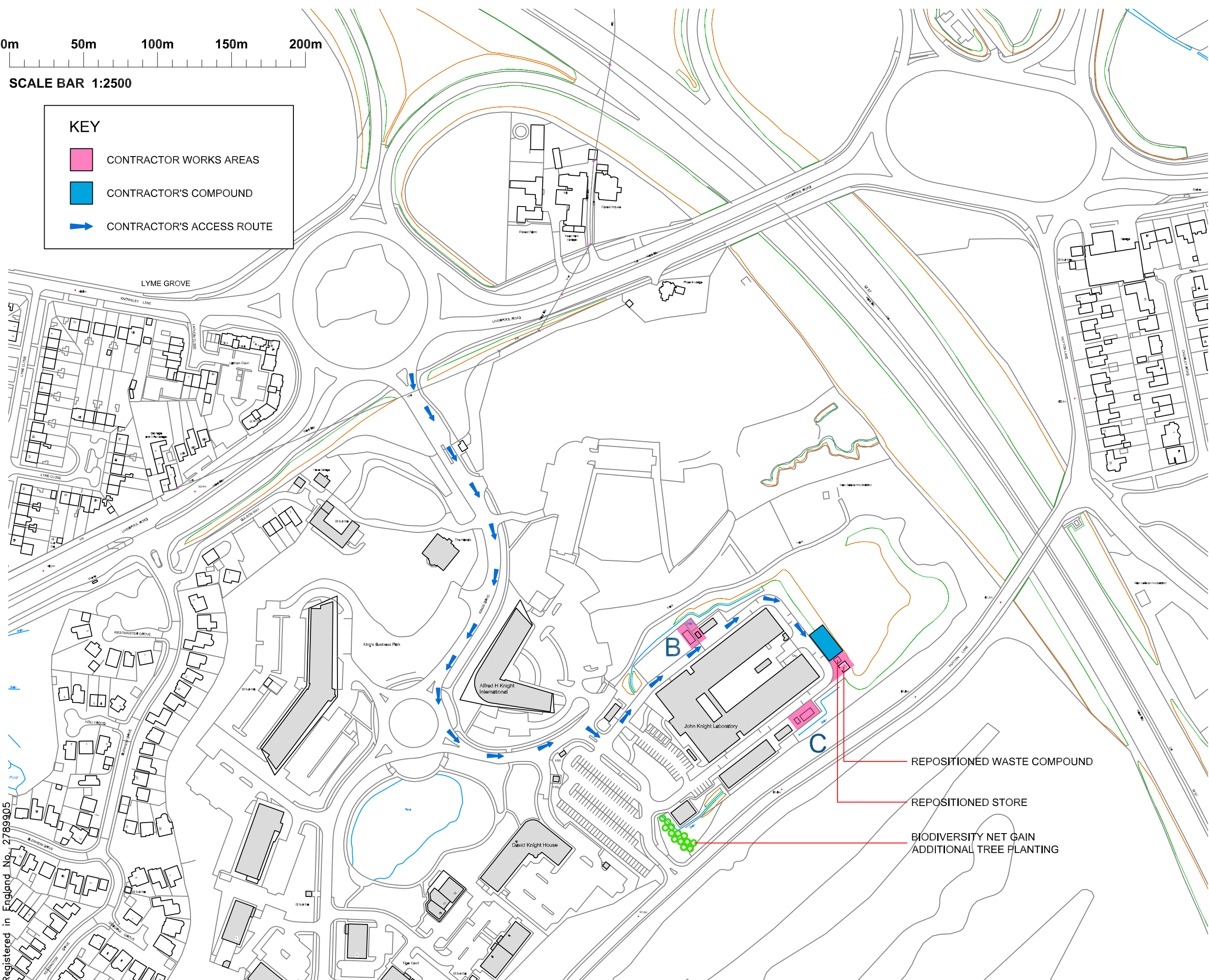
Notes: Study Site



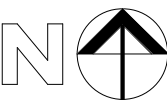
CC GEOTECHNICAL LIMITED
UNIT 1 DELTIC WAY
KNOWSLEY INDUSTRIAL ESTATE
LIVERPOOL
L33 7BA
0151 545 2750

Client: MDG	
Project: Kings Drive, Kings Business Park, Prescott, Knowsley L34	
Title: Aerial Photograph	
Scale: NTS	Issue: 01
Drawn by: DG	Date: June 2025
Project No. CCG-C-25-15523	Drawing No. 02





Use only labelled dimensions and levels for construction. All dimensions & levels to be checked on site before commencing work and any discrepancies to be notified to C.A. immediately. If in doubt ask ?



D	Redrawn at 1:2500 scale. Contractor access route, works areas & compound added.	AW	05/12/24
C	Site boundary changes for planning validation	CM	24/10/24
B	BNG tree planting added+waste compound relocated	CM	12/09/24
A	Building B rotated 90°	CM	05/08/24
rev	comments	initials	date

architects
interior designers
strategy planners
quantity surveyors
principal designers

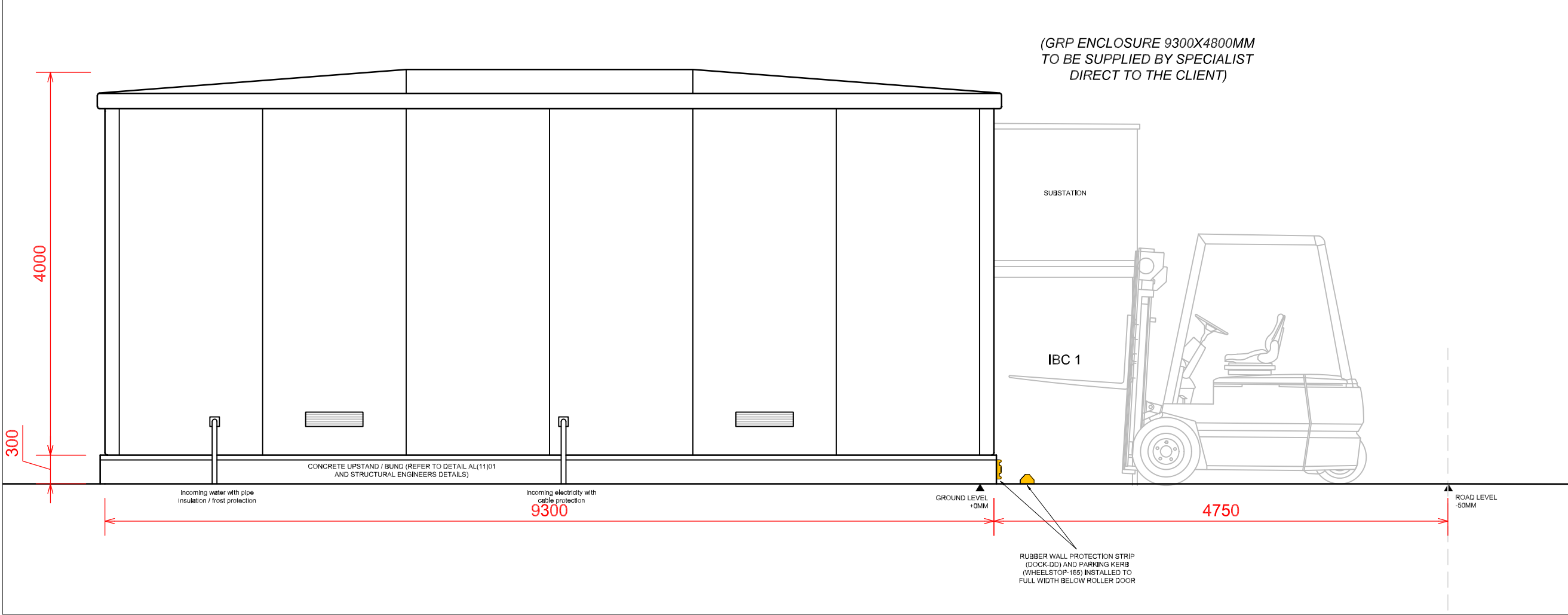
Mersey Design Group Ltd
Cleveland House
41 Shaw Street
Liverpool L6 1HL

telephone: 0151 207 9431
facsimile: 0151 207 9447
e-mail: info@mdg.design
web: www.mdg.design

client	Alfred H Knight International Ltd
project	Lab Effluent Project Kings Business Park, Kings Drive Prescot. L34 1PJ
content	Location Plan

scale 1:2500	sheet A3	date June 2024	drawn by CM	checked
project number 308-04	drawing number AL(9)03			rev D
purpose of issue	Tender			

BUILDING B FRONT ELEVATION B-1 1:50 (BELOW)



Use only labelled dimensions and levels for construction. All dimensions & levels to be checked on site before commencing work and any discrepancies to be notified to C.A. immediately. If in doubt ask ?



E	Minor amendments and notes for tender issue.	CM	12/12/24
D	Minor amendments and notes for tender issue.	AW	06/12/24
C	ground / finished floor level changes	CM	07/11/24
B	external carbon contained heightened to 1850mm	CM	13/08/24
A	to show Building B elevations and roof plan only	CM	05/08/24
rev	comments	initials	date



architects Mersey Design Group
interior designers Ltd
strategy planners Cleveland House
quantity surveyors 41 Shaw Street
principal designers Liverpool L6 1HL

telephone: 0151 207 9431
facsimile: 0151 207 9447
e-mail: info@mdg.design
web: www.mdg.design

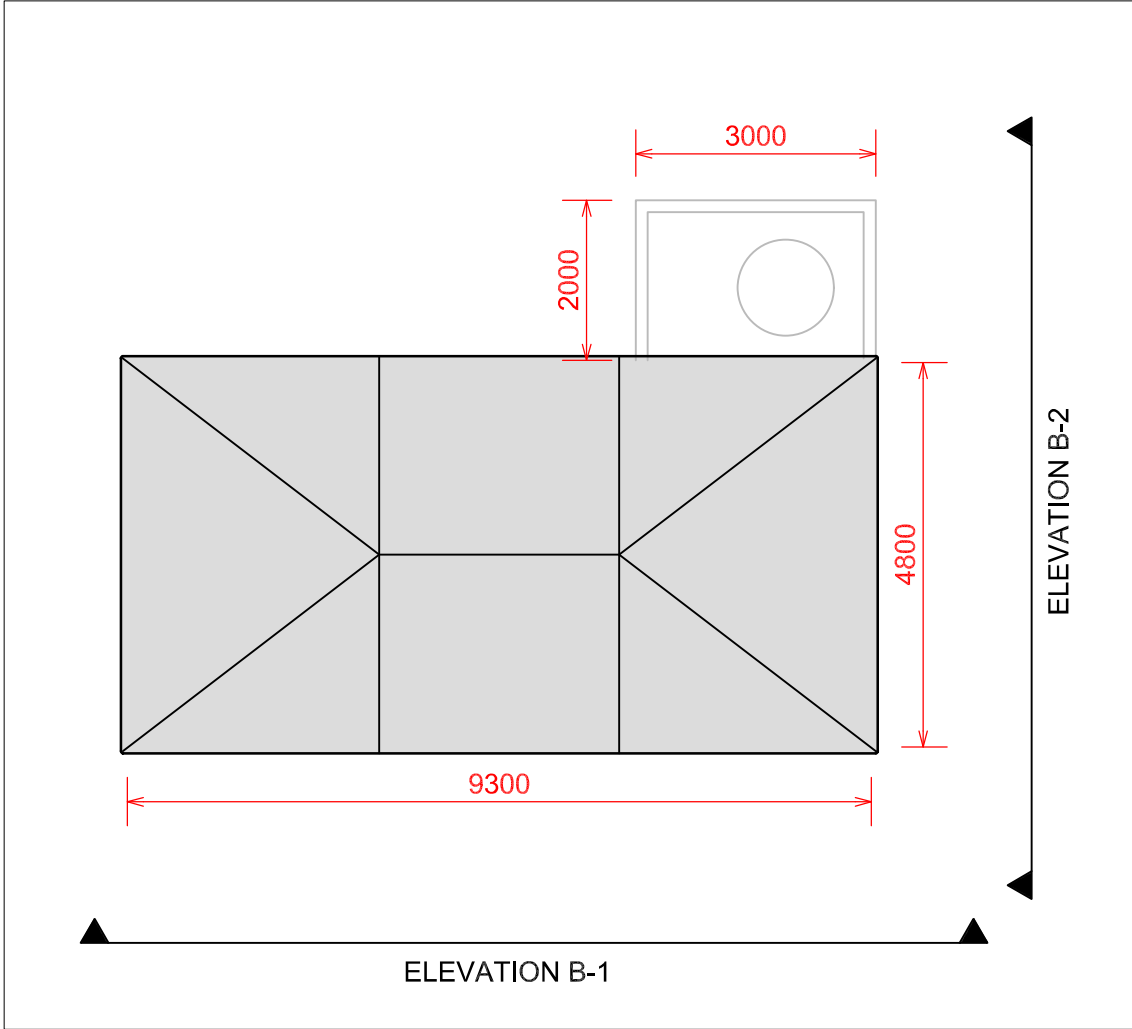
client
Alfred H Knight International Ltd

project
Lab Effluent Project
Kings Business Park, Kings Drive
Prescot. L34 1PJ

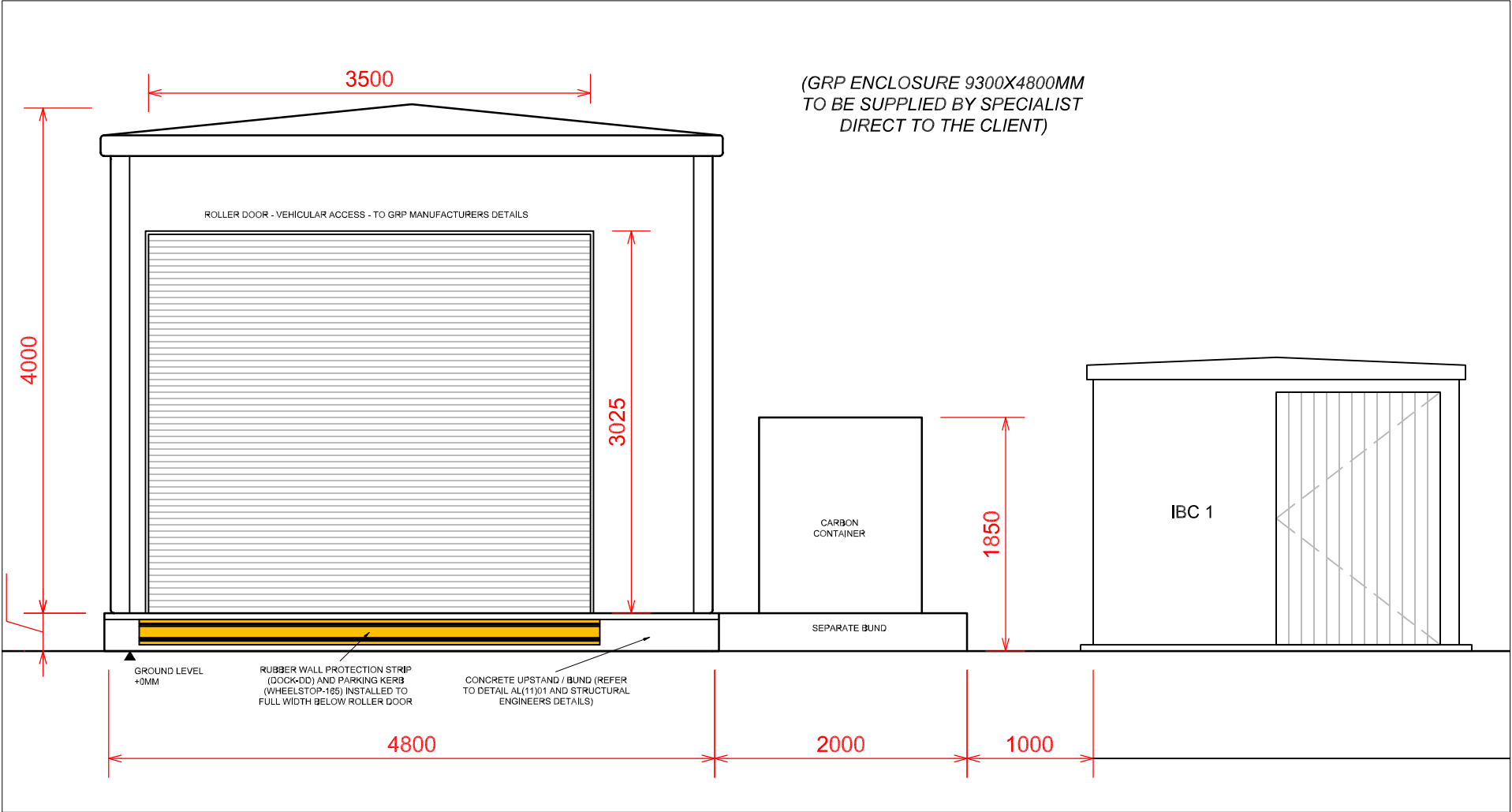
content
Elevations & Roof Plan
Building B

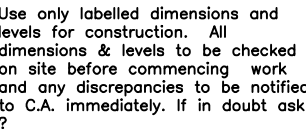
scale	1:50	sheet	A3	date	July 2024	drawn by	AW	checked	
project number	308-04	drawing number	AL(2)03	rev					E
purpose of issue	Tender								

BUILDING B ROOF PLAN 1:100 (BELOW)



BUILDING B SIDE ELEVATION B-2 1:50 (BELOW)





E	Minor notes and amendments for tender issue.	AW	06/12/24
D	shower added, incoming services added	CM	12/11/24
C	ground / ffi changes requiring external ramp	CM	07/11/24
B	personnel access door relocated	CM	13/08/24
A	15' ramp omitted, building rotated 90°	CM	05/08/24
rev	comments		initials date

mdg 

architects Mersey Design Group telephone: 0151 207 9431
interior designers Ltd facsimile: 0151 207 9447
strategy planners Cleveland House e-mail: info@mdg.design
quantity surveyors 41 Shaw Street web: www.mdg.design
principal designers Liverpool L6 1HL

client

Alfred H Knight International Ltd

project
Lab Effluent Project
Kings Business Park, Kings Drive
Prescot. L34 1PJ

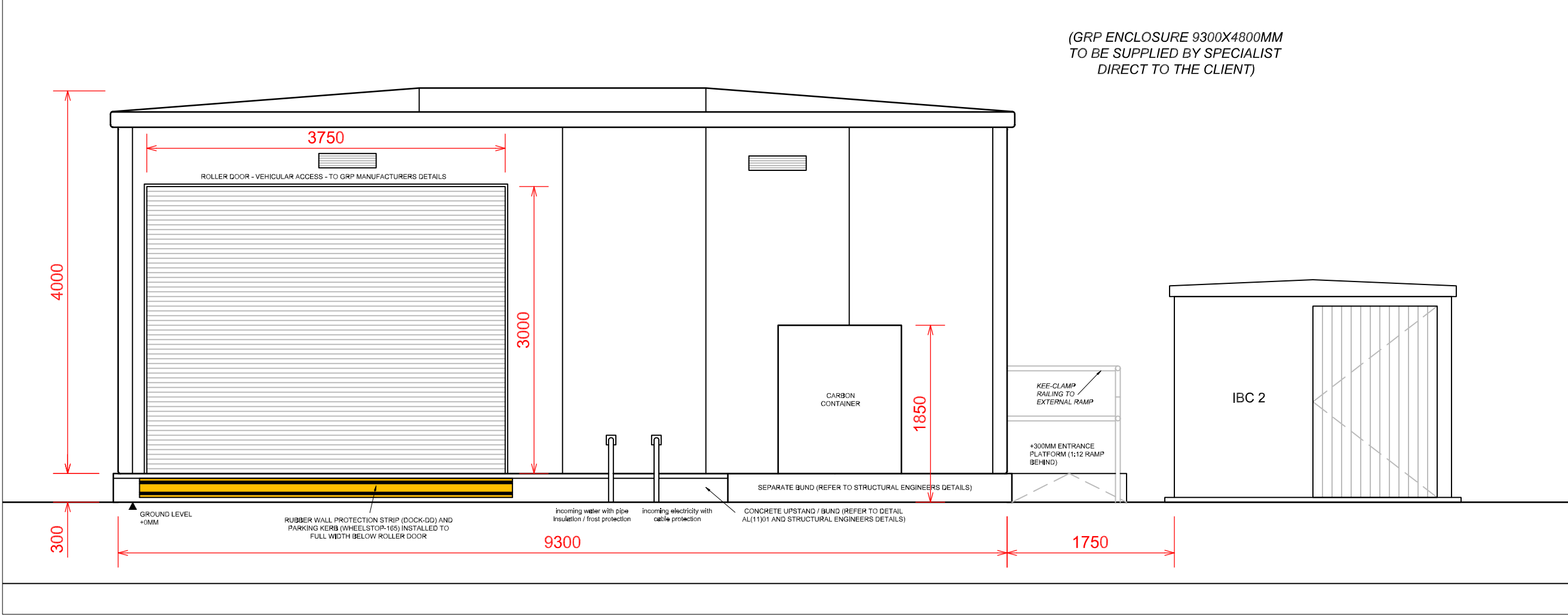
content

Proposed Ground Plan
Building B

scale 1:50	sheet A3	date 30/07/24	drawn by AW	checked
project number 308-04	drawing number AL(2)01	rev E		

Tender

BUILDING C FRONT ELEVATION B-1 1:50 (BELOW)



Use only labelled dimensions and levels for construction. All dimensions & levels to be checked on site before commencing work and any discrepancies to be notified to C.A. immediately. If in doubt ask ?



E	Minor amendments and notes for tender issue.	CM	12/12/24
D	Minor amendments and notes for tender issue.	AW	06/12/24
C	ground / finished floor level changes	CM	07/11/24
B	external carbon contained heightened to 1850mm	CM	13/08/24
A	to show Building C elevations and roof plan only	CM	05/08/24
rev	comments	initials	date



architects Mersey Design Group Ltd
interior designers Cleveland House
strategy planners 41 Shaw Street
quantity surveyors Liverpool L6 1HL
principal designers

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web: www.mdg.design

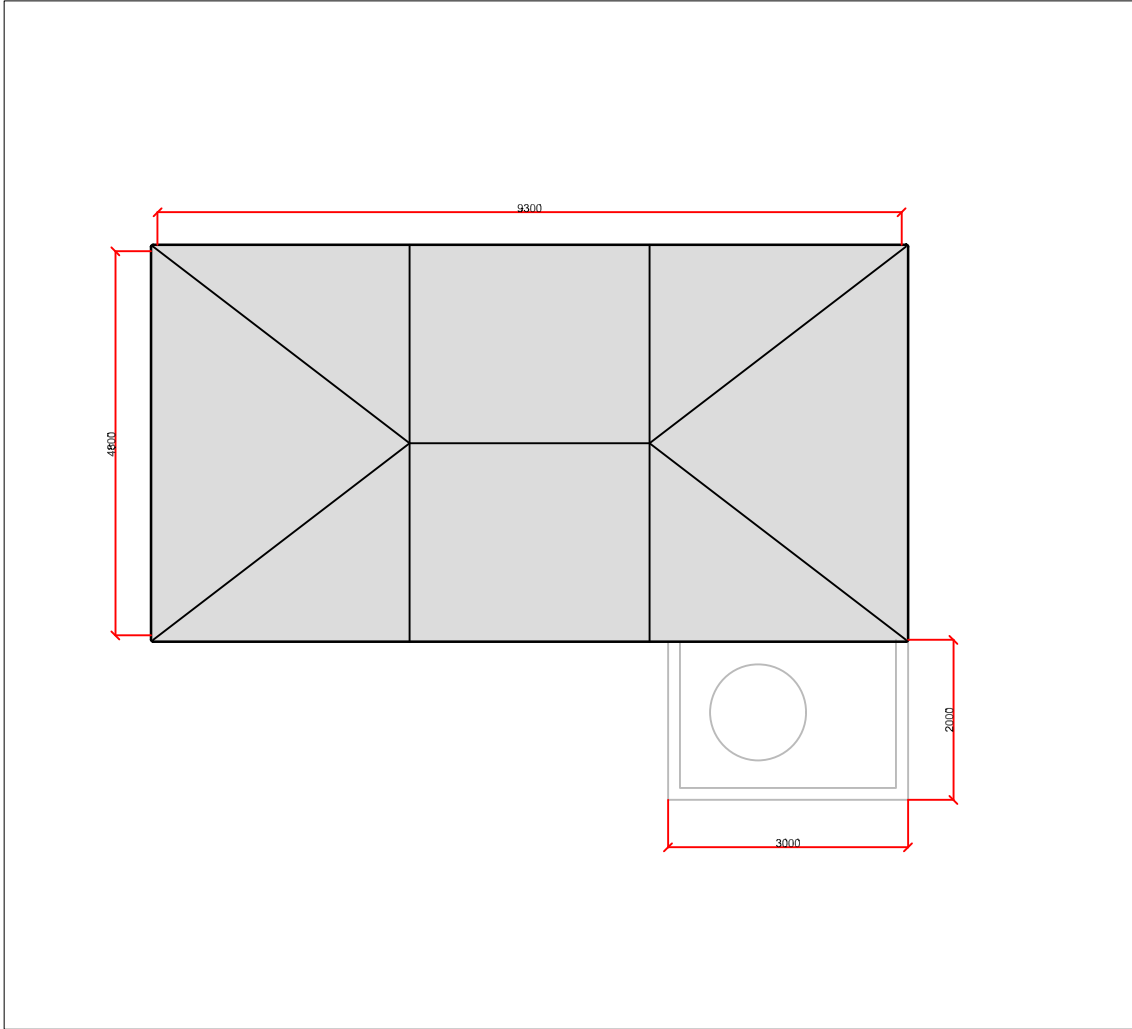
client
Alfred H Knight International Ltd

project
Lab Effluent Project
Kings Business Park, Kings Drive
Prescot. L34 1PJ

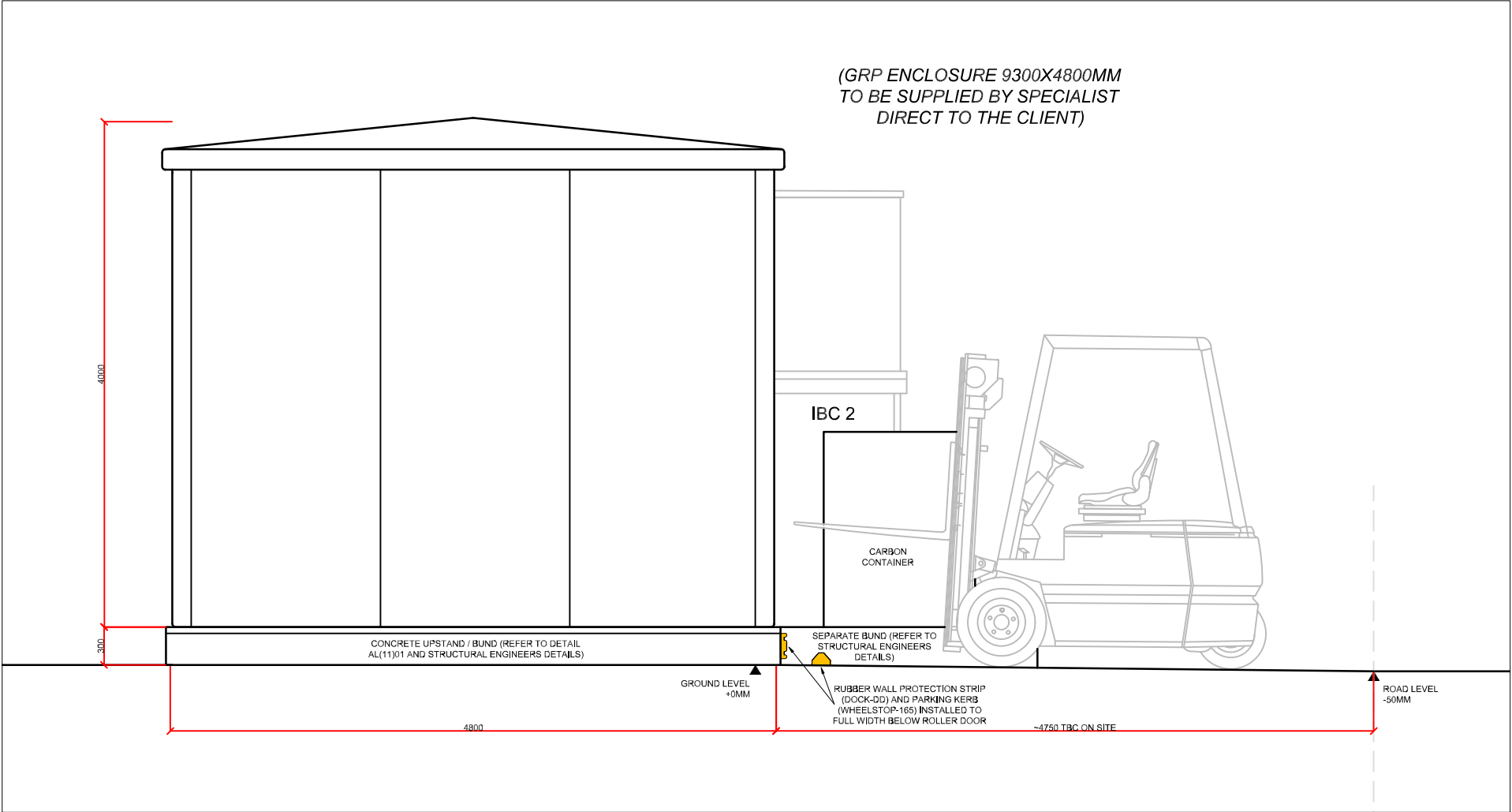
content
Elevations & Roof Plan
Building C

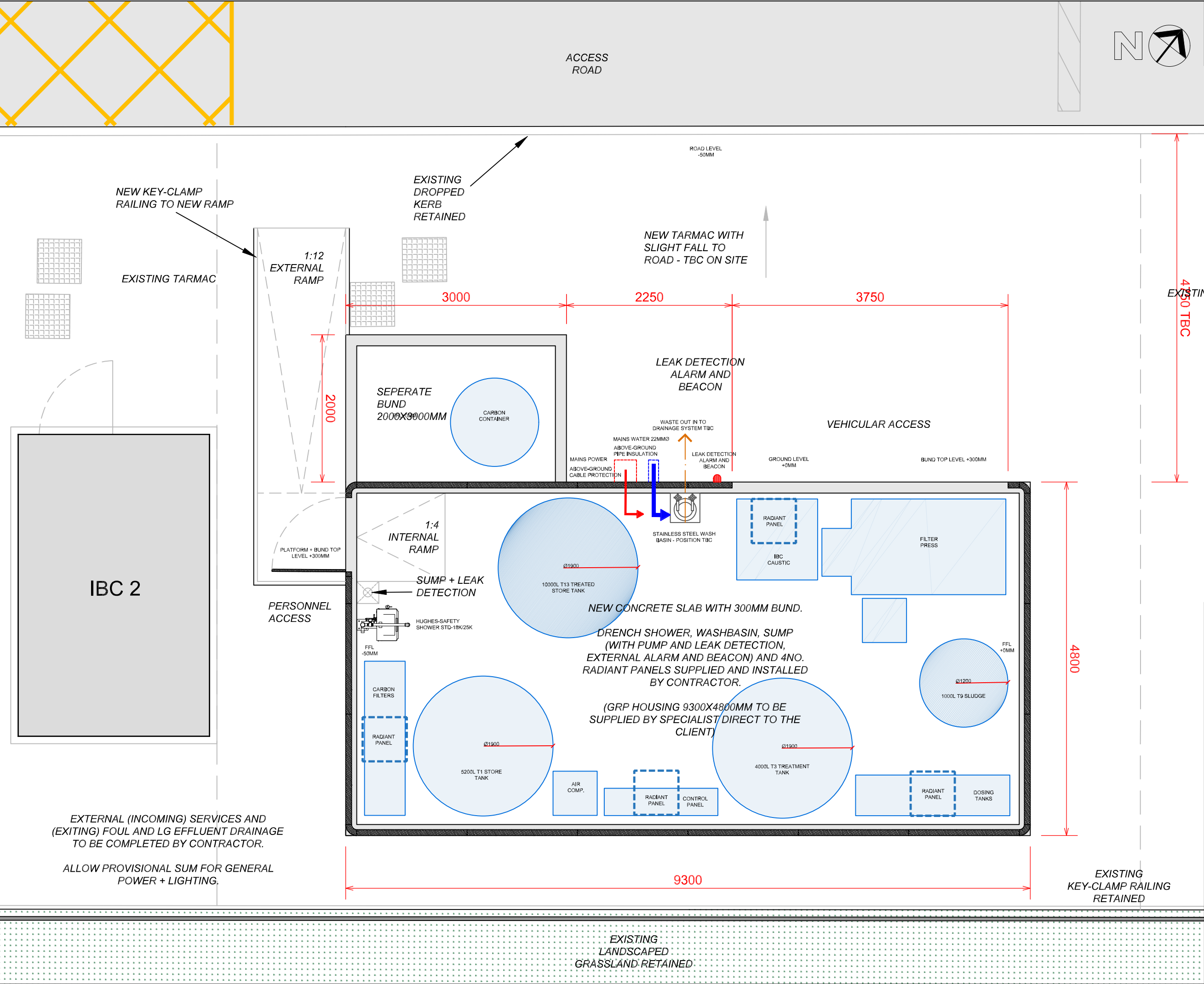
scale	sheet	date	drawn by	checked
1:50	A3	July 2024	AW	
project number	drawing number	rev		
308-04	AL(2)04	E		
purpose of issue	Tender			

BUILDING C ROOF PLAN 1:100 (BELOW)



BUILDING C SIDE ELEVATION B-2 1:50 (BELOW)





Use only labelled dimensions and levels for construction. All dimensions & levels to be checked on site before commencing work and any discrepancies to be notified to C.A. immediately. If in doubt ask ?

ISO 9001
REGISTERED
FIRM

D	Minor notes and amendments for tender issues	AW	06/12/24
C	shower added, incoming services added	CM	12/11/24
B	ground / ffi changes requiring external ramp	CM	07/11/24
A	15' ramp omitted, sack truck ramp added	CM	05/08/24
rev	comments	initials	date

mdg

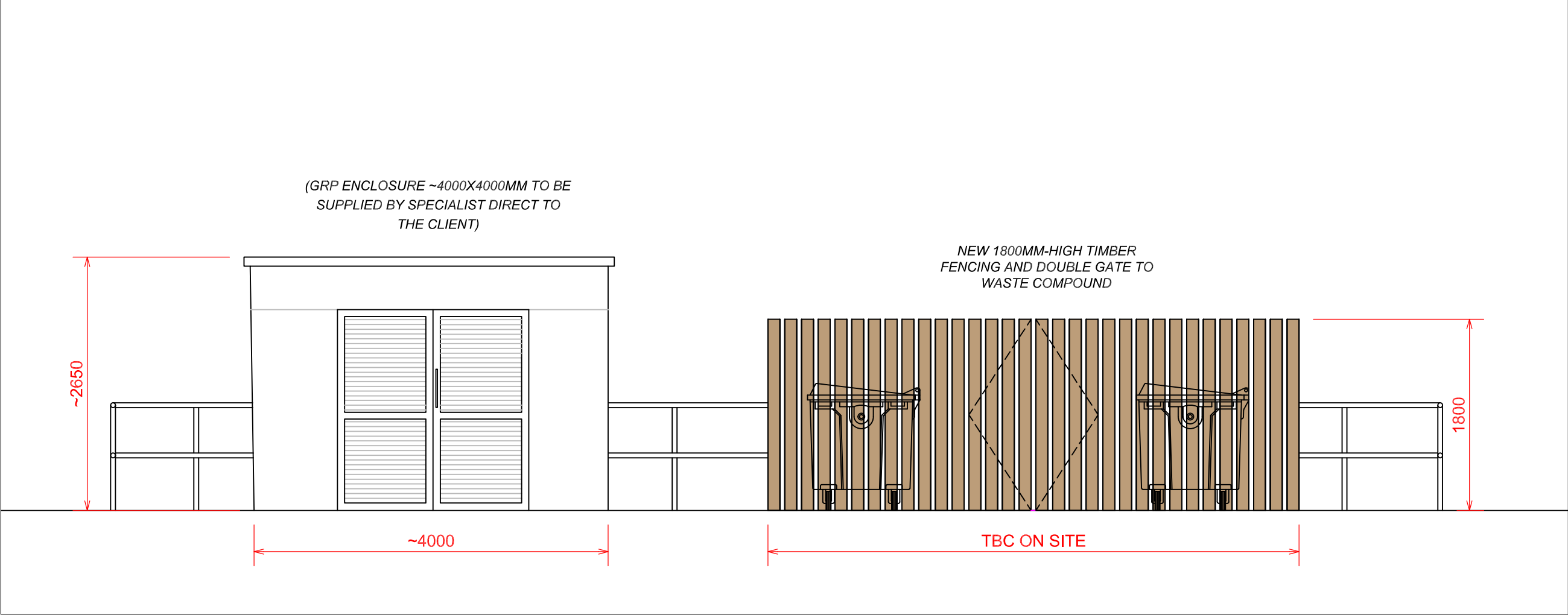
architects
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client	Alfred H Knight International Ltd		
project	Lab Effluent Project Kings Business Park, Kings Drive Prescot. L34 1PJ		
content	Proposed Ground Plan Building C		

scale 1:50	sheet A3	date July 2024	drawn by AW	checked
project number 308-04	drawing number AL(2)02			rev D
purpose of issue Tender				



Use only labelled dimensions and levels for construction. All dimensions & levels to be checked on site before commencing work and any discrepancies to be notified to C.A. immediately. If in doubt ask ?



A	Minor amendments and notes for tender issue.	AW	06/12/24
rev	comments	initials	date



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client

Alfred H Knight International Ltd

project

Lab Effluent Project
Kings Business Park, Kings Drive
Prescot. L34 1PJ

content

Proposed Elevation
Waste Compound and Store

scale	sheet	date	drawn by	checked
1:50	A3	Oct 2024	AW	
project number	drawing number		rev	
308-04	AL(2)07			A
purpose of issue				
Tender				

Use only labelled dimensions and levels for construction. All dimensions & levels to be checked on site before commencing work and any discrepancies to be notified to C.A. immediately. If in doubt ask ?



EXISTING
LANDSCAPED
GRASSLAND RETAINED

NEW KEE-CLAMP
RAILING

NEW TARMAC WITH
FALL TO REAR OF SITE

NEW 1800 HIGH-LEVEL
TIMBER FENCING AND
DOUBLE GATE TO WASTE
COMPOUND

NEW CONCRETE SLAB TO
NEW STORE - REFER TO
STRUCTURAL ENGINEERS
DETAILS

(GRP ENCLOSURE ~4000X4000MM TO BE
SUPPLIED BY SPECIALIST DIRECT TO
THE CLIENT)

NEW TARMAC

EXISTING
LANDSCAPED
GRASSLAND RETAINED

NEW KEE-CLAMP
RAILING EXTENDING
FROM EXISTING

NEW TARMAC WITH
NEW KERB TO
GRASS BOUNDARY

NEW TARMAC WITH
~1:80 FALL TO ROAD
- TBC ON SITE

NEW YELLOW HATCHING TO
LOADING AREA

NEW
DROPPED
KERB

A	Minor amendments and notes for tender issue	AW	06/12/24
rev	comments	Initials	date



architects Mersey Design Group Ltd
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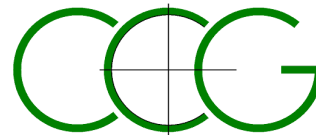
client
Alfred H Knight International Ltd

project
Lab Effluent Project
Kings Business Park, Kings Drive
Prescot. L34 1PJ

content
Proposed Ground Plan
Waste Compound & Store

scale 1:50	sheet A3	date Oct 2024	drawn by AW	checked
project number 308-04	drawing number AL(2)06	rev A		
purpose of Issue				

APPENDIX B: SAMPLING METHODOLOGIES



SAMPLING, SAMPLE TRANSPORTATION, AND FIELD MONITORING PROTOCOLS

Soil, water and gas sampling and monitoring methodologies employed by **CC GEOTECHNICAL LTD** are presented hereunder.

SAMPLING OF SOIL FOR CHEMICAL ANALYSIS

Soil samples may be recovered from a variety of intrusive investigation methods including *inter alia* dynamic sampling boreholes, cable percussion boreholes, machine or manual excavation of trial pits.

All equipment which has the potential to introduce extraneous materials into soils – borehole casings, sampling drilling rods, borehole sampling tools, hand tools such as trowels and spades etc. – must be cleaned by jet washing before initial use and between sampling positions.

Cable Percussion Boreholes

In this method of investigation disturbed bulk and small disturbed samples are recovered at regular depth increments throughout the length of the borehole. Each bulk/small disturbed sample is uniquely labelled with the Project Name / Project No / Borehole No / Depth / Date. Where possible, samples are immediately scanned by PID.

Light Dynamic Sampling Boreholes

In this method of investigation samples are recovered in relatively undisturbed 1m long Perspex liners. Each liner is uniquely labelled with the Project Name / Project No / Borehole No / Depth / Date. The liner tubes are sealed by air tight caps fitted at each end, and are temporarily stored out of sunlight. Where possible, samples are immediately split, scanned by PID, logged and subsampled. In the event that splitting and logging on site is not practicable, then the liners are immediately transported to the laboratory where they are immediately split, scanned by PID, logged and subsampled.

Trial Pits

Samples are to be taken from the bucket of an excavator and placed in appropriate airtight containers. Each container is uniquely labelled with the Project No / Trial Pit No / Depth / Date. The samples are then immediately placed in a cool box chilled by ice packs, and the boxes are sealed for transportation to the chemical laboratory.

Sampling Containers

Containers used to store soil samples are selected dependant on the required analysis. The testing laboratory will be consulted should there be any doubt as to the correct sampling container. Typically, a minimum of 1nr 1kg plastic tub, 1nr 500g plastic tub, 1nr 250g amber glass jar and 2nr glass vials are taken at each sample depth. Samples held on site awaiting same day courier collection are stored at 4°C in a cool box. Only in circumstances where same day collection cannot be arranged are samples held overnight, and in this event all samples are refrigerated at 4 °C either on site (if a refrigerator is available) or at CC GEOTECHNICAL soil laboratory. Courier collection is then arranged for immediate pick up the following day.

Chain of Custody records

A Chain of Custody Record (CoC) is to be sent with each batch of samples submitted to the testing laboratory. A copy of the CoC will be made available for inspection by the client, their agents, or any requesting regulatory authority.

HEADSPACE ANALYSES

Duplicate subsamples of all soil samples selected for laboratory analysis may be taken for headspace analyses.

Headspace analysis is undertaken using a MiniRae 2000 Photo Ionisation Detector (PID). In the test method, an amber glass jar is half filled with soil, and the lid is sealed with aluminium foil secured by an elastic band. The jar and contents are agitated for 30 seconds and left for a minimum of 30 minutes out of direct sunlight for the headspace to achieve equilibrium. The PID then pierces the seal and the maximum reading is recorded. Prevailing weather conditions and ambient air temperature are also recorded.

The PID headspace results are recorded on the exploratory borehole or trial pit logs.

PID headspace data is then used to inform the chemical testing schedule for volatile organic compounds analyses.

SAMPLING OF GROUNDWATER FOR CHEMICAL ANALYSIS

Groundwater is sampled from standpipes or piezometers installed during borehole drilling. On completion of the construction of the standpipe, the installation is initially developed by removing up to 10 x the internal volume of the

installation. The volume of water purged is recorded. The installation is then typically left for a week for hydraulic equilibrium to be restored.

Prior to sampling the standpipe, the depth to the water table, and the depth to the base of the installation are monitored using an electronic dipmeter. In circumstances where free phase product is suspected to be present, then an 'Interface Meter' is used to determine the free phase film thickness.

A minimum of 3 x the installation volume is then removed. The pH of the water is then monitored and the sample is taken when the change in pH between any two consecutive extracts is less than 10%. The volume of water removed is recorded.

A sample comprises of a minimum of 3 litres. Two litres are taken in amber glass bottles, and one litre in a plastic bottle.

To avoid cross-contamination one bailer is used per position.

The samples are uniquely labelled with Project Name / Project No / Borehole No / Depth / Date Sampled. They are placed in a cool box chilled by ice packs, and the containers are sealed for transportation to the laboratory.

Once the samples are received in the **CC GEOTECHNICAL LTD** laboratory, the samples are stored in a refrigerator and returned to the cool boxes once collected.

Water taken from the installations are taken back to the **CC GEOTECHNICAL LTD** laboratory and disposed.

Other data recorded in the sampling comprises:

- Volume of water removed during development of well
- Volume of water removed during purging of the well
- Results of on-site pH analyses
- Sample appearance – colour, suspended solids

MONITORING OF GAS

Prior to embarking on a gas-monitoring round, all equipment is checked for functionality and the calibration status is confirmed.

At the commencement of the monitoring round, the prevailing weather conditions, air temperature, barometric pressure and direction of movement of barometric pressure are recorded.

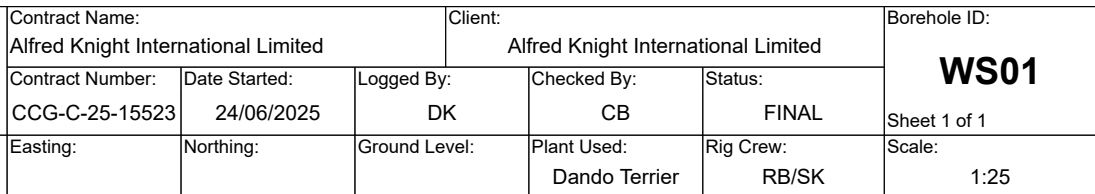
The flow meter is first attached to the standpipe valve, and the flow rate is measured (peak and steady flow) for 1 minute. The results are recorded in l.hr^{-1} . The flow meter tube is protected from the effects of wind by aligning the exhaust downwind.

Following measurement of borehole flow rate, the installation is left for a minimum of 10 minutes for the headspace to restore equilibrium.

Once the gas in the installation has regained equilibrium, the gas analyser is connected and monitoring commences. The peak and steady state readings for CH_4 , CO_2 , CO , H_2S and CO are recorded. The steady state is monitored for a minimum of one minute, and possibly up to a maximum of 10 minutes where fluctuations continue.

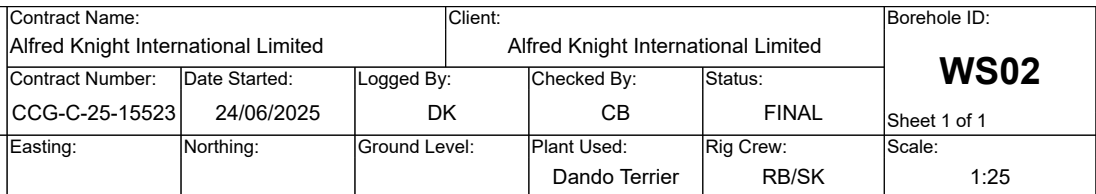
When the monitoring is complete, the depth to the water table, and the depth to the base of the well are monitored using an electronic dipmeter. In circumstances where free phase product is suspected to be present, then an 'Interface Meter' is used to determine the free phase film thickness.

APPENDIX C: BOREHOLE LOGS



Samples & In Situ Testing	Strata Details	Groundwater
---------------------------	----------------	-------------

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: 1hr hand digging / CAT scanning borehole starter pit GL-1.2mbgl					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
				0.00	0.50	PLAIN	50							
				0.50	1.60	SLOTTED	50							
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														

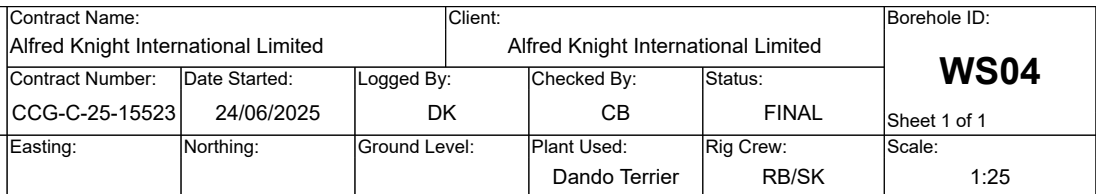


Samples & In Situ Testing	Strata Details	Groundwater
---------------------------	----------------	-------------

Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description
0.00 - 1.00	U					TOPSOIL. Recovered as dark brown silty fine to medium grained SAND with frequent inclusions of rootlets
0.30	ES	PID 0.30m, 0.0ppm		0.20		Greyish brown sandy slightly silty GRAVEL. Gravel is fine to coarse angular to sub-angular brick, concrete and ceramic (MADE GROUND)
0.50	ES	PID 0.50m, 0.0ppm		(0.60)		
				0.80		Greyish brown very sandy slightly silty GRAVEL. Gravel is fine to coarse angular to sub-angular sandstone (MADE GROUND)
1.00	ES	PID 1.00m, 0.0ppm		(0.40)		
1.00 - 1.70	U	SPT(S)100 (25 for 15mm/100 for 95mm) HVP=40		1.20		Dark brown sandy slightly gravelly silty CLAY. Gravel is fine to coarse sub-angular to sub-rounded brick and sandstone (MADE GROUND)
				1.40		Dark brown sandy slightly silty GRAVEL. Gravel is fine to coarse angular to sub-angular brick and concrete (MADE GROUND)
				1.55		Dense greyish brown sandy slightly silty GRAVEL. Gravel is fine to coarse angular to sub-angular sandstone (possibly weathered sandstone)
				1.70		End of Borehole at 1.70m

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	1hr hand digging / CAT scanning borehole starter pit GL-1.2mbgl					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
				0.00	0.50	PLAIN	50							
				0.50	1.50	SLOTTED	50							
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														

[illegible]



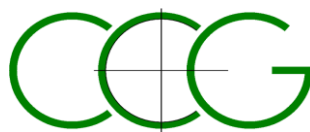
Samples & In Situ Testing	Strata Details	Groundwater
---------------------------	----------------	-------------

[illegible]

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	1hr hand digging / CAT scanning borehole starter pit GL-1.2mbgl					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00	0.50	PLAIN	50						
					0.50	1.80	SLOTTED	50						
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														

APPENDIX D: GAS – GROUNDWATER MONITORING

GAS AND WATER MONITORING RESULTS



	Date:	07-Jul-25	23-Jul-25	31-Jul-25	07-Aug-25							
	Visit Number	1	2	3	4							
	Atmos Press mb	1005	1005	1007	1000							
	Pressure Trend	Steady	Steady	Steady	Steady							
	Air Temp °C	18	17	17	18							
	Cloud cover	High white cloud	Overcast	Overcast	Overcast							
	Wind velocity	Windy	Windy	Windy	Breezy							
	Precipitation	Dry	Dry	Dry	Dry							
	State of Ground	Dry	Dry	Dry	Dry							
WS01	CH4 (%):	Nil	Nil	Nil	Nil							
	CO2 (%):	1.7	1.8	1.5	2.0							
	O2 (%):	19.5	19.4	19.6	19.1							
	H2S (ppm):	Nil	Nil	Nil	Nil							
	CO (ppm):	Nil	Nil	Nil	Nil							
	PID (ppm):	0.0	0.0	0.0	0.0							
	Flow (l/hr):	<0.1	<0.1	<0.1	<0.1							
WS02	Water Level (mbgl):	Dry	Dry	Dry	Dry							
	CH ₄ (%):	Nil	Nil	Nil	Nil							
	CO ₂ (%):	1.0	1.4	1.2	1.6							
	O ₂ (%):	19.8	19.7	19.9	19.5							
	H ₂ S (ppm):	Nil	Nil	Nil	Nil							
	CO (ppm):	Nil	Nil	Nil	Nil							
	PID (ppm):	0.0	0.0	0.0	0.0							
WS03	Flow (l/hr):	<0.1	<0.1	<0.1	<0.1							
	Water Level (mbgl):	Dry	Dry	Dry	Dry							
	CH4 (%):	Nil	Nil	Nil	Nil							
	CO2 (%):	0.3	0.4	0.3	0.7							
	O2 (%):	20.4	20.3	20.4	19.9							
	H2S (ppm):	Nil	Nil	Nil	Nil							
	CO (ppm):	Nil	Nil	Nil	Nil							
WS04	PID (ppm):	0.0	0.0	0.0	0.0							
	Flow (l/hr):	<0.1	<0.1	<0.1	<0.1							
	Water Level (mbgl):	Dry	Dry	Dry	Dry							
	CH4 (%):	Nil	Nil	Nil	Nil							
	CO2 (%):	0.5	0.5	0.4	0.6							
	O2 (%):	20.2	20.1	20.2	20.0							
	H2S (ppm):	Nil	Nil	Nil	Nil							
	CO (ppm):	Nil	Nil	Nil	Nil							
	PID (ppm):	0.0	0.0	0.0	0.0							
	Flow (l/hr):	<0.1	<0.1	<0.1	<0.1							
	Water Level (mbgl):	Dry	Dry	Dry	Dry							
	CH4 (%):	Nil	Nil	Nil	Nil							
	CO2 (%):	0.5	0.5	0.4	0.6							
	O2 (%):	20.2	20.1	20.2	20.0							
	H2S (ppm):	Nil	Nil	Nil	Nil							
	CO (ppm):	Nil	Nil	Nil	Nil							
	PID (ppm):	0.0	0.0	0.0	0.0							
	Flow (l/hr):	<0.1	<0.1	<0.1	<0.1							
	Water Level (mbgl):	Dry	Dry	Dry	Dry							
	CH4 (%):	Nil	Nil	Nil	Nil							
	CO2 (%):	0.5	0.5	0.4	0.6							
	O2 (%):	20.2	20.1	20.2	20.0							
	H2S (ppm):	Nil	Nil	Nil	Nil							
	CO (ppm):	Nil	Nil	Nil	Nil							
	PID (ppm):	0.0	0.0	0.0	0.0							
	Flow (l/hr):	<0.1	<0.1	<0.1	<0.1							
	Water Level (mbgl):	Dry	Dry	Dry	Dry							
	CH4 (%):	Nil	Nil	Nil	Nil							
	CO2 (%):	0.5	0.5	0.4	0.6							
	O2 (%):	20.2	20.1	20.2	20.0							
	H2S (ppm):	Nil	Nil	Nil	Nil							
	CO (ppm):	Nil	Nil	Nil	Nil							
	PID (ppm):	0.0	0.0	0.0	0.0							
	Flow (l/hr):	<0.1	<0.1	<0.1	<0.1							
	Water Level (mbgl):	Dry	Dry	Dry	Dry							

CCG-CMS-FO-129

Issue 2

Job No: CCG-C-25-15523

Site: Alfred Knight, Prescott

Instrument:

GFM436

TEST DATE AND CONDITIONS			
Date		07/02/2025	
Atmospheric Pressure Ambient Temperature EnviroNics Serial No.		1011	mB
		21.3	°C
		5089	

**GFM436 Final Inspection & Calibration
Check Certificate**

GAS DATA LTD

Unit D

Earlplace Business Park

Fletchamstead Highway

Coventry

CV4 9XL

Tel 02476303311

Fax 02476307711



GAS DATA
LISTEN • ANALYSE • INFORM

Customer	C C Geotechnical
Certificate Number	125962
Order Number	341091

Serial Number	12667
Software Version	G436-00.0027/0010

Recalibration DUE Date
07/02/26

Instrument Checks					
Keyboard	✓		Display Contrast	✓	
Pump Flow In	400	Accept > 200 cc/min	Pump Flow @ -200mB	300	Accept > 200 cc/min
Clock Set / Running	✓		Labels Fitted	✓	

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %
	Readings %		Readings %		Readings %	
	60.0	60	39.9	40	20.9	20.9
	Accept ±3.0		Accept ±3.0		Accept ±0.5	
	4.9	5	5.0	5	6.0	6
	Accept ±0.3		Accept ±0.3		Accept ±0.3	
Zero Reading 100% N ₂	0.0	0	0.0	0	0.0	0
	Accept ±0.0		Accept ±0.0		Accept ±0.1	

Optional Gas Checks						
Applied Gas & Range		Concentration Tested @ (ppm)	Instrument Readings (ppm)			
Gas Type	Range (ppm)		Zero Reading		Instrument Gas Reading	
H ₂ S	5000	1500	0	Accept ±0.0	1500	Accept ±5.0%
CO	2000	1000	0	Accept ±0.0	998	Accept ±5.0%
Hexane	2.0%	2.0%	0	Accept ±0.0	1.99	Accept ±10.0%

Cross Gas Effects									
Applied Gas (ppm)		Instrument Readings (ppm)							
Gas Type	Concentration	Toxic 1:	H2S	Toxic 2:	CO	Toxic 3:	HEX		
H2S	1500	1500		0		0			
CO	1000	70		998		0			
Hexane	2.0%	0		0		1.99			

Pressure Checks			
Atmospheric Pressure [AP] (mB)			
Current Atmospheric Pressure (mB)		Instrument Atmospheric Pressure Reading (mB)	
AP Open Ports		1011	Accept ± 2.0
AP Port (Internal)	+800 mB	800	Accept ± 5.0
	+1200mb	1200	Accept ± 5.0

Flow Checks					
Borehole Flow			Differential Pressure		
Applied Reading (l/h)	Instrument Reading (l/h)		Applied Pressure (Pa)	Instrument Reading (Pa)	
-30	-30.0	Accept ± 3.0	-435	-436	Accept ± 50
-3	-3.1	Accept ± 1.0	-17	-17	Accept ± 6.0
0	0.0	Accept ± 0.0	0	0	Accept ± 0.5
3	3.1	Accept ± 0.5	14	14	Accept ± 3.0
30	29.8	Accept ± 3.0	316	311	Accept ± 50
60	59.3	Accept ± 6.0	968	943	Accept ± 130
90	89.5	Accept ± 9.0	1920	1927	Accept ± 250

Temperature Checks		
Calibration Temperature	Instrument Temperature Reading $^{\circ}\text{C}$	
Applied Temperature $^{\circ}\text{C}$		
-10	-10.0	Accept ± 2.0
0	0.0	Accept ± 1.0
30	30.0	Accept ± 1.0
60	60.0	Accept ± 1.0
100	100.0	Accept ± 1.0

Technician:
<i>Jack Rutland</i>

Date Tested:
<i>07/02/2025</i>

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated.

The results displayed on the instrument at each stage are recorded above.

Gas Data Ltd is certified to BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018.



Instrument House
91-92 Shrivenham Hundred Business Park
Watchfield
Oxfordshire
SN6 8TY

SERVICE / INSPECTION SHEET

JOB NUMBER: 81795
INSTRUMENT: PhoCheck Tiger - W-2B

SERIAL NUMBER: T-106231
DATE RECEIVED: 09/01/2025

FIRMWARE: 1.0.07

CUSTOMER: The Home Office

[illegible]

TESTS	Pre Service	Post Service
Charger Test		OK
Battery charge Test		OK
Lamp Test		OK
Air Flow Test ≥ 220ml/min		240ml/min
Block Flow Test ≤ 15ml/min		10ml/min
Moisture Sensitivity = 0.0ppm		0.0 ppm
Switch Test		OK
Sensor Test		OK
Alarm Test		OK
PC Comms Test		OK
Datalog Test		OK
Display Test		OK
Physical Inspection		OK
PAT Test		PASS
Firmware Upgrade		1.0.07
Software Upgrade (usb)		N/A
Function Test		OK
Run time		82hrs0min

Comments:

Unit in for service and calibration.
Connected to Tiger PC and set clock to real-time.
PTFE filter, sensor seal, inlet/outlet seals, stack replaced as per annual service.
Lamp replaced as per bi-annual service.
Pneumatics, probe pipe, tubing inv cone replaced due to low airflow.
Airflow: 240ml/min, block test: 10ml/min, pump functioning correctly.
Factory and user calibration passed as per annual service.
Power supply/charger PAT test and function test passed.

TECHNICIAN: Paul Whiting

P.

DATE: 09/01/2025



Life-saving solutions

CERTIFICATE OF CALIBRATION

CALIBRATION CERTIFICATE NO: 81795

ISSUED BY: SHAWCITY LIMITED
DATE: 09/01/2025

APPROVED SIGNATORY: 

NAME: Paul Whiting

CUSTOMER: CC GEOTECHNICAL LTD
INSTRUMENT: PhoCheck Tiger - W-2B
SERIAL NUMBER: T-106231

CALIBRATION METHOD: CM03
AMBIENT CONDITIONS: 20°C ± 2°C and 50% (± 20%) RH

Prior to calibration the instrument was allowed to stabilise in the laboratory for at least 30 minutes.
The instrument was calibrated by exposing the sensor to known values of gas concentrations.
All gases were sampled through the complete probe and in line filter, where applicable.
The reference value is that generated by the certified source and the indicated value is that measured by the instrument.

CALIBRATION RESULTS

GAS	LOT No	REF. VALUE	INDICATED VALUE
Isobutylene	WO480708-2	100 ppm	100 ppm
Isobutylene	WO459183-2	1000 ppm	1000 ppm

COMMENTS:

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$.
This provides a level of confidence of uncertainty of approximately 95%.
The uncertainty of measurement is $\pm 2\%$
The results indicate that the instrument conforms to the applicable parts of the published specification.

HEALTH & SAFETY, OCCUPATIONAL HYGIENE AND ENVIRONMENTAL MONITORING INSTRUMENTS

Tel: 01793 780622
www.shawcity.co.uk

Instrument House, 91-92 Shrivenham Hundred Business Park
Watchfield, Oxfordshire, SN6 8TY

APPENDIX E: SOIL CLASSIFICATION REPORT

APPENDIX F: SOIL CONTAMINATION REPORT

CC Geotechnical
Unit 1-2 Deltic Place
Deltic Way
Knowsley Industrial Estate
Liverpool
L33 7BU

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 0151 545 2750

t: 01923 225404

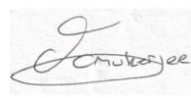
e: tony.gerrard@ccgeotechnical.com

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 25-033706

Project / Site name:	Alfred Knight Lab's, Prescot	Samples received on:	25/06/2025
Your job number:	CCG-C-25-15523	Samples instructed on / Analysis started on:	25/06/2025
Your order number:	CCG-PO-15523	Analysis completed by:	04/07/2025
Report Issue Number:	1	Report issued on:	04/07/2025
Samples Analysed:	4 soil samples - 2 leachate samples		



Signed:

Tuhina Mukerjee
Senior Customer Services Advisor
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting
air - once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 25-033706
 Project / Site name: Alfred Knight Lab's, Prescott
 Your Order No: CCG-PO-15523

Lab Sample Number	594685	594686	594687	594688
Sample Reference	WS01	WS02	WS03	WS04
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A
Depth (m)	0.5	0.5	0.5	0.5
Date Sampled	24/06/2025	24/06/2025	24/06/2025	24/06/2025
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.6	7.2	9.8	13
Total mass of sample received	kg	0.1	NONE	2	0.9	0.8	2

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MJN	MJN	MJN	MJN
Analysis completed	N/A	N/A	N/A	02/07/2025	02/07/2025	02/07/2025	02/07/2025

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.5	7.9	7.7	7.1
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	%	0.005	MCERTS	0.06	0.091	0.032	0.045
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	130	410	52	110
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	63.4	203	25.9	56.5
Sulphide	mg/kg	1	MCERTS	2.3	< 1.0	< 1.0	< 1.0
Organic Matter (automated)	%	0.1	MCERTS	1	1	1	0.8

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.08	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.07	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.19	0.39	0.08	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.06	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.41	0.59	0.15	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.4	0.58	0.13	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.21	0.26	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.23	0.3	0.08	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.33	0.39	0.11	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.16	0.13	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.33	0.35	0.08	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.15	0.17	0.06	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.21	0.24	0.06	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	2.63	3.61	< 0.80	< 0.80
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Analytical Report Number: 25-033706
Project / Site name: Alfred Knight Lab's, Prescot
Your Order No: CCG-PO-15523

Lab Sample Number	594685	594686	594687	594688
Sample Reference	WS01	WS02	WS03	WS04
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A
Depth (m)	0.5	0.5	0.5	0.5
Date Sampled	24/06/2025	24/06/2025	24/06/2025	24/06/2025
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	1.8	2.5	2.8	2.8
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	4.5	5.4	9.8	7.9
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	0.9	0.3	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	18	32	32
Copper (aqua regia extractable)	mg/kg	1	MCERTS	16	17	26	24
Lead (aqua regia extractable)	mg/kg	1	MCERTS	18	26	16	12
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	0.45	0.4	0.61	0.54
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	14	16	33	30
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	1.3	1.6
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	57	58	76	71

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC35 - EC40 _{EH_CU_1D_AL}	mg/kg	10	NONE	10	< 10	< 10	< 10
TPHCWG - Aliphatic >EC5 - EC40 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	10	< 10	< 10	< 10

TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10
TPHCWG - Aromatic >EC35 - EC40 _{EH_CU_1D_AR}	mg/kg	10	NONE	< 10	< 10	< 10	< 10
TPHCWG - Aromatic >EC5 - EC40 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	21	< 10	< 10	< 10

TPH Total >EC5 - EC40 _{EH_CU+HS_1D_TOTAL}	mg/kg	10	NONE	31	< 10	< 10	< 10
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VOCS

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 25-033706
Project / Site name: Alfred Knight Lab's, Prescot

Your Order No: CCG-PO-15523

Lab Sample Number	594685	594688
Sample Reference	WS01	WS04
Sample Number	None Supplied	None Supplied
Water Matrix	N/A	N/A
Depth (m)	0.5	0.5
Date Sampled	24/06/2025	24/06/2025
Time Taken	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Test Limit of detection
		Test Accreditation Status

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	8	7.6
Free Cyanide (Low Level 1 µg/l)	µg/l	1	NONE	< 1	< 1
Sulphate as SO ₄	mg/l	0.045	ISO 17025	4.17	4.47
Sulphide	µg/l	5	NONE	< 5.0	< 5.0
Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	40.3	17.8

Speciated PAHs

Naphthalene	µg/l	0.01	NONE	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	NONE	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	NONE	< 0.01	< 0.01
Fluorene	µg/l	0.01	NONE	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	NONE	< 0.01	< 0.01
Anthracene	µg/l	0.01	NONE	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	NONE	< 0.01	< 0.01
Pyrene	µg/l	0.01	NONE	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01
Chrysene	µg/l	0.01	NONE	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	NONE	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	NONE	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	NONE	< 0.16	< 0.16
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	4.4	< 1.0
Boron (dissolved)	µg/l	10	ISO 17025	23 [#]	21 [#]
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	5.1	1.2
Copper (dissolved)	µg/l	0.7	ISO 17025	15	4.2
Lead (dissolved)	µg/l	1	ISO 17025	8.8	3.6
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	2.7	0.9
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	15	3

Analytical Report Number: 25-033706
Project / Site name: Alfred Knight Lab's, Prescott

Your Order No: CCG-PO-15523

Lab Sample Number	594685	594688
Sample Reference	WS01	WS04
Sample Number	None Supplied	None Supplied
Water Matrix	N/A	N/A
Depth (m)	0.5	0.5
Date Sampled	24/06/2025	24/06/2025
Time Taken	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Test Limit of detection
		Test Accreditation Status

Petroleum Hydrocarbons

TPH - Aliphatic >EC5 - EC6 _{HS 1D_AL}	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aliphatic >EC6 - EC8 _{HS 1D_AL}	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aliphatic >EC8 - EC10 _{HS 1D_AL}	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aliphatic >EC10 - EC12 _{EH 1D_AL_MS}	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC12 - EC16 _{EH 1D_AL_MS}	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC16 - EC21 _{EH 1D_AL_MS}	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC21 - EC35 _{EH 1D_AL_MS}	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >EC5 - EC35 _{HS+EH 1D_AL_MS}	µg/l	10	NONE	< 10	< 10

TPH - Aromatic >EC5 - EC7 _{HS 1D_AR}	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 _{HS 1D_AR}	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 _{EH 1D_AR_MS}	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 _{EH 1D_AR_MS}	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC12 - EC16 _{EH 1D_AR_MS}	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC16 - EC21 _{EH 1D_AR_MS}	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC21 - EC35 _{EH 1D_AR_MS}	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC6 - EC35 _{HS+EH 1D_AR_MS}	µg/l	10	NONE	< 10	< 10

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	NONE	< 3.0	< 3.0
Benzene	µg/l	1	NONE	< 1.0	< 1.0
Toluene	µg/l	1	NONE	< 1.0	< 1.0
Ethylbenzene	µg/l	1	NONE	< 1.0	< 1.0
p & m-xylene	µg/l	1	NONE	< 1.0	< 1.0
o-xylene	µg/l	1	NONE	< 1.0	< 1.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 25-033706

Project / Site name: Alfred Knight Lab's, Prescott

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
594685	WS01	None Supplied	0.5	Brown loam and sand with gravel and vegetation
594686	WS02	None Supplied	0.5	Brown loam and sand with gravel and vegetation
594687	WS03	None Supplied	0.5	Brown clay and sand with gravel
594688	WS04	None Supplied	0.5	Brown clay and sand with gravel

Analytical Report Number : 25-033706

Project / Site name: Alfred Knight Lab's, Prescot

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode	In-house method	L010-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Sulphide in leachate	Determination of sulphide in leachate by ion selective electrode	In-house method	L029-PL	W	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total Hardness of leachates	Determination of hardness in leachates by calculation from calcium and magnesium	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045B	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-MS/GC-MS HS in leachate	Determination of total petroleum hydrocarbons in leachate by GC-MS/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L070B/L08B-PL	W	NONE
BTEX and/or Volatile organic compounds in leachate	Determination of volatile organic compounds in leachate by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	NONE

Analytical Report Number : 25-033706

Project / Site name: Alfred Knight Lab's, Prescott

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088-PL	D/W	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Free cyanide (low level) in leachate	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
pH at 20°C in leachate (automated)	Determination of pH in leachate by electrometric measurement	In-house method	L099-PL	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in leachate	SVOCs and PAHs in leachate	In-house method	L102B		NONE

Analytical Report Number : 25-033706
Project / Site name: Alfred Knight Lab's, Prescot

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

#- Quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted. The result should be considered as deviating and should be interpreted with caution. The result is not accredited.

APPENDIX G: SOIL CONTAMINATION SUMMARY TABLES

Contaminant	Assessment Criteria for Commercial at 1% SOM (mg/kg)	Assessment Criteria for Commercial at 2.5% SOM (mg/kg)	Assessment Criteria for Commercial at 6% SOM (mg/kg)
Metals			
Arsenic	640	640	640
Boron	240000	240000	240000
Cadmium	190	190	190
Chromium III	8600	8600	8600
Chromium VI	33	33	33
Copper	68000	68000	68000
*Lead	2300	2300	2300
Mercury	58	58	58
Nickel	980	980	980
Selenium	12000	12000	12000
Vanadium	9000	9000	9000
Zinc	730000	730000	730000
Non-Metals			
Phenol	440	690	1300
Polyaromatic Hydrocarbons (PAH)			
Acenaphthene	84000	97000	100000
Acenaphthylene	83000	97000	100000
Anthracene	520000	540000	540000
Benz[a]anthracene	170	170	180
Benzo[a]pyrene	35	35	36
Benzo[b]fluoranthene	44	44	45
Benzo[ghi]perylene	3900	4000	4000
Benzo[k]fluoranthene	1200	1200	1200
Chrysene	350	350	350
Dibenz[ah]anthracene	3.5	3.6	3.6
Fluoranthene	23000	23000	23000
Fluorene	63000	68000	71000
Indeno[123-cd]pyrene	500	510	510
Naphthalene	190	460	1100
Phenanthrene	22000	22000	22000
Pyrene	54000	54000	54000
Coal Tar [Bap as surrogate marker]	15	15	15
Petroleum Hydrocarbons			
Aliphatic EC 5-6	3200	5900	12000
Aliphatic EC >6-8	7800	17000	40000
Aliphatic EC >8-10	2000	4800	11000
Aliphatic EC >10-12	9700	23000	47000
Aliphatic EC >12-16	59000	82000	90000
Aliphatic EC >16-35	1600000	1700000	1800000
Aliphatic EC >35-44	1600000	1700000	1800000
Aromatic EC 5-7 (Benzene)	26000	46000	86000
Aromatic EC >7-8 (Toluene)	56000	110000	180000
Aromatic EC >8-10	3500	8100	17000
Aromatic EC >10-12	16000	28000	34000
Aromatic EC >12-16	36000	37000	38000
Aromatic EC >16-21	28000	28000	28000
Aromatic EC >21-35	28000	28000	28000
Aromatic EC >35-44	28000	28000	28000
Aliphatic – Aromatic EC >44-70	28000	28000	28000
Other			
Asbestos Containing Materials (ACM)	No Detection	No Detection	No Detection

Copyright: Land Quality Management Limited (LQM)

The above is based on criteria contained in publication LQM/CIEH S4UL's for Human Health Risk Assessment (2015) (CCG Licence No. S4UL3233), applicable to the "Commercial" land use scenario for soil organic matter (SOM) content of 1% - 6%.

*This document does not provide criteria for Lead, for which the results were compared to the C4SL published by DEFRA SP1010 Development of Category 4 Screening Levels.



METALS DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: **25-15523**

Site name: **Alfred Knight Labs', Prescott**

Prepared by: **TG**

Authorised by: **CB**

Proposed land use: **Commercial/Industrial**

SOM % used: **1.0**



= **Threshold exceeded**



= **Below Limit of detection**



= **Not tested**

			Metals							
Contaminants			Cadmium	Chromium III	Chromium VI	Copper	Lead	Mercury (elemental)	Nickel	Zinc
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Limit of Detection			0.5	5.0	0.8	5.0	5.0	0.5	5.0	5.0
Human Health Risk Assessment (GAC)			190	8600	33	68000	2300	58	980	730000
Sample Location	Sample Depth (m)	Sample type								
WS01	0.5	Soil	< 0.2	15	< 1.8	16	18	< 0.3	14	57
WS02	0.5	Soil	< 0.2	18	< 1.8	17	26	< 0.3	16	58
WS03	0.5	Soil	< 0.2	32	< 1.8	26	16	< 0.3	33	76
WS04	0.5	Soil	< 0.2	32	< 1.8	24	12	< 0.3	30	71
Human Health Risk Assessment (GAC)			190	8600	33	68000	2300	58	980	730000



SEMI-METALS, NON-METALS, INORGANICS AND OTHER DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: **25-15523**

Site name: **Alfred Knight Labs', Prescott**

Prepared by: **TG**

Authorised by: **CB**

Proposed land use: **Commercial/Industrial**

SOM % used: **1.0**

 = **Threshold exceeded**

 = **Below Limit of detection**

n/t = **Not tested**

			Semi/non-metals			Inorganics			Other	
Contaminants			Arsenic	Boron	Selenium	Cyanide (free)	Sulphate (water soluble)	Sulphate (water soluble)	pH (units)	Soil Organic Matter %
Units			mg/kg	mg/kg	mg/kg	mg/kg	g/l	mg/l	units	units
Limit of Detection			1.0	0.5	1.0	1.0	0.02	20.0	0.1	0.1
Human Health Risk Assessment (GAC)			640	240000	12000	120	NA	NA	NA	NA
Sample Location	Sample Depth (m)	Sample type								
WS01	0.5	Soil	4.5	0.5	< 1.0	< 1.0	n/t	63.4	8.5	1
WS02	0.5	Soil	5.4	0.9	< 1.0	< 1.0	n/t	203	7.9	1
WS03	0.5	Soil	9.8	0.3	1.3	< 1.0	n/t	25.9	7.7	1
WS04	0.5	Soil	7.9	0.5	1.6	< 1.0	n/t	56.5	7.1	0.8
Human Health Risk Assessment (GAC)			640	240000	190	120	NA	NA	NA	NA



SPECIATED PAH'S DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: 25-15523

Site name: Alfred Knight Labs', Prescott

Prepared by: TG

Authorised by: CB

Proposed land use: Commercial/Industrial

SOM % used: 1.0

 = Threshold exceeded

 = Below Limit of detection

 n/t = Not tested

			PAH's																
Contaminants			Acenapthene	Acenapthylene	Anthracene	Benz[a]anthracene	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[ghi]perylene	Benzo[k]fluoranthene	Chrysene	Dibenzo[ah]anthracene	fluoranthene	fluorene	Indeno[123-cd]pyrene	Napthalene	Pheanthrene	Pyrene	Total PAH's
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Limit of Detection			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
Human Health Risk Assessment (GAC)			84000	83000	520000	170	35	44	3900	1200	350	3.5	23000	63000	500	190	22000	54000	NA
Sample Location	Sample Depth (m)	Sample type																	
WS01	0.5	Soil	< 0.05	< 0.05	< 0.05	0.21	0.33	0.33	0.21	0.16	0.23	< 0.05	0.41	< 0.05	0.15	< 0.05	0.19	0.4	2.63
WS02	0.5	Soil	0.07	< 0.05	0.06	0.26	0.35	0.39	0.24	0.13	0.3	< 0.05	0.59	< 0.05	0.17	0.08	0.39	0.58	3.61
WS03	0.5	Soil	< 0.05	< 0.05	< 0.05	< 0.05	0.08	0.11	0.06	< 0.05	0.08	< 0.05	0.15	< 0.05	0.06	< 0.05	0.08	0.13	< 0.80
WS04	0.5	Soil	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.80
Human Health Risk Assessment (GAC)			84000	83000	190	170	35	44	3900	1200	350	3.5	23000	63000	500	190	22000	54000	NA



SPECIATED TPH'S DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: 25-15523

Site name: Alfred Knight Labs', Prescott

Prepared by: TG

Authorised by: CB

Proposed land use: Commercial/Industrial

SOM % used: 1.0

	=	Threshold exceeded
	=	Below Limit of detection
n/t	=	Not tested

			Speciated TPH's															
			Aromatics							Aliphatics								
Contaminants			EC5-7	EC7-8	EC8-10	EC10-12	EC12-16	EC16-21	EC21-35	EC35-44	EC5-6	EC6-8	EC8-10	EC10-12	EC12-16	EC16-35	EC35-44	TOTAL TPH'S
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Limit of Detection			0.01	0.01	1.0	1.0	1.0	1.0	1.0	1.0	0.01	0.01	1.0	1.0	1.0	1.0	1.0	1.0
Human Health Risk Assessment (GAC)			26000	56000	3500	16000	36000	28000	28000	28000	3200	7800	2000	9700	59000	1600000	1600000	NA
Sample Location	Sample Depth (m)	Sample type																
WS01	0.5	Soil	< 0.010	< 0.010	< 0.020	< 1.0	< 2.0	< 10	21	< 10	< 0.010	< 0.010	< 0.010	< 1.0	< 2.0	<8.0	10	31
WS02	0.5	Soil	< 0.010	< 0.010	< 0.020	< 1.0	< 2.0	< 10	< 10	< 10	< 0.010	< 0.010	< 0.010	< 1.0	< 2.0	<8.0	< 10	< 10
WS03	0.5	Soil	< 0.010	< 0.010	< 0.020	< 1.0	< 2.0	< 10	< 10	< 10	< 0.010	< 0.010	< 0.010	< 1.0	< 2.0	<8.0	< 10	< 10
WS04	0.5	Soil	< 0.010	< 0.010	< 0.020	< 1.0	< 2.0	< 10	< 10	< 10	< 0.010	< 0.010	< 0.010	< 1.0	< 2.0	<8.0	< 10	< 10
Human Health Risk Assessment (GAC)			26000	56000	190	16000	36000	28000	28000	28000	3200	7800	2000	9700	59000	1600000	1600000	NA



BTEX DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: **25-15523**

Site name: **Alfred Knight Labs', Prescot**

Prepared by: **TG**

Authorised by: **CB**

Proposed land use: **Commercial/Industrial**

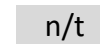
SOM % used: **1.0**



= **Threshold exceeded**



= **Below Limit of detection**



= **Not tested**

			BTEX			
Contaminants			Benzene	Toluene	Ethylbenzene	Total Xylenes
Units			µg/kg	µg/kg	µg/kg	µg/kg
Limit of Detection			10	10	10	10
Human Health Risk Assessment (GAC)			27000	56000000	5700000	5900000
Sample Location	Sample Depth (m)	Sample type				
WS01	0.5	Soil	< 5.0	< 5.0	< 5.0	< 5.0
WS02	0.5	Soil	< 5.0	< 5.0	< 5.0	< 5.0
WS03	0.5	Soil	< 5.0	< 5.0	< 5.0	< 5.0
WS04	0.5	Soil	< 5.0	< 5.0	< 5.0	< 5.0
Human Health Risk Assessment (GAC)			27000	190	5700000	5900000

APPENDIX H: PRELIMINARY WASTE CLASSIFICATION REPORT



Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)



B2F4P-5MIVX-UA5BS

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in **pale yellow**.

Report is invalid if pages are removed.

Job name

ALFRED KNIGHT INTERNATIONAL LTD

Description/Comments

Project

CCG-C-25-15523

Site

ALFRED KNIGHT INTERNATIONAL LTD

Classified by

Name: **Michael Hartley**
Date: **07 Jul 2025 14:30 GMT**
Telephone:
Company: **CC Geotechnical Ltd**
Units 1 & 2 Deltic Way
Knowsley Industrial Estate
Kirkby
L33 7BU

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

CERTIFIED

Course

Hazardous Waste Classification

Date

06 Apr 2023

Next 3 year Refresher due by Apr 2026

Purpose of classification

2 - Material Characterisation

Address of the waste

Pegasus House, Kings Drive, Kings Business Park, Prescott, Knowsley L34 1PJ

Post Code L34 1PJ

SIC for the process giving rise to the waste

41100 Development of building projects

Description of industry/producer giving rise to the waste

Redevelopment of land for building

Description of the specific process, sub-process and/or activity that created the waste

Ground Investigation

Description of the waste

Made ground granular soils



Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS01	0.5	Non Hazardous		3
2	WS02	0.5	Non Hazardous		6
3	WS03	0.5	Non Hazardous		9
4	WS04	0.5	Non Hazardous		12

Related documents

#	Name	Description
1	25-033706_HWOL.hwol	i2 Analytical .hwol file used to populate the Job
2	CCG SOIL A i2	waste stream template used to create this Job

Report

Created by: Michael Hartley

Created date: 07 Jul 2025 14:30 GMT

Appendices

	Page
Appendix A: Classifier defined and non GB MCL determinands	15
Appendix B: Rationale for selection of metal species	16
Appendix C: Version	17



Classification of sample: WS01

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS01	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.5 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
6.6%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 6.6% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	pH		PH		8.5 pH		8.5 pH	8.5 pH		
2	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %		<LOD
	006-007-00-5									
3	naphthalene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3							
4	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
5	acenaphthene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9							
6	fluorene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7							
7	phenanthrene				0.19 mg/kg		0.177 mg/kg	0.0000177 %	✓	
		201-581-5	85-01-8							
8	anthracene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		204-371-1	120-12-7							
9	fluoranthene				0.41 mg/kg		0.383 mg/kg	0.0000383 %	✓	
		205-912-4	206-44-0							
10	pyrene				0.4 mg/kg		0.374 mg/kg	0.0000374 %	✓	
		204-927-3	129-00-0							
11	benzo[a]anthracene				0.21 mg/kg		0.196 mg/kg	0.0000196 %	✓	
	601-033-00-9	200-280-6	56-55-3							
12	chrysene				0.23 mg/kg		0.215 mg/kg	0.0000215 %	✓	
	601-048-00-0	205-923-4	218-01-9							
13	benzo[b]fluoranthene				0.33 mg/kg		0.308 mg/kg	0.0000308 %	✓	
	601-034-00-4	205-911-9	205-99-2							
14	benzo[k]fluoranthene				0.16 mg/kg		0.149 mg/kg	0.0000149 %	✓	
	601-036-00-5	205-916-6	207-08-9							
15	benzo[a]pyrene; benzo[def]chrysene				0.33 mg/kg		0.308 mg/kg	0.0000308 %	✓	
	601-032-00-3	200-028-5	50-32-8							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	indeno[123-cd]pyrene	205-893-2	193-39-5		0.15 mg/kg		0.14 mg/kg	0.000014 %	✓	
17	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
18	benzo[ghi]perylene	205-883-8	191-24-2		0.21 mg/kg		0.196 mg/kg	0.0000196 %	✓	
19	antimony { antimony trioxide }	051-005-00-X	215-175-0		1.8 mg/kg	1.197	2.013 mg/kg	0.000201 %	✓	
20	arsenic { arsenic trioxide }	033-003-00-0	215-481-4		4.5 mg/kg	1.32	5.549 mg/kg	0.000555 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8		0.5 mg/kg	3.22	1.504 mg/kg	0.00015 %	✓	
22	cadmium { cadmium oxide }	048-002-00-0	215-146-2		<0.2 mg/kg	1.142	<0.228 mg/kg	<0.0000228 %		<LOD
23	chromium in Cr(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8		<1.8 mg/kg	1.923	<3.462 mg/kg	<0.000346 %		<LOD
24	chromium in Cr(III) compounds { chromium(III) oxide (worst case) }	215-160-9	1308-38-9		15 mg/kg	1.462	21.923 mg/kg	0.00219 %		
25	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7		16 mg/kg	1.126	16.825 mg/kg	0.00168 %	✓	
26	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6		1	18 mg/kg		16.812 mg/kg	0.00168 %	✓	
27	mercury { mercury dichloride }	080-010-00-X	231-299-8		<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
28	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7		0.45 mg/kg	1.5	0.631 mg/kg	0.0000631 %	✓	
29	nickel { nickel sulfate }	028-009-00-5	232-104-9		14 mg/kg	2.637	34.477 mg/kg	0.00345 %	✓	
30	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8			<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
31	zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]		57 mg/kg	2.469	131.46 mg/kg	0.0131 %	✓	
32	TPH (C6 to C40) petroleum group		TPH		31 mg/kg		31 mg/kg	0.0031 %		
33	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
34	benzene	601-020-00-8	200-753-7		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
35	toluene	601-021-00-3	203-625-9		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
36	ethylbenzene	601-023-00-4	202-849-4		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
37	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]		<0.013 mg/kg		<0.013 mg/kg	<0.0000013 %		<LOD
Total:								0.0265 %		



Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%)
because: Insufficient concentration to be considered flammable risk. No liquid free phase.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.0031%)



Classification of sample: WS02



Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS02	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.5 m	
Moisture content:	
7.2%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 7.2% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	pH		PH		7.9 pH		7.9 pH	7.9 pH		
2	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %		<LOD
	006-007-00-5									
3	naphthalene				0.08 mg/kg		0.0742 mg/kg	0.00000742 %	✓	
	601-052-00-2	202-049-5	91-20-3							
4	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
5	acenaphthene				0.07 mg/kg		0.065 mg/kg	0.0000065 %	✓	
		201-469-6	83-32-9							
6	fluorene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7							
7	phenanthrene				0.39 mg/kg		0.362 mg/kg	0.0000362 %	✓	
		201-581-5	85-01-8							
8	anthracene				0.06 mg/kg		0.0557 mg/kg	0.00000557 %	✓	
		204-371-1	120-12-7							
9	fluoranthene				0.59 mg/kg		0.548 mg/kg	0.0000548 %	✓	
		205-912-4	206-44-0							
10	pyrene				0.58 mg/kg		0.538 mg/kg	0.0000538 %	✓	
		204-927-3	129-00-0							
11	benzo[a]anthracene				0.26 mg/kg		0.241 mg/kg	0.0000241 %	✓	
	601-033-00-9	200-280-6	56-55-3							
12	chrysene				0.3 mg/kg		0.278 mg/kg	0.0000278 %	✓	
	601-048-00-0	205-923-4	218-01-9							
13	benzo[b]fluoranthene				0.39 mg/kg		0.362 mg/kg	0.0000362 %	✓	
	601-034-00-4	205-911-9	205-99-2							
14	benzo[k]fluoranthene				0.13 mg/kg		0.121 mg/kg	0.0000121 %	✓	
	601-036-00-5	205-916-6	207-08-9							
15	benzo[a]pyrene; benzo[def]chrysene				0.35 mg/kg		0.325 mg/kg	0.0000325 %	✓	
	601-032-00-3	200-028-5	50-32-8							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	indeno[123-cd]pyrene	205-893-2	193-39-5		0.17 mg/kg		0.158 mg/kg	0.0000158 %	✓	
17	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
18	benzo[ghi]perylene	205-883-8	191-24-2		0.24 mg/kg		0.223 mg/kg	0.0000223 %	✓	
19	antimony { antimony trioxide }	051-005-00-X	215-175-0	1309-64-4	2.5 mg/kg	1.197	2.777 mg/kg	0.000278 %	✓	
20	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3	5.4 mg/kg	1.32	6.616 mg/kg	0.000662 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2	0.9 mg/kg	3.22	2.689 mg/kg	0.000269 %	✓	
22	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0	<0.2 mg/kg	1.142	<0.228 mg/kg	<0.0000228 %		<LOD
23	chromium in Cr(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0	<1.8 mg/kg	1.923	<3.462 mg/kg	<0.000346 %		<LOD
24	chromium in Cr(III) compounds { chromium(III) oxide (worst case) }	215-160-9	1308-38-9		18 mg/kg	1.462	26.308 mg/kg	0.00263 %		
25	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	17 mg/kg	1.126	17.762 mg/kg	0.00178 %	✓	
26	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			26 mg/kg		24.128 mg/kg	0.00241 %	✓	
27	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
28	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7	1313-27-5	0.4 mg/kg	1.5	0.557 mg/kg	0.0000557 %	✓	
29	nickel { nickel sulfate }	028-009-00-5	232-104-9	7786-81-4	16 mg/kg	2.637	39.149 mg/kg	0.00391 %	✓	
30	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8			<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
31	zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]	58 mg/kg	2.469	132.907 mg/kg	0.0133 %	✓	
32	TPH (C6 to C40) petroleum group		TPH		<10 mg/kg		<10 mg/kg	<0.001 %		<LOD
33	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4	<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
34	benzene	601-020-00-8	200-753-7	71-43-2	<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
35	toluene	601-021-00-3	203-625-9	108-88-3	<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
36	ethylbenzene	601-023-00-4	202-849-4	100-41-4	<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
37	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]	<0.013 mg/kg		<0.013 mg/kg	<0.0000013 %		<LOD
Total:								0.0256 %		



Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification



Classification of sample: WS03

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS03	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.5 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
9.8%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 9.8% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	pH				7.7 pH		7.7 pH	7.7 pH		
2	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %		<LOD
	006-007-00-5									
3	naphthalene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3							
4	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
5	acenaphthene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9							
6	fluorene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7							
7	phenanthrene				0.08 mg/kg		0.0722 mg/kg	0.00000722 %	✓	
		201-581-5	85-01-8							
8	anthracene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		204-371-1	120-12-7							
9	fluoranthene				0.15 mg/kg		0.135 mg/kg	0.0000135 %	✓	
		205-912-4	206-44-0							
10	pyrene				0.13 mg/kg		0.117 mg/kg	0.0000117 %	✓	
		204-927-3	129-00-0							
11	benzo[a]anthracene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
	601-033-00-9	200-280-6	56-55-3							
12	chrysene				0.08 mg/kg		0.0722 mg/kg	0.00000722 %	✓	
	601-048-00-0	205-923-4	218-01-9							
13	benzo[b]fluoranthene				0.11 mg/kg		0.0992 mg/kg	0.00000992 %	✓	
	601-034-00-4	205-911-9	205-99-2							
14	benzo[k]fluoranthene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
	601-036-00-5	205-916-6	207-08-9							
15	benzo[a]pyrene; benzo[def]chrysene				0.08 mg/kg		0.0722 mg/kg	0.00000722 %	✓	
	601-032-00-3	200-028-5	50-32-8							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	indeno[123-cd]pyrene	205-893-2	193-39-5		0.06 mg/kg		0.0541 mg/kg	0.00000541 %	✓	
17	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
18	benzo[ghi]perylene	205-883-8	191-24-2		0.06 mg/kg		0.0541 mg/kg	0.00000541 %	✓	
19	antimony { antimony trioxide }	051-005-00-X	215-175-0	1309-64-4	2.8 mg/kg	1.197	3.023 mg/kg	0.000302 %	✓	
20	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3	9.8 mg/kg	1.32	11.671 mg/kg	0.00117 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2	0.3 mg/kg	3.22	0.871 mg/kg	0.0000871 %	✓	
22	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0	<0.2 mg/kg	1.142	<0.228 mg/kg	<0.0000228 %		<LOD
23	chromium in Cr(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0	<1.8 mg/kg	1.923	<3.462 mg/kg	<0.000346 %		<LOD
24	chromium in Cr(III) compounds { chromium(III) oxide (worst case) }	215-160-9	1308-38-9		32 mg/kg	1.462	46.77 mg/kg	0.00468 %		
25	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	26 mg/kg	1.126	26.404 mg/kg	0.00264 %	✓	
26	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			16 mg/kg		14.432 mg/kg	0.00144 %	✓	
27	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
28	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7	1313-27-5	0.61 mg/kg	1.5	0.825 mg/kg	0.0000825 %	✓	
29	nickel { nickel sulfate }	028-009-00-5	232-104-9	7786-81-4	33 mg/kg	2.637	78.484 mg/kg	0.00785 %	✓	
30	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8			1.3 mg/kg	1.405	1.648 mg/kg	0.000165 %	✓	
31	zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]	76 mg/kg	2.469	169.275 mg/kg	0.0169 %	✓	
32	TPH (C6 to C40) petroleum group		TPH		<10 mg/kg		<10 mg/kg	<0.001 %		<LOD
33	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4	<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
34	benzene	601-020-00-8	200-753-7	71-43-2	<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
35	toluene	601-021-00-3	203-625-9	108-88-3	<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
36	ethylbenzene	601-023-00-4	202-849-4	100-41-4	<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
37	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]	<0.013 mg/kg		<0.013 mg/kg	<0.0000013 %		<LOD
Total:								0.0354 %		



Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification



Classification of sample: WS04

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS04	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.5 m	
Moisture content:	
13%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 13% Wet Weight Moisture Correction applied (MC)

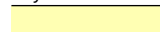
#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
1	pH		PH		7.1 pH		7.1	pH	7.1 pH		
2	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
	006-007-00-5										
3	naphthalene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3								
4	acenaphthylene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8								
5	acenaphthene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9								
6	fluorene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7								
7	phenanthrene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-581-5	85-01-8								
8	anthracene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		204-371-1	120-12-7								
9	fluoranthene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-912-4	206-44-0								
10	pyrene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		204-927-3	129-00-0								
11	benzo[a]anthracene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-033-00-9	200-280-6	56-55-3								
12	chrysene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-048-00-0	205-923-4	218-01-9								
13	benzo[b]fluoranthene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-034-00-4	205-911-9	205-99-2								
14	benzo[k]fluoranthene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-036-00-5	205-916-6	207-08-9								
15	benzo[a]pyrene; benzo[def]chrysene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-032-00-3	200-028-5	50-32-8								



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
17	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
18	benzo[ghi]perylene	205-883-8	191-24-2		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
19	antimony { antimony trioxide }	051-005-00-X	215-175-0		2.8 mg/kg	1.197	2.916 mg/kg	0.000292 %	✓	
20	arsenic { arsenic trioxide }	033-003-00-0	215-481-4		7.9 mg/kg	1.32	9.075 mg/kg	0.000907 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8		0.5 mg/kg	3.22	1.401 mg/kg	0.00014 %	✓	
22	cadmium { cadmium oxide }	048-002-00-0	215-146-2		<0.2 mg/kg	1.142	<0.228 mg/kg	<0.0000228 %		<LOD
23	chromium in Cr(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8		<1.8 mg/kg	1.923	<3.462 mg/kg	<0.000346 %		<LOD
24	chromium in Cr(III) compounds { chromium(III) oxide (worst case) }	215-160-9	1308-38-9		32 mg/kg	1.462	46.77 mg/kg	0.00468 %		
25	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7		24 mg/kg	1.126	23.509 mg/kg	0.00235 %	✓	
26	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6		1	12 mg/kg		10.44 mg/kg	0.00104 %	✓	
27	mercury { mercury dichloride }	080-010-00-X	231-299-8		<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
28	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7		0.54 mg/kg	1.5	0.705 mg/kg	0.0000705 %	✓	
29	nickel { nickel sulfate }	028-009-00-5	232-104-9		30 mg/kg	2.637	68.817 mg/kg	0.00688 %	✓	
30	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8			1.6 mg/kg	1.405	1.956 mg/kg	0.000196 %	✓	
31	zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]		71 mg/kg	2.469	152.528 mg/kg	0.0153 %	✓	
32	TPH (C6 to C40) petroleum group		TPH		<10 mg/kg		<10 mg/kg	<0.001 %		<LOD
33	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
34	benzene	601-020-00-8	200-753-7		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
35	toluene	601-021-00-3	203-625-9		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
36	ethylbenzene	601-023-00-4	202-849-4		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
37	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]		<0.013 mg/kg		<0.013 mg/kg	<0.0000013 %		<LOD
Total:								0.0318 %		



Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification



Appendix A: Classifier defined and non GB MCL determinands

• pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

• salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex

GB MCL index number: 006-007-00-5
Description/Comments: Conversion factor based on a worst case compound: sodium cyanide
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s):
20 Nov 2021 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

• acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

• acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

• fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

• anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351



■ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ **chromium(III) oxide (worst case)** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ **lead compounds with the exception of those specified elsewhere in this Annex (worst case)**

GB MCL index number: 082-001-00-6
Description/Comments: Worst Case: IARC considers lead compounds Group 2A; Probably carcinogenic to humans; Lead REACH Consortium, following MCL protocols, considers lead compounds from smelting industries, flue dust and similar to be Carcinogenic category 1A
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 1A; H350 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium www.reach-lead.eu/substanceinformation.html (worst case lead compounds). Review date 29/09/2015

■ **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Unknown Oil

Hazard statements taken from WM3 1st Edition 2015
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

■ **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

GB MCL index number: 601-023-00-4
Description/Comments:
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

Appendix B: Rationale for selection of metal species

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case as complex cyanides and those specified elsewhere in the annex are not likely to be present in this soil: [Note conversion factor based on a worst case compound: sodium cyanide]

antimony {antimony trioxide}

Worst case CLP species based on hazard statements/molecular weight and low solubility. Industrial sources include: flame retardants in electrical apparatus, textiles and coatings

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds

boron {diboron trioxide}

Reasonable case CLP species based on hazard statements/ molecular weight, physical form and low solubility. Industrial sources include: fluxing agent for glass/enamels; additive for fibre optics, borosilicate glass

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history

chromium in Cr(VI) compounds {chromium(VI) oxide}

Worst case CLP species based on hazard statements/molecular weight. Industrial sources include: production stainless steel, electroplating, wood preservation, anti-corrosion agents or coatings, pigments



chromium in Cr(III) compounds {chromium(III) oxide (worst case)}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected.

lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}

Insufficient concentration of chromium(VI) to be present. Low Solubility

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight

molybdenum {molybdenum(VI) oxide}

Worst case CLP species based on hazard statements/molecular weight

nickel {nickel sulfate}

Insufficient concentration of chromium(VI) to be present. Low Solubility

selenium {selenium compounds with the exception of cadmium sulposelenide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case. Pigment cadmium sulposelenide not likely to be present in this soil. No evidence for the other CLP entries: sodium selenite, nickel II selenite and nickel selenide, to be present in this soil.

zinc {zinc sulphate}

Insufficient concentration of chromium(VI) to be present. Low Solubility

Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition v1.2.GB - Oct 2021**

HazWasteOnline Classification Engine Version: 2025.184.6694.12158 (03 Jul 2025)

HazWasteOnline Database: 2025.184.6694.12158 (03 Jul 2025)

This classification utilises the following guidance and legislation:

WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020

GB MCL List - version 1.1 of 09 June 2021

GB MCL List v2.0 - version 2.0 of 20th October 2023

GB MCL List v3.0 - version 3.0 of 11th January 2024

GB MCL List v4.0 - version 4.0 of 2nd March 2024

GB MCL List v5.0 - version 5.0 of 26th June 2024

GB MCL List v6.0 - version 6.0 of 15th February 2025

APPENDIX I: CURRENT GUIDANCE & LEGISLATIONS

CURRENT CONTAMINATED LAND LEGISLATION / GUIDANCE & ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY

LEGISLATION OVERVIEW

This report includes hazard identification and 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". When considering the current use of land, Part IIA of the Environment Protection Act 1990 (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995, 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 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".

In order to assist in establishing if there is a "significant possibility of significant harm" there must be a "significant pollutant 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 source-pathway-receptor is termed a "pollutant linkage or SPR linkage."

Part IIA of The Environmental Protection Act 1990 is supported by a substantial quantity of guidance and other Regulations, especially DEFRA Circular 01/2006 Contaminated Land (this replaces DETR Circular 02/2000). Part IIA defines the duties of Local Authorities in dealing with it. With the exception of situations of very high pollution risk, Part IIA places contaminated land responsibility on the planning and redevelopment process. In situations where there is very high pollution risk direct action from the Local Authority is usually necessary. Planning Policy Statement 23 (PPS23) provides guidance on the planning process and requires that sites which have been developed shall not be capable of being determined "contaminated land" under Part IIA.

The criteria for assessing levels of pollutants 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; 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 pollutants does not therefore necessarily warrant action, and consideration must be given to the scale of risk involved for the current and proposed end use of the site.

RISK ASSESSMENT METHODOLOGY

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 (2000) publication "A Guide to Risk Assessment and Risk Management for Environmental Protection." 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 investigation process the above steps are repeated as more detailed information becomes available for the site.

Land contamination risk management' (LCRM) (2020)), a document published by the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) outlines a tiered approach to the assessment of risks posed by contaminated land, as summarised hereunder:

Tier 1: Preliminary Risk Assessment

A Preliminary Risk Assessment is usually undertaken as part of a desk study, outlines potential risks posed by potential contamination to all receptors by defining plausible "pollution linkages" and developing a preliminary conceptual model (PCM). The purpose of this model is to define all possible complete pollution linkages, where the requisite source – pathway – target elements are present, and these elements being defined as:

- a contaminant (source) is a hazardous substance or agent, present at levels that have the potential to cause harm or damage a receptor
- a pathway is the means by or through which a contaminant comes into contact with, or otherwise affects, the receptor
- a receptor (target) is an entity (human being, aquatic environment, flora and fauna etc) that is vulnerable to the adverse effects of the contaminant

This relationship is termed a "pollution linkage". It should be recognised that for a health or environmental risk to exist, all three elements of the relationship or linkage must be present, i.e.

- if there is no contaminant, or contaminant present at levels below those considered to be harmful or damaging to a receptor, then there can be no adverse effect on a receptor
- if there is no receptor present that can be adversely affected by a contaminant, no harm or damage can arise
- even where both a contaminant and a receptor are present, no harm or damage will occur if there is no pathway by or through which a linkage between the two can be established

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

The PCM is subject to continual refinement as additional data becomes available. As part of a Phase I Investigation (Desk Study and site walk over) a PCM is formed. Based on the PCM, potential pollutant linkages can be assessed. If the PCM 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 usually termed a Phase II Main Site Investigation and should provide additional data to allow refinement of the PCM and assess the level of risk from each pollutant linkage. Risk assessment will usually include Tier 2 Generic Quantitative Risk Assessment and / or, if necessary, a Tier 3 Detailed Quantitative Risk Assessment.

Tier 2: Generic Quantitative Risk Assessment (GQRA)

GQRA requires an intrusive investigation in order to characterise the site assisting in the re-assessment of the source-pathway receptor linkage. The conceptual model should be refined accordingly.

Upon completion of an intrusive investigation it must be decided whether Generic Assessment Criteria (GAC) are suitable for assessing the risk posed by observed contamination at the site. If GAC are deemed unacceptable for risk assessment purposes or cannot be developed, a Tier 3 Detailed Quantitative Risk Assessment (DQRA) is required.

If GQRA reveals that unacceptable risks are not present then no further action is required. If GQRA identifies a possibility of risk, a decision must be made whether further work is required or necessary for the purposes of risk assessment. If further risk assessment is deemed not suitable not required an Options Appraisal should be undertaken. If further risk assessment is required, the scope nature of further risk assessment must be decided – it is possible that a Tier 3 DQRA will be undertaken in this scenario.

Where the Environment Agency have published an SGV for a contaminant, this will be used in the GQRA. For contaminants where an SGV has not been published and an S4UL has been published by LQM/CIEH S4UL's, then this S4UL will be used.

Where an SGV or an S4UL is not available, and a DEFRA C4SL is available, then this C4SL will be used. In house derived GAC's will only be used for contaminants where there is no SGV or LQM S4UL or DEFRA C4SL.

Tier 3: Detailed Quantitative Risk Assessment (DQRA)

DQRA is used when pollutant linkages require further assessment. DQRA is often undertaken for pollutant linkages where GAC are unavailable or inappropriate for or more conservative than the actual circumstances of the site. Site specific data is used to create Site Specific Assessment Criteria (SSAC) and enable a more accurate assessment of the risks. Further investigation may or may not be required to formulate SSAC depending on the site specific conditions and information already obtained.

If DQRA reveals that unacceptable risks are not present then no further action is required. If DQRA identifies a possibility of risk, a decision must be made whether further work is required or necessary for the purposes of risk assessment. If further risk assessment is deemed not suitable not required an Options Appraisal should be undertaken. If further risk assessment is required, the scope and nature of further risk assessment must be decided at this point.

NOTE: A Tier 1 Preliminary Risk Assessment is undertaken as part of a Desk Study Report and a Preliminary Conceptual Model is developed for all pollutant linkages. However, the methodologies for assessing the risks to human health, risks to controlled waters and risk posed by ground gas using quantitative techniques vary considerably, therefore GQRA and DQRA for human health, controlled waters and ground gas must be undertaken separately. The risk assessment methodologies where quantitative assessment is used for risks to human health, risks to controlled waters and risks posed by ground gas, if relevant, are described hereunder.

BACKGROUND INFORMATION, CURRENT GUIDANCE AND RISK ASSESSMENT METHODOLOGY FOR RISKS POSED TO HUMAN HEALTH

Background

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 have since been withdrawn (August 2008) and the following documents have been published as revised guidance to the CLEA assessment:

- Environment Agency : 2008: Updated Technical Background to the CLEA model Science Report SC050021/SR3
- Environment Agency : 2008: Human Health Toxicological Assessment of Contaminants in Soil SC050021/SR2

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

- CL:AIRE :2008 Guidance on Comparing Data With a Critical Concentration

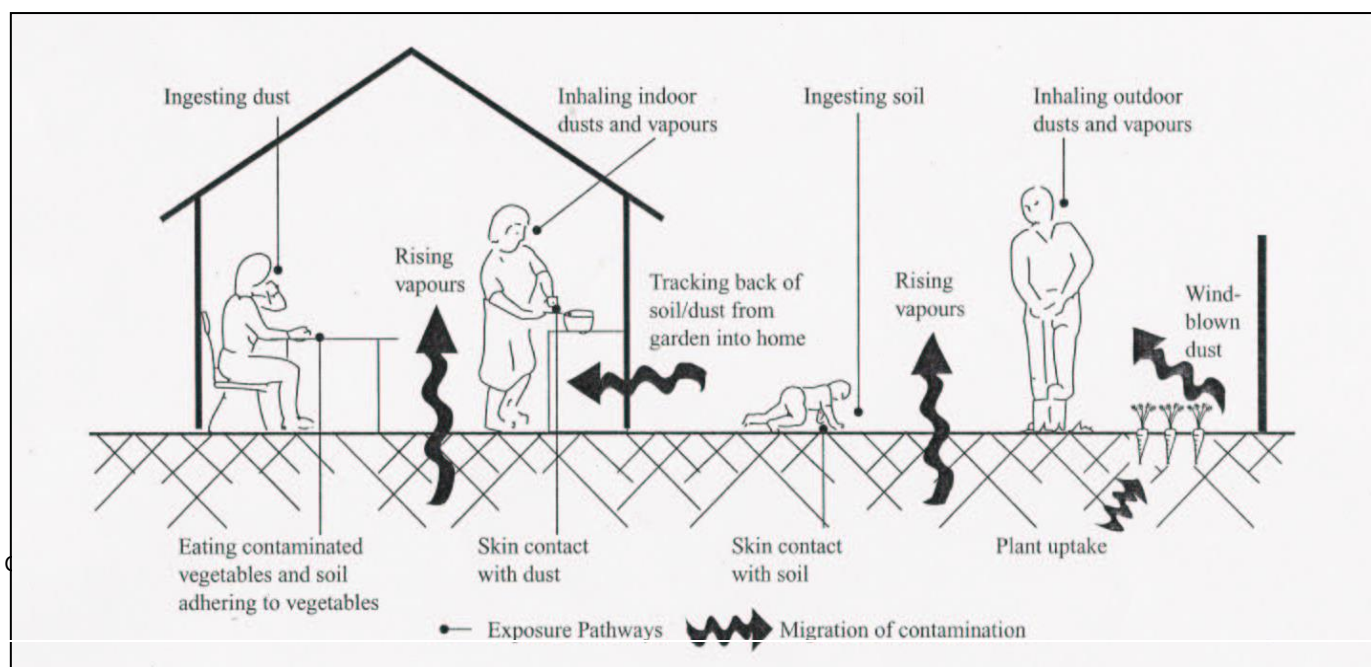
Other guidance/software used in spatial / statistical assessment is provided in:

- USEPA 2006: Data Quality Assessment: Statistical Methods for Practitioners
- Spatial Analysis and Decision Assistance (SADA) – The University of Tennessee

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 determine whether the site is suitable for new development in accordance with Planning guidance. This is discussed further in CL:AIRE :2008 "Guidance on Comparing Data With a Critical Concentration".

A program for the derivation of GAC's based on the above guidance is provided by the Environment Agency and is entitled "CLEA Software Version 1.06".

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 produce
- ingestion of soil attached to home grown produce

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.

Where contaminated water is present at a depth less than 2mbgl and there is a potential risk of inhalation of vapours (only when volatile compounds are present) the risk from inhalation of vapours from soil water will be assessed using a UK compliant version of BP Risc v4.02.

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
- allotments
- commercial / industrial land use

The above land use categories defined in the CLEA are detailed below:

Residential: This generic scenario assumes a typical residential property consisting of a two-storey house built on a ground-bearing slab with a private garden consisting of lawn, flowerbeds, and a small fruit and vegetable patch. The occupants are assumed to be parents with young children, who make regular use of the garden area.

Allotments: This generic scenario assumes a plot of open space (about 250 m²), commonly made available by the local authority to tenants to grow fruit and vegetables for their own consumption. There are usually several plots to a site and the overall site area may cover more than a hectare. The tenants are assumed to be parents or grandparents and that young children make occasional accompanied visits to the plot.

Commercial/Industrial: There are many different kinds of workplace and work-related activities. This generic scenario assumes a typical commercial or light industrial property consisting of a threestorey building at which employees spend most time indoors and are involved in officebased or relatively light physical work.

Human Health Risk Assessment Methodolgy

Assessment of risk for the protection of human health is undertaken using the methodology as outlined previously, and summarised hereunder:

- Tier 1 Preliminary Risk Assessment
- Tier 2 Generic Quantitative Risk Assessment
- Tier 3 Detailed Quantitative Risk Assessment

The Tier 1 Preliminary Risk Assessment is undertaken as part of the desk study report and includes the development of a Preliminary Conceptual Model. Tier 2 and Tier 3 Quantitative Risk Assessments are undertaken in order to develop and refine the Preliminary Conceptual Model aiding a more detailed assessment of the risk posed by contaminants revealed by site investigation and soil / soil water chemical analyses.

The methods used by *CC GEOTECHNICAL LTD* to derive assessment criteria, to statistically analyse chemical data and to compare chemical data to the derived assessment criteria are discussed herunder.

Derivation of Generic Assessment Criteria (GAC) and Site Specific Assessment Criteria (SSAC)

GAC's are derived on the basis of the proposed land use and the associated applicable exposure pathways. It should be noted that there are difficulties in establishing soil concentrations of contaminants beyond which risks from exposure to these contaminants would be 'unacceptable' and the GAC value does not necessarily equate to the level for "significant possibility of significant harm" as defined in Part IIA of The Environmental Protection Act (1990) to determine whether 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. The primary purpose of the CLEA derived GAC's are as 'minimal risk thresholds' for the assessment of human health risks in relation to land use.

Minimal risk thresholds calculated using generic input parameters for each of the above land uses are termed Generic Assessment Criteria (GAC) and are used for Generic Quantitative Risk Assessment (GQRA). However, further assessment may be required taking into consideration site specific factors such as the way the land is used, the soil type, the building

characteristics and the exact nature of the receptor, to determine whether there is a significant possibility of risk to human health to site users. Such an assessment is known as a Detailed Quantitative Risk Assessment (DQRA) and the resultant threshold concentrations are known as Site Specific Assessment Criteria (SSAC). Such assessments 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.

For the purposes of this report, assessment criteria have been derived in accordance with current guidance based on the conceptual model for the proposed land use using the CLEA v1.06 software. These criteria are not intended to indicate whether the site may be contaminated land nor do they replace any published soil guideline values. However, the values are intended to provide guidance for the local authority on whether the site may be considered uncontaminated. If, based on the site's proposed future use, the site would be considered by the local authority to be uncontaminated and therefore, on the basis of soil concentrations, fit for purpose, then no further risk assessment based on soil concentrations and the risk to human health would be necessary. However, should these criteria be exceeded or the conceptual site model vary from the model used in the risk assessment to derive these values then the risk assessment should be updated accordingly.

For contaminants routinely analysed where inhalation is a significant pathway (naphthalene, phenanthrene, Aromatic EC5-EC7, Aromatic EC7-EC8, Aromatic EC8-EC10, Aromatic EC10-EC12, Aromatic EC12-EC16, Aliphatic EC5-EC6, Aliphatic EC8-EC10, Aliphatic EC10-EC12, Aliphatic EC12-EC16), plots of the GAC as a function of Soil Organic Matter (SOM) are used to determine if they pose a potential risk to human health, which are presented hereunder. Where there is an exceedance further assessment may be undertaken.

Statistical Assessment of Soil Contamination Data & Comparison of Contamination Data to Threshold Values

In any site investigation only a small fraction of the soil on the site is analysed. Therefore the mean derived from the contamination data for a contaminant may not be the same as the true mean for the contaminant distribution on the site. To improve the reliability of any assessment a statistical analysis is undertaken in line with the CL:AIRE document "Guidance on Comparing Soil Contamination Data with a Critical Concentration".

Statistical assessment of soil data is undertaken using programs based on the guidance in the CL:AIRE document or the USEPA software ProUCL v4.0.

Where the number of results in a dataset is less than four, a statistical assessment is not undertaken, and the assessment is performed by comparison of the maximum value(s) with a Health Criteria Value (HCV), such as Generic Assessment Criteria value(s).

For the Planning situation, the regulator needs to check whether the concentration of contaminants is low compared to the HCV. 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 HCV.

For the Part IIA scenario the regulator needs to determine whether the concentration of contaminants is greater than the HCV. 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 HCV. However, the regulator may proceed with determination if there is just a 51% probability, "on the balance of probabilities".

The Outlier Test used in the statistical assessment may not be able to identify separate populations if numerous populations are present. In order to ensure that this is not the case a spatial assessment of the data will be undertaken using SADA.

If the screening levels are exceeded then more sophisticated quantitative risk assessment or remedial action may be undertaken. 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.

BACKGROUND INFORMATION, CURRENT GUIDANCE AND RISK ASSESSMENT METHODOLOGY FOR RISKS POSED TO CONTROLLED WATER

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).

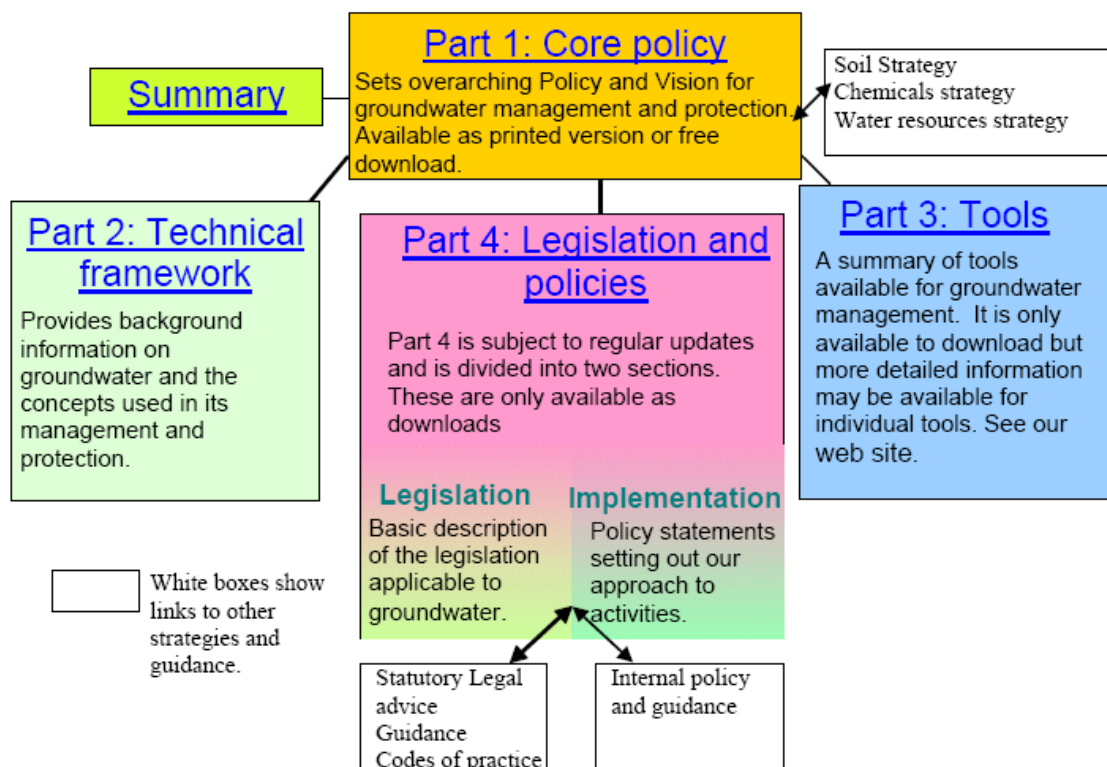
Environment Agency Guidance

Legislation and guidance surrounding the protection of controlled waters in the UK is abundant 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, 2006). 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. Further to legislative changes, gaps identified in the 1998 PPPG required addressing. These changes are reflected in the forthcoming Environment Agency Policy document entitled *Groundwater Protection : Policy and Practice (GP3)*, a draft version of which was available for public consultation (Parts 1 to 3) ending July 2006 with Part 4 issued in March 2008. Part 4 includes a section on key groundwater legislation and the Environment Agency's interpretation of it.

The following gives a breakdown of the structure of the document (taken from the Environment Agency GP3 draft consultation document, 2006)



Controlled Water Risk Assessment Methodology

The risk posed to controlled water is assessed by *CC GEOTECHNICAL* in accordance with current guidance as outlined hereunder.

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. The general approach for Groundwater Protection is detailed further in Part 3 of GP3.

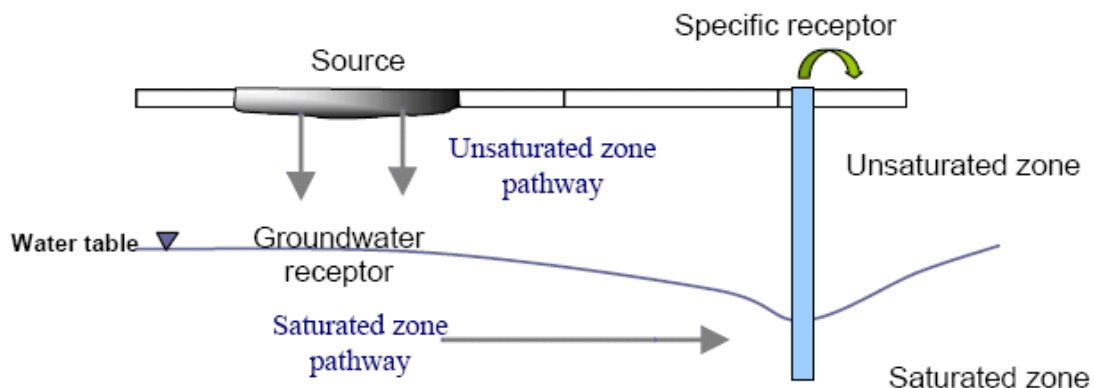
When assessing groundwater impact the Environment Agency advocate the application of their framework methodology "Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination" Environment Agency (2006). The methodology has four levels of assessment as described below:

- Level 1 considers whether contaminant concentrations in "pore water" in contaminated soil are sufficient to impact on the receptor, ignoring dilution, dispersion and attenuation along the pathway. The "pore water" concentration is determined from:
 - i) measured "pore water" concentrations or perched water quality
 - ii) soil leaching tests
 - iii) theoretical calculations based on soil/water partitioning equations
- Level 2 considers dilution by the receiving groundwater or surface water body and whether this is sufficient to reduce contaminant concentrations to acceptable levels. The remedial target is defined as the target concentration multiplied by a dilution factor (DF).
- Levels 3 and 4 consider whether natural attenuation (including dispersion, retardation and degradation) of the contaminant as it moves through the unsaturated and saturated zones to the receptor are sufficient to reduce contaminant concentrations to acceptable levels. The remedial target is defined as target concentration multiplied by a dilution factor (DF) and attenuation factor (AF). In Level 3 simple analytical models are used to calculate the significance of attenuation. The Environment Agency has released a "Remedial targets worksheet v3.1" to carry out basic calculations using a conservative approach up to Level 3 using basic principles assuming a simple migration of contaminants from the

source zone into the aquifer receptor. Level 4 assessment uses more sophisticated numerical models, and 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. Use of such software should only be used once agreement has been obtained from the Environment Agency.

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

1. Risk Screening (Tier 1 Preliminary Risk Assessment): 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 CSM is given below (taken from the Environment Agency GP3 draft consultation document, 2006):



2. Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Level 1): 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:

- Water Supply (Water Quality) Regulations 2000
- The Private Water Supplies Regulations 1991
- Environmental Quality Standards for surface waters based on The EC Dangerous Substances Directive (76/464/EEC and Daughter Directives)
- The Surface Waters (Abstraction for Drinking Water Classification) Regulations 1996
- World Health Organisation Drinking Water Standards 2004

Should the Level 1 assessment 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 determine if the materials are suitable for their proposed use, or devise site specific clean-up level

3. Detailed Quantitative Risk Assessment (EA Remedial Targets Methodology Levels 2 to 4): The decision to carry out a DQRA will be dependant 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 previous levels of assessment. The conceptual model 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, if 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.

BACKGROUND INFORMATION, CURRENT GUIDANCE AND RISK ASSESSMENT METHODOLOGY FOR RISKS POSED BY GROUND GAS

Background

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 5 below:

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.

Table 5. Potential Sources of Ground Gases

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 most likely.

Hazards Associated with Presence of Methane

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

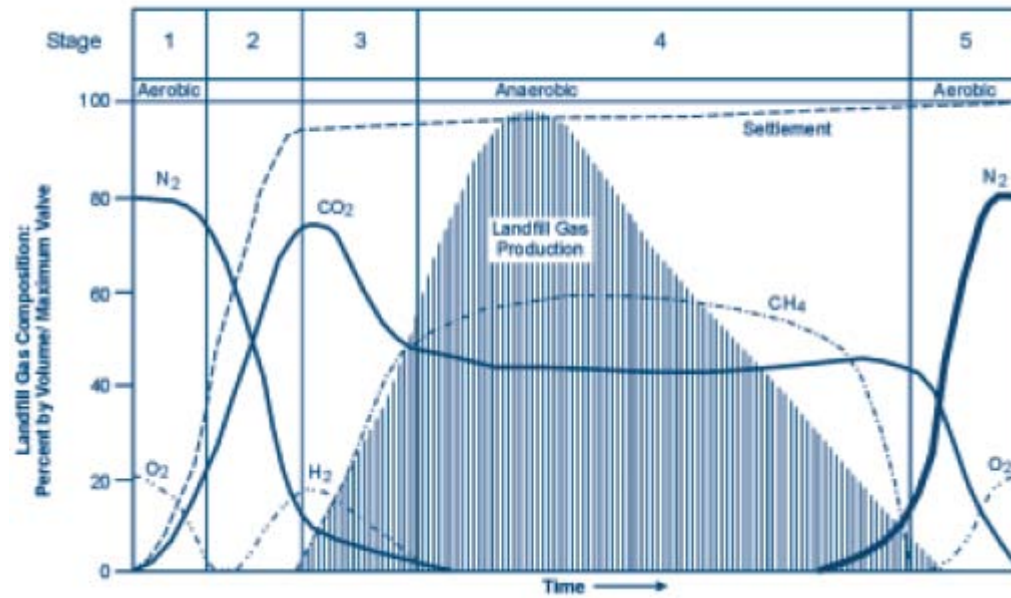
is no simple indicator of the presence of the gas until such a time as explosive limits are reached and an incident occurs. Methane is lighter than air and has a low toxicity. However, at high concentrations it can result in asphyxiation due to oxygen displacement.

Hazards Associated with Presence of Carbon Dioxide

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

The figure below is taken from EA guidance document LFTGN 03 illustrates typical ground gas generation curves from biodegradable materials:



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 above, 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 effect 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

Current Guidance

Previous versions of Building Regulations Approved Document C provided statutory guidance stating that consideration should be given to appropriate action and / or specific solutions in situations where methane concentration exceeded 1%v/v or carbon dioxide concentrations exceeded 5%v/v. The latest Building Regulations Approved Document C (DoE 2004) no longer endorses this approach and recommends the use of a risk based approach to interpreting a gas monitoring survey. This is in line with current EA guidance for landfill gas (LFTGN 03, 2004) which recommends the use of a structured risk based approach similar to that outlined in CLR 11. On this basis, 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 (Situation A)
 - Low rise housing with gardens (Situation B)
- 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).
- British Standard (BS 8485 2015 +A1 2019) ***"Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings"***
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.

Further guidance, Wilson and Card (CIEH) ***"Ground Gas Handbook for Designers and Regulators"*** providing practical guidance on ground gas assessments and the design and evaluation of protection measures, is expected to be published in March 2009.

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.

Ground Gas Risk Assessment Methodology

Assessment of risk posed by ground gas is undertaken using the methodology as outlined previously, and summarised hereunder:

- Tier 1 Preliminary Risk Assessment
- Tier 2 Generic Quantitative Risk Assessment
- Tier 3 Detailed Quantitative Risk Assessment

The methodology used in each of the above assessments with concern to ground gas is discussed hereunder.

Tier 1 Preliminary Risk Assessment

All potential sources of methane and carbon dioxide are identified in the Preliminary Conceptual Model and the generation potential determined. The background information discussed earlier is referred to in order to determine the potential for a source to generate ground gas.

CIRIA C665 provides idealised monitoring frequency / period dependant upon generation potential of gas source and sensitivity of the proposed land use 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.

The monitoring programme is decided using the above table prior to the intrusive site investigation. However, if the intrusive investigation reveals that a the potential source is better or worse than anticipated the monitoring programme should be modified accordingly. For example, if the made ground contains no evidence of organic material and comprises entirely granular brick fill, the potential for that made ground to generate ground gas is reduced considerably.

Tier 2 Generic Quantitative Risk Assessment

Generic Quantitative Risk Assessment is undertaken upon completion of the required gas monitoring period.

All three current guidance documents 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:

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

GSV's are compared to typical max concentrations and limiting gas screening values derived for either Situation A - All development except low rise housing with gardens, or Situation B low rise housing with gardens (NHBC Traffic Light System). Table 8.5 from CIRIA C665 is used for comparison of gas screening values for "Situation A Developments" and is presented hereunder:

Characteristic Situation (CIRIA R149)	Comparable Partners in Technology gas Regime (see Box 8.2)	Risk Classification	Gas Screening Value (CH ₄ or CO ₂) (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, mineworking flooded
4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking susceptible to flooding, completed landfill (WMP 26B criteria)
5	E	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
6	F	Very high risk	>70		Recent landfill site

Table 8.5 from CIRIA C665 Modified Wilson and Card Classification

Table 8.7 is used for comparison of gas screening values for "Situation B Developments" and is presented herunder:

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				
Amber 1	1	0.13	5	0.78
Amber 2	5	0.63	10	1.60
Red	20	1.60	30	3.10

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 decoder 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 Concentration can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

Table 8.7 from CIRIA C665 - NHBC Traffic light system for 150 mm void

Dependant on the outcome of the assessment of risk posed by ground gas it is determined whether gas protection measures are required for the proposed development, and or whether a detailed quantitative risk assessment is required for the site.

Selection & Design of Protective Measures

Table 8.6 and Box 8.4 of CIRIA C665 contain information on the detailed design of protection measures and were initially intended for the purposes of determining then level of protection measures a development requires. These tables and related text include some useful information on the design of gas protection measures, however BS8485:2007, which supersedes the guidance included within CIRIA C665, is used for selection of gas protection measures.

BS8485:2015 +A1 2019 uses a scoring system dependant on the Characteristic Situation / NHBC Traffic Light and proposed end use of the site. The scoring system is summarised in BS8485:2015 + A1 2019 Table 2 as presented hereunder:

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

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.

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.

BS8485:2015 A1 +2019 Table 2 Required gas protection by characteristic gas situation and type of building

Once a score is assigned, a combination of protection systems / elements is chosen from BS8485:2015 +A1 2019 Table 3 shown below:

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	Very good performance	2.5	<i>Ventilation performance in accordance with Annex A (BS8485)</i> <i>If passive ventilation is poor this is generally unacceptable and some form of active system will be required.</i> <i>There have to be robust management systems in place to ensure the continued maintenance of any ventilation system.</i> <i>Active ventilation can always be designed to meet good performance.</i> <i>Mechanically assisted systems come in two forms: extraction and positive pressurization.</i>
	Good performance	1	
Subfloor ventilation with active abstraction/pressurization (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^A		2.5	
Ventilated car park (basement or undercroft)		4	
b) Barriers			
Floor slabs			<i>It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum.</i> <i>Breaches in floor slabs such as joints have to be effectively sealed against gas ingress in order to maintain these performances.</i>
Block and beam floor slab		0	
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	<i>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.</i>
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	<i>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.</i>
Permanent monitoring and alarm system ^A	Installed in the underfloor venting/dilution system	2	
	Installed in the building	1	
e) Pathway Intervention			
Pathway intervention		-	<i>This can consist of site protection measures for off-site or on-site sources (see Annex A, BS8485)</i>
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.		

BS8485:2015 + A1 2019 Table 3 Solution Scores

Where the gas situation is 4 or more (and for NHBC Red situations) 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.

For a site which is impacted by migratory gases from an off site 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.

CURRENT GUIDANCE ON REMEDIATION

When risk assessment of the site has been completed and it indicates that remedial works are required, the main guidance in managing this process is set out in the DEFRA/EA publication LCRM (2020)) "*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 J: NOTES ON LIMITATIONS

Notes on Limitations For Geoenvironmental and Geotechnical Consultancy Services

General

This document has been prepared by CC GEOTECHNICAL LTD within the terms of the contract, scope of work, and resources agreed in writing with the client. The limitations of liability of CC GEOTECHNICAL LTD for the contents of this document have been agreed with the Client, as set out in the terms and conditions of offer and related contract documentation.

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The findings and opinions provided in this document are made in good faith and are subject to the limitations imposed by employing site assessment methods and techniques, appropriate to the time of investigation and within the limitations and constraints defined in this document.

The findings and opinions are relevant to the dates when the assessment was undertaken, but should not necessarily be relied upon to represent conditions at a substantially later date. In particular, seasonal groundwater levels, with the effects of precipitation, may affect the conditions found during the investigation. The report should be read in conjunction with the further Notes on Limitations included in Appendix A.

Where opinions expressed in this report are based on current available guidance and legislation, no liability can be accepted by CC GEOTECHNICAL LTD for the effects of any future changes to such guidelines and legislation. Additional information, improved practices, new guidance, changes in legislation, or amendments to design proposals, may necessitate this report having to be reviewed in whole or in part after that date. Opinions and interpretations are not accredited by UKAS.

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1. the consequences of this document being used for any purpose or project other than for which it was commissioned
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2. the consequences of use of this document by any party with whom an agreement has not been executed.

Phase I Environmental Audits / Desk Studies

The work undertaken to provide the basis of a Phase 1 Desk Study report comprises a study of available documented information from a variety of sources (including the client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in a Desk Study report have been dictated by finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in the report, CC GEOTECHNICAL LTD reserves the right to review such information and to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Factual Ground Investigations

The investigation of the site has been carried out in accordance with the scope and specification instructed by the Client. No interpretations of the data generated by the investigation have been provided or implied. The exploratory holes undertaken in this commission, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of site conditions. Conditions may exist on the site which have not been detected by the works undertaken. Furthermore, the number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" or more widespread contamination where concentrations may be significantly higher than those actually encountered.

Interpretative Phase II Environmental Audits

The investigation of the site has been carried out with the intention of providing sufficient information concerning the type and degree of contamination, and ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated to potential human targets, building materials, the environment (including adjacent land), and surface and groundwater.

The amount of exploratory work and chemical testing undertaken may have been restricted by factors including inter alia the Clients budget, the available timescale, access to all parts of the site, the existence of buried services etc., and where this is the case, a more comprehensive investigation may be required if the site is to be redeveloped, since a number of important engineering and environmental issues may need further assessment.

For those reasons, if costs have been included in relation to site remediation these must be considered as tentative only and must, in any event, be confirmed by a qualified quantity surveyor.

It must be borne in mind, that the exploratory holes undertaken, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site of each of the exploratory holes. There may be ground conditions present on the site which have not been disclosed by this investigation, and which have therefore not been taken into account in this report. The number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" or more widespread contamination where concentrations may be significantly higher than those actually encountered. The findings of the investigation are valid for the time of investigation and the passage of time may result in changes to the contamination status of the site, and a reassessment of the site may be required where significant time has elapsed.

Geoenvironmental Ground Investigations

The investigation of the site has been carried out within the constraints of Client budget, available timeframe, access to all parts of the site, the existence of buried services and a more comprehensive investigation may be required to provide sufficient information regarding the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions, to formulate a reasonable assessment of the environmental risks together with engineering and development implications.

If costs have been included in relation to the site remediation, these must be confirmed by a qualified quantity surveyor.

The exploratory holes undertaken, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of the site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site of each of the exploratory holes. There may be ground conditions present on the site which have not been disclosed by this investigation, and which have therefore not been taken into account in this report. The findings of the investigation are valid for the time of investigation and the passage of time may result in changes to the contamination status of the site, and a reassessment of the site may be required where significant time has elapsed.

The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that groundwater levels will vary owing to seasonal, tidal, weather, or other effects.

The risk assessment and opinions provided, inter alia, take into consideration currently available guidance relating to acceptable contamination concentrations and no liability can be accepted for the retrospective effects of any future changes or amendments to these values.