

CCG-C-17-9806B

**PHASE II GEOENVIRONMENTAL REPORT FOR LAND AT
ECCLES NEW ROAD, SALFORD, MANCHESTER, M50 1EP
DECEMBER 2017**

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1.0 INTRODUCTION

1.1 Background & Nature of Development

CC GEOTECHNICAL LIMITED (CCG) is providing consultancy to services to **KDP ARCHITECTS (KDP)** in connection with the proposed redevelopment of a parcel land located off Eccles New Road, Salford, Manchester, M50 1EP.

Following the demolition of an existing former motor vehicle maintenance workshop (**THE BODY SHOP**) and subsequent site clearance, it is proposed that the site be redeveloped for mixed commercial / residential land use by the construction of a 6-storey block incorporating mixed ground floor residential, retail and leisure facilities and ancillary office, with residential apartments occupying the remaining storeys. The existing and proposed site layouts, and elevations of the proposed scheme, are as illustrated on **KDP** architectural drawings contained herein.

The proposed redevelopment falls within the administrative jurisdiction of **SALFORD CITY COUNCIL**.

2.0 PREVIOUS STUDIES

The development site was the subject of a Phase I Desk Study Report prepared by **CCG** under report reference No. **CCG-C-17-9806**, dated July 2017 which concluded that a Phase II intrusive investigation was required, and made recommendations on the scope of a Phase II investigation.

This report documents the findings of the Phase II investigation. The report is required as a precondition of the granting of consent for the commencement of construction of the proposed development.

This report should be read in conjunction with **CCG** Desk Study Report No. **CCG-C-17-9806**, and with the Notes on Limitations, given in Appendix K.

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 particular respect to:

- The collation of data on soil and groundwater contamination, insofar as they may adversely impact on human and/or environmental receptors
- The collation of data on the properties of the substrata, insofar as they would form the basis of selection and design of foundations and infrastructure

4.0 SITE DATA

4.1 Site Location & Description

A detailed description of the site location and its immediate environs are discussed in the above referenced desk study report, and summarised hereunder.

The site comprises a rectangular shaped parcel of land located south of Eccles New Road, as shown on **CCG** Drawing No. CCG-C-17-9806-1, and Aerial Plate No. CCG-C-17-9806-2 contained herein. The **ORDNANCE SURVEY** coordinates for the approximate site centre are 379381, 398491. The site centre stands at an approximate elevation of 33mAOD.

The site is situated within a mixed residential / commercial context and comprises developed land which extends to the approximate dimensions of 92m x 40m, its long axis being on an east-west alignment. It is bound to the north and east by public pavements extending along Eccles New Road (A57) and Falcon Close. Its boundaries to the south and west are adjoined by commercial premises (*i.e.* **Art Image Limited – Salford CC Turnpike Depot**) located within the nearby West Link Business Park.

The surface topography within the western section of the site was seen to be sensibly flat with cover comprising well-maintained bituminous and concrete paving, with a linear strip of granite cobble sets extending along its southern boundary. The pavement cover within the remainder of the site comprised poorly maintained concrete / bituminous paving and gravel. Some minor oil staining was observed on the pavement extending along its southern boundary.

Buildings remaining on the site are positioned within the western section, and comprise a large rectangular well-maintained workshop unit incorporating a paint mixing room, open workshop space, and offices. A storage container is located to the rear of the building.

The internal floor slab appears to be well-constructed concrete, with no evidence of surface defects. Two square shaped depressions are located within the western section of the workshop floor, and these may be indicative of infilled vehicle maintenance pits.

The site is fully serviced with running water and electricity. Numerous metal service covers were observed within the external pavements.

No native and/or non-native plant species were observed within, or adjoining, the study site.

Vehicle and pedestrian access is via Eccles New Road to the north

4.3 Published Geology

The geology of the site was researched by reference to appended Groundsure Environmental Report and the **British Geological Survey (BGS)** 1:50, 000 scale Sheet 085 Manchester (2011), and 1:10, 000 scale (Solid and Drift Editions) geological mapping data.

These indicated that the site is underlain with natural drift deposits comprising impermeable Diamicton (*boulder clay*) of glacial origin (*Quaternary Period - Devensian Age*). The solid geology is documented as being the Chester Formation (*formerly the Bunter Pebble Beds*) of the Sherwood Sandstone Group comprising red-brown permeable fine>coarse grained locally pebbly cross-stratified sandstone of the Early-Triassic Period (*Olenekian Age*).

There are no documented geological lines of weakness (*i.e. faults and/or coal seams*) within 250m of the study site.

The general dip of the solid geology is documented on the BGS mapping data to be in a southerly direction, the angle of dip is not recorded.

As with many developed sites, imported made ground deposits of an unknown composition, thickness, may underlie the site.

The '*Indicative Atlas of Radon in England and Wales*' (Miles. J.C.H *et.al*, 2007) Map 13 '*Welsh Marshes and Liverpool*', shows the site to be situated within an area where between 1 and 3% of properties are above the Action Level and therefore Radon Protection Measures are not required.

As with many developed sites, imported made ground deposits of an unknown composition, thickness, may underlie the site.

4.4 Hydrogeology & Hydrology

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

- The solid geology (Chester Formation) is classified as being a Principal Aquifer
- The overlying boulder clay is documented as being an Unproductive Aquifer
- There are no Detailed River Networks within 250m of the study site
- There are no records pertaining to Detailed River Networks within 250m of the study site
- There are no records pertaining to Groundwater Water Abstraction Licences within 500m of the study site
- There are no records pertaining to Portable Water Abstraction Licences within 500m of the site
- There are no records pertaining to Surface Water Abstraction Licences within 1km of the site
- The site is located within a Source Protection Zone (Zone III – Total Catchment).
- The site not is located within an Environment Agency Zone II and/or III Flood Plain

5.0 PRELIMINARY CONCEPTUAL MODEL (TIER 1)

With regard to risks of pollution linkages potentially existing on the site, the Preliminary Conceptual Model developed in the Phase I desk study is summarised hereunder:

Table 1: Preliminary Conceptual Model (PCM)

POLLUTANT LINKAGE	SOURCE	PATHWAY	RECEPTOR	PROBABILITY	CONSEQUENCE	RISK RATING
1	Made Ground /Imported made ground associated with the development & redevelopment of the site & adjoining area and use as former motor vehicle repair workshop / garage	Soil and / or soil dust ingestion	Construction workers Future occupants (adults) Offsite receptors Flora	Likely	Medium	Moderate
2	Asbestos containing materials (ACM) in made ground soils associated with the development & redevelopment of the site & adjoining area	Fibre Inhalation	Construction workers Future occupants (adults) Offsite receptors	Likely	Severe (ACM)	High
3	Inhalation of vapours from solvents / spray paint products associated with former repair workshop / garage	Inhalation	Future occupants	Unlikely	Medium	Moderate
4	Inhalation of ground gases from onsite or offsite sources i.e. in-filled ground historical ponds or nearby sewage works	Inhalation	Future occupants	Unlikely	Medium	Moderate
5	pH & Sulphate attack on concrete	Future building	Future building	Likely	Mild	Moderate / Low
6	Mobile contaminants: Petroleum hydrocarbons BTEX compounds	Surface runoff Migration through permeable strata & preferable pathways	Groundwater aquifer Future occupants Offsite receptors Flora	Unlikely	Medium	Moderate
7	Organic contamination	Direct contact with water mains	Potable water supply	Unlikely	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 2: Summary of Contaminants of Concern based on PCM

SOURCE	LINKAGE NO.	METALS	NON-METALS	ORGANICS	GASES	OTHERS
Made Ground /Imported made ground associated with the development & redevelopment of the site & adjoining area	PL1, PL2 PL5, PL6 & PL7	Be, Cd, Cr (total and VI), Ni, Cu, Pb, Hg, Se	As, sulphates	TPHCWG, PAH's, BTEX, Volatiles (by PID)	-	pH Asbestos
Migrating gases associated imported made ground deposits in-filled ground / ponds & nearby sewage works	PL3 & PL4	-	-	-	CH ₄ , CO ₂ , H ₂ S	-
Contaminants associated with former onsite motor vehicle workshop /garage / car parking facilities nearby dye Workshop	PL1, PL6 & PL7	-	-	TPHCWG PAH's, BTEX, Volatiles (by PID)	-	-
Summary Suite	PL1-PL7	Be, Cd, Cr (total and VI), Ni, Cu, Pb, Hg, Se	As, sulphates	TPHCWG, BTEX PAH's, Volatiles (by PID)	CH ₄ , CO ₂ , H ₂ S	pH Asbestos

The foregoing analysis identified a significant number of potential risks, and if present, these could adversely impact on human or environmental receptors. Given the sensitivity of the proposed end use, and since no previous site investigation has been undertaken, an intrusive phase of investigation was undertaken to determine whether the postulated pollutant linkages were actually present on site.

6.0 FIELDWORK

6.1 Introduction

A programme of fieldwork investigation was undertaken in October / November 2017. The programme comprised:

- The sinking of 5nr boreholes by light dynamic sampling methods
- The sinking of 5nr boreholes by cable percussion boring methods
- The subsampling of borehole recovery for soil classification / contamination testing

- The extension of 3 of the cable percussion boreholes into the bedrock, by rotary coring drilling methods using a lorry mounted Terramec T10 rig and associated tools
- The installation of 50mm HDPE plain and slotted well-tube complete with non-lime pea gravel surround and bentonite seals at 4nr locations
- The undertaking of a gas and groundwater monitoring programme comprising 6nr visits over a 3-month period
- The sampling of groundwater from 2nr borehole positions for contamination analyses

The fieldwork was planned in accordance with BSEN 1997-1 (2007) Eurocode 7, BS10175: 2011, BS5930: 2015, and the sampling and monitoring methodologies employed by **CCG** as presented in Appendix B, insofar as they related to the scope of the investigation.

The layout of the investigation is as annotated on **KDP** 'Drawing No.1482-101 presented herein.

6.2 Light Dynamic Sampling Boreholes

5nr boreholes were sunk using light dynamic sampling methods using a Dando Terrier 2000 rig and associated tools.

Each borehole location was positioned clear of all services, and scanned using CAT cable avoidance scanner before and during hand excavation of a starter pit extending to 1.2mbgl.

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, with hand shear vane (HSV) testing being undertaken in cohesive strata. 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

Boring tools were decontaminated prior to commencement.

The logs of the boreholes, annotated with sampling details, SPT 'N' and HSV (Cu-kN/m²) values and details of standpipe construction are given in Appendix C.

6.3 Cable Percussion Boreholes

5nr cable percussive boreholes were sunk at locations as annotated on **KDP** 'Drawing No.1482-101 presented herein.

Each borehole position was positioned clear of known services and was scanned using a CAT service detector before and during manual excavation of a 1.2m deep service clearance pit.

Boring tools were decontaminated prior to commencement.

Each borehole was sunk by a Dando 150 shell and auger drilling rig and associated 150mm diameter tools and casings. Standard Penetration Tests (SPT) were carried out at regular intervals throughout the borehole depth. Bulk disturbed bag samples and small-disturbed glass amber jar/vial samples were recovered at regular incremental depths and changes in stratum within the borehole. The cable percussion boreholes terminated at rockhead.

Logs of the boreholes, annotated with sampling details, SPT 'N' values and standpipe construction details are given in Appendix C.

6.4 Rotary Cored Boreholes

In accordance with the ground investigation plan, 3 of the cable percussion boreholes were further extended by rotary coring methods using a Terramec T10 rotary rig and associated tools at locations as annotated on **KDP** 'Drawing No.1482-101 presented herein.

Coring tools were decontaminated prior to commencement, and between borehole moves.

Rotary coring was carried out in 1.5m runs using 90mm diameter coring equipment and polymer flush. Cores were recovered in Perspex core-liners. The ends of each run were sealed and the runs then stored in wooden core boxes for transportation to the laboratory for logging and rock strength testing.

On completion each borehole was grouted to rock-head with PFA/cement grout mix, with boreholes that were not utilized for gas-groundwater monitoring installations being backfilled to ground level with soil arisings.

The logs of the boreholes, annotated with TRC, SCR and RQD values are presented in Appendix C. Photographs of core recovery are presented in Appendix D.

6.5 Monitoring Installations

Standpipes comprising 50mm diameter HDPE plain and slotted welltube 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 3: Borehole Installation Details

BOREHOLE	DEPTH OF BOREHOLE (mbgl)	DEPTH OF STANDPIPE [mbgl]	RESPONSE ZONE (mbgl)	
			FROM	TO
BH1	21.2	6.0	0.5	6.0
WS2	5.0	5.0	0.5	5.0
BH3	12.2	6.6	0.5	6.6
BH4	21.2	6.5	0.5	6.5

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 dipmeter.

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

7.0 OBSERVED STRATIGRAPHY

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

Table 4: Observed Stratigraphy

GROUND INVESTIGATION - STRATIGRAPHY	
CABLE PERCUSSIVE BOREHOLES	
Location	
BH1	100mm tarmac paving overlying 300mm concrete slab underlain with made ground soils extending to 1.2mbgl, overlying natural drift deposits comprising firm becoming stiff brown boulder clay to 6.7mbgl, dense sands and gravel to 8mbgl, then red / orange sandstone initially recovered as slightly silty sand and gravel to 10.7mbgl, then intact extremely weak fine and medium grained sandstone thereafter proven by rotary coring methods to 21.2mbgl
BH2	100mm tarmac paving overlying 100mm concrete slab underlain with made ground deposits extending to 1.4mbgl, overlying natural drift deposits comprising firm becoming stiff boulder clay to 6.7mbgl, dense slightly silty gravelly sand to 8.2mbgl, stiff grey/brown boulder clay to 9.2mbgl, then red/orange sandstone initially recovered as slightly silty sand and gravel to 11.7mbgl, then intact extremely weak locally moderately weak fine to medium grained sandstone thereafter proven by rotary coring methods to 22.2mbgl
BH3	100mm granite cobble sets overlying made ground soils extending to 0.6mbgl, underlain with natural drift deposits comprising firm becoming stiff brown/grey boulder clay to 5.2mbgl, medium dense slightly silty gravelly sand to 7.2mbgl, brown boulder clay to 7.8mbgl, yellow gravelly sand to 8.2mbgl then red/orange sandstone recovered as slightly silty sandy gravel, terminating at 12.2mbgl
BH4	50mm tarmac paving overlying remnants of an old brick structure to 1.3mbgl, soft brown reworked clay to 1.7mbgl overlying natural drift deposits comprising stiff brown/grey boulder clay to 7.4mbgl, dense red/orange sands to 8.5mbgl, stiff brown boulder clay to 9.6mbgl, then red/orange sandstone initially recovered as slightly silty sand and gravel to 10.8mbgl then intact extremely weak fine and medium grained sandstone thereafter proven by rotary coring methods to 21.2mbgl
BH5	50mm tarmac paving overlying made ground soils extending to 1.2mbgl, underlain with natural drift deposits comprising firm becoming stiff brown boulder clay with occasional sand and gravel bands to 8.8mbgl, then red/orange sandstone recovered initially as slightly silty sand and gravel terminating at 10.2mbgl,
LIGHT DYNAMIC SAMPLING BOREHOLES	
WS1	200mm concrete paving slab overlying made ground soils extending to 1.5mbgl, underlain with natural drift deposits comprising firm becoming stiff brown boulder clay, locally interbedded with thin sand/gravel horizons thereafter, proven to 5mbgl. Ground water seepage recorded within sand/gravel band at 3mbgl
WS2	200mm concrete paving slab overlying made ground soils extending to 0.9mbgl, underlain with natural drift deposits comprising firm becoming stiff brown boulder clay thereafter, proven to 5mbgl.

	Groundwater seepage recorded within sand/gravel band at 3mbgl
WS3	350mm concrete paving slab overlying made ground soils extending to 1.5mbgl, underlain with natural drift deposits comprising soft becoming firm brown boulder clay thereafter, proven to 4mbgl Groundwater seepage recorded within sand/gravel band at 3mbgl
WS4	100mm tarmac pavement and associated subbase overlying made ground soils extending to 1.2mbgl, underlain with natural drift deposits comprising soft becoming firm brown boulder clay thereafter, proven to 4mbgl Groundwater seepage recorded within sand/gravel band at 3mbgl
WS5	Made ground soils extending to 1.5mbgl, underlain with natural drift deposits comprising soft becoming firm then stiff brown boulder clay thereafter, proven to 5mbgl Groundwater seepage recorded within sand/gravel band at 3mbgl

The rock was observed to comprise extremely weak red / brown fine to medium grained thickly laminated SANDSTONE.

There was no visual and/or olfactory evidence (by PID) of contamination and/or biodegradable materials affecting the made ground mass at any sampling location.

8.0 GROUNDWATER REGIME

Groundwater seepages were recorded within the natural drift deposits at some sampling locations, with monitored standing water levels being in the order of 3.5mbgl at BH1 and 2.78mbgl at WS2 during the ongoing gas / groundwater monitoring programme.

9.0 LABORATORY TESTING

9.1 Engineering Testing

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 (9nr)
- Determination of Atterberg Limits in accordance with BS1377: Part 2: 1990 (12nr)
- Determination of Particle Size Distribution by wet sieve in accordance with BS 1377: Part 2: 1990 (2nr)
- Determination of Undrained Shear Strength in triaxial compression in accordance with BS:1377: Part 8: 1990 (3nr)
- Uniaxial Compressive Strength in accordance with 'ISRM Vol. 2. Pp. 135-140 (1979)' (3nr)
- Determination of Point Load Strength in accordance with 'Int'. J. Rock Mech. Sci. & Geomech. Abstr. Vol.22. pp. 51-60. (1985)' (50nr)

The soil engineering test results are presented in Appendix F.

9.2 Chemical Laboratory Testing

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

- 8nr subsamples of made ground soils were analysed to a broad range of contaminants including pH, metals, non-metals, and speciated PAH's
- 8nr subsamples of made ground soils were analysed for BTEX compounds
- 8nr subsamples were analysed for hydrocarbons to the TPHCWG methodology
- 8nr subsamples of made ground soils were screened for asbestos contaminants
- Asbestos quantification testing was undertaken on 1nr positive detection
- Groundwater samples recovered from 2nr boreholes were analysed for a broad range of contaminants including pH, metals, non-metals, speciated PAH's
- Groundwater recovered from 2nr boreholes were analysed for hydrocarbons to the TPHCWG methodology

The soil and groundwater contamination test results and certificates are presented in Appendix G.

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 5: 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?	Mobile	
Highest water-soluble Sulphate results	210mg/l	Design Sulphate Class of DS-1 Class of AC-1
Lowest pH result	8.2	
Intended Working Life	50 years	Adopt Design Chemical Classification of DC-1

Table 6: Design Chemical Class Based on Groundwater Data

CONCRETE SPECIFICATION DATA SHEET		
Is the site Brownfield or Greenfield?	Brownfield	
Is the water table static or mobile?	Mobile	
Highest soluble Sulphate results	103mg/l	Design Sulphate Class of DS-1 Class of AC-1
Lowest pH result	7.7	
Intended Working Life	50 years	Adopt Design Chemical Classification of DC-1

On the basis of 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 Assessment of Risk from Ground Gases

Standpipes were constructed such that response zones were within the permeable made ground strata. 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 J) 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 generally considered as sources of “Low” generation potential, but since the development is of high sensitivity, a programme of monitoring comprising of 6 rounds distributed over a 3-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 7: Gas Monitoring Data

Position	BH1	WS2	BH3	BH4
No Monitoring Visits	2	2	2	2
CH ₄ (%)	Nil	Nil	Nil	Nil
CO ₂ (%)	6.6	0.1	1.0	0.4
O ₂ (%)	6.6	20.1	19.1	19.7
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)	3.5	2.78	Dry	Dry
PID response	0.0	0.0	0.0	0.0
Pressure Range (mb)	987-1018mbars			

Based on these results, a maximum Gas Screening Value (GSV) of 0.0066l/hrs is calculated for CO₂. Using this GSV value, the risk to the proposed development was assessed in line with Situation B as defined in CIRIA C665, and on this basis the site complies with Characteristic Situation 2. Under Characteristic Situation 2, gas protective measures are required.

When assessed against BS8485:2007 Tables F7 – F8, residential buildings (Type A) require a score of 3.5 for Characteristic Situation 2. This score may be achieved by adoption of fully suspended passively vented subfloor void (2.5 points) incorporating a proprietary gas resistant membrane such as Visqueen, or similar, installed to high levels of workmanship in line with good practice and validation (2 points).

It must be borne in mind that a further 4nr rounds of monitoring are required to finalise gas risk assessment.

10.3 New Water Mains Supply

The assessment of requirements for new water mains at this site 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 findings indicate that the soil concentrations of pertinent organic contaminant species are above the threshold concentrations permitted under the UKWIR and UUW guidance and on this basis, new water mains may be specified as Protectaline (AL/PE/AL) pipe construction. Good practice requires that the water 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.

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 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

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 J.

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 J, and since it is proposed that the site be redeveloped for residential 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 "Residential without plant uptake" land use scenario. 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.

11.4 Assessment of Contamination Data

Based on a Soil Organic Matter content of an average 2.5%, an assessment of the soil data was undertaken as summarised in the tabulations hereunder, and presented on the worksheets in Appendix H.

11.4.1 Assessment of Metal Data

The assessment of the metal data is presented hereunder:

Table 8: Assessment of Metal Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Mean (mg/kg)	Maximum (mg/kg)	Exceedances	
				(mg/kg)	Location
Cadmium	85	0.93	1.6	-	-
Chromium	910	21.8	31.1	-	-
Copper	7100	226.1	538	-	-
Lead	310	170.7	609	609	BH1
Mercury	1.2	1.34	2.6	2.1	WS2
				2.6	WS5
				1.6	BH1
				1.5	BH3
Nickel	180	38.5	68.1	-	-
Zinc	40000	265.7	579	-	-

The above assessment concludes that concentrations of Lead and Mercury at various positions exceed their respective residential land use acceptance assessment criterion and therefore a potential 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 9: Assessment of Non-Metal Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Mean (mg/kg)	Maximum (mg/kg)	Exceedances	
				(mg/kg)	Location
Arsenic	40	27.5	59.6	59.6	WS5
				40.2	BH1
				45.3	BH3
Selenium	430	1	1	-	-
Free Cyanide	22	1	1	-	-

The above assessment concludes that concentrations of Arsenic at various positions exceed its respective residential land use acceptance assessment criterion (37mg/kg) and therefore a potential risk to human health is indicated.

11.4.3 Assessment of Polycyclic Aromatic Hydrocarbon Data

The assessment of the Polycyclic Aromatic Hydrocarbon (PAH's) data is presented hereunder:

Table 10: Assessment of PAH Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Mean (mg/kg)	Maximum (mg/kg)	Exceedances	
				(mg/kg)	Location
Naphthalene	5.6	1.1	4.1	-	-
Acenaphthylene	4600	0.49	1.7	-	-
Acenaphthene	4700	3.70	23.5	-	-
Fluorene	3800	3.04	19.5	-	-
Phenanthrene	1500	40.5	275	-	-
Anthracene	35000	10.5	70.3	-	-
Fluoranthene	1600	70.3	469	-	-
Pyrene	3800	64.2	427	-	-
Benz(a)anthracene	14	35.93	243	19.1	WS4
				18.9	BH1
				243	BH3
Chrysene	31	39.7	270	270	BH3
Benzo(b)fluoranthene	4	36.5	248	19.4	WS4
				18.4	BH1
				248	BH3
Benzo(k)fluoranthene	110	32.96	270	270	BH3
Benzo(a)pyrene	3.2	38.6	262	3.2	WS2

				21.5 18.7 262	WS4 BH1 BH3
Indeno(123-cd)pyrene	46	32.01	223	223	BH3
Dibenz(ah)anthracene	0.32	5.53	35.4	0.7 3.5 0.6 3.6 35.4	WS2 WS4 WS5 BH1 BH3
Benzo(ghi)perylene	360	25.5	173	-	-

The above assessment confirms the presence of some PAH contaminants (i.e. Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenz(ah)anthracene etc.) in soils at various positions and therefore a potential 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 11: Assessment of Hydrocarbon Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Mean (mg/kg)	Maximum (mg/kg)	Exceedances	
				(mg/kg)	Location
Aromatic EC5-EC7	140	0.01	0.01	-	-
Aromatic EC7-EC8	290	0.01	0.01	-	-
Aromatic EC8-EC10	83	1	1	-	-
Aromatic EC10-EC12	180	1	1	-	-
Aromatic EC12-EC16	330	4.65	16	-	-
Aromatic EC16-EC21	540	33.52	63.2	-	-
Aromatic EC21-EC35	1500	77.7	70.4	-	-
Aliphatic EC5-EC6	78	0.01	0.01	-	-
Aliphatic EC6-EC8	230	0.01	0.01	-	-
Aliphatic EC8-EC10	65	1	1	-	-
Aliphatic EC10-EC12	330	1.81	7.5	-	-
Aliphatic EC12-EC16	2400	6.41	35	-	-
Aliphatic EC16-EC35	92000	50.5	150.8	-	-

The above assessment confirms that no hydrocarbon fraction exceeds its respective guideline criteria and therefore no risk to human health is indicated.

11.4.5 Assessment of Asbestos Data

Asbestos containing materials (ACM's - Chrysotile (Asbestos cement)) were detected in soils recovered from borehole BH1 (0.5m) and therefore a risk to human health is indicated. Quantification testing undertaken on this detection gave a result of 0.412% ACM in soil analysed.

With regards offsite disposal, current legislations, 'The Hazardous Waste (England and Wales) Regulations 2005' and 'The Special Waste Amendment (Scotland) Regulations 2004', state that any soil having an asbestos content greater than 0.1% weight/weight (w/w) is classified as 'Hazardous Waste', and any soil with an asbestos content of less than 0.1% w/w can be classified as 'Non-Hazardous Waste'. Based on this assessment, it is concluded that the soils at BH1 can be classified as 'Hazardous Waste'.

11.4.6 Assessment of BTEX Data

Positive BTEX detections are as tabulated hereunder:

Table 12: Assessment of BTEX Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Mean (mg/kg)	Maximum (mg/kg)	Exceedances	
				(mg/kg)	Location
Toluene	290	0.0316	0.0316	-	-

The above assessment confirms that a single concentration of Toluene was detected in soils at WS2 (0.5mbgl) when assessed against current guideline criteria, it is concluded that this detection poses insignificant risk to human health. All other BTEX compounds are reported to be below their limit of detection (LOD) and therefore no risk to human health is indicated.

11.4.7 Summary of Human Health Assessment

The above assessment confirms the presence of Lead, Mercury, Arsenic, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenz(ah)anthracene etc. in soils at various locations within the site and therefore a potential human health risk is identified.

In addition, ACM's in the form of Chrysotile (Asbestos cement) was detected in soils recovered from BH1 (0.5mbgl). Exposure risk associated with these contaminants includes oral/dermal and ingestion pathways and as such some remedial works will be required to mitigate these risks. The proposed forms of remediation are discussed in Section 13.0 hereunder.

12.0 CONTROLLED WATERS RISK ASSESSMENT

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

Groundwater samples obtained from 2nr borehole positions (BH1 and WS2) were analysed for a broad range of contaminants including speciated PAH and TPH concentrations. The results were assessed against Environmental Quality Standards (AA-EQS) for freshwater as shown hereunder.

Table 13: Assessment of Groundwater Data

Contaminant	BH1 Result (ug/l)	WS2 Result (ug/l)	AA-EQS (ug/l)
Naphthalene	0.06	0.56	2.4
Lead	1	1	20
Fluoranthene	0.61	8.49	0.1
Phenanthrene	0.42	6.38	-
Anthracene	0.11	1.78	-
Acenaphthylene	0.01	0.09	-
Pyrene	0.54	7.18	-
Chrysene	0.30	3.35	-
Fluorene	0.05	0.60	-
Nickel	5	6	150
Indeno(123-cd)pyrene	0.11	1.79	0.02
Benzo(ghi)perylene	0.16	2.16	0.02
Copper	5	7	40
Benzo[a]pyrene	0.25	3.84	0.05
Benzo[a]anthracene	0.22	3.84	0.05
Benzo[k]fluoranthene	0.23	3.01	0.03
Benzo[b]fluoranthene	0.17	2.42	0.03
Boron	7	46	1000
Cyanide	5	5	-
Arsenic	5	5	25
Mercury	0.1	0.1	1
Selenium	5	5	-
Cadmium	1	1	5
pH	7.7	7.7	-
Sulphate	5.4	103	400000

The above assessment confirms that some polyromantic hydrocarbons exceed their respective AA-EQS guideline criterion for inland waters and therefore a potential risk to controlled waters is indicated.

12.2 Assessment of Groundwater Hydrocarbon Data

Speciated hydrocarbon results were assessed by comparison with AA-EQS values for inland waters. In case of determinands 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 Groundwater Hydrocarbon Data

Contaminant	BH1 Result (ug/l)	WS2 Result (ug/l)	AA-EQS (ug/l)	WHO ug/l
Aromatic EC5-EC7 (benzene)	1	1	10	10
Aromatic EC7-EC8 (toluene)	1	1	-	700
Aromatic EC8-EC10 (ethyl benzene)	5	5	-	300

Aromatic EC10-EC12	5	5	-	100
Aromatic EC12-EC16	5	13.3	-	100
Aromatic EC16-EC21	5	42.4	-	90
Aromatic EC21-EC35	106	230	-	90
Aliphatic EC5-EC6	1	1	-	15000
Aliphatic EC6-EC8	1	1	-	15000
Aliphatic EC8-EC10	5	5	-	300
Aliphatic EC10-EC12	5	5	-	300
Aliphatic EC12-EC16	5	13.2	-	300
Aliphatic EC16-EC21	5	41.2	-	(300)*
Aliphatic EC21-EC35	142	242	-	(300)*

The above assessment confirms that Aromatic EC21-EC35 at BH11 and WS2 (106µg/l - 230ug/l) exceeds their respective WHO criteria (90ug/l) and therefore a potential risk to controlled waters is indicated.

12.3 Summary of Groundwater Data

The above assessment confirms that some PAH contaminants and long chained Aromatic EC21-EC35 at BH1 and WS2, exceeds its respective AA-EQS and WHO guideline criterion. However, given affected soils may be removed during site preparation works, and given the absence of nearby sensitive receptors (i.e. *licensed abstraction, river networks Environment Agency Flood Plans etc.*), and the presence of a deep stiff clay aquiclude protecting the underlying bed-rock formation (Principal Aquifer), it is concluded that the risk posed to controlled waters is insignificant.

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
Soil contamination assessment confirmed the presence of Lead, Mercury, Arsenic, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(ah)anthracene etc. contaminants in made ground soils & therefore a potential risk to human health is indicated	Oral / inhalation / ingestion / dermal pathways	Construction works Future occupants Wider environment	No remedial works required under areas of permanent hard standing. The widespread incidence of contamination detected in the investigation indicates that some pre/post construction works will be required In areas of proposed soft landscaping, existing ground levels are to be reduced to 600mm below finished garden level, with site levels being reconstructed by the placement of 600mm of clean imported subsoil / topsoil, placed under a strict validation regime comprising 1nr analyses per 100m³ with a minimum of 4 analyses per subsoil / topsoil source. Where made ground soils remain at 600mm below finished site levels, then a suitable hi-vis' geotextile fabric, such as Terram 1000, or similar, must be placed at the interface of in-situ made ground soils & imported cover systems. Independent validation inspections will be required to confirm the conditions at the reduced level and hence the requirements for Terram determined Cover thickness on all soft landscaped area is to be independently validated by excavation and photography for inclusion in a Validation Report. Imported soils are to comply with the analysis criteria contained in Appendix G
ACM's were identified in made ground soils at 1nr sampling position. Quantification testing confirms the presence of 0.412% ACM in soil analysed	Oral / inhalation pathways	Construction workers Future occupants Adjoining properties	Since site preparation works will involve removal/disturbance of soils in which positive asbestos detections were recorded, it is incumbent on the developer / contractor to devise a Health and Safety Plan which takes account of the risks of human exposure to airborne fibres during excavation and similar works which may cause disturbance of the ground. Developers / contractors should refer to CIRIA C733: Asbestos in Soils and Made Ground: A Guide to Understanding and Managing Risks. The management of works within the areas potentially affected

			by asbestos contamination in soils should be guided by CL:aire document <i>Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials – Industry Guidance</i> Recognising the risk of convective air currents, since fully suspended precast floors are to be adopted, the base of the subfloor void must receive a 50mm cover of blinding concrete
Ground gas CO ₂ levels as CS2 classification	Ingress into buildings	Future residential occupants	After 2 of 6NR rounds of gas monitoring, a Gas Screening Value (GSV) of 0.0012l/hrs is calculated for CO₂. Using this GSV value, the risk to the proposed development was assessed in line with Situation A as defined in CIRIA C665, and on this basis the site complies with Characteristic Situation 2. Under Characteristic Situation 2, gas protective measures are required. When assessed against BS8485:2007 Tables F7 – F8, residential buildings (Type A) require a score of 3.5 for Characteristic Situation 2. This score may be achieved by adoption of fully suspended vented subfloor void (2.5 points) incorporating a proprietary gas resistant membrane such as Visqueen GX, or similar, installed to high levels of workmanship in line with good practice and validation (2 points)
Some PAH contaminants and long chained Aromatic EC21-EC35 at BH1 and WS2, exceed its respective AA-EQS and WHO guideline criterion	Lateral / vertical migration of impacted water through granular made ground soil	Sensitive receptors	Given the absence of nearby sensitive receptors (i.e. licensed abstraction, river networks Environment Agency Flood Plans etc.), and the presence of a deep stiff clay aquiclude protecting the underlying bed-rock (Principal Aquifer), it is concluded that the risk posed to controlled waters is insignificant.

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 I. This program generates the baseline *Hazardous / Non-Hazardous* classification of soils.

It can be seen that the appended **HAZWASTE** report classify the soil analysed from 1nr position (BH3) classify as being '*Hazardous Waste*' by virtue of elevated concentrations of Benzo[a]anthracene (243mg/kg), Dibenzo[a,h,]anthracene (35.4mg/kg) and TPHCWG (1520mg/kg). All other samples analysed classify as being '*Non-Hazardous Waste*'.

In addition, Asbestos quantification testing undertaken on 1nr positive asbestos detection confirm the presence by weight (%), 0.412% ACM in soils analysed BH1. With regards offsite disposal, current legislations, 'The Hazardous Waste (England and Wales) Regulations 2005' and 'The Special Waste Amendment (Scotland) Regulations 2004', state that any soil having an asbestos content greater than 0.1% weight/weight (w/w) is classified as Hazardous Waste.

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 FOUNDATIONS & FLOOR SLABS

15.1 Introduction

Following the demolition of an existing former motor vehicle maintenance workshop (**THE BODY SHOP**) and subsequent site clearance, it is proposed that the site be redeveloped for mixed commercial / residential land use by the construction of a 6-storey block incorporating mixed ground floor residential, retail and leisure facilities and ancillary offices etc., with residential apartments occupying the remaining storeys. The existing and proposed site layouts, and elevations of the proposed scheme, are as illustrated on **KDP** architectural drawings contained herein.

15.2 Observed Ground Conditions

This site investigation confirms the presence of concrete / tarmac paving and associated subbase overlying made ground soils comprising loose locally medium dense gravelly sand / soft brown clay deposits extending to depths varying between 0.6m – 1.7mbgl. The sequence thereafter continues in natural drift deposits comprising firm becoming stiff brown boulder clay locally extending to 8.8mbgl, overlying medium dense grey/brown gravelly sand locally interbedded with thin stiff clay horizons before continuing in red / orange sandstone recovered at the surface

(by cable percussive methods) as very dense gravelly sand (drilling induced), then a weak locally moderately weak (by rotary coring methods) sandstone thereafter, proven to 22.2mbgl (BH2).

Soil classification testing confirms the cohesive clay soils to be of 'Low to Intermediate' plasticity, and hence 'Low to Intermediate' shrinkability.

15.3 Foundations

Taking account of the potentially high loads imposed by the construction of a 6-storey block, piled foundations are the preferred solution.

In the observed ground conditions piles will be installed by CFA methods. Piling contractors must satisfy themselves regarding the preferred piling method, particularly in relation to the observed rock strength parameters, and if necessary should commission further rock coring to supplement the data on which these conclusions have been based.

For the purposes of preliminary design, the approximate carrying capacity of single isolated piles installed 2m into the bedrock formation may be taken as follows:

Table 16: Pile Carrying Capacity

Pile Diameter mm	Carrying capacity kN
450	750
600	1000

Piling contractors must be required to provide capacity calculations for their own proprietary pile type in isolation and in groups as appropriate to the design.

15.4 Floor Slabs

Given the variable depth, and poor density of the underlying made ground soils, and taking account of the gassing regime recorded to date, it is recommended that a fully suspended passively vented precast concrete flooring system, such as 'Bison Hollowfloor' or similar be adopted incorporating a gas-proof membrane, carried on a series of piled ground-beams with vented subfloor void space blinded with 50mm concrete at base of void

15.5 Excavations

Excavations may be undertaken in the observed ground condition by light hydraulic excavators. Excavations in excess of 1.2mbgl will require side support.

15.6 Groundwater Management

Monitored standing water levels are recorded to be in the order of 3.5mbgl at BH1 and 2.78mbgl at WS2 during the ongoing gas / groundwater monitoring programme. A prudent contractor would allow for some minor pumping during ground beam construction and/or service installations to maintain dry working conditions during periods of prolonged 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 Authority review.

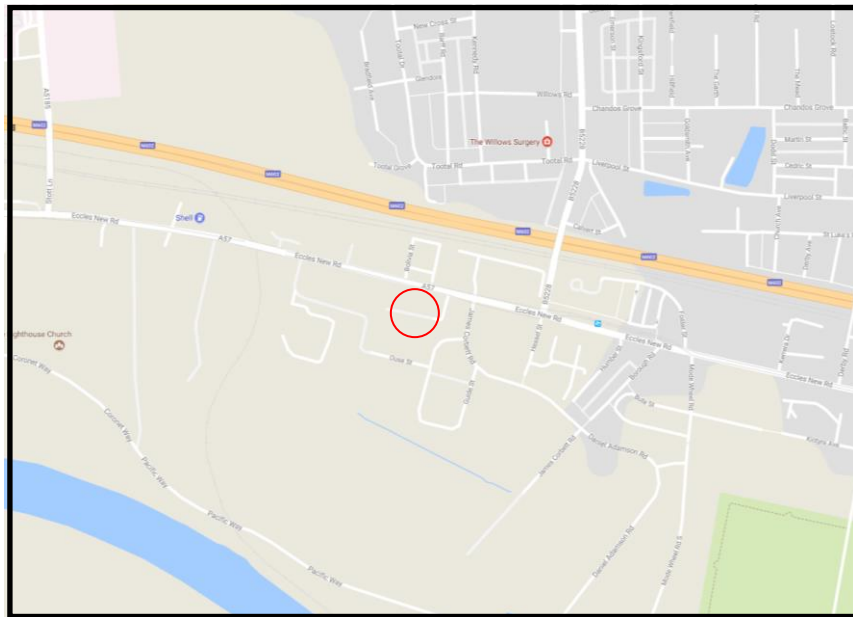
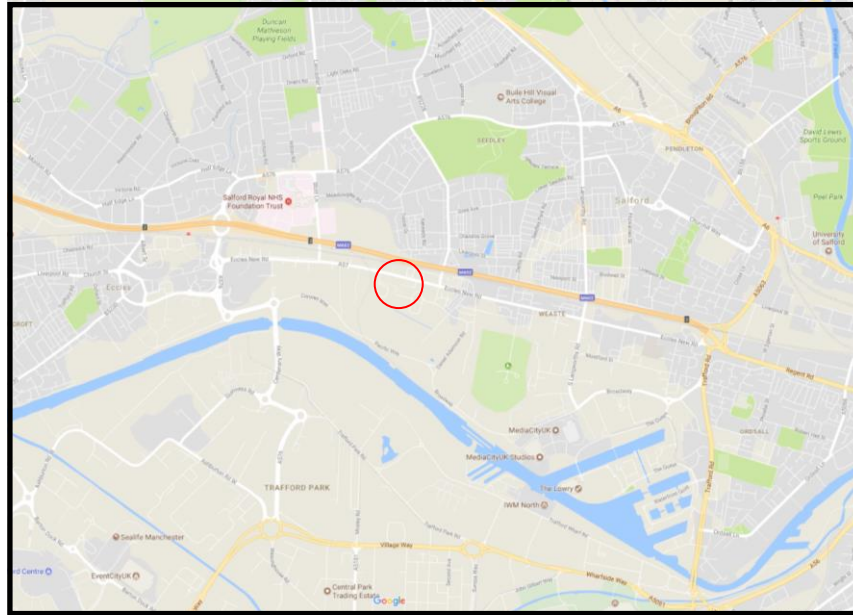
Table 17: Summary of Conclusions

Soil Chemical Contamination & Remediation	Soil contamination assessment confirmed the presence of Lead, Mercury, Arsenic, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenz(ah)anthracene etc. contaminants in made ground soils & therefore a potential risk to human health is indicated In areas of proposed soft landscaping, existing ground levels are to be reduced to 600mm below finished garden level, with site levels being reconstructed by the placement of 600mm of clean imported subsoil / topsoil, placed under a strict validation regime comprising 1nr analyses per 100m³ with a minimum of 4 analyses per subsoil / topsoil source. Where made ground soils remain at 600mm below finished site levels, then a suitable hi-vis' geotextile fabric, such as Terram 1000, or similar, must be placed at the interface of in-situ made ground soils & imported cover systems. Independent validation inspections will be required to confirm the conditions at the reduced level and hence the requirements for Terram determined Cover thickness on all soft landscaped area is to be independently validated by excavation and photography for inclusion in a Validation Report.
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	Imported soils are to comply with the analysis criteria contained in Appendix G
Soil Contamination (Asbestos) & Remediation	ACM's were identified in made ground soils at 1nr sampling position. Quantification testing confirms the presence of 0.412% ACM in soil analysed. No remedial works required under areas of permanent hard standing – roads, driveways, buildings. Since site preparation works will involve removal/disturbance of soils in which positive asbestos detections were recorded, it is incumbent on the developer / contractor to devise a Health and Safety Plan which takes account of the risks of human exposure to airborne fibres during excavation and similar works which may cause disturbance of the ground. Developers / contractors should refer to CIRIA C733: Asbestos in Soils and Made Ground: A Guide to Understanding and Managing Risks. The management of works within the areas potentially affected by asbestos contamination in soils should be guided by CL:aire document <i>Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials – Industry Guidance</i> Since fully suspended block and beam floors are to be adopted, and on this basis subfloor void at all locations must receive a 50mm cover of blinding concrete
Controlled Waters Risk Assessment	Some PAH contaminants and long chained Aromatic EC21-EC35 at BH1 and WS2, exceed its respective AA-EQS and WHO guideline criterion. Given the absence of nearby sensitive receptors (i.e. licensed abstraction, river networks Environment Agency Flood Plans etc.), and the presence of a deep stiff clay aquiclude protecting the underlying bed-rock (Principal Aquifer), it is concluded that the risk posed to controlled waters is insignificant.
Water Mains	The findings indicate that the soil concentrations of pertinent organic contaminant species are above the threshold concentrations permitted under the UKWIR and UUV guidance and on this basis, new water mains may be specified as Protectaline (AL/PE/AL) pipe construction. Good practice requires that the water 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.
Foundations	See Section 15.0 for a full discussion
Floor slabs	See Section 15.0 for fuller discussion
Concrete specification	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 2nr round of gas monitoring, a maximum Gas Screening Value (GSV) of 0.0066l/hrs is calculated for CO₂. Using this GSV value, the risk to the proposed development was assessed in line with Situation A as defined in CIRIA C665, and on this basis the site complies with Characteristic Situation 2. Under Characteristic Situation 2, gas protective measures are required. When assessed against BS8485:2007 Tables F7 – F8, residential buildings (Type A) require a score of 3.5 for Characteristic Situation 2. This score may be achieved by adoption of fully suspended vented subfloor void (2.5 points) incorporating a proprietary gas resistant membrane such as Visqueen GX, or similar, installed to high levels of workmanship in line with good practice and validation (2 points). It must be borne in mind that a further 5nr rounds of monitoring are required to finalise gas risk assessment.
Waste Classification	The soil analysed from 1nr position (BH3) classify as 'Hazardous Waste' by virtue of elevated concentrations of Benzo[a]anthracene (243mg/kg), Dibenzo[a,h]anthracene (35.4mg/kg) and TPHCWG (1520mg/kg). All other samples analysed classify as being 'Non-Hazardous Waste'. In addition, Asbestos quantification testing undertaken on 1nr positive asbestos detection confirm the presence, by weight (%), 0.412% ACM in soils analysed BH1. Notwithstanding the above asbestos detections, with regards offsite disposal, current legislations, 'The Hazardous Waste (England and Wales) Regulations 2005' and 'The Special Waste Amendment (Scotland) Regulations 2004', state that any soil having an asbestos content greater than 0.1% weight/weight (w/w) is classified as Hazardous Waste. 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.
Groundwater Control	Monitored standing water levels are recorded to be in the order of 3.5mbgl at BH1 and 2.78mbgl at WS2 during the ongoing gas / groundwater monitoring programme. A prudent contractor would allow for some minor pumping during ground beam construction and/or service installations to maintain dry working conditions during periods of prolonged precipitation.
Excavations	Light hydraulic excavators may undertake excavations. Excavations in excess of 1.2mbgl will require side support.
Further work	Complete ongoing gas monitoring & update gas risk assessment Prepare Phase III Remediation Strategy Report Prepare Phase IV Validation / Completion Report



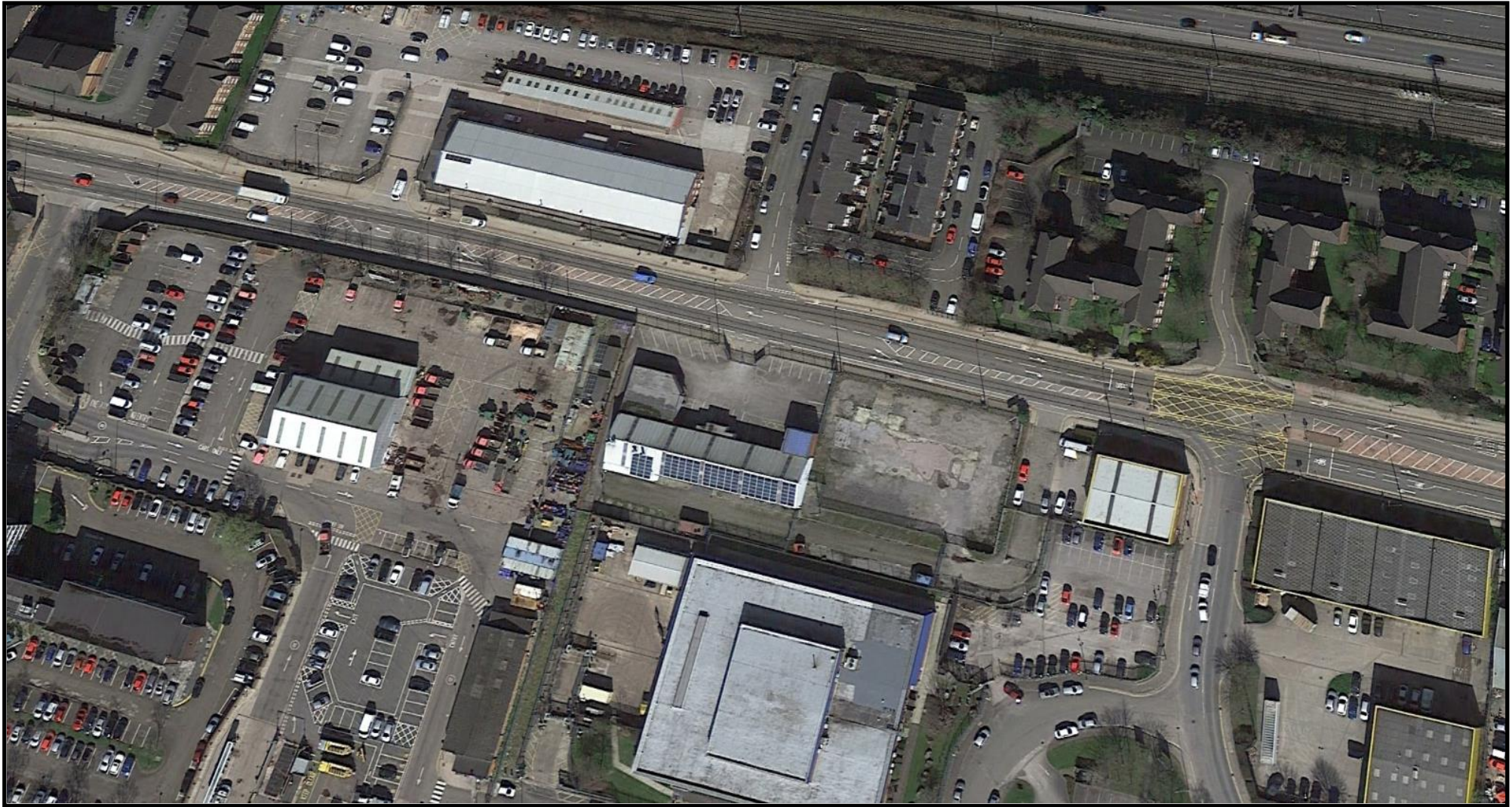
APPENDIX A: DRAWINGS



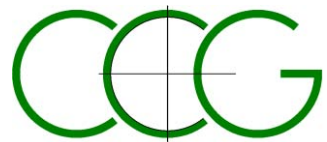
Drawing Number:	17-9806-1
Site Location:	Eccles New Road, Salford, Manchester
Map Information:	Site Location

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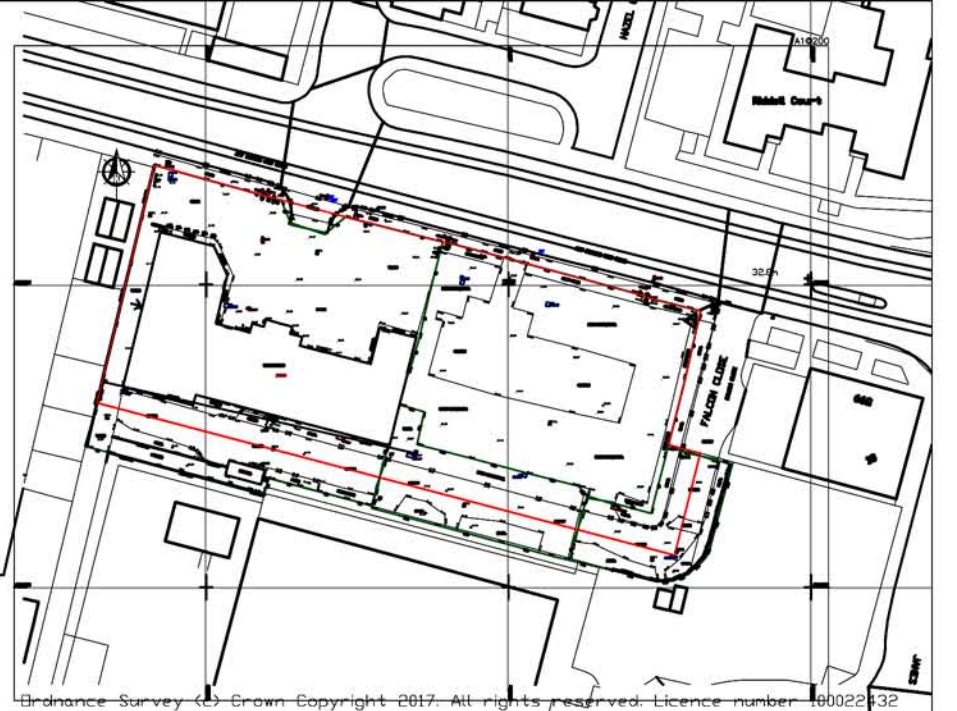


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Drawing Number:	17-9806-2
Site Location:	Eccles New Road, Salford, Manchester
Map Information:	Aerial Photo
Scale:	NTS



Existing Site Plan
Scale 1:1250

- Cable percussive borehole
- Light dynamic sampling borehole
- Sampling positions, BH1, WS2, BH3 & BH4 to be utilised for gas groundwater monitoring

Existing Site Plan
Scale 1:200



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Revisions				Revisions				Revisions				Revisions				Revisions			
Rev	Date	Description		Rev	Date	Description		Rev	Date	Description		Rev	Date	Description		Rev	Date	Description	
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Client
West One Residence Ltd.

Job title
**Land Eccles New Rd. Salford
Residential Scheme**

Drawing title
Existing Site Plan

Planning

Job number
1482

Drawing number
101

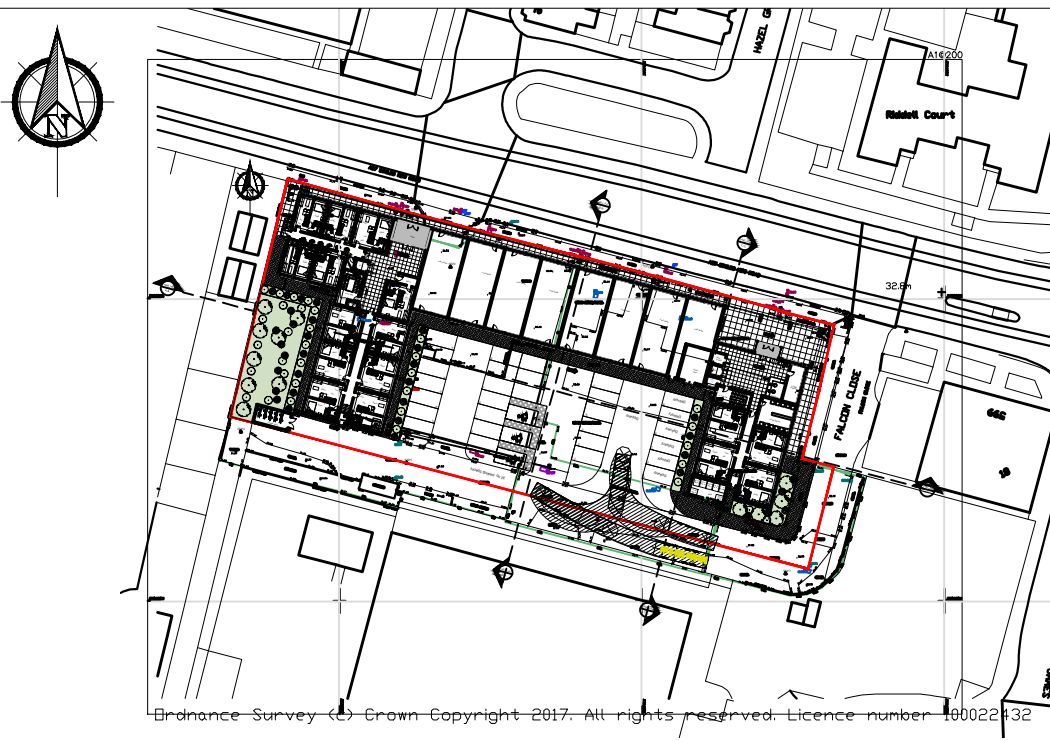
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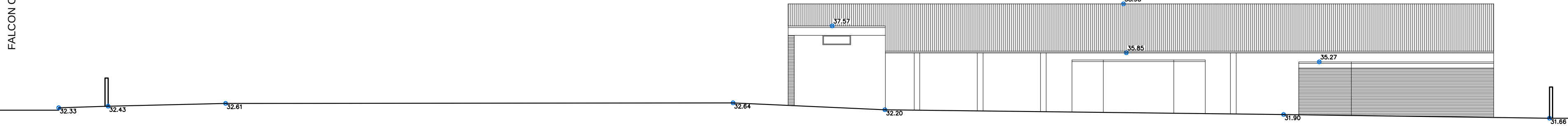
Revision



Proposed Site Plan
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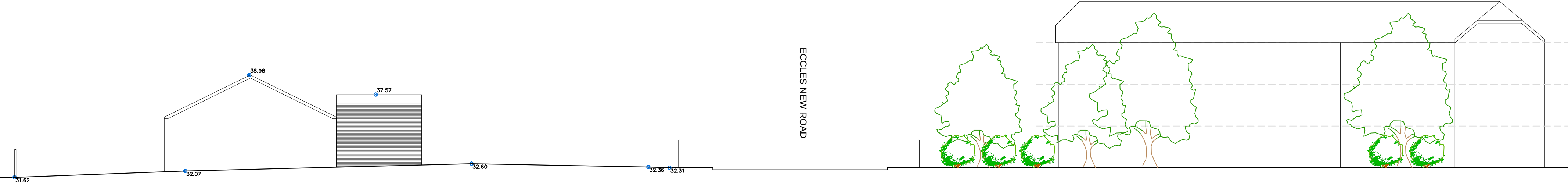
FALCON CLOSE

GARAGE



Existing Site Section A-A
Scale 1:200

ECCLES NEW ROAD



FALCON CLOSE

Existing Site Section B-B
Scale 1:200



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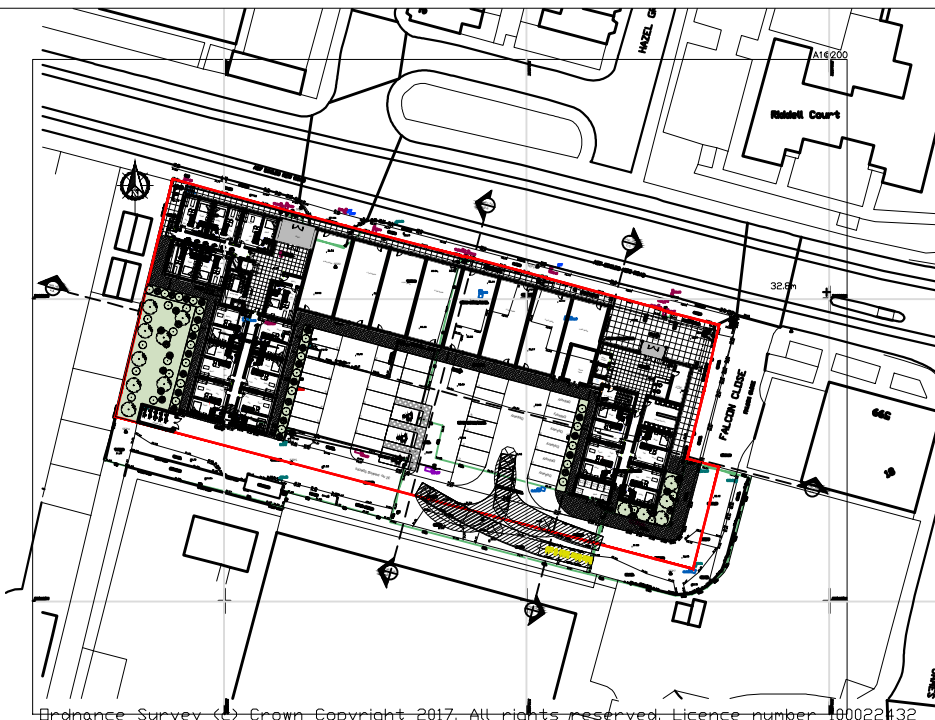
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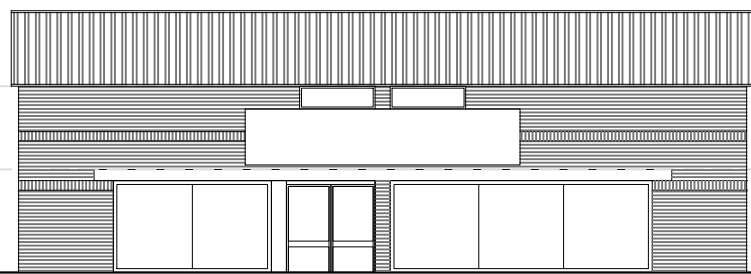
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13 Seymour Terrace		1482	
Seymour Street		Drawing number	
Liverpool		201	
L3 5PE		Revision	
Telephone: +44 (0) 151 709 1777		Client	
Facsimile: +44 (0) 151 708 9998		West One Residence Ltd.	
Email: info@kdparchitects.com		Job title	
Website: www.kdparchitects.com		Land Eccles New Rd. Salford	
Drawing title		Residential Scheme	
Existing Site Sections		Scale	
		1:200/A1 GLP SRD	
		Date	
		01.06.17	



Proposed Site Plan
Scale 1:1250

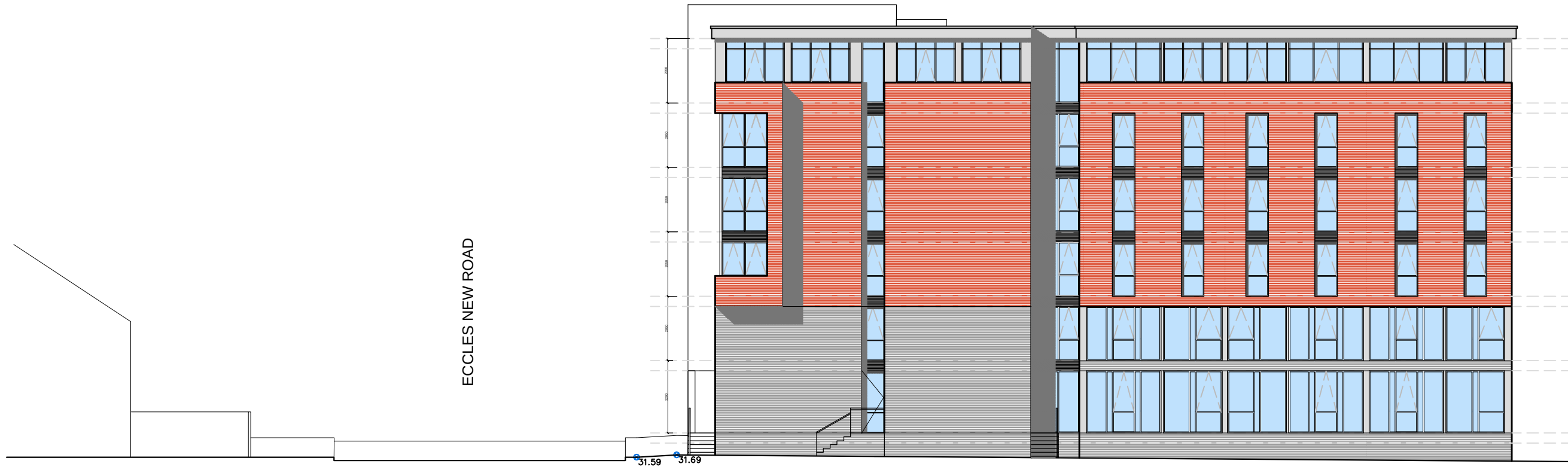


FALCON CLOSE



Proposed Street Scene from Eccles New Road
Scale 1:200

ECCLES NEW ROAD



Proposed Street Scene
Scale 1:200



FALCON CLOSE

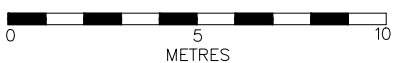
Proposed Street Scene from Rear Side
Scale 1:200



ECCLES NEW ROAD

Proposed Street Scene from Falcon Close
Scale 1:200

FALCON CLOSE



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Job title
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Residential Scheme**

Job number
1482
Drawing number

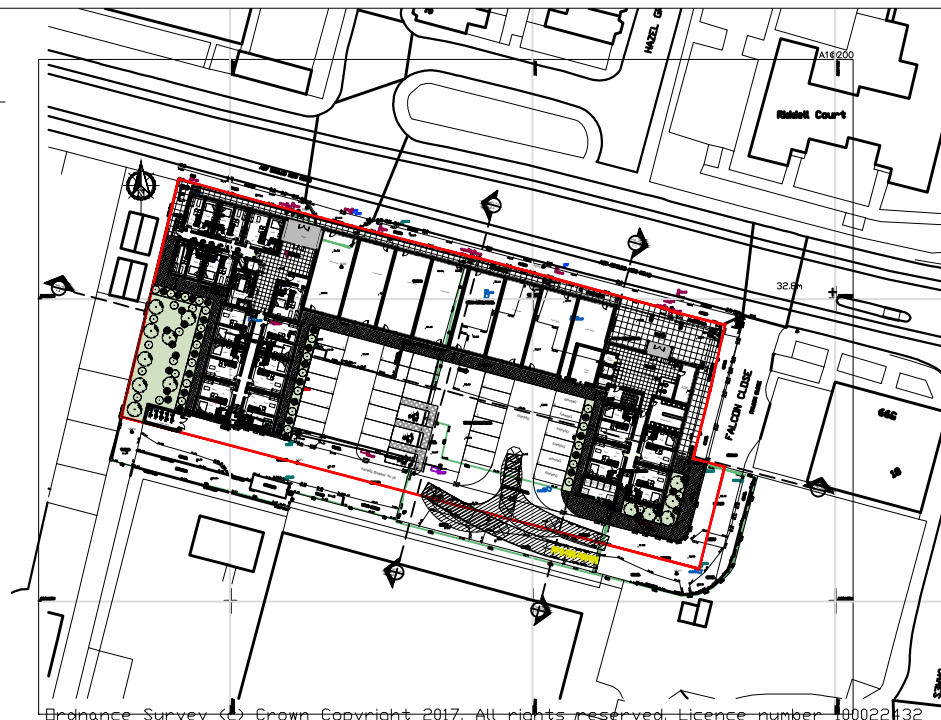
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Proposed Street Scenes

Scale	Drawn	Checked	Date
1:200/A1	GLP	SRD	01.06.17

Planning

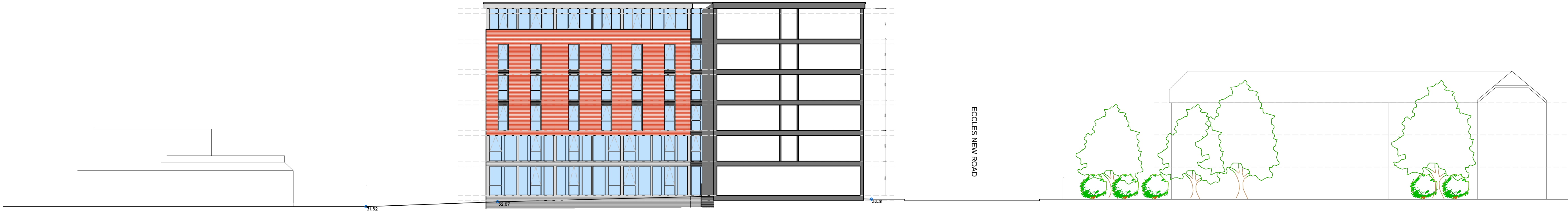
Revision



Proposed Site Plan
Scale 1:1250



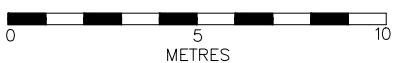
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Scale 1:200



Proposed Site Section B-B
Scale 1:200



Proposed Section C-C
Scale 1:200



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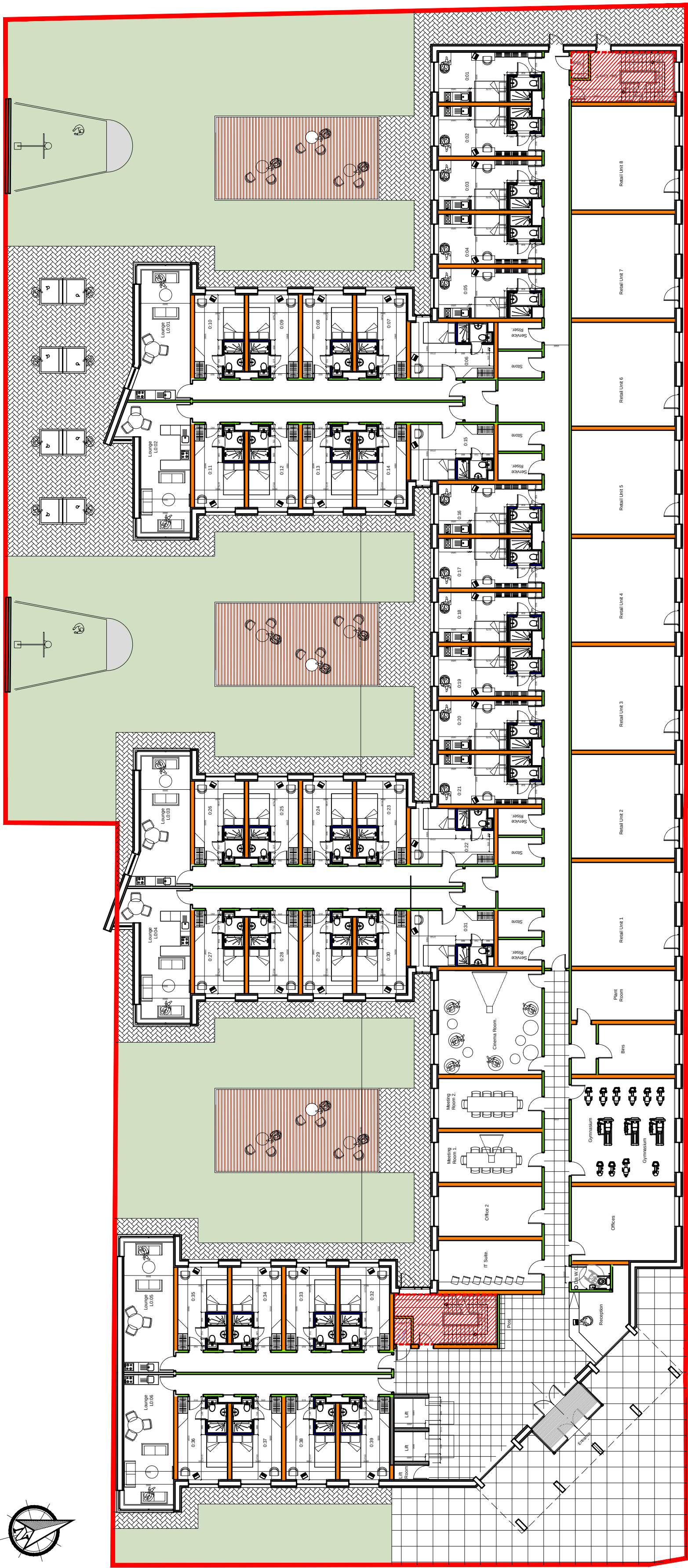
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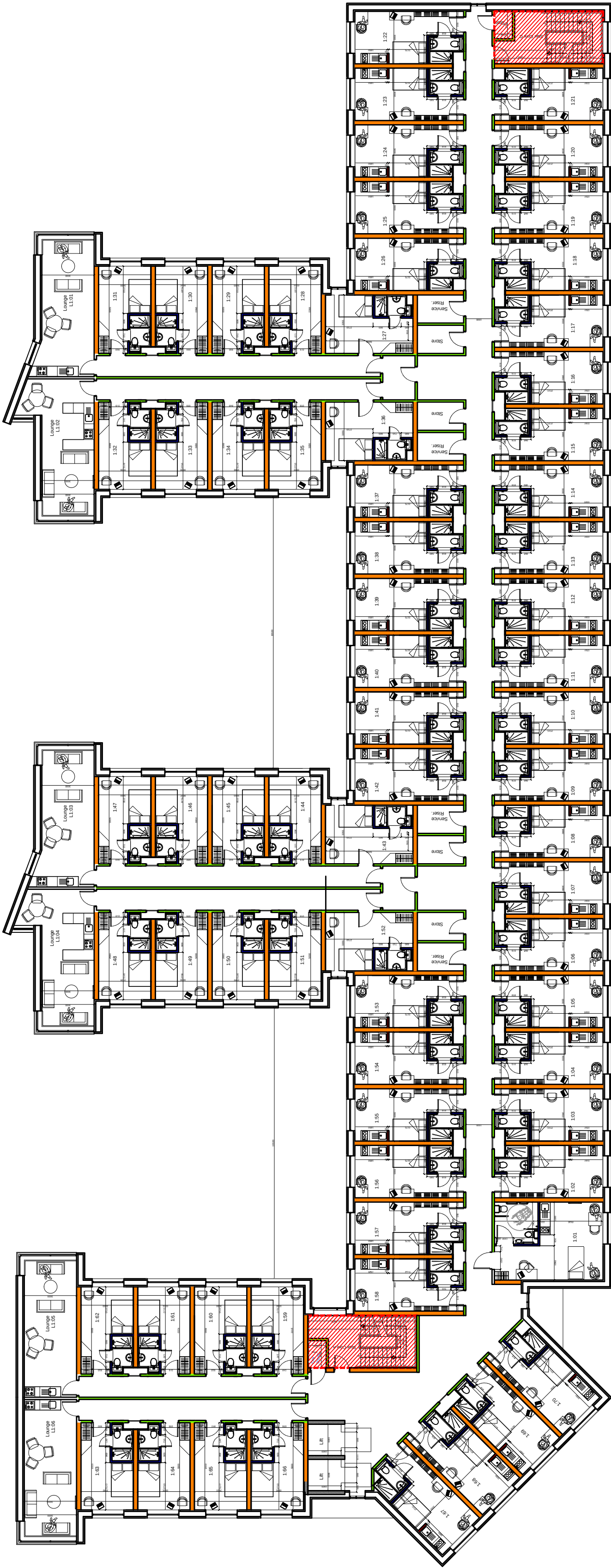
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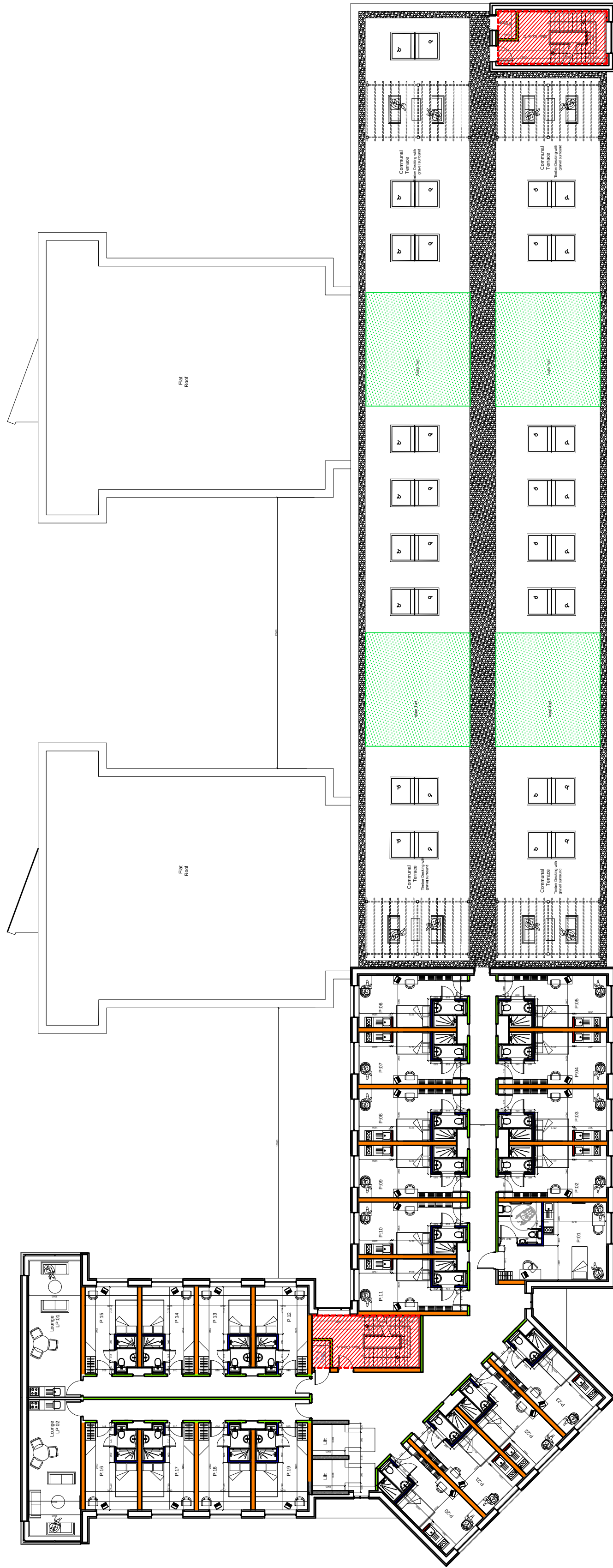
THE KEITH DAVIDSON PARTNERSHIP				Planning	
CHARTERED ARCHITECTS - PROJECT MANAGEMENT - 3D VISUALISATION				Job number	Revision
13 Seymour Terrace Seymour Street Liverpool L3 5PE Telephone: +44 (0) 151 709 1777 Facsimile: +44 (0) 151 708 9998 Email: info@kdparchitects.com Website: www.kdparchitects.com				Client West One Residence Ltd. Job title Land Eccles New Rd. Salford Residential Scheme	1482 Drawing number
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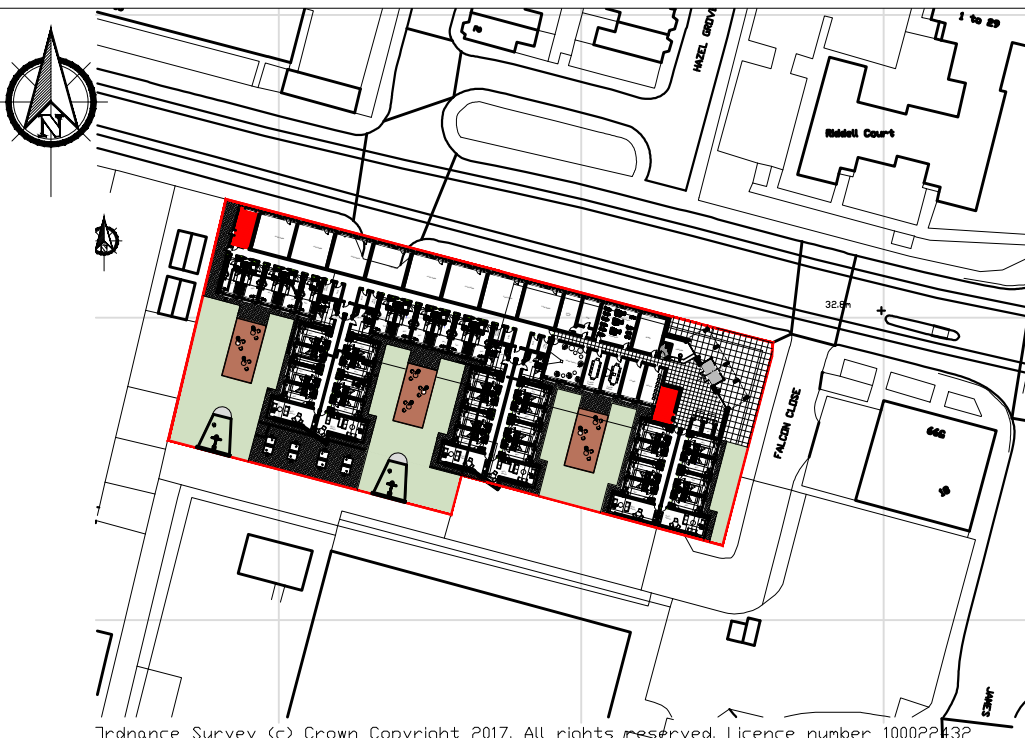
Proposed Ground Floor Plan
Scale 1:200



Proposed First Floor Plan - (typical floor plan)
Scale 1:200



Proposed Penthouse Floor Plan
Scale 1:200



Proposed Site Plan
Scale 1:1250

LEGEND

Ground Floor	= 6 no. Cluster Rooms	39 Rooms
	15 no. Studios	
1st Floor	= 28 no. Cluster Rooms	70 Rooms
	41 no. Studios	
	1 no. Accessible Rooms	
Penthouse Floor	= 8 no. Cluster Rooms	23Rooms
	14 no. Studios	
	1 no. Accessible Rooms	
TOTAL	=	



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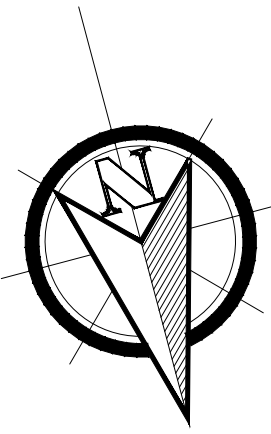
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13 Seymour Terrace Seymour Street Liverpool L3 5PE				ENR/YUG	100
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Telephone: +44 (0) 151 709 1777 Facsimile: +44 (0) 151 708 9998 Email: info@kdparchitects.com Website: www.kdparchitects.com				Client	YU Group Job title Land Eccles New Rd. Salford Student Scheme
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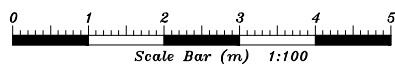


Proposed Second Floor Plan
Scale 1:100

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Proposed Third Floor Plan
Scale 1:100



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Client
West One Residence Ltd.
Job title
Land Eccles New Rd. Salford
Residential Scheme

Drawing title
Proposed Third Floor Plan

PLANNING

Job number
1482

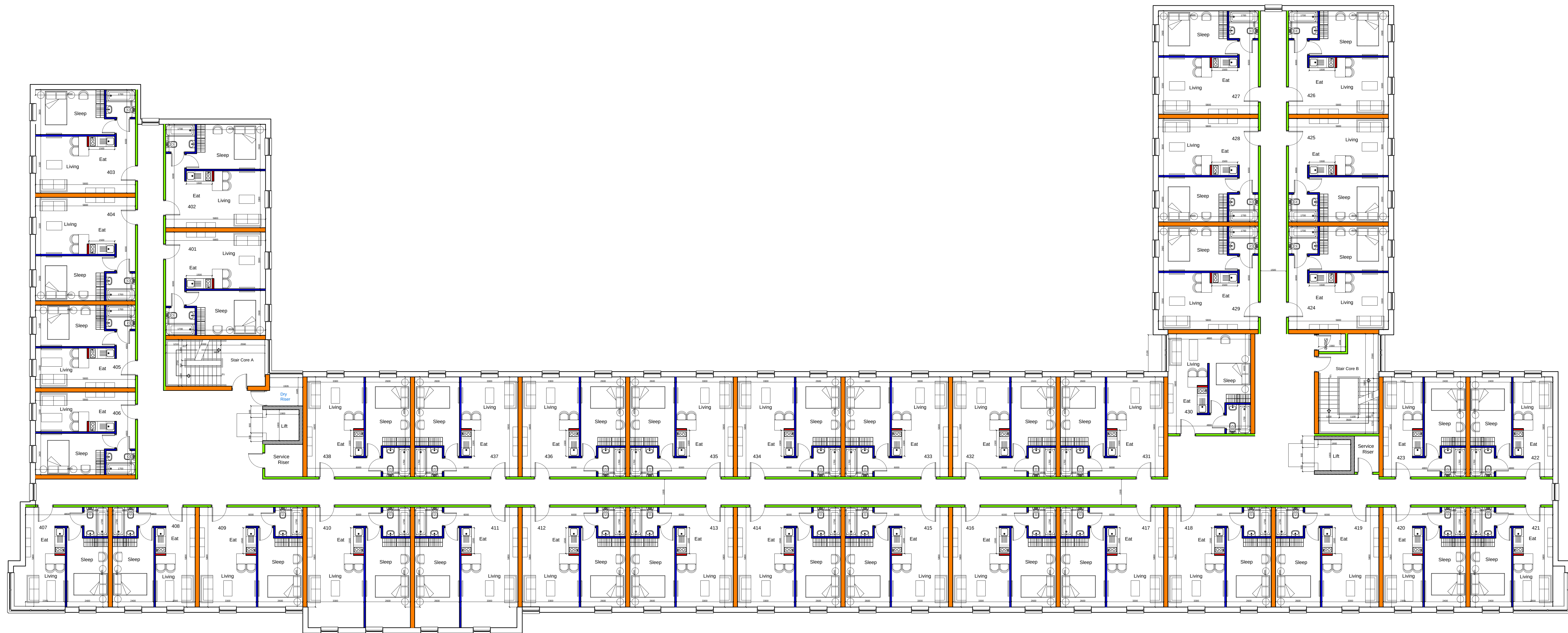
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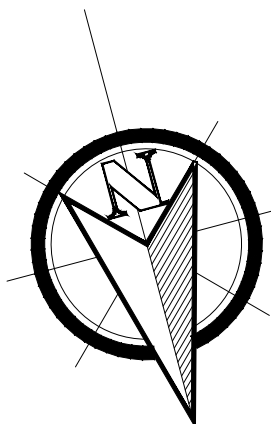
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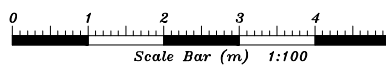


Proposed Fourth Floor Plan
Scale 1:100

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Proposed Fifth Floor Plan
Scale 1:100



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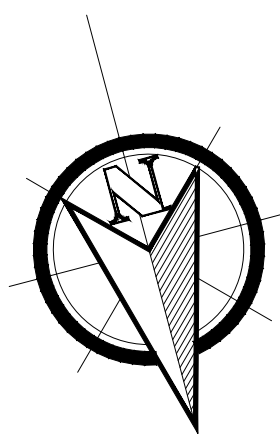
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Seymour Street
LIVERPOOL
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Telephone: +44 (0) 151 709 1777
Facsimile: +44 (0) 151 709 9568
Email: info@kdparchitects.com
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West One Residence Ltd.
Job title
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Residential Scheme

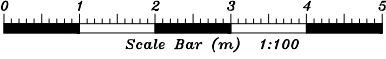
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Drawing number
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Drawn
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Checked
SPD
Date
01.06.17

Drawing title
Proposed Fifth Floor Plan



Proposed Sixth Floor Plan
Scale 1:100



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Client
West One Residence Ltd.

Job title
**Land Eccles New Rd. Salford
Residential Scheme**

Drawing title
Proposed Roof Plan

Job number
1482

Drawing number
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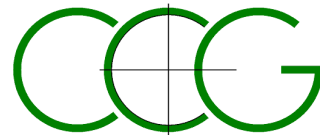
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PLANNING

Revision



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.

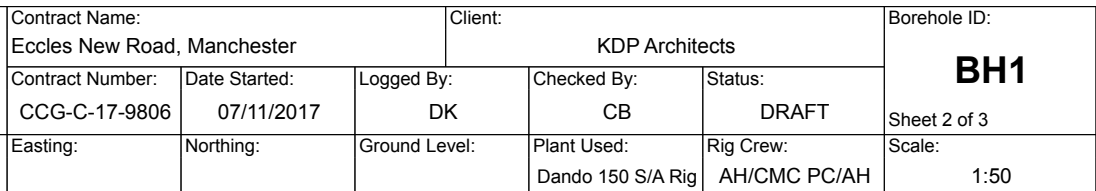
Once the gas in the installation has regained equilibrium, the gas analyser is connected and monitoring commences. The peak and steady state readings for CH_4 , CO_2 , CO , H_2S and CO are recorded. The steady state is monitored for a minimum of one minute, and possibly up to a maximum of 10 minutes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

	Contract Name: Eccles New Road, Manchester		Client: KDP Architects			Borehole ID: BH1	
	Contract Number: CCG-C-17-9806	Date Started: 07/11/2017	Logged By: DK	Checked By: CB	Status: DRAFT		
Cable Percussion Borehole Log	Easting:	Northing:	Ground Level:	Plant Used: Dando 150 S/A Rig	Rig Crew: AH/CMC PC/AH	Sheet 1 of 3	
						Scale: 1:50	
Weather:		Termination:			SPT Hammer: N/R, Energy Ratio: N/R		
Samples & In Situ Testing			Strata Details				Groundwater
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike
0.50	B	SPT(S)N=12 (2,2/3,3,3,3)		0.10 (0.30) 0.40		TARMAC CONCRETE	
1.00	B			(0.80)		Brown slightly sandy gravelly silty CLAY. Gravel is fine to coarse angular brick (MADE GROUND)	1
1.50	B			1.20		Firm brown slightly sandy slightly gravelly silty CLAY	
2.00 - 2.45	UT	SPT(S)N=16 (2,3/3,4,4,5)		(1.20)		Firm to stiff grey slightly sandy slightly gravelly silty CLAY	2
3.50	B			2.40		LIMITED RECOVERY IN U100 SAMPLING - 2.00-2.45mbgl	
4.00 - 4.45	UT			(4.30)		Firm to stiff grey slightly sandy slightly gravelly silty CLAY with occasional bands of gravel	3
4.50	B	SPT(S)N=15 (2,3/3,4,4,4)					4
6.00	B						5
6.00 - 6.45	UT						6
7.50	B	SPT(S)N=39 (4,7/9,9,10,11)		6.70		Medium dense to dense grey/brown slightly silty SAND and GRAVEL with occasional pockets of clay	7
				(1.30)			
9.00	B			8.00		Red/orange weathered SANDSTONE recovered initially at the surface as very dense slightly silty very sandy gravel (drilling induced)	8
		SPT(C)N=82 (9,16/20,19,21,22)		(2.70)			9
Continued next sheet							
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)
1 hour hand excavating 1.20mbgl service avoidance pit							
Water Strikes							
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks		
			0		Borehole dry		
Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)
7.10	7.30	01:00	Boulder/Cobble	0.00	0.50	PLAIN	
				0.50	6.00	SLOTTED	
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com							

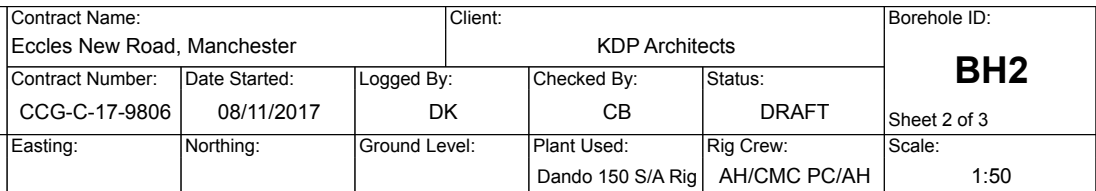


Samples & In Situ Testing	Strata Details	Groundwater
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Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	1 hour hand excavating 1.20mbgl service avoidance pit					
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
7.10	7.30	01:00	Boulder/Cobble		0.00	0.50	PLAIN					0		Borehole dry
					0.50	6.00	SLOTTED							
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														

	Contract Name: Eccles New Road, Manchester				Client: KDP Architects				Borehole ID: BH1					
	Contract Number: CCG-C-17-9806	Date Started: 07/11/2017	Logged By: DK	Checked By: CB	Status: DRAFT									
Rotary Core Drilling Log	Easting:	Northing:	Ground Level:	Plant Used: Dando 150 S/A Rig	Rig Crew: AH/CMC PC/AH	Scale: 1:50								
	Weather:		Termination:		SPT Hammer: N/R, Energy Ratio: N/R									
Samples & In Situ Testing						Strata Details					Groundwater			
Depth	TCR	SCR	RQD	Fracture Spacing	Water Added	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description		Water Strike	Backfill/ Installation		
19.70 - 21.20	95	68	47	41			21.20		HIGHLY WEATHERED - 20.94-21.01mbgl NO RECOVERY - 21.15-21.20mbgl End of Borehole at 21.20m	20				
				94						21				
				200						22				
				140						23				
										24				
										25				
										26				
										27				
										28				
										29				
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)	1 hour hand excavating 1.20mbgl service avoidance pit					
Flush Information						Installation				Water Strikes				
Top (m)	Base (m)	Flush Type	Return	Flush Colour	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00	0.50	PLAIN					0		Borehole dry
					0.50	6.00	SLOTTED		Fracture spacing reported in mm as min, Average and Max values. TCR, SCR and RQD reported in %					
CCGEOTECHNICAL LTD 0151 545 2750 www.ccgteotechnical.com														

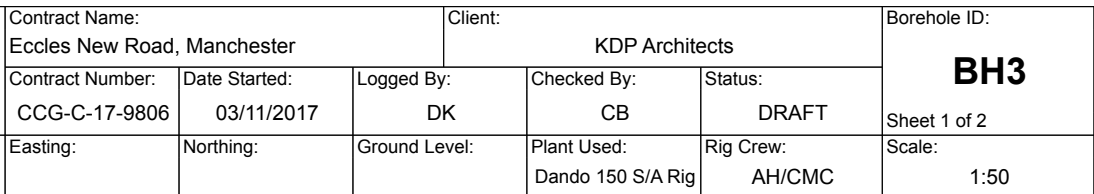
	Contract Name: Eccles New Road, Manchester			Client: KDP Architects			Borehole ID: BH2		
	Contract Number: CCG-C-17-9806	Date Started: 08/11/2017	Logged By: DK	Checked By: CB	Status: DRAFT				
	Cable Percussion Borehole Log	Easting:	Northing:	Ground Level:	Plant Used: Dando 150 S/A Rig	Rig Crew: AH/CMC PC/AH	Sheet 1 of 3		
Weather:		Termination:			SPT Hammer: N/R, Energy Ratio: N/R			Scale: 1:50	
Samples & In Situ Testing				Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation	
0.30	B	SPT(S)N=11 (1,2/2,3,3,3)		0.10	TARMAC	1			
0.60	B			0.20	CONCRETE				
				(0.30)	Brown slightly silty sandy GRAVEL. Gravel is fine to coarse angular brick (MADE GROUND)				
				(0.30)	Black/grey slightly gravelly sandy silty CLAY (MADE GROUND)				
				(0.80)	Firm brown/grey slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse angular brick (MADE GROUND)				
1.00	B		(0.60)						
1.50	B			1.40	Firm becoming stiff grey slightly sandy slightly gravelly silty CLAY with occasional inclusions of coal				
2.00 - 2.45	UT					2			
		SPT(S)N=18 (2,3/4,4,5,5)							
3.50	B								
4.00 - 4.45	UT			(5.30)		4			
4.50	B								
		SPT(S)N=20 (3,4/4,5,5,6)							
6.00	B								
6.00 - 6.45	UT					6			
				6.70	Dense red/brown slightly silty slightly gravelly SAND with frequent pockets of clay				
7.50	B	SPT(S)N=35 (4,6/8,8,9,10)		(1.50)		7			
				8.20	Stiff grey/brown slightly sandy slightly gravelly silty CLAY	8			
				(1.00)					
9.00	B	SPT(S)N=40 (4,7/9,9,11,11)		9.20	Red/orange weathered SANDSTONE recovered initially at the surface as very dense slightly silty sandy GRAVEL (drilling induced)	9			
Continued next sheet									
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)	1 hour hand excavating 1.20mbgl service avoidance pit
Chiselling					Installation				Water Strikes
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)
10.70	11.70	01:00	Sandstone					Sealed (m)	Time (mins)
								Rose to (m)	Remarks
								0	Borehole dry
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Samples & In Situ Testing	Strata Details	Groundwater
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Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: 1 hour hand excavating 1.20mbgl service avoidance pit					
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
10.70	11.70	01:00	Sandstone									0		Borehole dry
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	Contract Name: Eccles New Road, Manchester				Client: KDP Architects				Borehole ID: BH2					
	Contract Number: CCG-C-17-9806	Date Started: 08/11/2017	Logged By: DK	Checked By: CB	Status: DRAFT									
Rotary Core Drilling Log	Easting:	Northing:	Ground Level:	Plant Used: Dando 150 S/A Rig	Rig Crew: AH/CMC PC/AH	Sheet 3 of 3 Scale: 1:50								
	Weather:		Termination:		SPT Hammer: N/R, Energy Ratio: N/R									
Samples & In Situ Testing						Strata Details						Groundwater		
Depth	TCR	SCR	RQD	Fracture Spacing	Water Added	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/Installation	
19.20 - 20.70	95			35 84 191					HIGHLY WEATHERED - 20.46-20.70mbgl HIGHLY WEATHERED - 21.70-21.80mbgl HIGHLY WEATHERED - 22.08-22.20mbgl End of Borehole at 22.20m			20		
20.70 - 22.20	100			28 83 112		22.20	21							
				30			22							
							23							
												24		
												25		
												26		
												27		
												28		
												29		
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)	1 hour hand excavating 1.20mbgl service avoidance pit					
Flush Information						Installation				Water Strikes				
Top (m)	Base (m)	Flush Type	Return	Flush Colour	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0		Borehole dry
Fracture spacing reported in mm as min, Average and Max values. TCR, SCR and RQD reported in %														
CCGEOTECHNICAL LTD 0151 545 2750 www.ccgteotechnical.com														



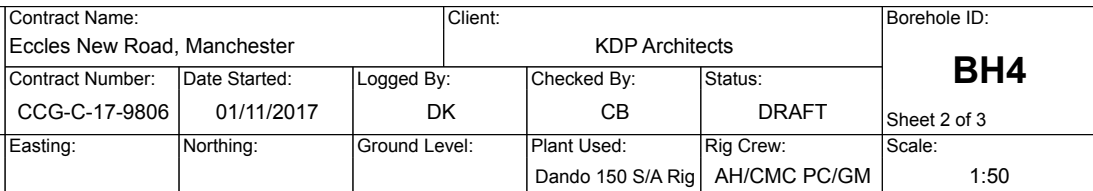
Samples & In Situ Testing	Strata Details	Groundwater
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Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation	
0.50	B	SPT(S) 2.00m, N=14 (2,2/3,3,4,4)		0.10		COBBLE ROAD			
				(0.50)		Black slightly silty sandy GRAVEL. Gravel is fine to coarse angular brick and ash (MADE GROUND)			
0.60				Firm becoming stiff brown/grey slightly sandy slightly gravelly silty CLAY with inclusions of coal	1				
1.00	B								
1.70	B								2
2.50	B								
3.00 - 3.45	UT			(4.60)					3
3.50	B								
4.50	B			SPT(S) 4.00m, N=18 (3,4/4,4,5,5)					4
				SPT(S) 5.00m, N=35 (4,6/8,8,9,10)					5
6.00	B	SPT(S) 6.00m, N=21 (3,6/6,5,5,5)	5.20		Dense varying to medium dense yellow/orange slightly silty slightly gravelly SAND with frequent pockets of clay	6			
			(2.00)			7			
7.50	B		7.20		Brown slightly sandy slightly gravelly silty CLAY				
7.50 - 7.95	UT		(0.60)						
			7.80		Yellow slightly silty gravelly SAND	8			
			(0.40)						
9.00	B	SPT(C) 9.00m, N=81 (7,18/19,20,20,22)	8.20		Red/orange weathered SANDSTONE recovered initially at the surface as very dense slightly silty sandy GRAVEL (drilling induced)	9			
						10			
					Continued next sheet				

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)	1 hour hand excavating 1.20mbgl service avoidance pit					
									Water Strikes					
Chiselling					Installation				Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)				0		Borehole dry
					0.00	0.50	PLAIN	50						
					0.50	6.60	SLOTTED	50						
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	Contract Name: Eccles New Road, Manchester				Client: KDP Architects			Borehole ID: BH3		
	Contract Number: CCG-C-17-9806	Date Started: 03/11/2017	Logged By: DK	Checked By: CB	Status: DRAFT					
Cable Percussion Borehole Log	Easting:	Northing:	Ground Level:	Plant Used: Dando 150 S/A Rig	Rig Crew: AH/CMC	Sheet 2 of 2 Scale: 1:50				
	Weather:		Termination:		SPT Hammer: N/R, Energy Ratio: N/R					
Samples & In Situ Testing			Strata Details					Groundwater		
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description		Water Strike	Backfill/Installation	
10.50	B	SPT(C) 10.50m, N=86 (6,19/20,20,22,24)		(4.00)		Red/orange weathered SANDSTONE recovered initially at the surface as very dense slightly silty sandy GRAVEL (drilling induced)		11		
12.00	B	SPT(C) 12.00m, N=100 (9,16/100 for 295mm)		12.20		End of Borehole at 12.20m		12		
								13		
								14		
								15		
								16		
								17		
								18		
								19		
								20		
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)	1 hour hand excavating 1.20mbgl service avoidance pit	
Chiselling					Installation				Water Strikes	
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)
				0.00	0.50	PLAIN	50			
				0.50	6.60	SLOTTED	50			
									Time (mins)	Rose to (m)
									0	
									Remarks	
									Borehole dry	
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	Contract Name: Eccles New Road, Manchester			Client: KDP Architects			Borehole ID: BH4			
	Contract Number: CCG-C-17-9806	Date Started: 01/11/2017	Logged By: DK	Checked By: CB	Status: DRAFT					
	Cable Percussion Borehole Log	Easting:	Northing:	Ground Level:	Plant Used: Dando 150 S/A Rig	Rig Crew: AH/CMC PC/GM	Sheet 1 of 3 Scale: 1:50			
Weather:			Termination:			SPT Hammer: N/R, Energy Ratio: N/R				
Samples & In Situ Testing				Strata Details				Groundwater		
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation		
				0.05		TARMAC				
				0.30		Yellow/black slightly silty sandy GRAVEL. Gravel is fine to coarse angular brick and ash (MADE GROUND)				
				(1.00)		BRICK STRUCTURE				
1.50	B	SPT(S)N=7 (1,2/2,1,2,2)		1.30		Soft brown slightly sandy gravelly silty CLAY. Gravel is fine to coarse angular brick with occasional inclusions of coal (MADE GROUND)				
2.00 - 2.45	UT			1.70		Stiff grey becoming grey/brown slightly sandy slightly gravelly silty CLAY				
2.50	B									
		SPT(S)N=20 (3,4/4,5,5,6)								
3.50	B									
4.00 - 4.45	UT									
4.50	B									
		SPT(S)N=16 (2,3/3,4,4,5)								
6.00	B									
6.00 - 6.45	UT									
7.50	B	SPT(S)N=43 (6,9/10,10,11,12)		7.40		Dense red/orange slightly silty slightly gravelly SAND				
				(0.50)						
				7.90		Dense red/orange slightly silty slightly gravelly SAND with frequent pockets of clay				
				(0.60)						
				8.50		Stiff grey/brown slightly gravelly sandy silty CLAY				
9.00	B									
9.00 - 9.45	UT			(1.10)						
				9.60		Red/orange SANDSTONE recovered initially at the surface as very dense slightly silty sandy GRAVEL (drilling induced)				
						Continued next sheet				
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)	2 hours hand excavating 1.20mbgl service avoidance pit	
					Water Strikes Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks 0 Borehole dry					
Chiselling					Installation					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)		
					0.00	0.60	PLAIN			
					0.60	6.60	SLOTTED			
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com										

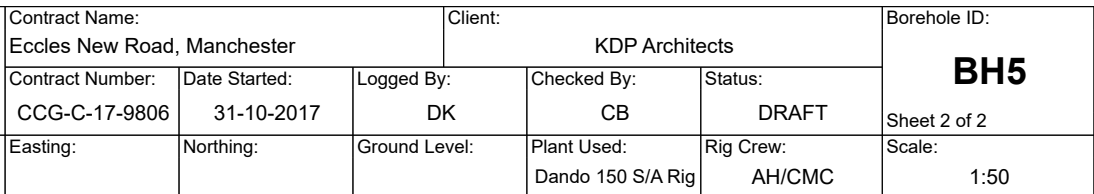


Samples & In Situ Testing	Strata Details	Groundwater
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Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
									2 hours hand excavating 1.20mbgl service avoidance pit					
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	0.60	PLAIN					0		Borehole dry
					0.60	6.60	SLOTTED							
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	Contract Name: Eccles New Road, Manchester				Client: KDP Architects				Borehole ID: BH4					
	Contract Number: CCG-C-17-9806		Date Started: 01/11/2017		Logged By: DK		Checked By: CB				Status: DRAFT			
Rotary Core Drilling Log		Easting:		Northing:		Ground Level:		Plant Used: Dando 150 S/A Rig		Rig Crew: AH/CMC PC/GM		Sheet 3 of 3 Scale: 1:50		
Weather:				Termination:				SPT Hammer: N/R, Energy Ratio: N/R						
Samples & In Situ Testing						Strata Details						Groundwater		
Depth	TCR	SCR	RQD	Fracture Spacing	Water Added	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/ Installation	
19.70 - 21.20	94	86	53	23 89 260			21.20		Weak reddish brown fine to medium grained thickly laminated SANDSTONE. Moderately weathered. Discontinuities are very close to medium spaced, horizontal, clean, rough and tight to open			20		
									End of Borehole at 21.20m			21		
												22		
												23		
												24		
												25		
												26		
												27		
												28		
												29		
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)	2 hours hand excavating 1.20mbgl service avoidance pit					
Flush Information						Installation				Water Strikes				
Top (m)	Base (m)	Flush Type	Return	Flush Colour	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00	0.60	PLAIN					0		Borehole dry
					0.60	6.60	SLOTTED		Fracture spacing reported in mm as min, Average and Max values. TCR, SCR and RQD reported in %					
CCGEOTECHNICAL LTD 0151 545 2750 www.ccgteotechnical.com														

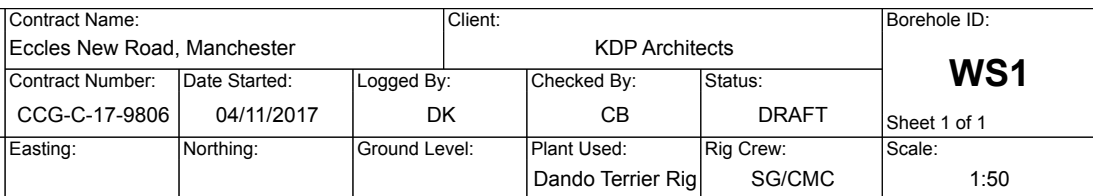
	Contract Name: Eccles New Road, Manchester				Client: KDP Architects			Borehole ID: BH5		
	Contract Number: CCG-C-17-9806		Date Started: 31-10-2017		Logged By: DK		Checked By: CB		Status: DRAFT	
	Easting:		Northing:		Ground Level:		Plant Used: Dando 150 S/A Rig		Rig Crew: AH/CMC	
Cable Percussion Borehole Log								Scale: 1:50		
Weather:				Termination:				SPT Hammer: N/R, Energy Ratio: N/R		
Samples & In Situ Testing				Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/ Installation
0.30	B			0.05 (0.35)		TARMAC SUB-BASE				
0.50	B			0.40		Brown slightly sandy gravelly silty CLAY with occasional inclusions of coal				
1.00	B	SPT(S) 1.20m, N=11 (1,2/2,3,3,3)		(0.80)					1	
1.50	B			1.20		Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY				
2.00 - 2.45	UT					LIMITED RECOVERY IN U100 SAMPLING - 2.00-2.45mbgl			2	
2.50	B									
		SPT(S) 3.00m, N=17 (3,3/4,4,4,5)							3	
3.50	B			(4.50)						
4.00 - 4.45	UT					NO RECOVERY IN U100 SAMPLING - 4.00-4.45mbgl			4	
4.70	B									
		SPT(S) 5.00m, N=18 (3,3/4,4,5,5)							5	
6.00	B	SPT(S) 6.00m, N=43 (7,9/9,10,12,12)		5.70		Stiff brown/grey slightly sandy slightly gravelly silty CLAY with occasional pockets of sand and gravel			6	
									7	
7.50	B	SPT(S) 7.50m, N=40 (6,8/9,9,10,12)		(3.10)					8	
8.50 - 8.95	UT					LIMITED RECOVERY IN U100 SAMPLING - 8.50-8.95mbgl				
9.00	B	SPT(C) 9.00m, N=64 (8,11/12,14,16,22)		8.80		Red/orange weathered SANDSTONE recovered initially at the surface as very dense slightly silty sandy GRAVEL (drilling induced)			9	
				(1.40)						
						Continued next sheet			10	
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)	1 hour hand excavating 1.20mbgl service avoidance pit	
Chiselling					Installation		Strike (m)		Casing (m)	Sealed (m)
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)			
							Time (mins)		Rose to (m)	Remarks
							0			Borehole dry
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.co.uk										



Samples & In Situ Testing	Strata Details	Groundwater
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Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(C) 10.00m, 100 (12,13/100 for 275mm)		10.20	: : : : :	Red/orange weathered SANDSTONE recovered initially at the surface as very dense slightly silty sandy GRAVEL (drilling induced) End of Borehole at 10.20m		
							11	
							12	
							13	
							14	
							15	
							16	
							17	
							18	
							19	
							20	

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)	
									1 hour hand excavating 1.20mbgl service avoidance pit
									Water Strikes
Chiselling					Installation				Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	
									0 Borehole dry
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.co.uk									



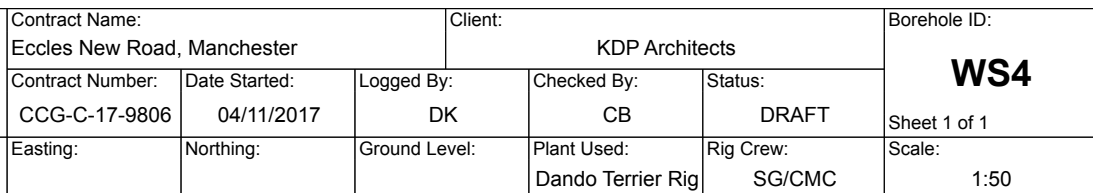
Samples & In Situ Testing	Strata Details	Groundwater
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[illegible]

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)	1 hour hand excavating 1.20mbgl service avoidance pit					
									Water Strikes					
Chiselling					Installation				Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	3.00			0		Seepage
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														

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)	1 hour hand excavating 1.20mbgl service avoidance pit					
									Water Strikes					
Chiselling					Installation				Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	3.00			0		Seepage
					0.00	0.60	PLAIN							
					0.60	5.00	SLOTTED							
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														

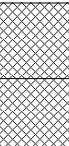
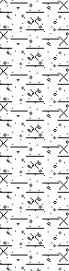
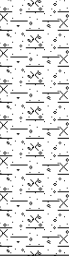
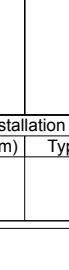
Weather: Dry					Termination:					SPT Hammer: N/R, Energy Ratio: N/R				
Samples & In Situ Testing					Strata Details					Groundwater				
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description				Water Strike	Backfill/ Installation			
0.00 - 1.00	U			(0.35)		CONCRETE								
				0.35		Loose brown slightly silty sandy GRAVEL (MADE GROUND)								
1.00 - 2.00	U	SPT(S)N=5 (1,3/1,2,1,1)		(1.15)						1				
				1.50		Soft becoming firm brown slightly sandy slightly gravelly silty CLAY with occasional thin gravelly sand horizons								
1.80 - 2.00	B													
2.00 - 3.00	U	SPT(S)N=10 (1,1/2,3,2,3)								2				
2.50 - 2.70	B													
				(2.50)										
3.00 - 4.00	U	SPT(S)N=11 (3,2/3,3,2,3)								3				
		SPT(S)N=12 (2,3/2,3,3,4)		4.00		End of Borehole at 4.00m				4				
										5				
										6				
										7				
										8				
										9				
										10				
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)	1 hour hand excavating 1.20mbgl service avoidance pit					
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	
								3.00			0		Seepage	
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														



Samples & In Situ Testing	Strata Details	Groundwater
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[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)	1 hour hand excavating 1.20mbgl service avoidance pit					
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
									3.00			0		Seepage
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														

	Contract Name: Eccles New Road, Manchester			Client: KDP Architects			Borehole ID: WS5	
	Contract Number: CCG-C-17-9806	Date Started: 04/11/2017	Logged By: DK	Checked By: CB	Status: DRAFT	Sheet 1 of 1		
Dynamic Sampling Borehole Log	Easting:	Northing:	Ground Level:	Plant Used: Dando Terrier Rig	Rig Crew: SG/CMC	Scale: 1:50		
	Weather: Dry		Termination:		SPT Hammer: N/R, Energy Ratio: N/R			
Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/Installation
0.00 - 1.00	U			(0.50)		Brown slightly silty slightly sandy GRAVEL (MADE GROUND)		
				0.50		Very loose brown slightly silty occasionally clayey sandy GRAVEL. Gravel is fine to coarse angular brick (MADE GROUND)	1	
1.00 - 2.00	U	SPT(S)N=3 (1,0/1,1,0,1)		(1.00)				
				1.50		Soft becoming firm then stiff brown slightly sandy slightly gravelly silty CLAY with occasional thin gravelly sand horizons	2	
1.80 - 2.00	B							
2.00 - 3.00	U	SPT(S)N=3 (1,0/0,1,1,1)						
							3	
2.80 - 3.00	B							
3.00 - 4.00	U	SPT(S)N=6 (1,2/1,2,1,2)		(3.50)				
							4	
4.00 - 5.00	U	SPT(S)N=15 (3,4/4,3,4,4)						
		SPT(S)N=18 (3,5/4,5,4,5)		5.00		End of Borehole at 5.00m	5	
							6	
							7	
							8	
							9	
							10	

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)					
									1 hour hand excavating 1.20mbgl service avoidance pit				
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
								3.00			0		Seepage
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com													



APPENDIX D: ROCK CORE RECOVERY PHOTOGRAPHS

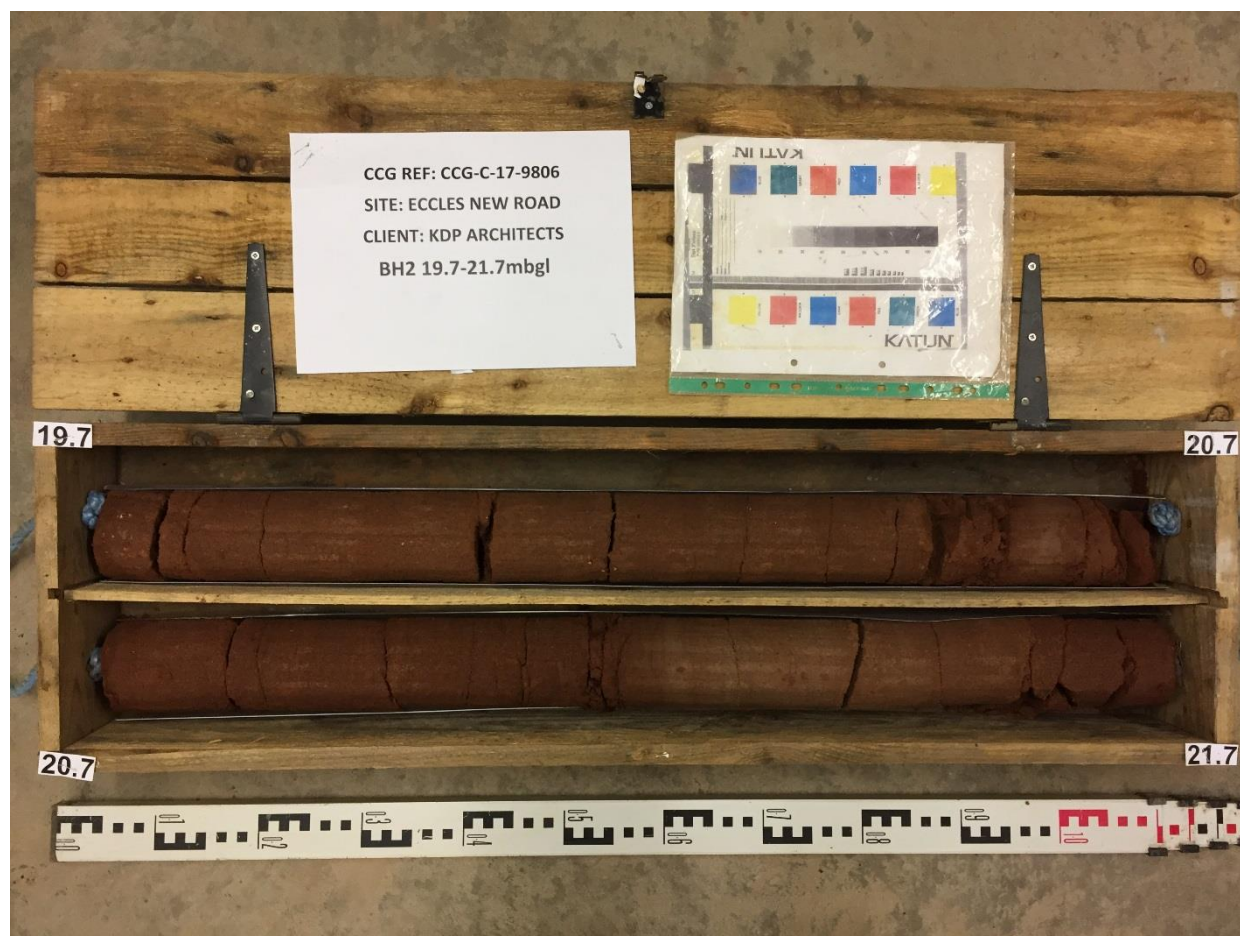






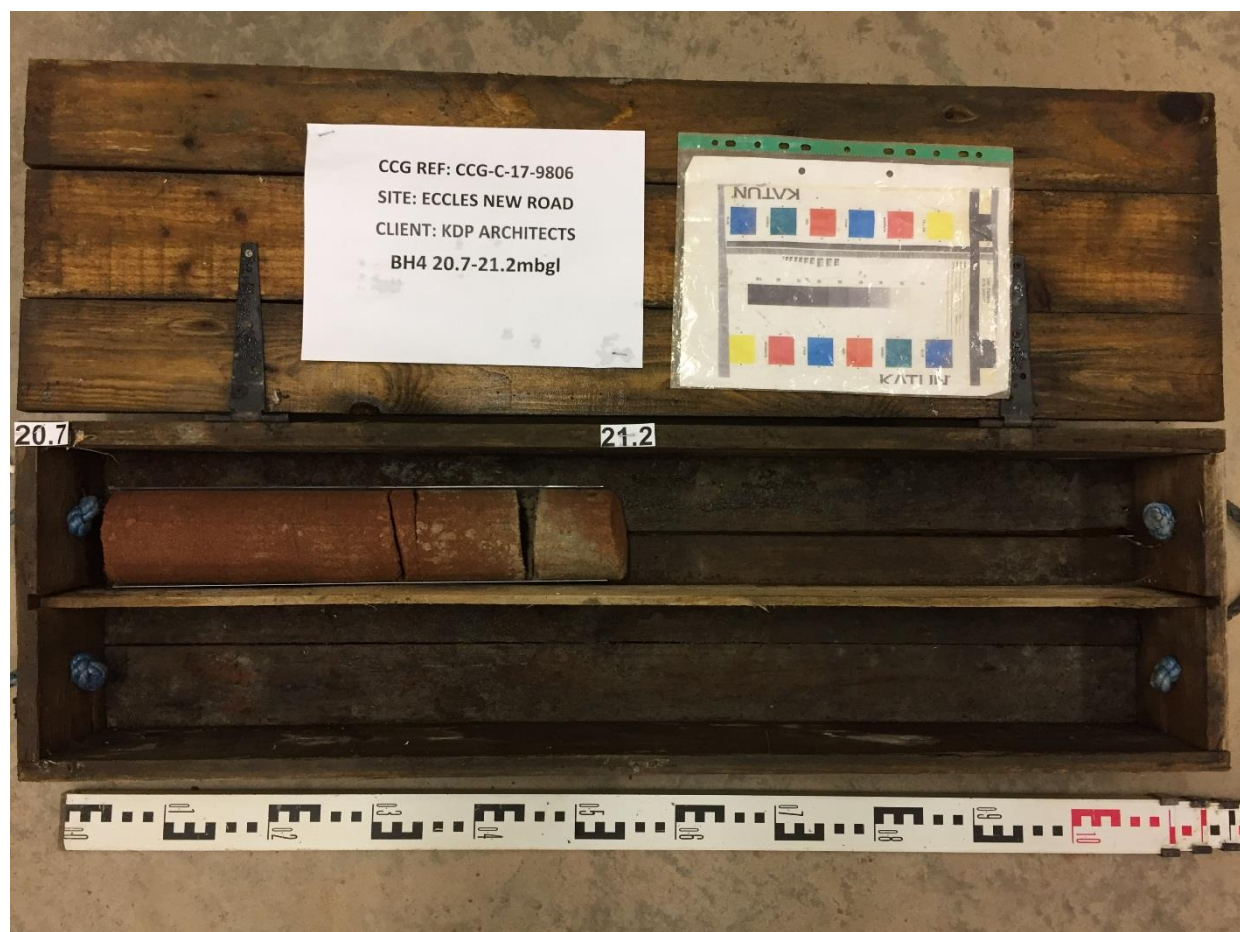














APPENDIX E: GAS – GROUNDWATER MONITORING RESULTS

GAS AND WATER MONITORING RESULTS



	Date:	22/11/2017	18-Dec-17										
	Visit Number	1	2	3	4	5	6	7	8	9	10	11	12
	Atmos Press mb	987	1018										
	Pressure Trend	Steady	Steady										
	Air Temp °C	14	4										
	Cloud cover	Overcast	Clear										
	Wind velocity	Windy	Windy										
	Precipitation	Dry	Dry										
	State of Ground	Dry	Dry										
BH1	CH ₄ (%) (max/steady):	Nil	Nil										
	CO ₂ (%) (max/steady):	6.6	4.8										
	O ₂ (%) (max/steady):	6.6	7.9										
	H ₂ S (ppm) (max/steady):	Nil	Nil										
	CO (ppm) (max/steady):	Nil	Nil										
	PID (ppm) (max/steady)	0.0	0.0										
	Flow (l/hr) (max/steady)	<0.1	<0.1										
	Water Level / depth to base (m):	3.51/5.9	3.42										
WS2	CH ₄ (%) (max/steady):	Nil	Nil										
	CO ₂ (%) (max/steady):	0.1	<0.1										
	O ₂ (%) (max/steady):	20.1	20.1										
	H ₂ S (ppm) (max/steady):	Nil	Nil										
	CO (ppm) (max/steady):	Nil	Nil										
	PID (ppm) (max/steady)	0.0	0.0										
	Flow (l/hr) (max/steady)	<0.1	<0.1										
	Water Level / depth to base (m):	2.78/4.00	2.74										
BH3	CH ₄ (%) (max/steady):	Nil	Nil										
	CO ₂ (%) (max/steady):	1.0	0.8										
	O ₂ (%) (max/steady):	19.1	19.4										
	H ₂ S (ppm) (max/steady):	Nil	Nil										
	CO (ppm) (max/steady):	Nil	Nil										
	PID (ppm) (max/steady)	0.0	0.0										
	Flow (l/hr) (max/steady)	<0.1	<0.1										
	Water Level / depth to base (m):	Dry/6.5	Dry										
BH4	CH ₄ (%) (max/steady):	Nil	Nil										
	CO ₂ (%) (max/steady):	0.4	0.3										
	O ₂ (%) (max/steady):	19.7	19.8										
	H ₂ S (ppm) (max/steady):	Nil	Nil										
	CO (ppm) (max/steady):	Nil	Nil										
	PID (ppm) (max/steady)	0.0	0.0										
	Flow (l/hr) (max/steady)	<0.1	<0.1										
	Water Level / depth to base (m):	Dry/6.5	Dry										
	CH ₄ (%) (max/steady):												
	CO ₂ (%) (max/steady):												
	O ₂ (%) (max/steady):												
	H ₂ S (ppm) (max/steady):												
	CO (ppm) (max/steady):												
	PID (ppm) (max/steady)												
	Flow (l/hr) (max/steady)												
	Water Level / depth to base (m):												

CCG-CMS-FO-129

Issue 2

Job No: CCG-C-17-9808b

Site: Eccles New Road, Manchester

Instrument:

GFM

TEST DATE AND CONDITIONS	
Date	12/05/2017
Atmospheric Pressure	980 mB
Ambient Temp	22.4 °C
Envionics Serial No.	5089

GAS DATA LTD

Pegasus House
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB
Tel 02476303311 Fax 02476307711



GFM436-1 FINAL INSPECTION & CALIBRATION CHECK CERTIFICATE

INSTRUMENT DETAILS	
Serial No	Customer
12099	Shaw City Ltd

INSTRUMENT CHECKS			
Keyboard	✓	Pump Flow	500 cc/min
Display Contrast	✓	Pump Flow @ -200mB	400 cc/min
Clock Set / Running	✓	S/W Version	G436.0027/0009
Labels Fitted	✓	Recalibration Date	12/05/2018

GAS CHECKS							
Calibration Gas		Instrument Gas Channels Read					
Gas Type	Applied Conc.	CH4 (%)	tol. (% vol.)	CO2 (%)	tol. (% vol.)	O2 (%)	tol. (% vol.)
N2	100%	0.0	0.0	0.0	0.0	0.0	+/-0.1
CH4	5%	4.9	+/-0.3	0.0	0.0	0.0	+/-0.1
	60%	60.5	+/-3.0	0.0	0.0	0.0	+/-0.1
CO2	5%	0.0	0.0	4.8	+/-0.3	0.0	+/-0.1
	40%	0.0	0.0	40.1	+/-3.0	0.0	+/-0.1
O2	20.9%	0.0	0.0	0.0	+0.1	20.7	+/-0.5

OPTIONAL GAS CHECKS							
Calibration Gas		Instrument Gas Channels Read					
Gas Type	Applied Conc.	Label	H2S	CO		Hexane	tol. (% vol.)
		Range	5000ppm	2000ppm		2.00%	
N2	100%		0	0		0	+/- 5.0
H2S	1500ppm		1500	0			+/- 5.0
CO	1000ppm		80	1003			+/- 5.0
Hexane	2.00%					1.99	+/- 10.0

PRESSURE CHECKS							
Calibration Pressure		Instrument Pressure Channels Read					
Pressure @	Applied Pressure	Atmospheric [Ap] (mB)	tol. (mB)				
All Ports	Current Atmospheric	980	+/-2.0				
Ap Port (Internal)	+800mB(a)	799	+/-5.0				
	+1200mB(a)	1200	+/-5.0				

TEST DATE AND CONDITIONS	
Date	12.5.17
Atmospheric Pressure	986 mB
Ambient Temp	22.4 °C
EnviroNics Serial No.	5039

GAS DATA LTD

Pegasus House
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB
Tel 02476303311 Fax 02476307711

GFM436-1 OUTWARD INSPECTION & QUALITY CHECK SHEET

INSTRUMENT DETAILS			
SO Number	Instrument Type	Instrument Serial Number + SW Version	Job Number(s)
316582	GFM 436	12099 G436-CV3 27/0005	12099 05.04.17

Calibration Technician

.....

Date

12.5.17

Inspection Technician

.....

Date

15.5.17

INSTRUMENT CHECKS		Pass (P), Fail (F) or not applicable (NA)	INSTRUMENT PACKING LIST		Tick if included
Function Tests	Dust Caps Fitted	P	Instrument		✓
	Keyboard Test (All Keys)	P	Leather Case		✓
	Backlight	P	Instrument Strap		✓
	Clock Set / Running	P	AC Battery Charger (UK)		✓
	Comms Test	P	AC Battery Charger (EURO)		N/A
	Pump Flow Test (In & Out)	P	AC Battery Charger (US)		N/A
	Overall Leak Test (30mB)	P	AC Battery Charger (AUS)		N/A
	Battery Charge Test	P	Gas Sample Pipe		✓
	Service Date set to?	12.5.18	Hard Carry Case		✓
Channel Tests	Data Logging Enabled?	P	Spares Pot		✓
	Verify CH4/LEL/Hexane/PID	P	Allen Key		X
	Verify CO2	P	Flow Sample Pipe		X
	Verify O2	P	Temperature Probe		X
	Verify H2S	P	Vane Anemometer		X
	Verify CO	P	USB Cable		✓
	Verify LEL	P	USB Memory stick		X
	Verify 1 st Option Gas	N/A	SM V5 Software	Ver 6.05	X
	Verify Atmospheric pressure	P	Internal Filter Pack	Qty	X
	Verify differential pressure	P	External Filter Pack	Qty	X
	Verify flow	P	Field Guide		✓
	Verify temperature probe input	P	Extra Items:		
	Verify vane anemometer input	P			
DataBase Checks	Jobcard(s) completed and signed	P	Comments:		
	Jobcard(s) booked off database	P			
	Calibration certificate completed	P			
	Complete & print QI record	N/A			
Label Checks	No. of Calibration label fitted	GDC 08089			
	MCERTS label displayed	P			
	Warranty label fitted	N/A			
H2S Range	H2S Range from Sales Order	5000 PPM			
	H2S Range from Cal Cert	5000 PPM			
	Over-range value correct?	P			



APPENDIX F: LABORATORY SOIL – ROCK TEST RESULTS

Units 1 & 2
Deltic Place
Deltic Way
Knowsley Industrial Estate
Liverpool
L33 7BU

Telephone: (0151) 545 2750
Fax: (0151) 548 7892
Email: enquiries@ccgeotechnical.com
www.ccgeotechnical.com



LABORATORY REPORT

CONTRACT NUMBER: CCG-C-17-9806

CONTRACT TITLE: ECCLES NEW ROAD, MANCHESTER

CLIENT: KDP ARCHITECTS
13 Seymour St, Liverpool L3 5PE

DATE RECEIVED: 10/11/16
DATE COMMENCED: 13/11/16
DATE COMPLETED: 15/11/16
REPORT DATE: 15/11/16

Test Description	Qty
Determination of Moisture Content BS 1377-2:1990 (a)	9
Particle Size Distribution BS 1377-2:1990 (a)	2
Determination of Plastic & Liquid Limits BS 1377-2:1990 (a)	12
Determination of Shear Strength in Triaxial Compression BS 1377-7:1990 (a)	3
Determination of Point Load Strength Int. J. Rock Mech. Sci. & Geomech. Abstr. Vol.22, No.2, pp. 51 - 60, 1985 (#)	50
Uniaxial Compressive Strength ISRM Vol 16 No 2, pp 135-140 (1979)	3

Notes: Observations and interpretations are not accredited by UKAS
denotes non-accredited test
a denotes UKAS accredited test
s denotes test undertaken by approved subcontractor

This report is issued in accordance with the requirements of the United Kingdom Accreditation Services and EN ISO/IEC 17025:2005. The results reported herein relate only to the material supplied to the laboratory. This report shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories: Chris Bolan (Managing Director) – Daniel Kerfoot (Laboratory Manager)

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Shear Strength (kN/m ²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425m m (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
BH1	U100	4.00	4.45	16	-	-	90*	33	17	16	92	CL	Y	Brown slightly sandy slightly gravelly silty CLAY of high undrained shear strength. (BS1377Pt2:3.2)
BH1	U100	6.00	6.45	12	-	-	100*	27	13	14	91	CL	Y	Brown slightly sandy slightly gravelly silty CLAY of high undrained shear strength. (BS1377Pt2:3.2)
BH1	B	7.50	7.50	-	-	-	-	-	-	-	-	-	Y	Brown sandy slightly gravelly silty CLAY recovered as slightly gravelly sand with clay pockets. (BS1377Pt2:9.2)
BH2	U100	2.00	2.45	15	2.17	1.88	92	34	17	17	85	CL	Y	Brown slightly sandy slightly gravelly silty CLAY of high undrained shear strength. (BS1377Pt2:3.2,Pt7:8)
BH2	U100	6.00	6.45	17	-	-	70*	35	17	18	69	CL	Y	Brown slightly sandy slightly gravelly silty CLAY of medium undrained shear strength. (BS1377Pt2:3.2,Pt7:8)
BH2	B	7.50	7.50	-	-	-	-	-	-	-	-	-	Y	Brown very clayey gravelly SAND recovered as gravelly sand with clay pockets. (BS1377Pt2:9.2)
BH4	U100	2.00	2.45	17	2.23	1.91	225	34	18	16	83	CL	Y	Brown slightly sandy slightly gravelly silty CLAY of very high undrained shear strength. (BS1377Pt2:3.2,Pt7:8)
BH4	U100	6.00	6.45	15	2.18	1.89	120	29	18	11	89	CL	Y	Brown slightly sandy slightly gravelly silty CLAY of high undrained shear strength. (BS1377Pt2:3.2,Pt7:8)

SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)
CLIENT: KDP ARCHITECTS

DATE: 06.12.17

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample

CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic

(* Denotes Hand Shear Vane test result)

Sample description not accredited by UKAS



9806 RES BH.xls

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Shear Strength (kN/m ²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425m m (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
WS1	WS	2.20	2.20	16	-	-	-	34	18	16	89	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse subangular sandstone & mudstone. (BS1377Pt2:3.2,4,4,5)
WS2	WS	2.30	2.30	16	-	-	-	33	17	16	87	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse subangular sandstone & mudstone. (BS1377Pt2:3.2,4,4,5)
WS3	WS	1.80	1.80	19	-	-	-	33	18	15	87	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse subangular sandstone & mudstone. (BS1377Pt2:3.2,4,4,5)
WS4	WS	2.50	2.50	18	-	-	-	33	17	16	85	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse subangular sandstone & mudstone. (BS1377Pt2:3.2,4,4,5)
WS5	WS	1.80	1.80	17	-	-	-	33	17	16	89	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse subangular sandstone & mudstone. (BS1377Pt2:3.2,4,4,5)
WS5	WS	2.80	2.80	28	-	-	-	36	18	18	77	CI	Y	Grey slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse subangular sandstone & mudstone. (BS1377Pt2:3.2,4,4,5)

SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)

DATE: 02.12.17

CLIENT: KDP ARCHITECTS

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample

CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic

(* Denotes Hand Shear Vane test result)

Sample description not accredited by UKAS



9806 RES WS.xls



CC Geotechnical Ltd
Tel: 0151 545 2750
e: lab@ccgeotechnical.com

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

Job Ref

CCG-C-17-9806

Borehole/Pit No.

BH2

Sample No.

3

Site Name

ECCLES NEW ROAD, MANCHESTER

Soil Description

Brown slightly sandy slightly gravelly silty CLAY of high undrained shear strength

Depth

2.00

Specimen Reference

Specimen
Depth

2.00

m

Sample Type

UT

Specimen Description

Date of test

04.12.17

Test Method

BS 1377:1990:Part 7



Test Number

1

Length

204.0

mm

Diameter

103.1

mm

Bulk Density

2.17

Mg/m³

Moisture Content

15.4

%

Dry Density

1.88

Mg/m³

Rate of Strain

2.0

%/min

Cell Pressure

40

kPa

At failure

Axial Strain

13.7

%

Deviator Stress, $(\sigma_1 - \sigma_3)_f$

185

kPa

Undrained Shear Strength, c_u

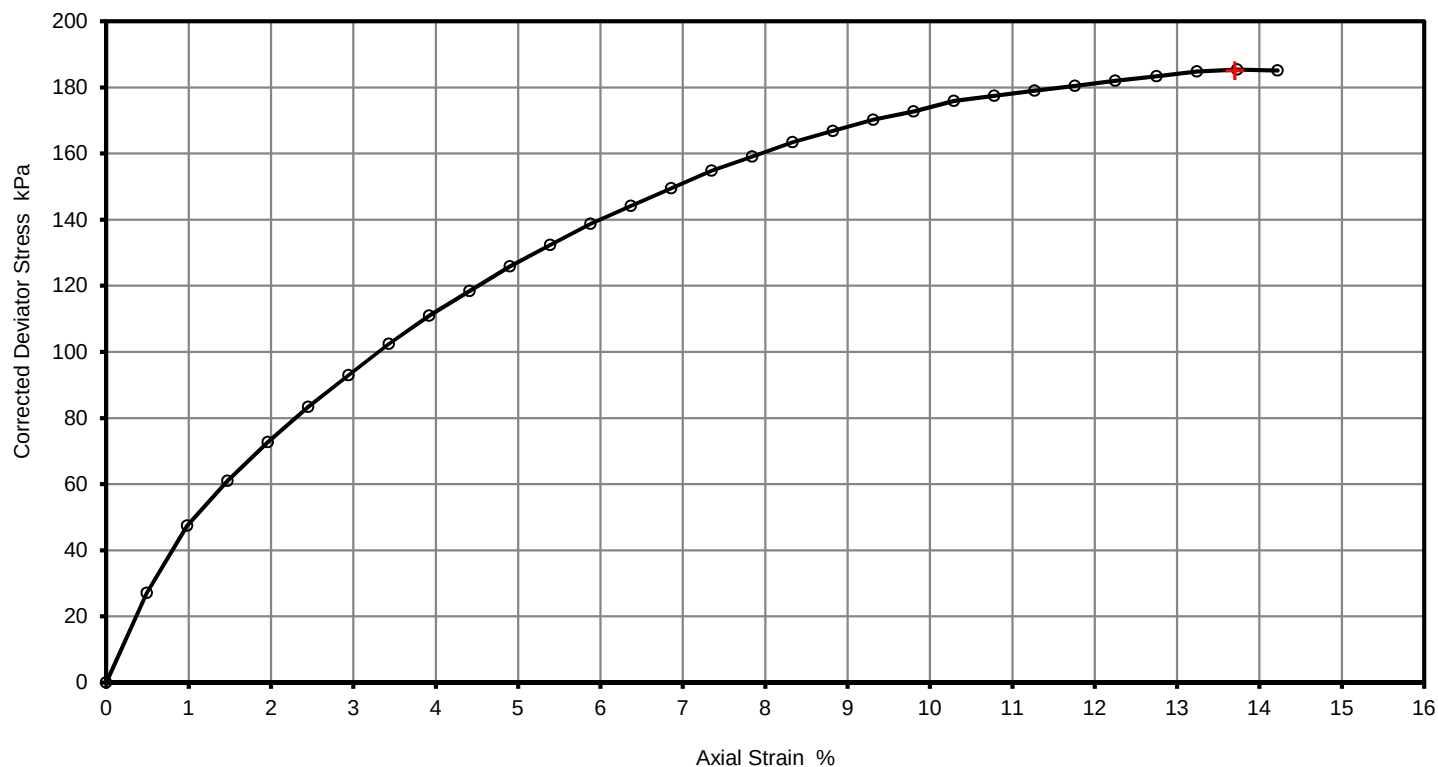
92

kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$

Mode of Failure

compound

Deviator Stress v Axial Strain



Remarks

Approved

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05/12/2017 11:08

Fig. No.

1

Sheet

1



CC Geotechnical Ltd
Tel: 0151 545 2750
e: lab@ccgeotechnical.com

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

Job Ref

CCG-C-17-9806

Borehole/Pit No.

BH4

Sample No.

3

Site Name

ECCLES NEW ROAD, MANCHESTER

Soil Description

Brown slightly sandy slightly gravelly silty CLAY of very high undrained shear strength

Depth

2.00

Specimen Reference

Specimen
Depth

2.00

m

Sample Type

UT

Specimen Description

Date of test

04.12.17

Test Method

BS 1377:1990:Part 7



Test Number

1

Length

204.0

mm

Diameter

103.3

mm

Bulk Density

2.23

Mg/m³

Moisture Content

16.5

%

Dry Density

1.91

Mg/m³

Rate of Strain

2.0

%/min

Cell Pressure

40

kPa

At failure

Axial Strain

11.8

%

Deviator Stress, $(\sigma_1 - \sigma_3)_f$

451

kPa

Undrained Shear Strength, c_u

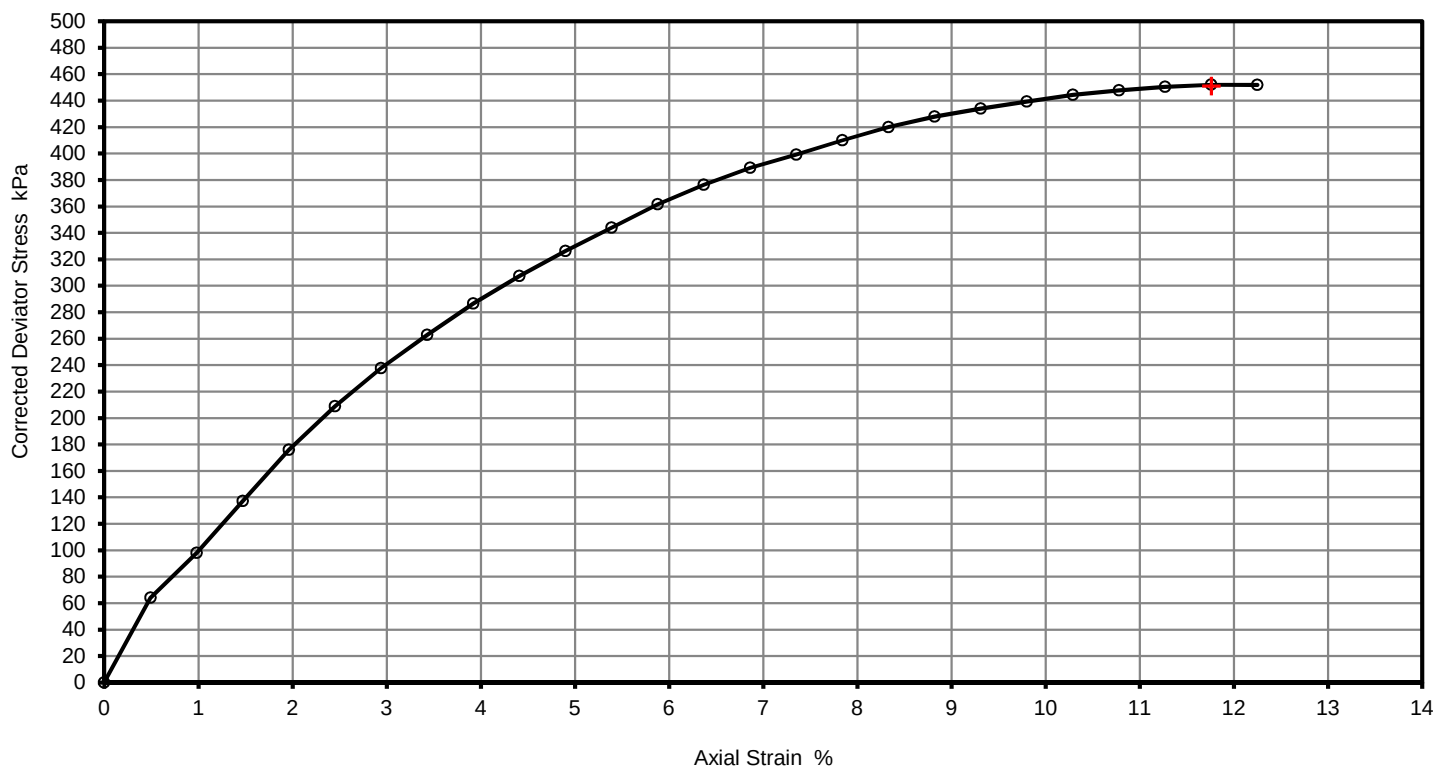
225

kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$

Mode of Failure

compound

Deviator Stress v Axial Strain



Remarks

Approved

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05/12/2017 11:13

Fig. No.

1

Sheet

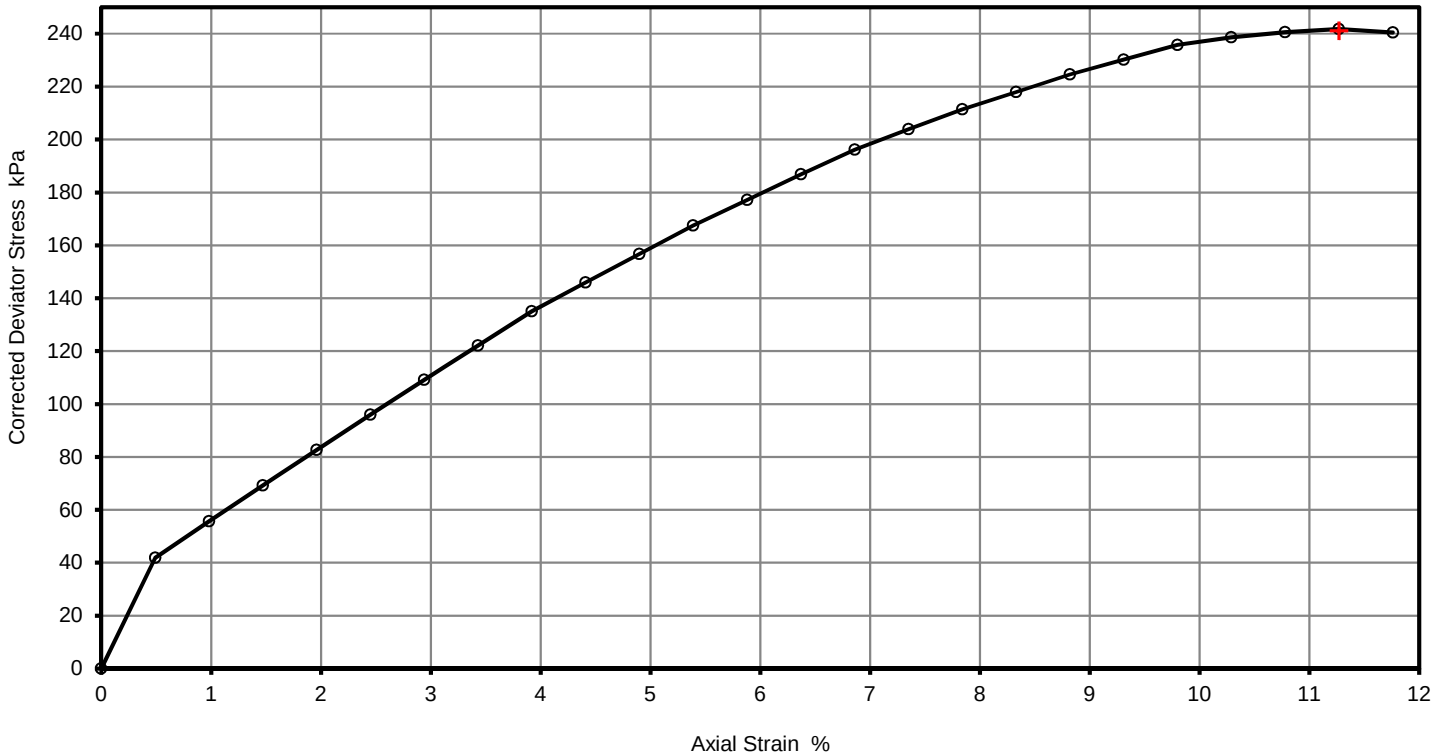
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 CC Geotechnical Ltd Tel: 0151 545 2750 e: lab@ccgeotechnical.com	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	CCG-C-17-9806	
				Borehole/Pit No.	BH4	
Site Name	ECCLES NEW ROAD, MANCHESTER			Sample No.	12	
Soil Description	Brown slightly sandy slightly gravelly silty CLAY of high undrained shear strength			Depth	6.00	
Specimen Reference		Specimen Depth	6.00	m	Sample Type	UT
Specimen Description				Date of test		
Test Method	BS 1377:1990:Part 7			04.12.17		



Test Number	1	
Length	204.0	mm
Diameter	103.2	mm
Bulk Density	2.18	Mg/m ³
Moisture Content	15.2	%
Dry Density	1.89	Mg/m ³
Rate of Strain	2.0	%/min
Cell Pressure	120	kPa
At failure	11.3	%
Axial Strain	241	kPa
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	120	kPa ½($\sigma_1 - \sigma_3$) _f
Undrained Shear Strength, c _u	compound	
Mode of Failure		

Deviator Stress v Axial Strain



Remarks

Approved

Printed

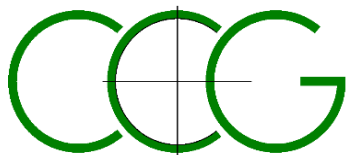
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Fig. No.

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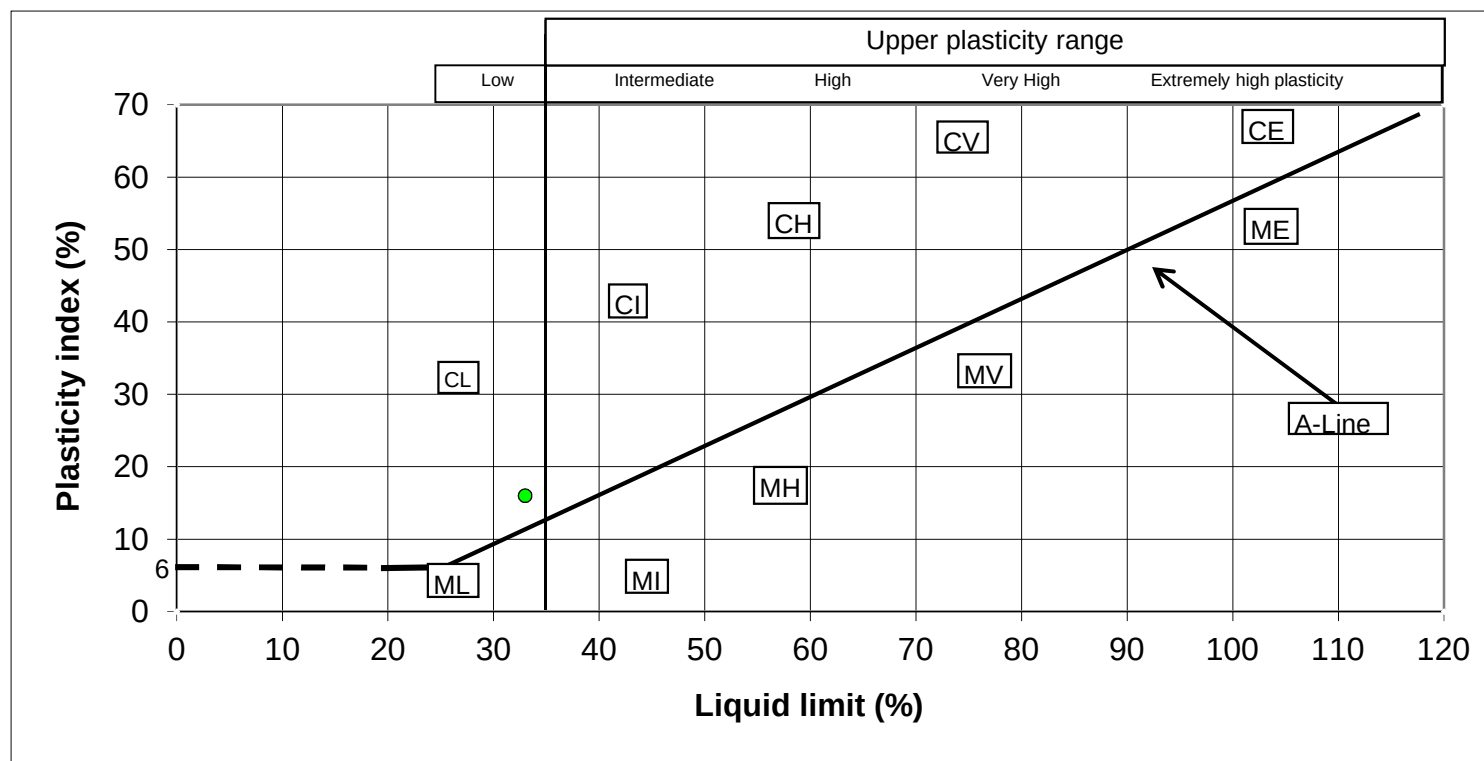
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ATTERBERG TEST RESULT SHEET

BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
BH1	4.00	33.0	16.0



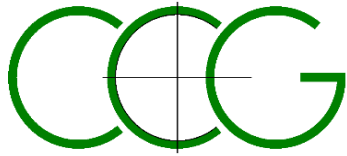
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APPROVED BY	DK
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CLIENT: KDP ARCHITECTS

SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)

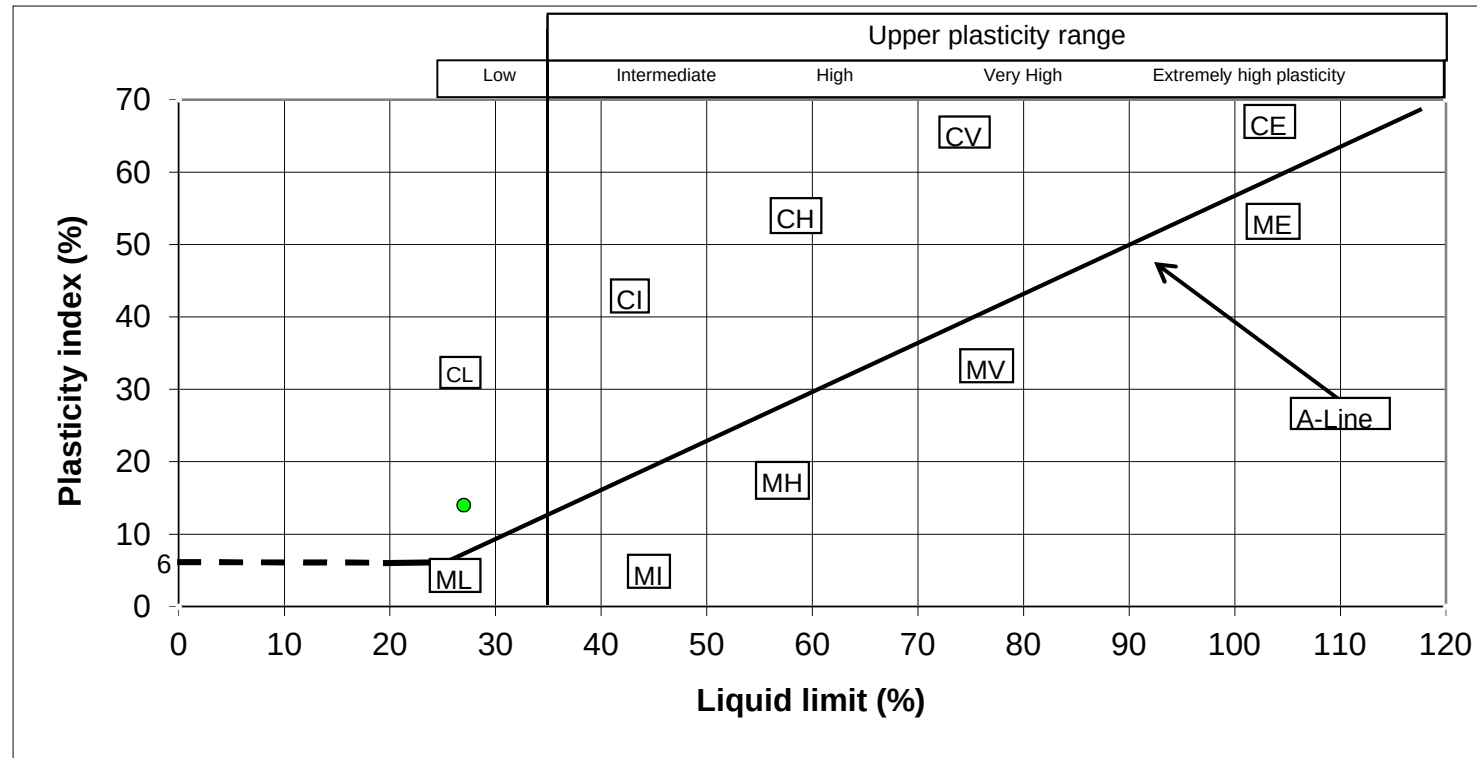
CCG-CMS-FO-204 Issue 2



ATTERBERG TEST RESULT SHEET

BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
BH1	6.00	27.0	14.0

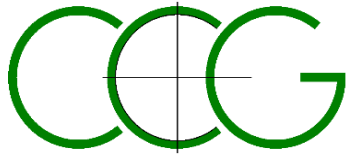


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CLIENT: KDP ARCHITECTS	SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)
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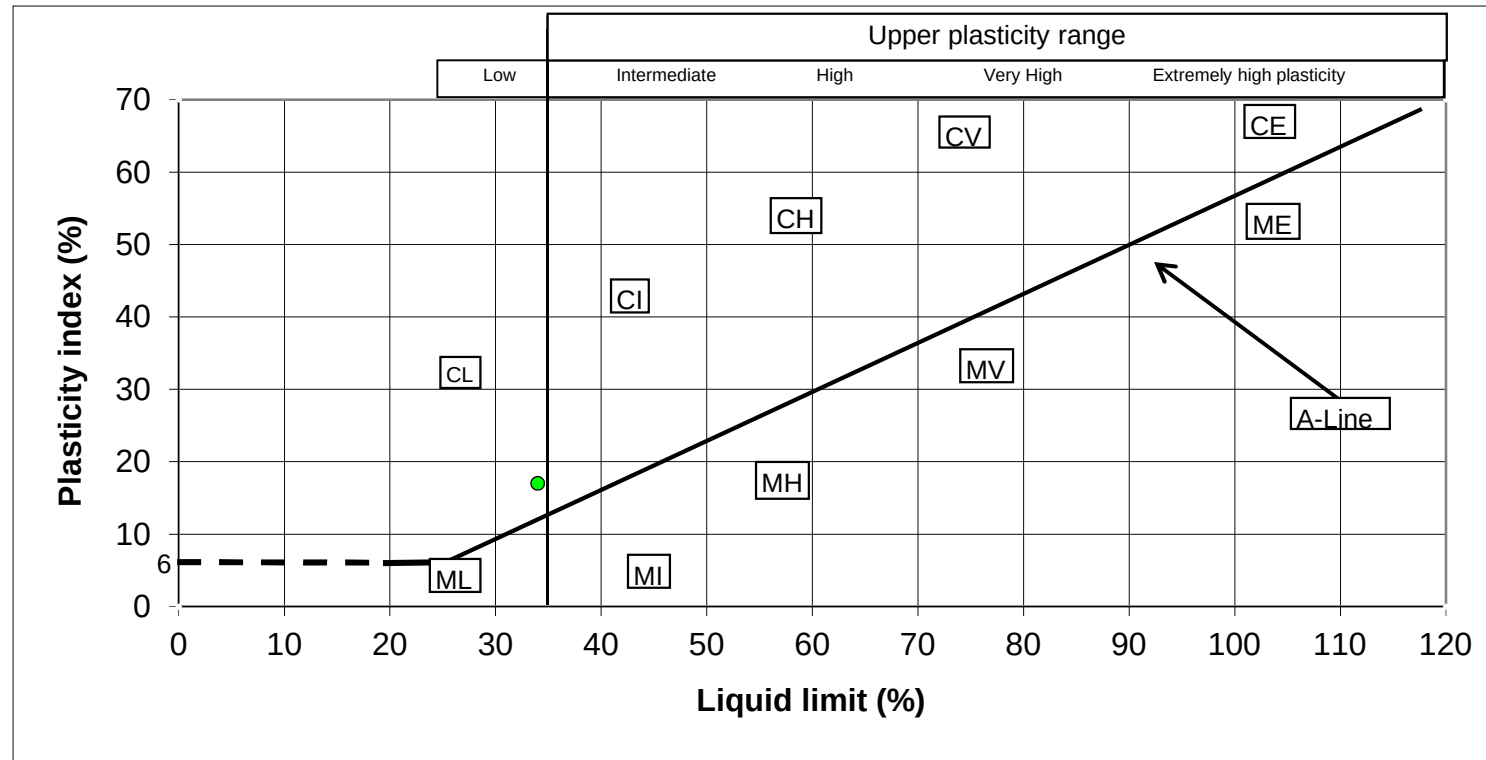
CCG-CMS-FO-204 Issue 2



ATTERBERG TEST RESULT SHEET

BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
BH2	2.00	34.0	17.0

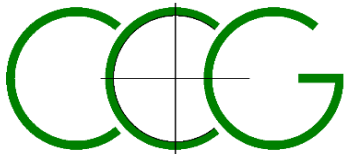


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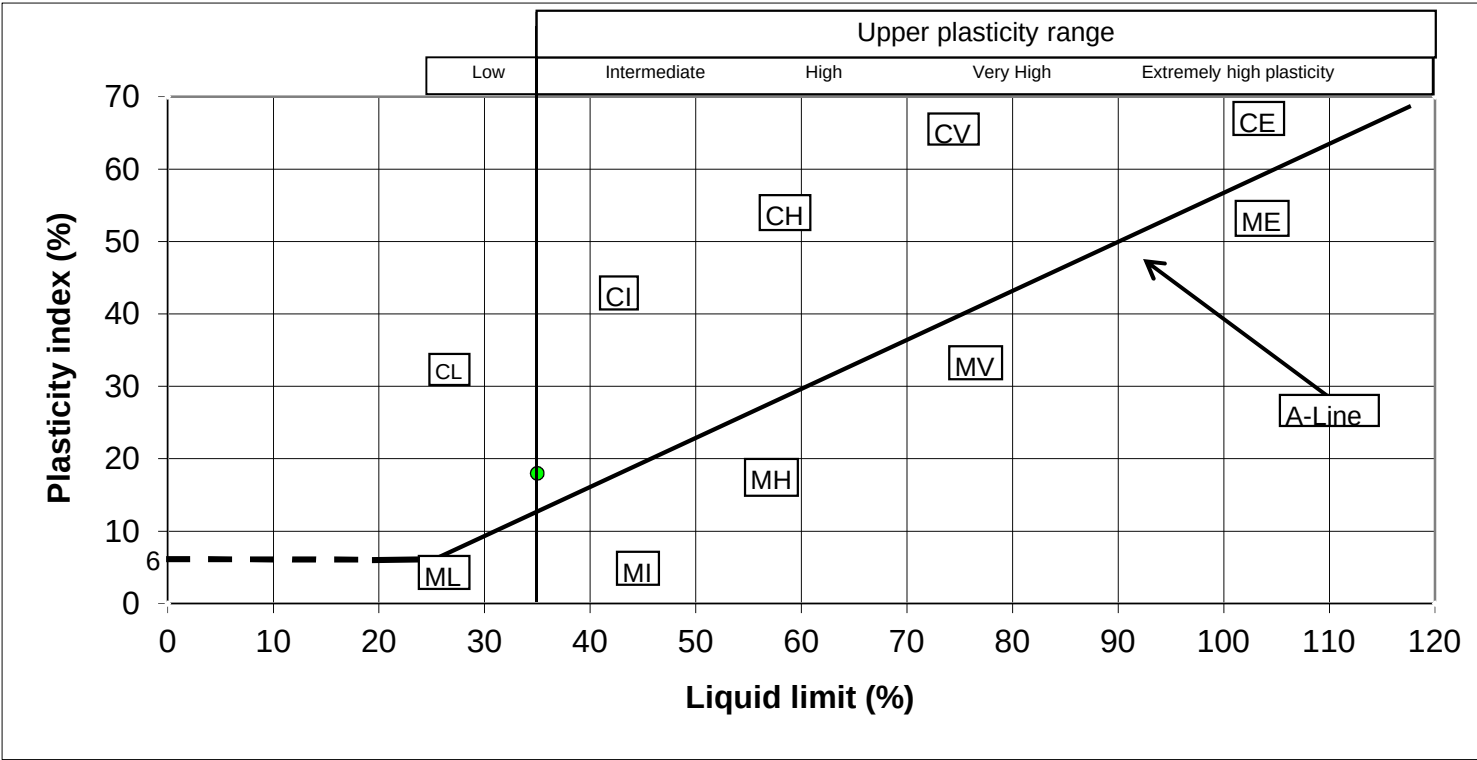
CLIENT: KDP ARCHITECTS	SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)
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CCG-CMS-FO-204 Issue 2



ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



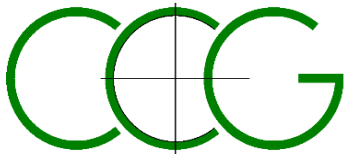
BH	Sample Depth	Liquid limit	Plasticity index
BH2	6.00	35.0	18.0



4514

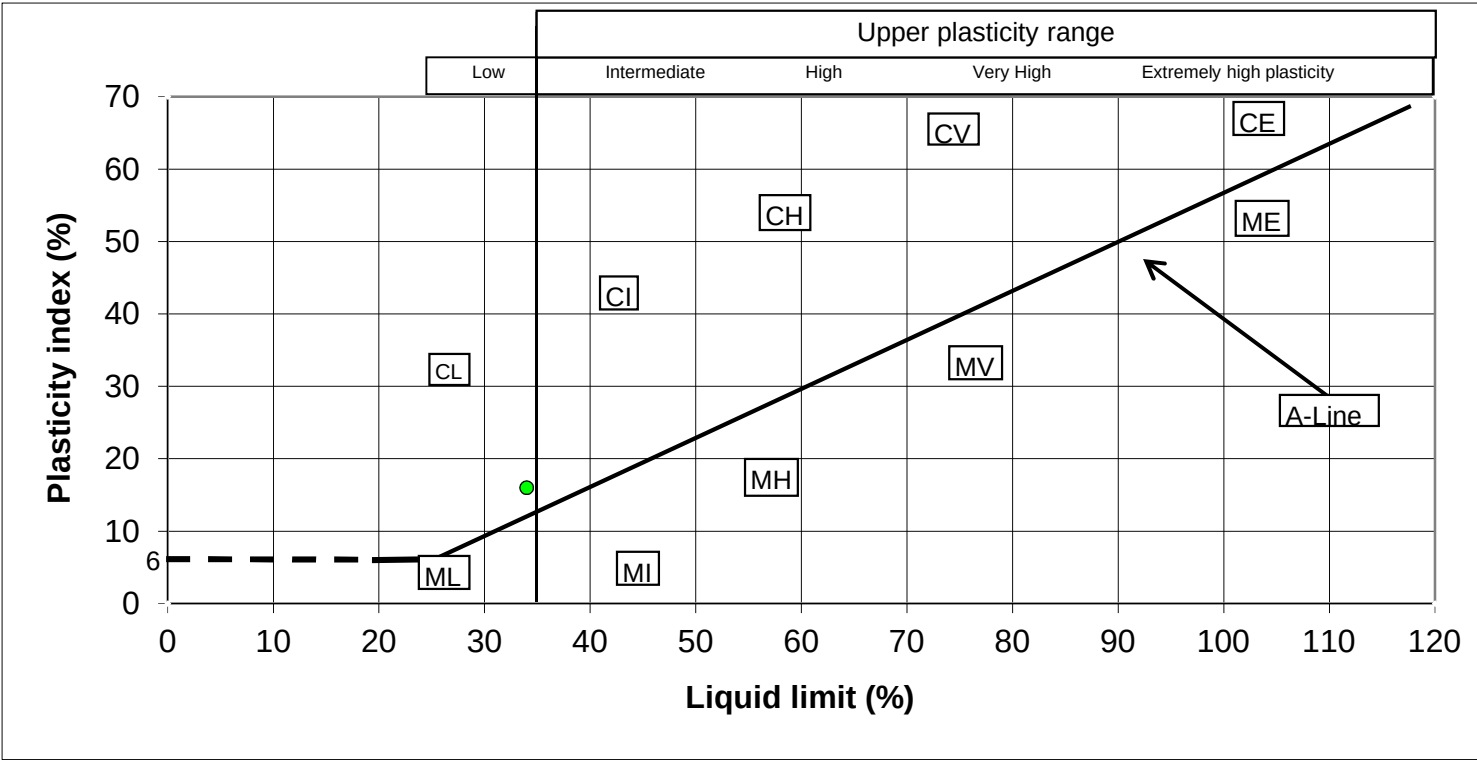
APPROVED BY	DK
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CLIENT: KDP ARCHITECTS	SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)
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ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



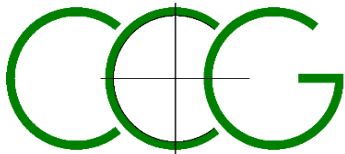
BH	Sample Depth	Liquid limit	Plasticity index
BH4	2.00	34.0	16.0



4514

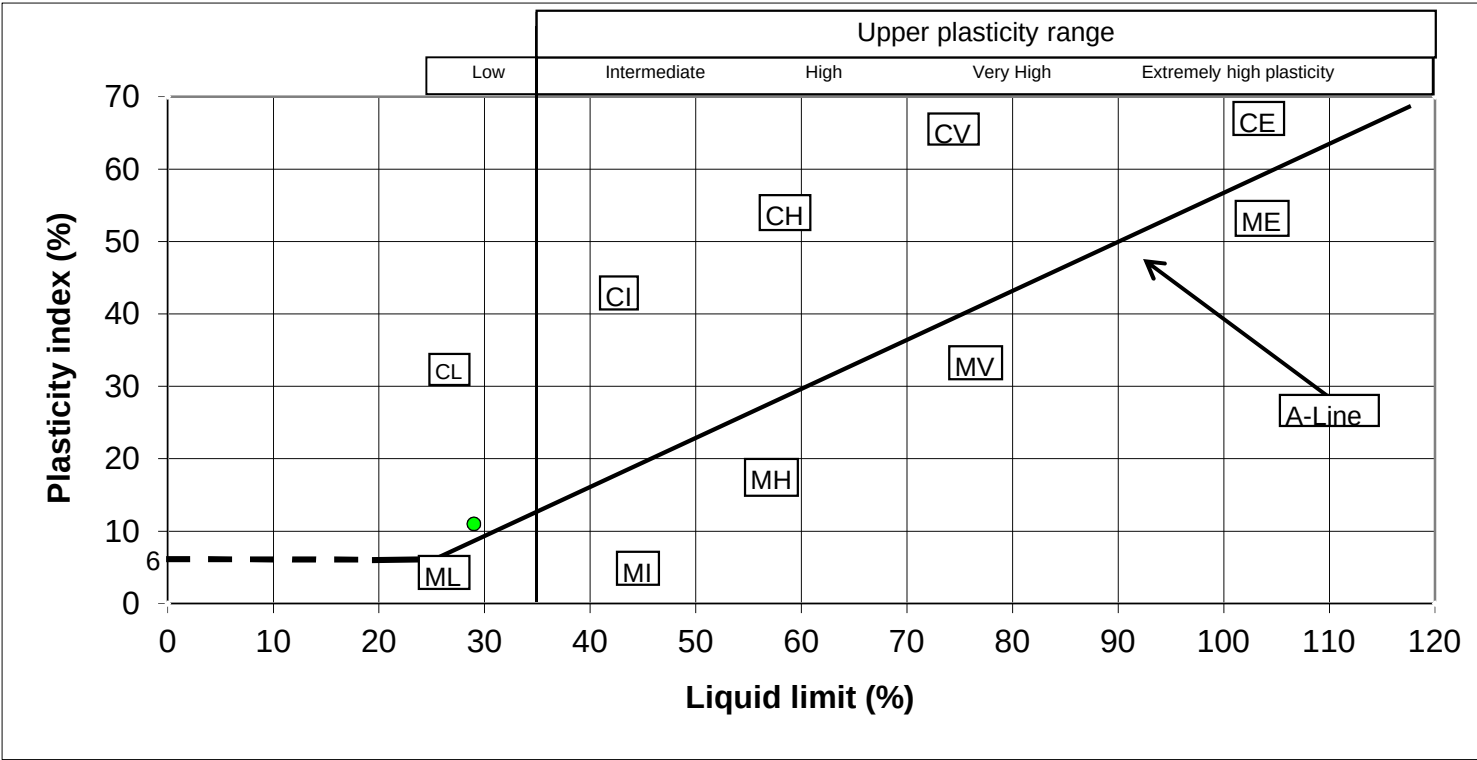
APPROVED BY	DK
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CLIENT: KDP ARCHITECTS	SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)
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ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



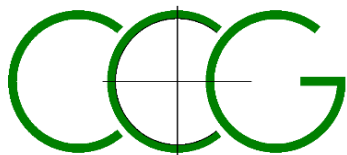
BH	Sample Depth	Liquid limit	Plasticity index
BH4	6.00	29.0	11.0



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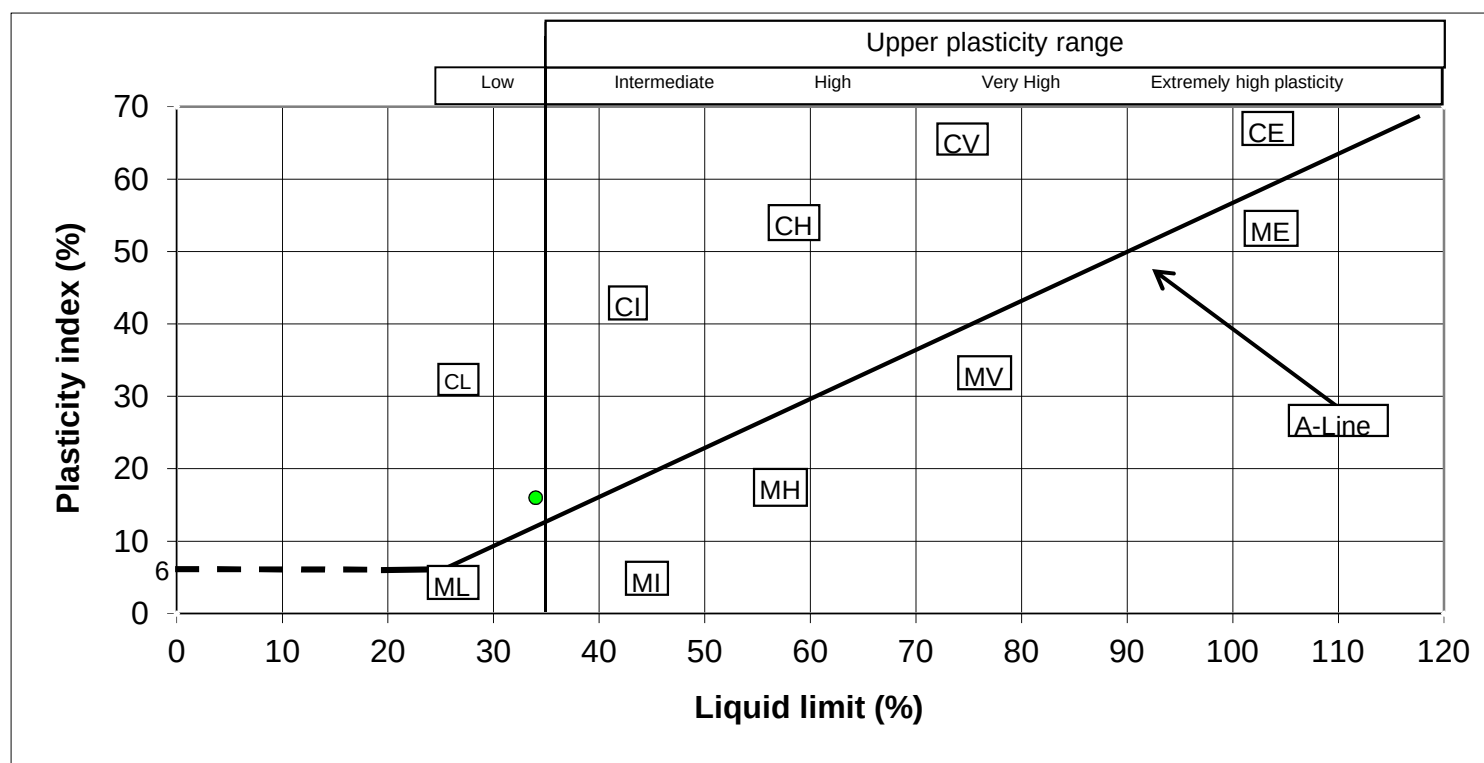
CLIENT: KDP ARCHITECTS	SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)
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ATTERBERG TEST RESULT SHEET

BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
WS1	2.20	34.0	16.0



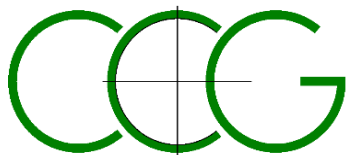
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APPROVED BY	DK
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CLIENT: KDP ARCHITECTS

SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)

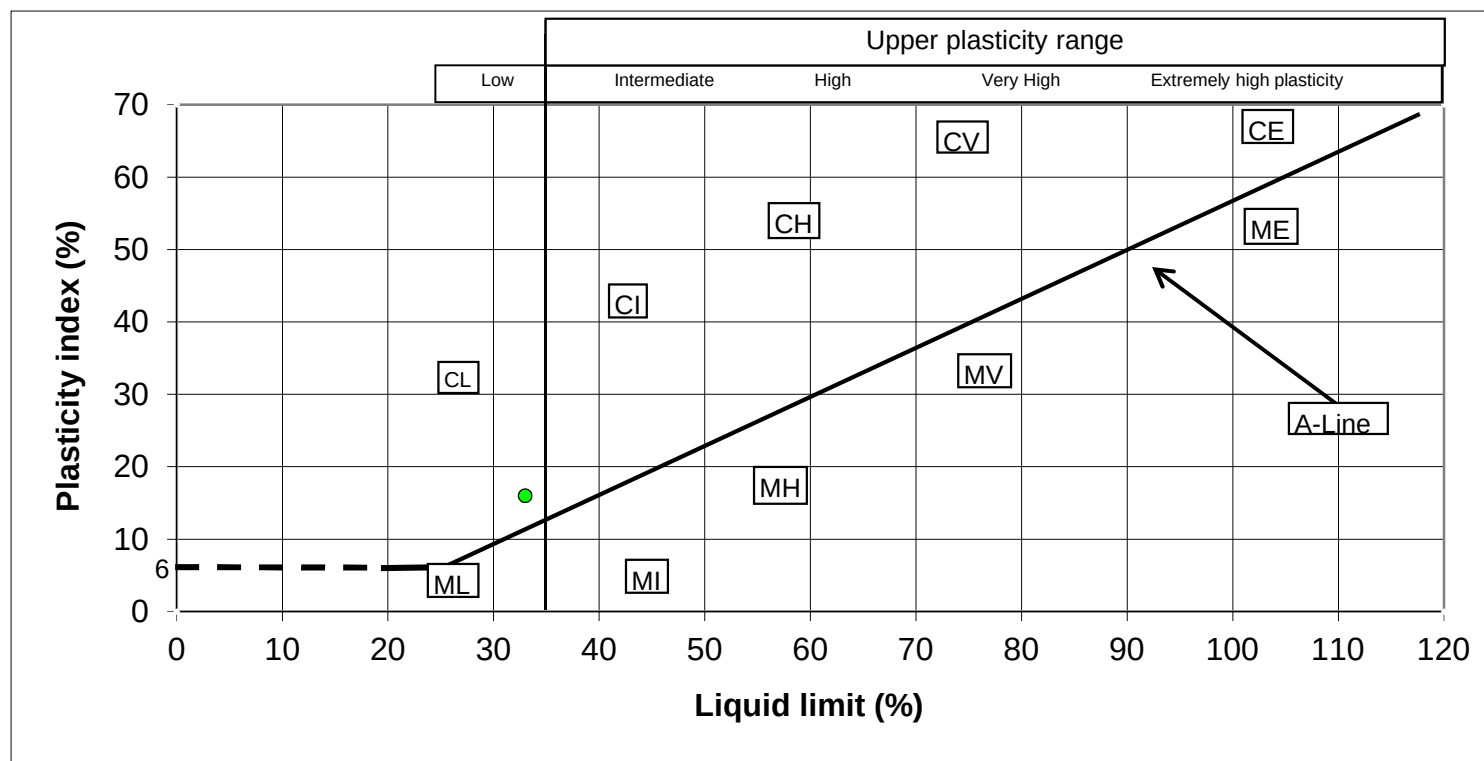
CCG-CMS-FO-204 Issue 2



ATTERBERG TEST RESULT SHEET

BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
WS2	2.30	33.0	16.0



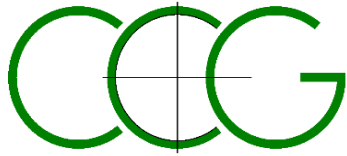
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APPROVED BY	DK
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CLIENT: KDP ARCHITECTS

SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)

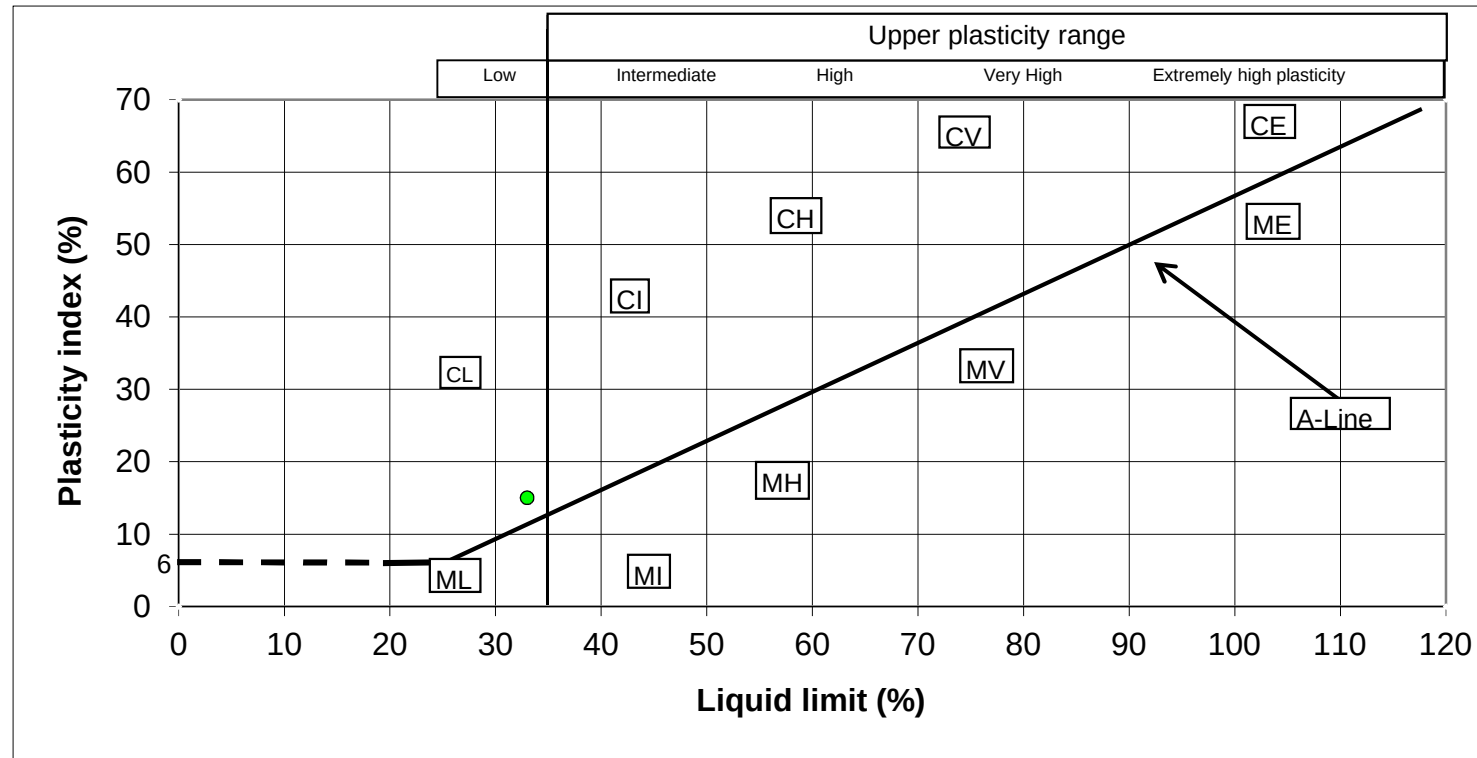
CCG-CMS-FO-204 Issue 2



ATTERBERG TEST RESULT SHEET

BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
WS3	1.80	33.0	15.0



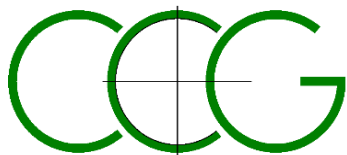
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APPROVED BY	DK
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CLIENT: KDP ARCHITECTS

SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)

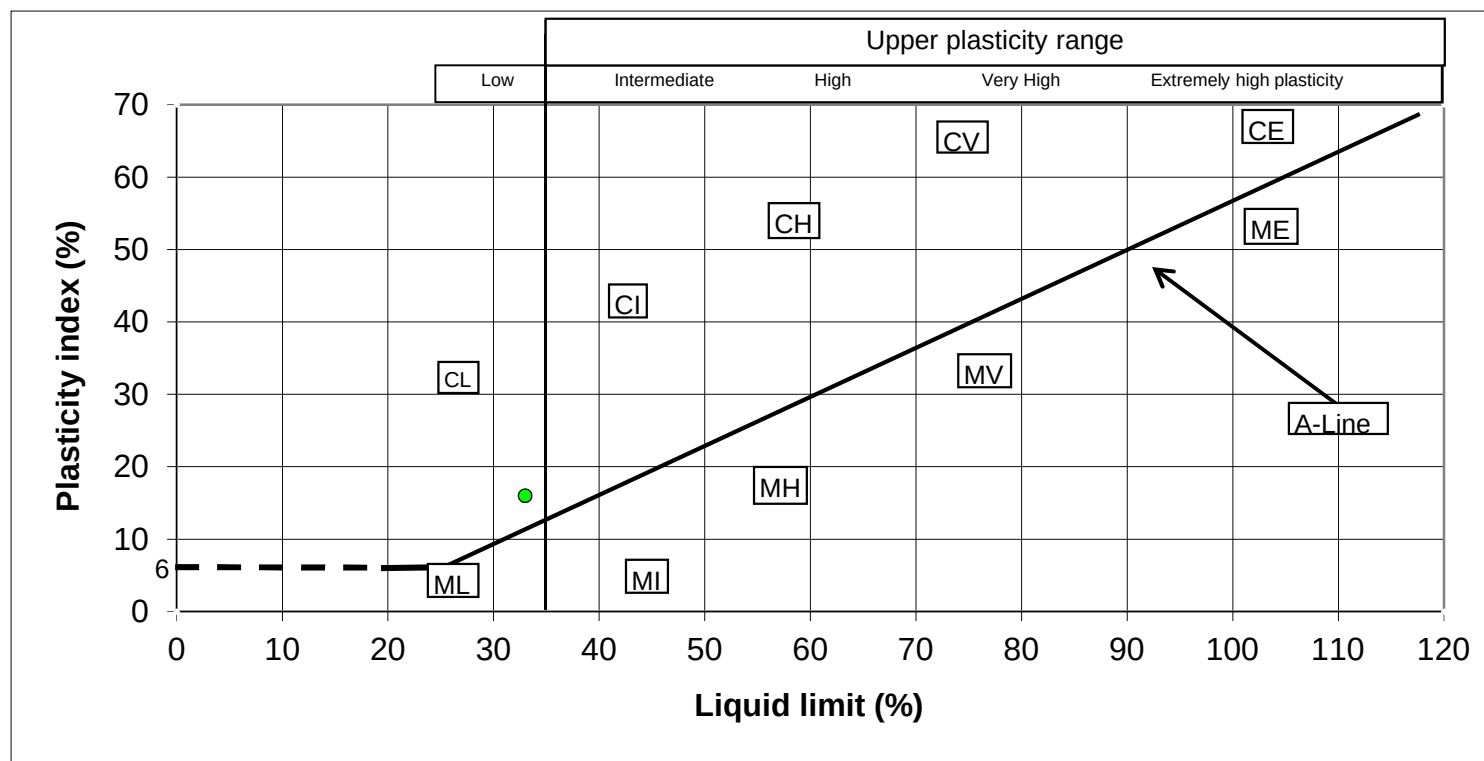
CCG-CMS-FO-204 Issue 2



ATTERBERG TEST RESULT SHEET

BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
WS4	2.50	33.0	16.0



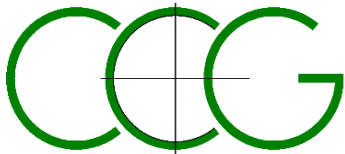
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CLIENT: KDP ARCHITECTS

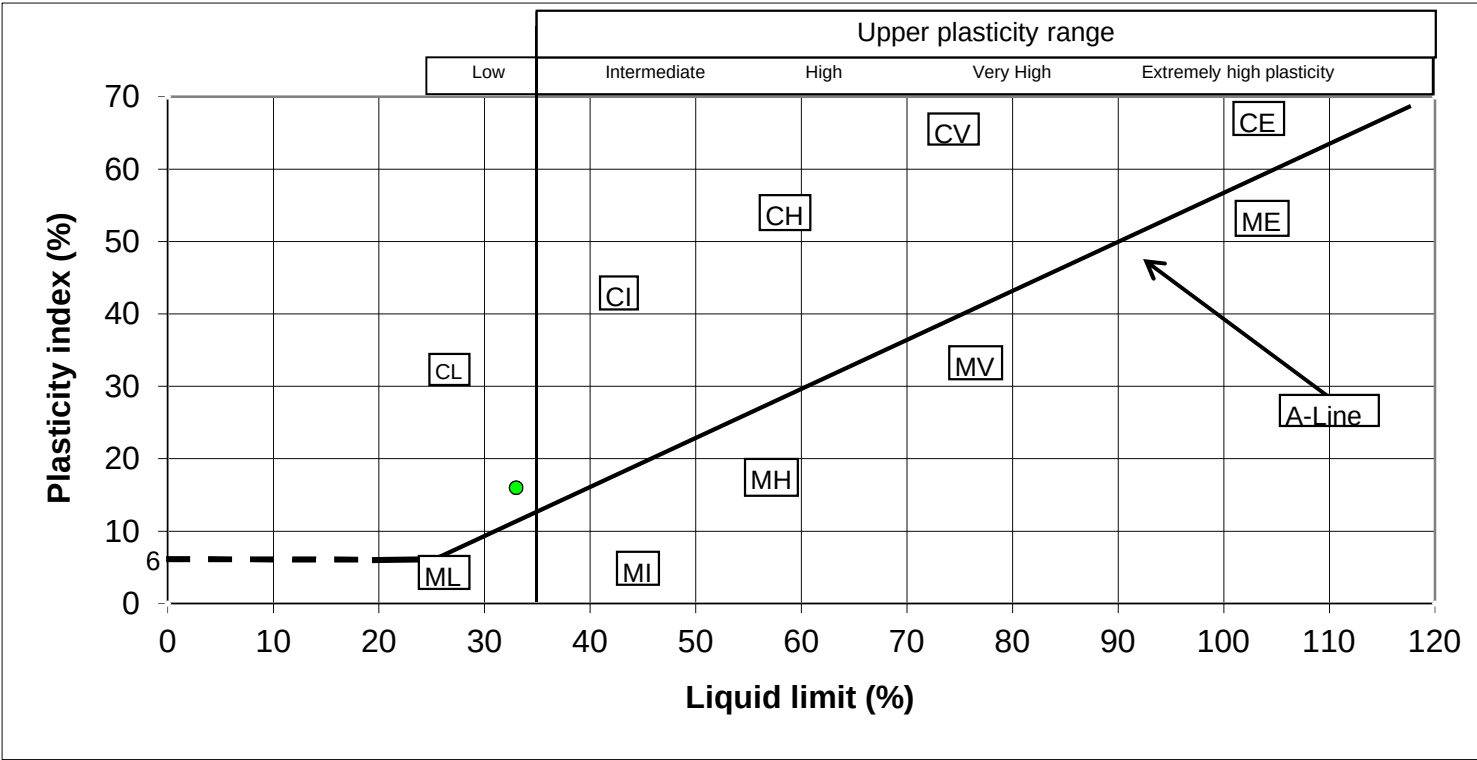
SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)

CCG-CMS-FO-204 Issue 2



ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



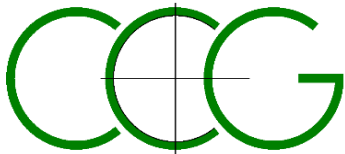
BH	Sample Depth	Liquid limit	Plasticity index
WS5	1.80	33.0	16.0



4514

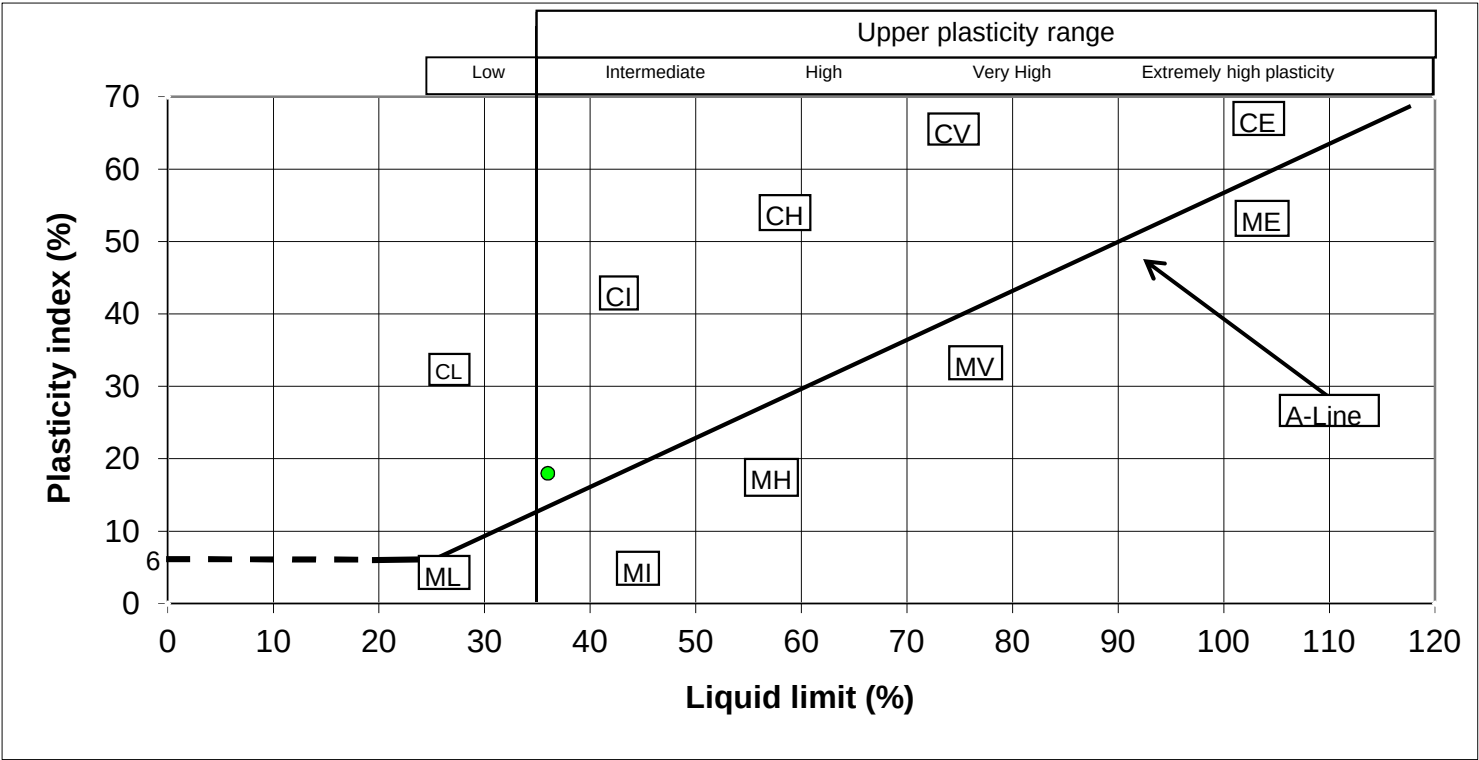
APPROVED BY	DK
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CLIENT: KDP ARCHITECTS	SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)
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ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
WS5	2.80	36.0	18.0

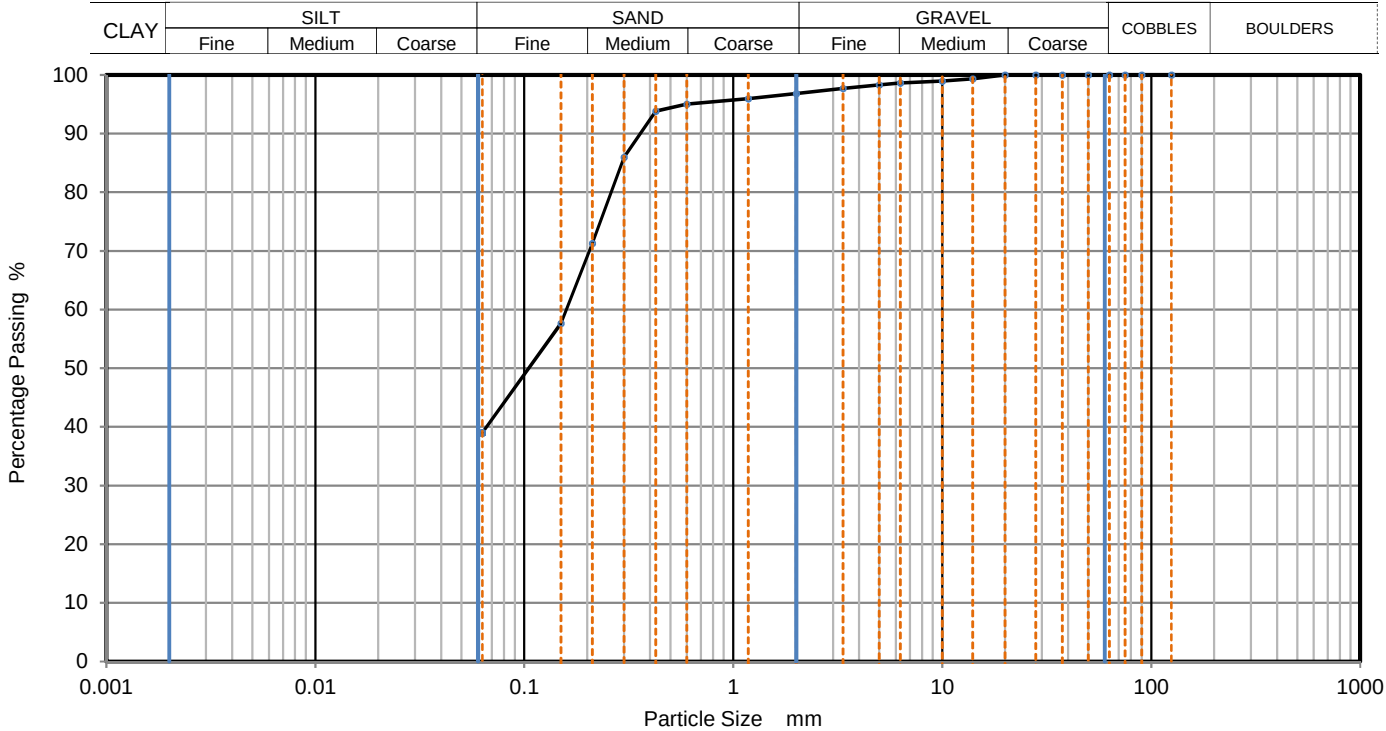


4514

APPROVED BY	DK
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CLIENT: KDP ARCHITECTS	SITE: ECCLES NEW ROAD, MANCHESTER (CCG-C-17-9806)
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 CC Geotechnical Ltd Tel: 0151 545 2750 e: lab@ccgeotechnical.com		PARTICLE SIZE DISTRIBUTION			Job Ref	CCG-C-17-9806
					Borehole/Pit No.	BH1
Site Name	ECCLES NEW ROAD, MANCHESTER				Sample No.	8
Specimen Description	Brown sandy slightly gravelly silty CLAY recovered as slightly gravelly sand with clay pockets				Depth, m	7.50
Specimen Reference		Specimen Depth	7.5	m	Sample Type	B
Test Method	WET SIEVE				KeyLAB ID	



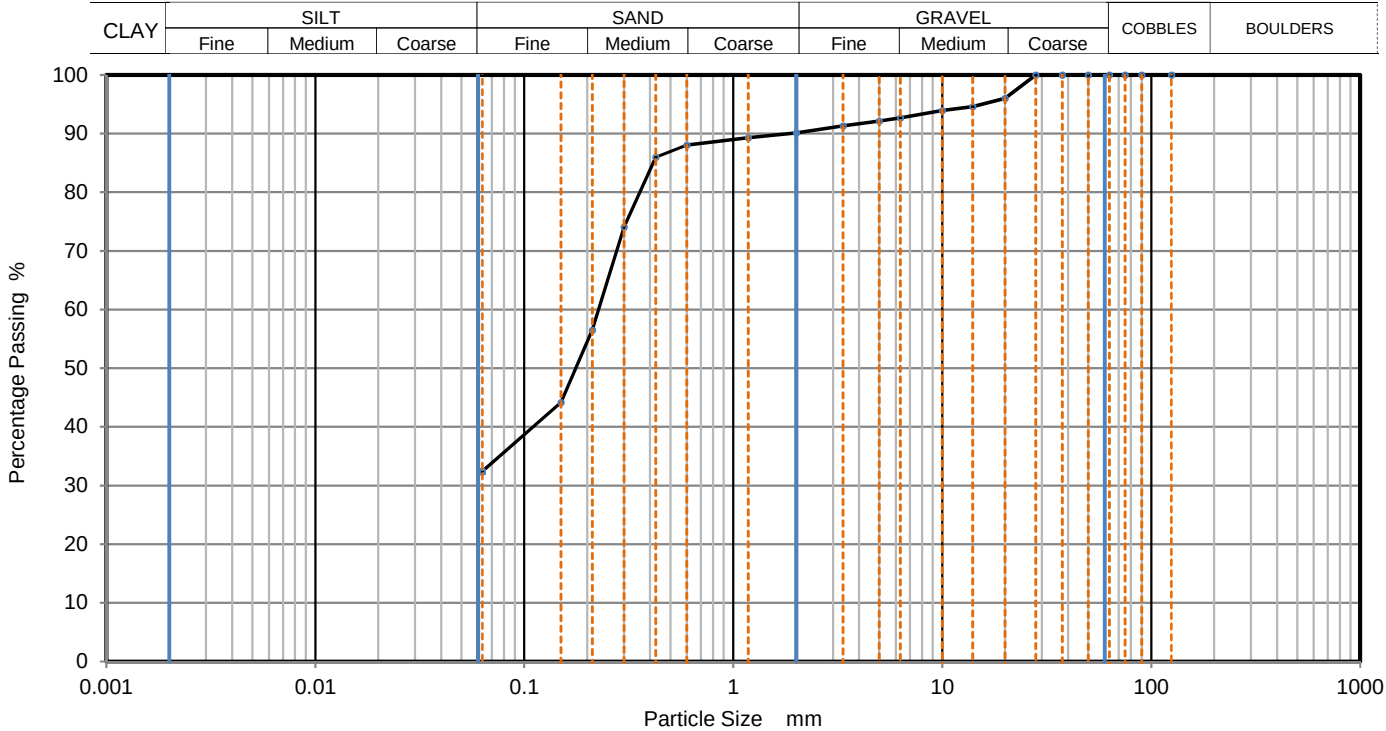
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	99		
6.3	99		
5	98		
3.35	98		
2	97		
1.18	96		
0.6	95		
0.425	94		
0.3	86		
0.212	71		
0.15	58		
0.063	39		

Dry Mass of sample, g	854
Sample Proportions	
	% dry mass
Very coarse	0
Gravel	3
Sand	58
Fines <0.063mm	39
Grading Analysis	
D ₁₀₀	mm
D ₆₀	mm
D ₃₀	mm
D ₁₀	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig Sheet
JE	DK	DK	05/12/2017 10:47	

 CC Geotechnical Ltd Tel: 0151 545 2750 e: lab@ccgeotechnical.com		PARTICLE SIZE DISTRIBUTION			Job Ref	CCG-C-17-9806
					Borehole/Pit No.	BH2
Site Name	ECCLES NEW ROAD, MANCHESTER				Sample No.	8
Specimen Description	Brown very clayey gravelly SAND recovered as gravelly sand with clay pockets				Depth, m	7.50
Specimen Reference		Specimen Depth	7.5	m	Sample Type	B
Test Method	WET SIEVE				KeyLAB ID	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	96		
14	95		
10	94		
6.3	93		
5	92		
3.35	91		
2	90		
1.18	89		
0.6	88		
0.425	86		
0.3	74		
0.212	57		
0.15	44		
0.063	32		

Dry Mass of sample, g	1274
Sample Proportions	% dry mass
Very coarse	0
Gravel	10
Sand	58
Fines <0.063mm	32
Grading Analysis	
D ₁₀₀ mm	
D ₆₀ mm	
D ₃₀ mm	
D ₁₀ mm	
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig Sheet
JE	DK	DK	05/12/2017 10:49	

Int. J. Rock Mech. Sci. & Geomech. Abstr. Vol.22, No.2, pp. 51 - 60, 1985

ECCLES NEW ROAD, MANCHESTER

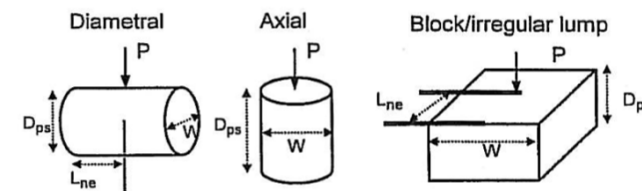
[illegible]

* NOTE- a = axial ; d = diametral ; i = irregular lump or block (see diagrams, right, for details)

DIA. KEY- P = load ; Dps = platen separation ;

W = width of shortest dimension perpendicular to load ;

Lne = length from platens to nearest free end

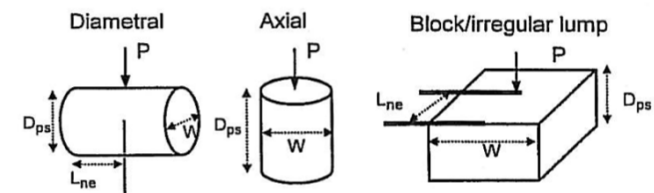


Int. J. Rock Mech. Sci. & Geomech. Abstr. Vol.22, No.2, pp. 51 - 60, 1985

ECCLES NEW ROAD, MANCHESTER

[illegible]

Lne = length from platens to nearest free end





POINT LOAD TEST RESULTS

Int. J. Rock Mech. Sci. & Geomech. Abstr. Vol.22, No.2, pp. 51 - 60, 1985

PROJECT No.: CCG-C-17-9806

SITE:-

ECCLES NEW ROAD, MANCHESTER

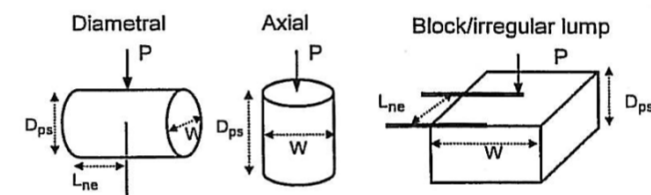
Borehole Number	Depth (m)	Type of Test*			Width (W) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D _e) (mm)	Point Load (I _s) (MPa)	Size Factor (F)	Point Load Index (I _{s(50)}) (MPa)	Estimated Uniaxial Compressive Strength (MPa)	Remarks
		a	d	i									
BH4	11.60	a			85	45	0.30	70	0.06	1.16	0.07	1.43	
	11.80		d		133	85	0.50	-	0.07	1.27	0.09	1.76	
	11.85	a			85	55	0.50	77	0.08	1.22	0.10	2.04	
	12.20	a			85	57	0.40	79	0.06	1.23	0.08	1.59	
	13.30	a			85	50	0.30	74	0.06	1.19	0.07	1.32	
	13.60	a			85	47	0.40	71	0.08	1.17	0.09	1.85	
	16.00	a			85	52	0.70	75	0.12	1.20	0.15	2.99	
	16.45	a			85	51	0.30	74	0.05	1.20	0.06	1.30	
	17.20		d		141	85	0.70	-	0.10	1.27	0.12	2.46	
	17.25	a			85	55	1.00	77	0.17	1.22	0.20	4.08	
	17.90	a			85	53	0.50	76	0.09	1.21	0.11	2.10	
	18.50	a			85	54	0.50	76	0.09	1.21	0.10	2.07	
	18.90	a			85	47	0.70	71	0.14	1.17	0.16	3.23	
	19.40	a			85	49	0.60	73	0.11	1.18	0.13	2.68	
	19.80		d		149	85	0.40	-	0.06	1.27	0.07	1.41	
	19.85	a			85	44	0.50	69	0.10	1.16	0.12	2.43	
	20.25	a			85	51	0.40	74	0.07	1.20	0.09	1.73	
	20.60	a			85	43	0.50	68	0.11	1.15	0.12	2.47	
	21.00	a			85	57	0.70	79	0.11	1.23	0.14	2.78	
	21.15	a			85	60	0.70	81	0.11	1.24	0.13	2.67	

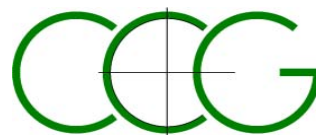
*NOTE- a = axial ; d = diametral ; i = irregular lump or blor (see diagrams, right, for details)

DIA. KEY- P = load ; Dps = platen separation ;

W = width of shortest dimension perpendicular to load ;

Lne = length from platens to nearest free end



TEST REPORT**UNIAXIAL COMPRESSIVE STRENGTH***In accordance with ISRM Vol 16 No 2, pp 135-140 (1979)*

PROJECT: ECCLES NEW ROAD, MANCHESTER
CLIENT: KDP ARCHITECTS
CCG REF: CCG-C-17-9806

Sample ref: BH1 20.40mbgl

Date of coring: 07.11.17

Sampled by: AH

Sample description: SANDSTONE

TEST DATA

Specimen Height (mm): 170

Specimen Diameter (mm): 85

L/D ratio: 2:1

Mode of failure: AXIAL CLEAVAGE

Test duration: 5m 5s

Maximum load at failure (kN): 15.5

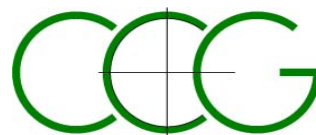
Compressive strength (N/mm²): **2.7**

Test date: 01.12.17

Tested by: JE

Report prepared by: DK

Report approved by: DK

TEST REPORT**UNIAXIAL COMPRESSIVE STRENGTH***In accordance with ISRM Vol 16 No 2, pp 135-140 (1979)*

PROJECT: ECCLES NEW ROAD, MANCHESTER
CLIENT: KDP ARCHITECTS
CCG REF: CCG-C-17-9806

Sample ref: BH2 19.85mbgl

Date of coring: 08.11.17

Sampled by: AH

Sample description: SANDSTONE

TEST DATA

Specimen Height (mm): 170

Specimen Diameter (mm): 85

L/D ratio: 2:1

Mode of failure: AXIAL CLEAVAGE

Test duration: 4m 21s

Maximum load at failure (kN): 14.9

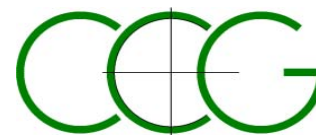
Compressive strength (N/mm²): **2.6**

Test date: 01.12.17

Tested by: JE

Report prepared by: DK

Report approved by: DK

TEST REPORT**UNIAXIAL COMPRESSIVE STRENGTH***In accordance with ISRM Vol 16 No 2, pp 135-140 (1979)*

PROJECT: ECCLES NEW ROAD, MANCHESTER
CLIENT: KDP ARCHITECTS
CCG REF: CCG-C-17-9806

Sample ref: BH4 20.70mbgl

Date of coring: 01.11.17

Sampled by: AH

Sample description: SANDSTONE

TEST DATA

Specimen Height (mm): 170

Specimen Diameter (mm): 85

L/D ratio: 2:1

Mode of failure: AXIAL CLEAVAGE

Test duration: 4m 40s

Maximum load at failure (kN): 12.1

Compressive strength (N/mm²): **2.1**

Test date: 01.12.17

Tested by: JE

Report prepared by: DK

Report approved by: DK



APPENDIX G: SOIL GROUNDWATER LABORATORY TEST RESULTS



Unit A2
Windmill Road
Ponswood Industrial Estate
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Telephone: (01424) 718618
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info@elab-uk.co.uk

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 17-14893

Issue: 2

Date of Issue: 22/11/2017

Contact: Tony Gerrard

Customer Details: CC Geotechnical Ltd
Unit 1 & 2 Deltic Place
Deltic Way
Liverpool
Merseyside L33 7BA

Quotation No: Q14-00045

Order No: Not Supplied

Customer Reference: 17-9806

Date Received: 13/11/2017

Date Approved: 22/11/2017

Details: Land at Eccles New Road, Manchester

Approved by: 

Mike Varley, Technical Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)



Sample Summary

Report No.: 17-14893

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
117931	WS1 0.70	08/11/2017	14/11/2017	Loamy sand	
117932	WS2 1.00	08/11/2017	14/11/2017	Sandy silty loam	
117933	WS3 1.70	08/11/2017	14/11/2017	Silty clayey loam	
117934	WS4 0.25	08/11/2017	14/11/2017	Loamy sand + stones	
117935	WS5 1.40	08/11/2017	14/11/2017	Sandy loam	
117936	BH1 0.50	08/11/2017	21/11/2017	Sandy silty loam	
117937	BH3 0.50	07/11/2017	14/11/2017	Silty loam	
117938	BH4 0.50	08/11/2017	14/11/2017	Silty loam	

Results Summary

Report No.: 17-14893

				ELAB Reference	117931	117932	117933	117934	117935	117936	117937	117938
				Customer Reference								
				Sample ID								
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Location	WS1	WS2	WS3	WS4	WS5	BH1	BH3	BH4
				Sample Depth (m)	0.70	1.00	1.70	0.25	1.40	0.50	0.50	0.50
				Sampling Date	08/11/2017	08/11/2017	08/11/2017	08/11/2017	08/11/2017	08/11/2017	07/11/2017	08/11/2017
Determinand	Codes	Units	LOD									
Metals												
Arsenic	M	mg/kg	1	7.4	24.5	10.1	^ 15.7	59.6	40.2	45.3		17.2
Cadmium	M	mg/kg	0.5	1.4	< 0.5	< 0.5	^ 0.9	0.9	1.6	1.1		< 0.5
Chromium	M	mg/kg	5	12.8	25.9	31.1	^ 10.2	29.4	27.8	21.1		15.9
Copper	M	mg/kg	5	142	125	84.9	^ 61.0	538	297	513		47.6
Lead	M	mg/kg	5	69.3	168	27.9	^ 134	166	609	146		45.3
Mercury	M	mg/kg	0.5	< 0.5	2.1	0.9	^ 0.8	2.6	1.6	1.5		0.7
Nickel	M	mg/kg	5	14.0	29.7	52.1	^ 18.2	60.1	47.7	68.1		17.8
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	^ < 1.0	< 1.0	< 1.0	< 1.0		< 1.0
Zinc	M	mg/kg	5	222	128	147	^ 154	579	648	189		58.5
Anions												
Water Soluble Sulphate	M	g/l	0.02	0.15	0.21	0.09	^ < 0.02	0.02	0.04	< 0.02		< 0.02
Inorganics												
Free Cyanide	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		< 1.0
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8		< 0.8
Total Sulphide	N	mg/kg	2	< 2	< 2	5	< 2	6	3	4		6
Acid Soluble Sulphate (SO4)	U	%	0.02	0.22	0.12	0.08	0.03	0.08	0.08	0.07		0.08
Water Soluble Boron	N	mg/kg	0.5	0.7	1.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5
Miscellaneous												
pH	M	pH units	0.1	11.2	8.7	9.0	^ 8.5	8.3	10.8	8.2		8.8
Soil Organic Matter	U	%	0.1	0.9	5.4	1.6	10	2.9	3.4	15		1.6
Polyaromatic hydrocarbons												
Naphthalene	M	mg/kg	0.1	< 0.1	2.4	< 0.1	^ 1.0	0.1	0.5	4.1		0.5
Acenaphthylene	M	mg/kg	0.1	< 0.1	0.4	< 0.1	^ 1.7	< 0.1	0.3	1.1		< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	1.7	0.1	^ 0.9	0.6	2.6	23.5		0.1
Fluorene	M	mg/kg	0.1	< 0.1	1.2	< 0.1	^ 1.1	0.5	1.7	19.5		< 0.1
Phenanthrene	M	mg/kg	0.1	0.3	6.8	0.1	^ 16.2	5.3	19.4	275		0.6
Anthracene	M	mg/kg	0.1	< 0.1	2.3	< 0.1	^ 5.2	1.4	4.8	70.3		0.1
Fluoranthene	M	mg/kg	0.1	0.5	7.8	0.1	^ 38.2	5.0	40.8	469		1.0
Pyrene	M	mg/kg	0.1	0.4	6.4	0.1	^ 36.1	4.4	38.0	427		1.0
Benzo(a)anthracene	M	mg/kg	0.1	0.3	3.1	< 0.1	^ 19.1	2.1	18.9	243		0.8
Chrysene	M	mg/kg	0.1	0.3	3.8	0.1	^ 20.7	2.5	21.5	270		0.8
Benzo (b) fluoranthene	M	mg/kg	0.1	0.3	3.3	< 0.1	^ 19.4	1.9	18.4	248		0.5
Benzo(k)fluoranthene	M	mg/kg	0.1	0.3	2.9	< 0.1	^ 18.3	1.8	17.3	222		0.7
Benzo (a) pyrene	M	mg/kg	0.1	0.2	3.2	< 0.1	^ 21.5	2.2	18.7	262		0.6
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.1	0.3	2.4	0.2	^ 14.9	1.7	13.1	223		0.5
Dibenzo(a,h)anthracene	M	mg/kg	0.1	0.2	0.7	0.1	^ 3.5	0.6	3.6	35.4		0.1
Benzo(g,h,i)perylene	M	mg/kg	0.1	0.3	2.2	0.1	^ 14.3	1.4	12.2	173		0.4
Total PAH(16)	M	mg/kg	0.4	3.5	50.6	1.5	^ 232	31.7	232	2970		8.1
BTEX												
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	^ < 10.0	< 10.0	< 10.0	< 10.0		< 10.0
Toluene	M	ug/kg	10	< 10.0	31.6	< 10.0	^ < 10.0	< 10.0	< 10.0	< 10.0		< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	^ < 10.0	< 10.0	< 10.0	< 10.0		< 10.0
Xylenes	M	ug/kg	10	< 10.0	< 10.0	< 10.0	^ < 10.0	< 10.0	< 10.0	< 10.0		< 10.0
TPH CWG												
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	7.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	< 1.0	35.0	< 1.0	1.3	< 1.0	< 1.0	10.0		< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	< 1.0	35.0	2.5	13.3	< 1.0	2.9	30.8		3.1
>C21-C35 Aliphatic	N	mg/kg	1	7.1	26.0	16.6	66.3	3.0	15.7	120		59.7
>C35-C40 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	1.8	6.9	< 1.0	2.6	12.8		21.2
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		< 1.0
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		< 1.0
>C12-C16 Aromatic	N	mg/kg	1	< 1.0	11.1	< 1.0	5.0	< 1.0	< 1.0	16.0		< 1.0
>C16-C21 Aromatic	N	mg/kg	1	< 1.0	20.3	1.8	63.2	< 1.0	12.1	167		2.2
>C21-C35 Aromatic	N	mg/kg	1	6.3	24.9	10.1	430	6.7	70.4	1050		60.3
>C35-C40 Aromatic	N	mg/kg	1	1.2	2.9	2.3	51.6	1.5	14.9	110		26.4
Total (>C5-C40) Ali/Aro	N	mg/kg	1	14.6	163	35.0	637	11.3	119	1520		173

Results Summary

Report No.: 17-14893

Asbestos Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Asbestos Identification	Gravimetric Analysis Total (%)	Gravimetric Analysis by ACM Type (%)	Free Fibre Analysis (%)	Total Asbestos (%)
117931	0.70	WS1	Brown sandy soil, concrete, brick, clinker	No asbestos detected	n/t	n/t	n/t	n/t
117932	1.00	WS2	Brown sandy soil, stones, concrete, brick, clinker, ceramics	No asbestos detected	n/t	n/t	n/t	n/t
117933	1.70	WS3	Brown soil, stones, concrete, clinker	No asbestos detected	n/t	n/t	n/t	n/t
117934	0.25	WS4	Brown sandy soil, stones, concrete, brick, clinker	No asbestos detected	n/t	n/t	n/t	n/t
117935	1.40	WS5	Brown sandy soil, stones, brick, clinker	No asbestos detected	n/t	n/t	n/t	n/t
117936	0.50	BH1	Brown sandy soil, stones, concrete, brick, clinker, metal	Chrysotile (asbestos cement)	0.412	Asbestos cement (0.412%)	< 0.001	0.412
117937	0.50	BH3	Brown sandy soil, stones, clinker	No asbestos detected	n/t	n/t	n/t	n/t
117938	0.50	BH4	Sand, stones, concrete, brick	No asbestos detected	n/t	n/t	n/t	n/t

Method Summary

Report No.: 17-14893

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Free cyanide	N	As submitted sample	15/11/2017	107	Colorimetry
Sulphide	N	As submitted sample	16/11/2017	109	Colorimetry
Hexavalent chromium	N	As submitted sample	15/11/2017	110	Colorimetry
pH	M	Air dried sample	16/11/2017	113	Electromeric
Acid Soluble Sulphate	U	Air dried sample	16/11/2017	115	Ion Chromatography
Aqua regia extractable metals	M	Air dried sample	15/11/2017	118	ICPMS
PAH (GC-FID)	M	As submitted sample	15/11/2017	133	GC-FID
Water soluble anions	M	Air dried sample	15/11/2017	172	Ion Chromatography
BTEX in solids	M	As submitted sample	16/11/2017	181A	GC-MS
Water soluble boron	N	Air dried sample	15/11/2017	202	Colorimetry
Aliphatic hydrocarbons in soil	N	As submitted sample	15/11/2017	214	GC-FID
Aliphatic/Aromatic hydrocarbons in soil	N	As submitted sample	16/11/2017	214	GC-FID
Aromatic hydrocarbons in soil	N	As submitted sample	15/11/2017	214	GC-FID
Low range Aliphatic hydrocarbons soil	N	As submitted sample	16/11/2017	214	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	16/11/2017	214	GC-MS
Asbestos identification	U	As submitted sample	15/11/2017	260	Microscopy
Soil organic matter	U	Air dried sample	15/11/2017	BS1377:P3	Titrimetry
Asbestos identification	U	As submitted sample	15/11/2017	PMAN	Microscopy

Tests marked N are not UKAS accredited

Report Information

Report No.: 17-14893

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis (dried at < 30°C)

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage



Unit A2
Windmill Road
Ponswood Industrial Estate
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East Sussex
TN38 9BY
Telephone: (01424) 718618
Facsimile: (01424) 729911
info@elab-uk.co.uk

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 17-15073

Issue: 1

Date of Issue: 29/11/2017

Contact: Tony Gerrard

Customer Details: CC Geotechnical Ltd
Unit 1 & 2 Deltic Place
Deltic Way
Liverpool
Merseyside L33 7BA

Quotation No: Q14-00045

Order No: Not Supplied

Customer Reference: 17-9806

Date Received: 24/11/2017

Date Approved: 29/11/2017

Details: Land at Eccles New Road, Manchester

Approved by:

Mike Varley, Technical Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)



Sample Summary

Report No.: 17-15073

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
119081	BH1	22/11/2017	24/11/2017		
119082	WS2	22/11/2017	24/11/2017		

Results Summary

Report No.: 17-15073

ELAB Reference	119081	119082
Customer Reference		
Sample ID		
Sample Type	WATER	WATER
Sample Location	BH1	WS2
Sample Depth (m)		
Sampling Date	22/11/2017	22/11/2017

Determinand	Codes	Units	LOD		
Dissolved Metals					
Arsenic	U	ug/l	5	< 5	< 5
Boron	N	ug/l	5	7	46
Calcium	U	ug/l	100	13700	85200
Cadmium	U	ug/l	1	< 1	< 1
Chromium	U	ug/l	5	< 5	< 5
Copper	U	ug/l	5	< 5	7
Mercury	U	ug/l	0.1	< 0.1	< 0.1
Magnesium	U	ug/l	100	2450	29400
Nickel	U	ug/l	5	< 5	6
Lead	U	ug/l	1	< 1	< 1
Selenium	U	ug/l	5	< 5	< 5
Zinc	U	ug/l	5	< 5	< 5
Anions					
Sulphate	U	mg/l	0.5	5.4	103
Inorganics					
Free Cyanide	N	ug/l	5	< 5	< 5
Miscellaneous					
Dissolved organic carbon	U	mg/l	1.5	< 1.5	18
Hardness (CaCO ₃)	N	mg/l CaCO ₃	0.1	44	334
pH	U	pH units	0.1	7.7	7.7
Polyaromatic hydrocarbons					
Naphthalene GCMS	N	ug/l	0.01	0.06	0.56
Acenaphthylene GCMS	N	ug/l	0.01	0.01	0.09
Acenaphthene GCMS	N	ug/l	0.01	0.05	0.68
Fluorene GCMS	N	ug/l	0.01	0.05	0.60
Phenanthrene GCMS	N	ug/l	0.01	0.42	6.38
Anthracene GCMS	N	ug/l	0.01	0.11	1.78
Fluoranthene GCMS	N	ug/l	0.01	0.61	8.49
Pyrene GCMS	N	ug/l	0.01	0.54	7.18
Benzo (a) anthracene GCMS	N	ug/l	0.01	0.22	3.84
Chrysene GCMS	N	ug/l	0.01	0.30	3.35
Benzo (b) fluoranthene GCMS	N	ug/l	0.01	0.17	2.42
Benzo (k) fluoranthene GCMS	N	ug/l	0.01	0.23	3.01
Benzo (a) pyrene GCMS	N	ug/l	0.01	0.25	3.84
Indeno (1,2,3-cd) pyrene GCMS	N	ug/l	0.01	0.11	1.79
Dibenzo(a,h)anthracene GCMS	N	ug/l	0.01	0.05	0.78
Benzo(ghi)perylene GCMS	N	ug/l	0.01	0.16	2.16
Total PAH(16) GCMS	N	ug/l	0.01	3.34	46.9
BTEX					
Benzene	U	ug/l	1	< 1.00	< 1.00
Toluene	U	ug/l	1	< 1.00	< 1.00
Ethylbenzene	U	ug/l	1	< 1.00	< 1.00
Xylenes	U	ug/l	1	< 1.00	< 1.00
MTBE	U	ug/l	1	< 1.00	< 1.00
TPH CWG					
>C5-C6 Aliphatic	N	ug/l	1	< 1.0	< 1.0
>C6-C8 Aliphatic	N	ug/l	1	< 1.0	< 1.0
>C8-C10 Aliphatic	N	ug/l	5	< 5.0	< 5.0
>C10-C12 Aliphatic	N	ug/l	5	< 5.0	< 5.0
>C12-C16 Aliphatic	N	ug/l	5	< 5.0	13.2
>C16-C21 Aliphatic	N	ug/l	5	< 5.0	41.2

Tests marked N are not UKAS accredited.



Results Summary

Report No.: 17-15073

ELAB Reference	119081	119082
Customer Reference		
Sample ID		
Sample Type	WATER	WATER
Sample Location	BH1	WS2
Sample Depth (m)		
Sampling Date	22/11/2017	22/11/2017

Determinand	Codes	Units	LOD		
>C21-C35 Aliphatic	N	ug/l	5	142	242
>C35-C40 Aliphatic	N	ug/l	5	27.5	29.1
Total (>C5-C40) Aliphatic	N	ug/l	5	170	325
>C5-C7 Aromatic	N	ug/l	1	< 1.0	< 1.0
>C7-C8 Aromatic	N	ug/l	1	< 1.0	< 1.0
>C8-C10 Aromatic	N	ug/l	5	< 5.0	< 5.0
>C10-C12 Aromatic	N	ug/l	5	< 5.0	< 5.0
>C12-C16 Aromatic	N	ug/l	5	< 5.0	13.3
>C16-C21 Aromatic	N	ug/l	5	< 5.0	42.4
>C21-C35 Aromatic	N	ug/l	5	106	230
>C35-C40 Aromatic	N	ug/l	5	< 5.0	12.7
Total (>C5-C40) Aromatic	N	ug/l	5	106	298
Total (>C5-C40) Ali/Aro	N	ug/l	5	276	623

Method Summary

Report No.: 17-15073

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Water					
Aliphatic/Aromatic hydrocarbons in water	N		28/11/2017		GC-FID
Aromatic hydrocarbons in water	N		28/11/2017		GC-FID
Dissolved metals by ICP in waters	U		28/11/2017	101	ICPMS
Dissolved organic carbon	U		29/11/2017	102	IR
pH of waters	U		27/11/2017	113	Electromeric
Anions	U		28/11/2017	131	Ion Chromatography
Cyanide in waters	N		28/11/2017	132	Colorimetry
PAHs and/or PCBs in waters	N		27/11/2017	135	GC-MS
BTEX in waters	U		28/11/2017	200A	GC-MS
Aliphatic hydrocarbons in water	N		27/11/2017	215	GC-FID
Aromatic hydrocarbons in water	N		27/11/2017	215	GC-FID
Low range Aliphatic hydrocarbons water	N		28/11/2017	215	GC-MS
Low range Aromatic hydrocarbons water	N		28/11/2017	215	GC-MS
Hardness in waters	N		28/11/2017	APHA	ICPMS

Tests marked N are not UKAS accredited

Report Information

Report No.: 17-15073

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis (dried at < 30°C)

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

-
- | | |
|---|--|
| a | No date of sampling supplied |
| b | No time of sampling supplied (Waters Only) |
| c | Sample not received in appropriate containers |
| d | Sample not received in cooled condition |
| e | The container has been incorrectly filled |
| f | Sample age exceeds stability time (sampling to receipt) |
| g | Sample age exceeds stability time (sampling to analysis) |

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage



APPENDIX H: SOIL CONTAMINATION SUMMARY TABLES

SOIL ASSESSMENT CRITERIA FOR RESIDENTIAL LAND USE (WITHOUT HOME GROWN PRODUCE)

Contaminant	Assessment Criteria for Residential at 1% SOM (mg/kg)	Assessment Criteria for Residential at 2.5% SOM (mg/kg)	Assessment Criteria for Residential at 6% SOM (mg/kg)
<u>Metals</u>			
Arsenic	40	40	40
Boron	11000	11000	11000
Cadmium	85	85	85
Chromium III	910	910	910
Chromium VI	6	6	6
Copper	7100	7100	7100
*Lead	310	310	310
Mercury	1.2	1.2	1.2
Nickel	180	180	180
Selenium	430	430	430
Vanadium	1200	1200	1200
Zinc	40000	40000	40000
<u>Non-Metals</u>			
Phenol	750	1300	2300
<u>Polyaromatic Hydrocarbons (PAH)</u>			
Acenaphthene	3000	4700	6000
Acenaphthylene	2900	4600	6000
Anthracene	31000	35000	37000
Benz[a]anthracene	11	14	15
Benzo[a]pyrene	3.2	3.2	3.2
Benzo[b]fluoranthene	3.9	4.0	4.0
Benzo[ghi]perylene	360	360	360
Benzo[k]fluoranthene	110	110	110
Chrysene	30	31	32
Dibenz[ah]anthracene	0.31	0.32	0.32
Fluoranthene	1500	1600	1600
Fluorene	2800	3800	4500
Indeno[123-cd]pyrene	45	46	46
Naphthalene	2.3	5.6	13
Phenanthrene	1300	1500	1500
Pyrene	3700	3800	3800
Coal Tar [Bap as surrogate marker]	1.2	1.2	1.2
<u>Petroleum Hydrocarbons</u>			
Aliphatic EC 5-6	42	78	160
Aliphatic EC >6-8	100	230	530
Aliphatic EC>8-10	27	65	150
Aliphatic EC>10-12	130	330	770
Aliphatic EC>12-16	1100	2400	4400
Aliphatic EC>16-35	65000	92000	110000
Aliphatic EC>35-44	65000	92000	110000
Aromatic EC5-7 (Benzene)	370	690	1400
Aromatic EC>7-8 (Toluene)	860	1800	3900
Aromatic EC>8-10	47	110	270
Aromatic EC>10-12	250	590	1200
Aromatic EC>12-16	1800	2300	2500
Aromatic EC>16-21	1900	1900	1900
Aromatic EC>21-35	1900	1900	1900
Aromatic EC>35-44	1900	1900	1900
Aliphatic – Aromatic EC>44-70	1900	1900	1900

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 "Residential" land use (without home grown produce) 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: 17-9806
Site name: Land at Eccles New Road, Manchester
Prepared by: A. Gerrard
Authorised by: C. Bolan
Proposed land use: Residential with plant uptake
SOM % used: 2.5

Contaminants			Metals							
			Cadmium	Chromium (total)	Chromium VI	Copper	Lead	Mercury (total)	Nickel	Zinc
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample Location	Sample Depth (m)	Sample type								
WS1	0.70	Loamy sand	1.4	12.8	0.8	142	69.3	0.5	14	222
WS2	1.00	Sandy silty loam	0.5	25.9	0.8	125	168	2.1	29.7	128
WS3	1.70	Silty clayey loam	0.5	31.1	0.8	84.9	27.9	0.9	52.1	147
WS4	0.29	Loamy sand + stones	0.9	10.2	0.8	61	134	0.8	18.2	154
WS5	1.40	Sandy loam	0.9	29.4	0.8	538	166	2.6	60.1	579
BH1	0.50	Sandy silty loam	1.6	27.8	0.8	297	609	1.6	47.7	648
BH3	0.50	Silty loam	1.1	21.1	0.8	513	146	1.5	68.1	189
BH4	0.50	Silty loam	0.5	15.9	0.8	47.6	45.3	0.7	17.8	58.5
Human Health Risk Assessment (GAC)			85	910	6	7100	310	1.2	180	40000



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

Job number: 17-9806
Site name: Land at Eccles New Road, Manchester
Prepared by: A. Gerrard
Authorised by: C. Bolan
Proposed land use: Residential with plant uptake
SOM % used: 2.5

			Semi-metals/non-metals			Inorganics		Other	
Contaminants			Arsenic	Boron	Selenium	Cyanide (total)	Sulphide	pH (units)	Soil Organic Matter %
Sample Location	Sample Depth (m)	Sample type							
WS1	0.70	Loamy sand	7.4	0.7	1	1	2	11.2	0.9
WS2	1.00	Sandy silty loam	24.5	1.5	1	1	2	8.7	5.4
WS3	1.70	Silty clayey loam	10.1	0.5	1	1	5	9	1.6
WS4	0.29	Loamy sand + stones	15.7	0.5	1	1	2	8.5	10
WS5	1.40	Sandy loam	59.6	0.5	1	1	6	8.3	2.9
BH1	0.50	Sandy silty loam	40.2	0.5	1	1	3	10.8	3.4
BH3	0.50	Silty loam	45.3	0.5	1	1	4	8.2	15
BH4	0.50	Silty loam	17.2	0.5	1	1	6	8.8	1.6
Human Health Risk Assessment (GAC)			40	11000	430	460	NA	NA	NA



SPECIATED PAH'S DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: 17-9806

Site name: Land at Eccles New Road, Manchester

Prepared by: A. Gerrard

Authorised by: C. Bolan

Proposed land use: Residential with plant uptake

SOM % used: 2.5

Contaminants			PAH's															
			Acenaphthene	Acenaphthylene	Anthracene	Benz[a]anthracene	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[ghi]perylene	Benzo[k]fluoranthene	Chrysene	Dibenzo[a,h]anthracene	Flouranthene	Flourene	Indeno[123-cd]pyrene	Napthalene	Pheanthrene	Pyrene
Sample Location	Sample Depth (m)	Sample type																
WS1	0.70	Loamy sand	0.1	0.1	0.1	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.5	0.1	0.3	0.1	0.3	0.4
WS2	1.00	Sandy silty loam	1.7	0.4	2.3	3.1	3.2	3.3	2.2	2.9	3.8	0.7	7.8	1.2	2.4	2.4	6.8	6.4
WS3	1.70	Silty clayey loam	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1
WS4	0.29	Loamy sand + stones	0.9	1.7	5.2	19.1	21.5	19.4	14.3	18.3	20.7	3.5	38.2	1.1	14.9	1	16.2	36.1
WS5	1.40	Sandy loam	0.6	0.1	1.4	2.1	2.2	1.9	1.4	1.8	2.5	0.6	5	0.5	1.7	0.1	5.3	4.4
BH1	0.50	Sandy silty loam	2.6	0.3	4.8	18.9	18.7	18.4	12.2	17.3	21.5	3.6	40.8	1.7	13.1	0.5	19.4	38
BH3	0.50	Silty loam	23.5	1.1	70.3	243	262	248	173	222	270	35.4	469	19.5	223	4.1	275	427
BH4	0.50	Silty loam	0.1	0.1	0.1	0.8	0.6	0.5	0.4	0.7	0.8	0.1	1	0.1	0.5	0.5	0.6	1
Human Health Risk Assessment (GAC)			4700	4600	35000	14	3.2	4	360	110	31	0.32	1600	3800	46	5.6	1500	3800



SPECIATED TPH'S DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: 17-9806

Site name: Land at Eccles New Road, Manchester

Prepared by: A. Gerrard

Authorised by: C. Bolan

Proposed land use: Residential with plant uptake

SOM % used: 2.5

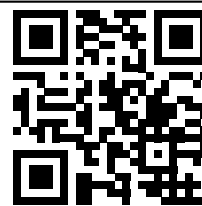
			Speciated TPH's															
			Aromatics							Aliphatics								
Contaminants			EC5-7	EC7-8	EC8-10	EC10-12	EC12-16	EC16-21	EC21-35	EC35-44	EC5-6	EC6-8	EC8-10	EC10-12	EC12-16	EC16-35	EC35-44	TOTAL TPH'S
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample Location	Sample Depth (m)	Sample type																
WS1	0.70	Loamy sand	0.01	0.01	1	1	1	1	6.3	1.2	0.01	0.01	1	1	1	8.1	1	14.6
WS2	1.00	Sandy silty loam	0.01	0.03	1	1	11.1	20.3	24.9	2.9	0.01	0.01	1	7.5	35	61	1	163
WS3	1.70	Silty clayey loam	0.01	0.01	1	1	1	1.38	10.1	2.3	0.01	0.01	1	1	1	19.1	1.8	35
WS4	0.29	Loamy sand + stones	0.01	0.01	1	1	5	63.2	430	51.6	0.01	0.01	1	1	1.3	79.6	6.9	637
WS5	1.40	Sandy loam	0.01	0.01	1	1	1	1	6.7	1.5	0.01	0.01	1	1	1	4	1	11.3
BH1	0.50	Sandy silty loam	0.01	0.01	1	1	1	12.1	70.4	14.9	0.01	0.01	1	1	1	18.6	2.6	119
BH3	0.50	Silty loam	0.01	0.01	1	1	16	167	10.5	110	0.01	0.01	1	1	10	150.8	12.8	1520
BH4	0.50	Silty loam	0.01	0.01	1	1	1	2.2	60.3	26.4	0.01	0.01	1	1	1	62.8	21.2	173
Human Health Risk Assessment (GAC)			140	290	83	180	330	540	1500	1500	78	230	65	330	2400	92000	92000	NA



APPENDIX I: PRELIMINARY WASTE CLASSIFICATION



Waste Classification Report



V6XR2-G9UVB-2VWBC

Job name

Eccles New Road, Manchester

Description/Comments

Project

Site

Waste Stream Template

CCG Soil A 2016

Classified by

Name:

Tony Gerrard

Date:

11/12/2017 10:20:31 UTC

Telephone:

0151 545 2750

Company:

CC Geotechnical Limited

Unit 1 and 2, Deltic Place

Deltic Way, Knowsley Industrial Estate

Liverpool

L33 7BU

Report

Created by: Tony Gerrard

Created date: 11/12/2017 10:20 UTC

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	WS1	0.70	Non Hazardous		2
2	WS2	1.00	Non Hazardous		5
3	WS3	1.70	Non Hazardous		8
4	WS4	0.25	Non Hazardous		11
5	WS5	1.40	Non Hazardous		14
6	BH1	0.50	Non Hazardous		17
7	BH3	0.50	Hazardous	HP 3(i), HP 7, HP 11, HP 14	20
8	BH4	0.50	Non Hazardous		23

Appendices

	Page
Appendix A: Classifier defined and non CLP determinands	26
Appendix B: Rationale for selection of metal species	28
Appendix C: Version	28



Classification of sample: WS1

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

Sample details

Sample Name:	LoW Code:
WS1	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.70 m	Entry:
	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value		MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number										
1		arsenic { arsenic trioxide }				7.4	mg/kg	1.32	9.77	mg/kg	0.000977 %	✓		
	033-003-00-0	215-481-4	1327-53-3											
2		cadmium { cadmium sulfide }			1	1.4	mg/kg	1.285	1.799	mg/kg	0.00014 %	✓		
	048-010-00-4	215-147-8	1306-23-6											
3		chromium(III) oxide				12.8	mg/kg		12.8	mg/kg	0.00128 %	✓		
		215-160-9	1308-38-9											
4		copper {  dicopper oxide; copper (I) oxide }				142	mg/kg	1.126	159.876	mg/kg	0.016 %	✓		
	029-002-00-X	215-270-7	1317-39-1											
5		lead { lead chromate }			1	69.3	mg/kg	1.56	108.095	mg/kg	0.00693 %	✓		
	082-004-00-2	231-846-0	7758-97-6											
6		mercury { mercury dichloride }				<0.5	mg/kg	1.353	<0.677	mg/kg	<0.0000677 %		<LOD	
	080-010-00-X	231-299-8	7487-94-7											
7		nickel { nickel dihydroxide }				14	mg/kg	1.579	22.113	mg/kg	0.00221 %	✓		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]											
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD	
	034-002-00-8													
9		zinc { zinc oxide }				222	mg/kg	1.245	276.327	mg/kg	0.0276 %	✓		
	030-013-00-7	215-222-5	1314-13-2											
10		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													
11		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<0.8	mg/kg		<0.8	mg/kg	<0.00008 %		<LOD	
	024-017-00-8													
12		boron {  boron tribromide/trichloride/trifluoride (combined) }				0.7	mg/kg	13.43	9.401	mg/kg	0.00094 %	✓		
			10294-33-4, 10294-34-5, 7637-07-2											



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
13	pH				11.2 pH		11.2	pH	11.2 pH		
14	naphthalene				<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-052-00-2	202-049-5	91-20-3								
15	acenaphthylene				<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8								
16	acenaphthene				<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-469-6	83-32-9								
17	fluorene				<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7								
18	phenanthrene				0.3 mg/kg		0.3	mg/kg	0.00003 %	✓	
		201-581-5	85-01-8								
19	anthracene				<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7								
20	fluoranthene				0.5 mg/kg		0.5	mg/kg	0.00005 %	✓	
		205-912-4	206-44-0								
21	pyrene				0.4 mg/kg		0.4	mg/kg	0.00004 %	✓	
		204-927-3	129-00-0								
22	benzo[a]anthracene				0.3 mg/kg		0.3	mg/kg	0.00003 %	✓	
	601-033-00-9	200-280-6	56-55-3								
23	chrysene				0.3 mg/kg		0.3	mg/kg	0.00003 %	✓	
	601-048-00-0	205-923-4	218-01-9								
24	benzo[b]fluoranthene				0.3 mg/kg		0.3	mg/kg	0.00003 %	✓	
	601-034-00-4	205-911-9	205-99-2								
25	benzo[k]fluoranthene				0.3 mg/kg		0.3	mg/kg	0.00003 %	✓	
	601-036-00-5	205-916-6	207-08-9								
26	benzo[a]pyrene; benzo[def]chrysene				0.2 mg/kg		0.2	mg/kg	0.00002 %	✓	
	601-032-00-3	200-028-5	50-32-8								
27	indeno[123-cd]pyrene				0.3 mg/kg		0.3	mg/kg	0.00003 %	✓	
		205-893-2	193-39-5								
28	dibenz[a,h]anthracene				0.2 mg/kg		0.2	mg/kg	0.00002 %	✓	
	601-041-00-2	200-181-8	53-70-3								
29	benzo[ghi]perylene				0.3 mg/kg		0.3	mg/kg	0.00003 %	✓	
		205-883-8	191-24-2								
30	benzene				<10 mg/kg		<10	mg/kg	<0.001 %		<LOD
	601-020-00-8	200-753-7	71-43-2								
31	toluene				<10 mg/kg		<10	mg/kg	<0.001 %		<LOD
	601-021-00-3	203-625-9	108-88-3								
32	ethylbenzene				<10 mg/kg		<10	mg/kg	<0.001 %		<LOD
	601-023-00-4	202-849-4	100-41-4								
33	xylene				<10 mg/kg		<10	mg/kg	<0.001 %		<LOD
	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]								
34	TPH (C6 to C40) petroleum group				14.6 mg/kg		14.6	mg/kg	0.00146 %	✓	
			TPH								
Total:									0.0625 %		

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) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: Force this Hazardous property to non hazardous because Concentrations too low to be considered flammable risk



Classification of sample: WS2

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

Sample details

Sample Name:	LoW Code:
WS2	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
1.00 m	Entry:
	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	arsenic { arsenic trioxide }				24.5 mg/kg	1.32	32.348 mg/kg	0.00323 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
2	cadmium { cadmium sulfide }			1	<0.5 mg/kg	1.285	<0.643 mg/kg	<0.00005 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
3	chromium(III) oxide				25.9 mg/kg		25.9 mg/kg	0.00259 %	✓	
		215-160-9	1308-38-9							
4	copper { dicopper oxide; copper (I) oxide }				125 mg/kg	1.126	140.736 mg/kg	0.0141 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
5	lead { lead chromate }			1	168 mg/kg	1.56	262.049 mg/kg	0.0168 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
6	mercury { mercury dichloride }				2.1 mg/kg	1.353	2.842 mg/kg	0.000284 %	✓	
	080-010-00-X	231-299-8	7487-94-7							
7	nickel { nickel dihydroxide }				29.7 mg/kg	1.579	46.911 mg/kg	0.00469 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %		<LOD
	034-002-00-8									
9	zinc { zinc oxide }				128 mg/kg	1.245	159.323 mg/kg	0.0159 %	✓	
	030-013-00-7	215-222-5	1314-13-2							
10	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									
11	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<0.8 mg/kg		<0.8 mg/kg	<0.00008 %		<LOD
	024-017-00-8									
12	boron { boron tribromide/trichloride/trifluoride (combined) }				1.5 mg/kg	13.43	20.145 mg/kg	0.00201 %	✓	
			10294-33-4, 10294-34-5, 7637-07-2							



#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
13	● pH		PH		8.7	pH		8.7	pH	8.7 pH		
14	naphthalene	601-052-00-2	202-049-5	91-20-3	2.4	mg/kg		2.4	mg/kg	0.00024 %	✓	
15	● acenaphthylene		205-917-1	208-96-8	0.4	mg/kg		0.4	mg/kg	0.00004 %	✓	
16	● acenaphthene		201-469-6	83-32-9	1.7	mg/kg		1.7	mg/kg	0.00017 %	✓	
17	● fluorene		201-695-5	86-73-7	1.2	mg/kg		1.2	mg/kg	0.00012 %	✓	
18	● phenanthrene		201-581-5	85-01-8	6.8	mg/kg		6.8	mg/kg	0.00068 %	✓	
19	● anthracene		204-371-1	120-12-7	2.3	mg/kg		2.3	mg/kg	0.00023 %	✓	
20	● fluoranthene		205-912-4	206-44-0	7.8	mg/kg		7.8	mg/kg	0.00078 %	✓	
21	● pyrene		204-927-3	129-00-0	6.4	mg/kg		6.4	mg/kg	0.00064 %	✓	
22	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	3.1	mg/kg		3.1	mg/kg	0.00031 %	✓	
23	chrysene	601-048-00-0	205-923-4	218-01-9	3.8	mg/kg		3.8	mg/kg	0.00038 %	✓	
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	3.3	mg/kg		3.3	mg/kg	0.00033 %	✓	
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	2.9	mg/kg		2.9	mg/kg	0.00029 %	✓	
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	3.2	mg/kg		3.2	mg/kg	0.00032 %	✓	
27	● indeno[123-cd]pyrene		205-893-2	193-39-5	2.4	mg/kg		2.4	mg/kg	0.00024 %	✓	
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.7	mg/kg		0.7	mg/kg	0.00007 %	✓	
29	● benzo[ghi]perylene		205-883-8	191-24-2	2.2	mg/kg		2.2	mg/kg	0.00022 %	✓	
30	benzene	601-020-00-8	200-753-7	71-43-2	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
31	toluene	601-021-00-3	203-625-9	108-88-3	31.6	mg/kg		31.6	mg/kg	0.00316 %	✓	
32	● ethylbenzene	601-023-00-4	202-849-4	100-41-4	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
33	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]	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
34	● TPH (C6 to C40) petroleum group		TPH		163	mg/kg		163	mg/kg	0.0163 %	✓	
Total:										0.0877 %		

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) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: Force this Hazardous property to non hazardous because Concentrations too low to be considered flammable risk



Classification of sample: WS3

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

Sample details

Sample Name:	LoW Code:
WS3	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
1.70 m	Entry:
	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
1		arsenic { arsenic trioxide }				10.1	mg/kg	1.32	13.335	mg/kg	0.00133 %	✓	
	033-003-00-0	215-481-4	1327-53-3										
2		cadmium { cadmium sulfide }			1	<0.5	mg/kg	1.285	<0.643	mg/kg	<0.00005 %		<LOD
	048-010-00-4	215-147-8	1306-23-6										
3		chromium(III) oxide				31.1	mg/kg		31.1	mg/kg	0.00311 %	✓	
		215-160-9	1308-38-9										
4		copper {  dicopper oxide; copper (I) oxide }				84.9	mg/kg	1.126	95.588	mg/kg	0.00956 %	✓	
	029-002-00-X	215-270-7	1317-39-1										
5		lead { lead chromate }			1	27.9	mg/kg	1.56	43.519	mg/kg	0.00279 %	✓	
	082-004-00-2	231-846-0	7758-97-6										
6		mercury { mercury dichloride }				0.9	mg/kg	1.353	1.218	mg/kg	0.000122 %	✓	
	080-010-00-X	231-299-8	7487-94-7										
7		nickel { nickel dihydroxide }				52.1	mg/kg	1.579	82.292	mg/kg	0.00823 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]										
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	034-002-00-8												
9		zinc { zinc oxide }				147	mg/kg	1.245	182.973	mg/kg	0.0183 %	✓	
	030-013-00-7	215-222-5	1314-13-2										
10		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												
11		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<0.8	mg/kg		<0.8	mg/kg	<0.00008 %		<LOD
	024-017-00-8												
12		boron {  boron tribromide/trichloride/trifluoride (combined) }				<0.5	mg/kg	13.43	<6.715	mg/kg	<0.000672 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2										



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
13	● pH		PH		9 pH		9	pH	9pH		
14	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
15	● acenaphthylene		205-917-1	208-96-8	<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
16	● acenaphthene		201-469-6	83-32-9	0.1 mg/kg		0.1	mg/kg	0.00001 %	✓	
17	● fluorene		201-695-5	86-73-7	<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
18	● phenanthrene		201-581-5	85-01-8	0.1 mg/kg		0.1	mg/kg	0.00001 %	✓	
19	● anthracene		204-371-1	120-12-7	<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
20	● fluoranthene		205-912-4	206-44-0	0.1 mg/kg		0.1	mg/kg	0.00001 %	✓	
21	● pyrene		204-927-3	129-00-0	0.1 mg/kg		0.1	mg/kg	0.00001 %	✓	
22	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
23	chrysene	601-048-00-0	205-923-4	218-01-9	0.1 mg/kg		0.1	mg/kg	0.00001 %	✓	
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
27	● indeno[123-cd]pyrene		205-893-2	193-39-5	0.2 mg/kg		0.2	mg/kg	0.00002 %	✓	
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.1 mg/kg		0.1	mg/kg	0.00001 %	✓	
29	● benzo[ghi]perylene		205-883-8	191-24-2	0.1 mg/kg		0.1	mg/kg	0.00001 %	✓	
30	benzene	601-020-00-8	200-753-7	71-43-2	<10 mg/kg		<10	mg/kg	<0.001 %		<LOD
31	toluene	601-021-00-3	203-625-9	108-88-3	<10 mg/kg		<10	mg/kg	<0.001 %		<LOD
32	● ethylbenzene	601-023-00-4	202-849-4	100-41-4	<10 mg/kg		<10	mg/kg	<0.001 %		<LOD
33	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]	<10 mg/kg		<10	mg/kg	<0.001 %		<LOD
34	● TPH (C6 to C40) petroleum group			TPH	35 mg/kg		35	mg/kg	0.0035 %	✓	
Total:									0.0524 %		

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) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: Force this Hazardous property to non hazardous because
Concentrations too low to be considered flammable risk



Classification of sample: WS4

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

Sample details

Sample Name:	LoW Code:
WS4	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.25 m	Entry:
	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	arsenic { arsenic trioxide }				15.7 mg/kg	1.32	20.729 mg/kg	0.00207 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
2	cadmium { cadmium sulfide }			1	0.9 mg/kg	1.285	1.157 mg/kg	0.00009 %	✓	
	048-010-00-4	215-147-8	1306-23-6							
3	chromium(III) oxide				10.2 mg/kg		10.2 mg/kg	0.00102 %	✓	
		215-160-9	1308-38-9							
4	copper { dicopper oxide; copper (I) oxide }				61 mg/kg	1.126	68.679 mg/kg	0.00687 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
5	lead { lead chromate }			1	134 mg/kg	1.56	209.015 mg/kg	0.0134 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
6	mercury { mercury dichloride }				0.8 mg/kg	1.353	1.083 mg/kg	0.000108 %	✓	
	080-010-00-X	231-299-8	7487-94-7							
7	nickel { nickel dihydroxide }				18.2 mg/kg	1.579	28.747 mg/kg	0.00287 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %		<LOD
	034-002-00-8									
9	zinc { zinc oxide }				154 mg/kg	1.245	191.686 mg/kg	0.0192 %	✓	
	030-013-00-7	215-222-5	1314-13-2							
10	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									
11	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<0.8 mg/kg		<0.8 mg/kg	<0.00008 %		<LOD
	024-017-00-8									
12	boron { boron tribromide/trichloride/trifluoride (combined) }				<0.5 mg/kg	13.43	<6.715 mg/kg	<0.000672 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2							



#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
13	● pH		PH		8.5	pH		8.5	pH	8.5 pH		
14	naphthalene	601-052-00-2	202-049-5	91-20-3	1	mg/kg		1	mg/kg	0.0001 %	✓	
15	● acenaphthylene		205-917-1	208-96-8	1.7	mg/kg		1.7	mg/kg	0.00017 %	✓	
16	● acenaphthene		201-469-6	83-32-9	0.9	mg/kg		0.9	mg/kg	0.00009 %	✓	
17	● fluorene		201-695-5	86-73-7	1.1	mg/kg		1.1	mg/kg	0.00011 %	✓	
18	● phenanthrene		201-581-5	85-01-8	16.2	mg/kg		16.2	mg/kg	0.00162 %	✓	
19	● anthracene		204-371-1	120-12-7	5.2	mg/kg		5.2	mg/kg	0.00052 %	✓	
20	● fluoranthene		205-912-4	206-44-0	38.2	mg/kg		38.2	mg/kg	0.00382 %	✓	
21	● pyrene		204-927-3	129-00-0	36.1	mg/kg		36.1	mg/kg	0.00361 %	✓	
22	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	19.1	mg/kg		19.1	mg/kg	0.00191 %	✓	
23	chrysene	601-048-00-0	205-923-4	218-01-9	20.7	mg/kg		20.7	mg/kg	0.00207 %	✓	
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	19.4	mg/kg		19.4	mg/kg	0.00194 %	✓	
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	18.3	mg/kg		18.3	mg/kg	0.00183 %	✓	
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	21.5	mg/kg		21.5	mg/kg	0.00215 %	✓	
27	● indeno[123-cd]pyrene		205-893-2	193-39-5	14.9	mg/kg		14.9	mg/kg	0.00149 %	✓	
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	3.5	mg/kg		3.5	mg/kg	0.00035 %	✓	
29	● benzo[ghi]perylene		205-883-8	191-24-2	14.3	mg/kg		14.3	mg/kg	0.00143 %	✓	
30	benzene	601-020-00-8	200-753-7	71-43-2	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
31	toluene	601-021-00-3	203-625-9	108-88-3	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
32	● ethylbenzene	601-023-00-4	202-849-4	100-41-4	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
33	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]	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
34	● TPH (C6 to C40) petroleum group		TPH		637	mg/kg		637	mg/kg	0.0637 %	✓	
Total:										0.138 %		

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) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: Force this Hazardous property to non hazardous because Concentrations too low to be considered flammable risk



Classification of sample: WS5

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

Sample details

Sample Name:	LoW Code:
WS5	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
1.40 m	Entry:
	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
1		arsenic { arsenic trioxide }				59.6	mg/kg	1.32	78.691	mg/kg	0.00787 %	✓	
	033-003-00-0	215-481-4	1327-53-3										
2		cadmium { cadmium sulfide }			1	0.9	mg/kg	1.285	1.157	mg/kg	0.00009 %	✓	
	048-010-00-4	215-147-8	1306-23-6										
3		chromium(III) oxide				29.4	mg/kg		29.4	mg/kg	0.00294 %	✓	
		215-160-9	1308-38-9										
4		copper {  dicopper oxide; copper (I) oxide }				538	mg/kg	1.126	605.728	mg/kg	0.0606 %	✓	
	029-002-00-X	215-270-7	1317-39-1										
5		lead { lead chromate }			1	166	mg/kg	1.56	258.929	mg/kg	0.0166 %	✓	
	082-004-00-2	231-846-0	7758-97-6										
6		mercury { mercury dichloride }				2.6	mg/kg	1.353	3.519	mg/kg	0.000352 %	✓	
	080-010-00-X	231-299-8	7487-94-7										
7		nickel { nickel dihydroxide }				60.1	mg/kg	1.579	94.928	mg/kg	0.00949 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]										
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	034-002-00-8												
9		zinc { zinc oxide }				579	mg/kg	1.245	720.689	mg/kg	0.0721 %	✓	
	030-013-00-7	215-222-5	1314-13-2										
10		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												
11		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<0.8	mg/kg		<0.8	mg/kg	<0.00008 %		<LOD
	024-017-00-8												
12		boron {  boron tribromide/trichloride/trifluoride (combined) }				<0.5	mg/kg	13.43	<6.715	mg/kg	<0.000672 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2										



#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
13	● pH		PH		8.3	pH		8.3	pH	8.3 pH		
14	naphthalene	601-052-00-2	202-049-5	91-20-3	0.1	mg/kg		0.1	mg/kg	0.00001 %	✓	
15	● acenaphthylene		205-917-1	208-96-8	<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
16	● acenaphthene		201-469-6	83-32-9	0.6	mg/kg		0.6	mg/kg	0.00006 %	✓	
17	● fluorene		201-695-5	86-73-7	0.5	mg/kg		0.5	mg/kg	0.00005 %	✓	
18	● phenanthrene		201-581-5	85-01-8	5.3	mg/kg		5.3	mg/kg	0.00053 %	✓	
19	● anthracene		204-371-1	120-12-7	1.4	mg/kg		1.4	mg/kg	0.00014 %	✓	
20	● fluoranthene		205-912-4	206-44-0	5	mg/kg		5	mg/kg	0.0005 %	✓	
21	● pyrene		204-927-3	129-00-0	4.4	mg/kg		4.4	mg/kg	0.00044 %	✓	
22	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	2.1	mg/kg		2.1	mg/kg	0.00021 %	✓	
23	chrysene	601-048-00-0	205-923-4	218-01-9	2.5	mg/kg		2.5	mg/kg	0.00025 %	✓	
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	1.9	mg/kg		1.9	mg/kg	0.00019 %	✓	
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	1.8	mg/kg		1.8	mg/kg	0.00018 %	✓	
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	2.2	mg/kg		2.2	mg/kg	0.00022 %	✓	
27	● indeno[123-cd]pyrene		205-893-2	193-39-5	1.7	mg/kg		1.7	mg/kg	0.00017 %	✓	
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.6	mg/kg		0.6	mg/kg	0.00006 %	✓	
29	● benzo[ghi]perylene		205-883-8	191-24-2	1.4	mg/kg		1.4	mg/kg	0.00014 %	✓	
30	benzene	601-020-00-8	200-753-7	71-43-2	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
31	toluene	601-021-00-3	203-625-9	108-88-3	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
32	● ethylbenzene	601-023-00-4	202-849-4	100-41-4	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
33	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]	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
34	● TPH (C6 to C40) petroleum group		TPH		11.3	mg/kg		11.3	mg/kg	0.00113 %	✓	
Total:										0.179 %		

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) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: Force this Hazardous property to non hazardous because Concentrations too low to be considered flammable risk



Classification of sample: BH1

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

Sample details

Sample Name:	LoW Code:	
BH1	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)
0.50 m		

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	arsenic { arsenic trioxide }				40.2 mg/kg	1.32	53.077 mg/kg	0.00531 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
2	cadmium { cadmium sulfide }			1	1.6 mg/kg	1.285	2.056 mg/kg	0.00016 %	✓	
	048-010-00-4	215-147-8	1306-23-6							
3	chromium(III) oxide				27.8 mg/kg		27.8 mg/kg	0.00278 %	✓	
		215-160-9	1308-38-9							
4	copper { dicopper oxide; copper (I) oxide }				297 mg/kg	1.126	334.389 mg/kg	0.0334 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
5	lead { lead chromate }			1	609 mg/kg	1.56	949.927 mg/kg	0.0609 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
6	mercury { mercury dichloride }				1.6 mg/kg	1.353	2.166 mg/kg	0.000217 %	✓	
	080-010-00-X	231-299-8	7487-94-7							
7	nickel { nickel dihydroxide }				47.7 mg/kg	1.579	75.342 mg/kg	0.00753 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %		<LOD
	034-002-00-8									
9	zinc { zinc oxide }				648 mg/kg	1.245	806.575 mg/kg	0.0807 %	✓	
	030-013-00-7	215-222-5	1314-13-2							
10	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									
11	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<0.8 mg/kg		<0.8 mg/kg	<0.00008 %		<LOD
	024-017-00-8									
12	boron { boron tribromide/trichloride/trifluoride (combined) }				<0.5 mg/kg	13.43	<6.715 mg/kg	<0.000672 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2							



#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
13	● pH		PH		10.8	pH		10.8	pH	10.8 pH		
14	naphthalene	601-052-00-2	202-049-5	91-20-3	0.5	mg/kg		0.5	mg/kg	0.00005 %	✓	
15	● acenaphthylene		205-917-1	208-96-8	0.3	mg/kg		0.3	mg/kg	0.00003 %	✓	
16	● acenaphthene		201-469-6	83-32-9	2.6	mg/kg		2.6	mg/kg	0.00026 %	✓	
17	● fluorene		201-695-5	86-73-7	1.7	mg/kg		1.7	mg/kg	0.00017 %	✓	
18	● phenanthrene		201-581-5	85-01-8	19.4	mg/kg		19.4	mg/kg	0.00194 %	✓	
19	● anthracene		204-371-1	120-12-7	4.8	mg/kg		4.8	mg/kg	0.00048 %	✓	
20	● fluoranthene		205-912-4	206-44-0	40.8	mg/kg		40.8	mg/kg	0.00408 %	✓	
21	● pyrene		204-927-3	129-00-0	38	mg/kg		38	mg/kg	0.0038 %	✓	
22	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	18.9	mg/kg		18.9	mg/kg	0.00189 %	✓	
23	chrysene	601-048-00-0	205-923-4	218-01-9	21.5	mg/kg		21.5	mg/kg	0.00215 %	✓	
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	18.4	mg/kg		18.4	mg/kg	0.00184 %	✓	
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	17.3	mg/kg		17.3	mg/kg	0.00173 %	✓	
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	18.7	mg/kg		18.7	mg/kg	0.00187 %	✓	
27	● indeno[123-cd]pyrene		205-893-2	193-39-5	13.1	mg/kg		13.1	mg/kg	0.00131 %	✓	
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	3.6	mg/kg		3.6	mg/kg	0.00036 %	✓	
29	● benzo[ghi]perylene		205-883-8	191-24-2	12.2	mg/kg		12.2	mg/kg	0.00122 %	✓	
30	benzene	601-020-00-8	200-753-7	71-43-2	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
31	toluene	601-021-00-3	203-625-9	108-88-3	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
32	● ethylbenzene	601-023-00-4	202-849-4	100-41-4	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
33	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]	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
34	● TPH (C6 to C40) petroleum group		TPH		119	mg/kg		119	mg/kg	0.0119 %	✓	
Total:										0.231 %		

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) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: Force this Hazardous property to non hazardous because Concentrations too low to be considered flammable risk



Classification of sample: BH3

 **Hazardous Waste**
Classified as **17 05 03 ***
in the List of Waste

Sample details

Sample Name:	LoW Code:
BH3	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 03 * (Soil and stones containing hazardous substances)
0.50 m	

Hazard properties

HP 7: Carcinogenic "waste which induces cancer or increases its incidence"

Hazard Statements hit:

Carc. 1B; H350 "May cause cancer [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.152%)

HP 11: Mutagenic "waste which may cause a mutation, that is a permanent change in the amount or structure of the genetic material in a cell"

Hazard Statements hit:

Muta. 1B; H340 "May cause genetic defects [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.152%)

HP 14: Ecotoxic "waste which presents or may present immediate or delayed risks for one or more sectors of the environment"

Risk phrases hit:

R52/53 "Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment"

Because of determinands:

dibenz[a,h]anthracene: (conc.: 0.00354%)

benzo[a]anthracene: (conc.: 0.0243%)

Hazard properties (substances considered hazardous until shown otherwise)

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"

Hazard Statements hit:

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

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.152%)

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)



#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
1		arsenic { arsenic trioxide }				45.3	mg/kg	1.32	59.811	mg/kg	0.00598 %	✓	
	033-003-00-0	215-481-4	1327-53-3										
2		cadmium { cadmium sulfide }			1	1.1	mg/kg	1.285	1.414	mg/kg	0.00011 %	✓	
	048-010-00-4	215-147-8	1306-23-6										
3		chromium(III) oxide				21.1	mg/kg		21.1	mg/kg	0.00211 %	✓	
		215-160-9	1308-38-9										
4		copper {  dicopper oxide; copper (I) oxide }				513	mg/kg	1.126	577.581	mg/kg	0.0578 %	✓	
	029-002-00-X	215-270-7	1317-39-1										
5		lead { lead chromate }			1	146	mg/kg	1.56	227.733	mg/kg	0.0146 %	✓	
	082-004-00-2	231-846-0	7758-97-6										
6		mercury { mercury dichloride }				1.5	mg/kg	1.353	2.03	mg/kg	0.000203 %	✓	
	080-010-00-X	231-299-8	7487-94-7										
7		nickel { nickel dihydroxide }				68.1	mg/kg	1.579	107.564	mg/kg	0.0108 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]										
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	034-002-00-8												
9		zinc { zinc oxide }				189	mg/kg	1.245	235.251	mg/kg	0.0235 %	✓	
	030-013-00-7	215-222-5	1314-13-2										
10		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												
11		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<0.8	mg/kg		<0.8	mg/kg	<0.00008 %		<LOD
	024-017-00-8												
12		boron {  boron tribromide/trichloride/trifluoride (combined) }				<0.5	mg/kg	13.43	<6.715	mg/kg	<0.000672 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2										
13		pH				8.2	pH		8.2	pH	8.2 pH		
			PH										
14		naphthalene				4.1	mg/kg		4.1	mg/kg	0.00041 %	✓	
	601-052-00-2	202-049-5	91-20-3										
15		acenaphthylene				1.1	mg/kg		1.1	mg/kg	0.00011 %	✓	
		205-917-1	208-96-8										
16		acenaphthene				23.5	mg/kg		23.5	mg/kg	0.00235 %	✓	
		201-469-6	83-32-9										
17		fluorene				19.5	mg/kg		19.5	mg/kg	0.00195 %	✓	
		201-695-5	86-73-7										
18		phenanthrene				275	mg/kg		275	mg/kg	0.0275 %	✓	
		201-581-5	85-01-8										
19		anthracene				70.3	mg/kg		70.3	mg/kg	0.00703 %	✓	
		204-371-1	120-12-7										
20		fluoranthene				469	mg/kg		469	mg/kg	0.0469 %	✓	
		205-912-4	206-44-0										
21		pyrene				427	mg/kg		427	mg/kg	0.0427 %	✓	
		204-927-3	129-00-0										
22		benzo[a]anthracene				243	mg/kg		243	mg/kg	0.0243 %	✓	
	601-033-00-9	200-280-6	56-55-3										
23		chrysene				270	mg/kg		270	mg/kg	0.027 %	✓	
	601-048-00-0	205-923-4	218-01-9										
24		benzo[b]fluoranthene				248	mg/kg		248	mg/kg	0.0248 %	✓	
	601-034-00-4	205-911-9	205-99-2										
25		benzo[k]fluoranthene				222	mg/kg		222	mg/kg	0.0222 %	✓	
	601-036-00-5	205-916-6	207-08-9										



#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
26	benzo[a]pyrene; benzo[def]chrysene				262	mg/kg		262	mg/kg	0.0262 %	✓	
	601-032-00-3	200-028-5	50-32-8									
27	indeno[123-cd]pyrene				223	mg/kg		223	mg/kg	0.0223 %	✓	
		205-893-2	193-39-5									
28	dibenz[a,h]anthracene				35.4	mg/kg		35.4	mg/kg	0.00354 %	✓	
	601-041-00-2	200-181-8	53-70-3									
29	benzo[ghi]perylene				173	mg/kg		173	mg/kg	0.0173 %	✓	
		205-883-8	191-24-2									
30	benzene				<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
	601-020-00-8	200-753-7	71-43-2									
31	toluene				<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
	601-021-00-3	203-625-9	108-88-3									
32	ethylbenzene				<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
	601-023-00-4	202-849-4	100-41-4									
33	xylene				<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
	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]									
34	TPH (C6 to C40) petroleum group				1520	mg/kg		1520	mg/kg	0.152 %	✓	
			TPH									
Total:										0.569 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	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: BH4

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

Sample details

Sample Name:	LoW Code:
BH4	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.50 m	Entry:
	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
1		arsenic { arsenic trioxide }				17.2	mg/kg	1.32	22.71	mg/kg	0.00227 %	✓	
	033-003-00-0	215-481-4	1327-53-3										
2		cadmium { cadmium sulfide }			1	<0.5	mg/kg	1.285	<0.643	mg/kg	<0.00005 %		<LOD
	048-010-00-4	215-147-8	1306-23-6										
3		chromium(III) oxide				15.9	mg/kg		15.9	mg/kg	0.00159 %	✓	
		215-160-9	1308-38-9										
4		copper {  dicopper oxide; copper (I) oxide }				47.6	mg/kg	1.126	53.592	mg/kg	0.00536 %	✓	
	029-002-00-X	215-270-7	1317-39-1										
5		lead { lead chromate }			1	45.3	mg/kg	1.56	70.66	mg/kg	0.00453 %	✓	
	082-004-00-2	231-846-0	7758-97-6										
6		mercury { mercury dichloride }				0.7	mg/kg	1.353	0.947	mg/kg	0.0000947 %	✓	
	080-010-00-X	231-299-8	7487-94-7										
7		nickel { nickel dihydroxide }				17.8	mg/kg	1.579	28.115	mg/kg	0.00281 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]										
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	034-002-00-8												
9		zinc { zinc oxide }				58.5	mg/kg	1.245	72.816	mg/kg	0.00728 %	✓	
	030-013-00-7	215-222-5	1314-13-2										
10		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												
11		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<0.8	mg/kg		<0.8	mg/kg	<0.00008 %		<LOD
	024-017-00-8												
12		boron {  boron tribromide/trichloride/trifluoride (combined) }				<0.5	mg/kg	13.43	<6.715	mg/kg	<0.000672 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2										



#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
13	● pH		PH		8.8	pH		8.8	pH	8.8 pH		
14	naphthalene	601-052-00-2	202-049-5	91-20-3	0.5	mg/kg		0.5	mg/kg	0.00005 %	✓	
15	● acenaphthylene		205-917-1	208-96-8	<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
16	● acenaphthene		201-469-6	83-32-9	0.1	mg/kg		0.1	mg/kg	0.00001 %	✓	
17	● fluorene		201-695-5	86-73-7	<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
18	● phenanthrene		201-581-5	85-01-8	0.6	mg/kg		0.6	mg/kg	0.00006 %	✓	
19	● anthracene		204-371-1	120-12-7	0.1	mg/kg		0.1	mg/kg	0.00001 %	✓	
20	● fluoranthene		205-912-4	206-44-0	1	mg/kg		1	mg/kg	0.0001 %	✓	
21	● pyrene		204-927-3	129-00-0	1	mg/kg		1	mg/kg	0.0001 %	✓	
22	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	0.8	mg/kg		0.8	mg/kg	0.00008 %	✓	
23	chrysene	601-048-00-0	205-923-4	218-01-9	0.8	mg/kg		0.8	mg/kg	0.00008 %	✓	
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	0.5	mg/kg		0.5	mg/kg	0.00005 %	✓	
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.7	mg/kg		0.7	mg/kg	0.00007 %	✓	
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	0.6	mg/kg		0.6	mg/kg	0.00006 %	✓	
27	● indeno[123-cd]pyrene		205-893-2	193-39-5	0.5	mg/kg		0.5	mg/kg	0.00005 %	✓	
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.1	mg/kg		0.1	mg/kg	0.00001 %	✓	
29	● benzo[ghi]perylene		205-883-8	191-24-2	0.4	mg/kg		0.4	mg/kg	0.00004 %	✓	
30	benzene	601-020-00-8	200-753-7	71-43-2	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
31	toluene	601-021-00-3	203-625-9	108-88-3	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
32	● ethylbenzene	601-023-00-4	202-849-4	100-41-4	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
33	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]	<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
34	● TPH (C6 to C40) petroleum group		TPH		173	mg/kg		173	mg/kg	0.0173 %	✓	
Total:										0.0473 %		

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) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: Force this Hazardous property to non hazardous because Concentrations too low to be considered flammable risk



Appendix A: Classifier defined and non CLP determinands

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

Conversion factor: 1.462

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: 17/07/2015

Risk Phrases: R61 , R60 , R50/53 , R43 , R42 , R38 , R37 , R36 , R22 , R20

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Repr. 1B H360FD , Skin Sens. 1 H317 , Resp. Sens. 1 H334 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302 , Acute Tox. 4 H332

• **dicopper oxide; copper (I) oxide** (EC Number: 215-270-7, CAS Number: 1317-39-1)

CLP index number: 029-002-00-X

Data source: Regulation (EU) 2016/1179 of 19 July 2016 (ATP9)

Additional Risk Phrases: N R50/53 >= 0.25 % , N R50/53

Additional Hazard Statement(s): None.

Reason for additional Hazards Statement(s)/Risk Phrase(s):

10/10/2016 - N R50/53 >= 0.25 % risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

10/10/2016 - N R50/53 risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

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

CLP index number: 006-007-00-5

Data source: Commission Regulation (EC) No 790/2009 - 1st Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP1)

Additional Risk Phrases: None.

Additional Hazard Statement(s): EUH032 >= 0.2 %

Reason for additional Hazards Statement(s)/Risk Phrase(s):

14/12/2015 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

• **boron tribromide/trichloride/trifluoride (combined)** (CAS Number: 10294-33-4, 10294-34-5, 7637-07-2)

Conversion factor: 13.43

Description/Comments: Combines the hazard statements and the average of the conversion factors for boron tribromide, boron trichloride and boron trifluoride

Data source: N/A

Data source date: 06/08/2015

Risk Phrases: C R35 , C R34 , T+ R26/28 , R14

Hazard Statements: Skin Corr. 1B H314 , Skin Corr. 1A H314 , Acute Tox. 2 H300 , Acute Tox. 2 H330 , EUH014

• **pH** (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25/05/2015

Risk Phrases: None.

Hazard Statements: None.

• **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: 17/07/2015

Risk Phrases: R38 , R37 , R36 , R27 , R26 , R22

Hazard Statements: Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 1 H310 , Acute Tox. 1 H330 , Acute Tox. 4 H302

• **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: 17/07/2015

Risk Phrases: N R51/53 , N R50/53 , R38 , R37 , R36

Hazard Statements: Aquatic Chronic 2 H411 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319



• **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: 06/08/2015
Risk Phrases: N R50/53
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

• **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: 06/08/2015
Risk Phrases: N R50/53 , R43 , R40 , R38 , R37 , R36 , R22
Hazard Statements: Skin Irrit. 2 H315 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Carc. 2 H351 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302

• **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: 17/07/2015
Risk Phrases: N R50/53 , R43 , R38 , R37 , R36
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

• **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: 21/08/2015
Risk Phrases: N R50/53 , Xn R22
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Acute Tox. 4 H302

• **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: 21/08/2015
Risk Phrases: N R50/53 , Xi R36/37/38
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Skin Irrit. 2 H315

• **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: 06/08/2015
Risk Phrases: R40
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: 23/07/2015
Risk Phrases: N R50/53
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

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

CLP index number: 601-023-00-4
Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)
Additional Risk Phrases: None.
Additional Hazard Statement(s): Carc. 2 H351
Reason for additional Hazards Statement(s)/Risk Phrase(s):
03/06/2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2B (77) 2000

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

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
Risk Phrases: R65 , R63 , R51/53 , R46 , R45 , R10
Hazard Statements: Aquatic Chronic 2 H411 , Repr. 2 H361d , Carc. 1B H350 , Muta. 1B H340 , STOT RE 2 H373 , Asp. Tox. 1 H304 , Flam. Liq. 3 H226



Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on risk phrases

cadmium {cadmium sulfide}

Worst case species based on risk phrases

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead chromate}

Worst case species based on risk phrases

mercury {mercury dichloride}

Worst case species based on risk phrases

nickel {nickel dihydroxide}

Worst case species based on risk phrases

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

Worst case species based on risk phrases

zinc {zinc oxide}

Amount of chromium present in soils mitigate against Zinc Chromate

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}

Worst case species

boron {boron tribromide/trichloride/trifluoride (combined)}

Worst case species based on risk phrases

Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition, May 2015**

HazWasteOnline Classification Engine Version: 2017.342.3469.7046 (08 Dec 2017)

HazWasteOnline Database: 2017.342.3469.7046 (08 Dec 2017)

This classification utilises the following guidance and legislation:

WM3 - Waste Classification - May 2015

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 Wastes 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

POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004

1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010

2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010



APPENDIX J: 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.

CLR11- 'Model Procedures for the Management of Land Contamination', 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 a it must be decided whether Generic Assessment Criteria (GAC) are suitable for assessing the risk posed by potential 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 lieu, if the SGV is suitable for the subject site, of the GAC derived by **CC GEOTECHNICAL Ltd.** Where contaminants where a SGV has not been published

and a GAC has been published by LQM this will be used. In house derived GAC's will only be used for contaminants where there is no SGV or LQM GAC.

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

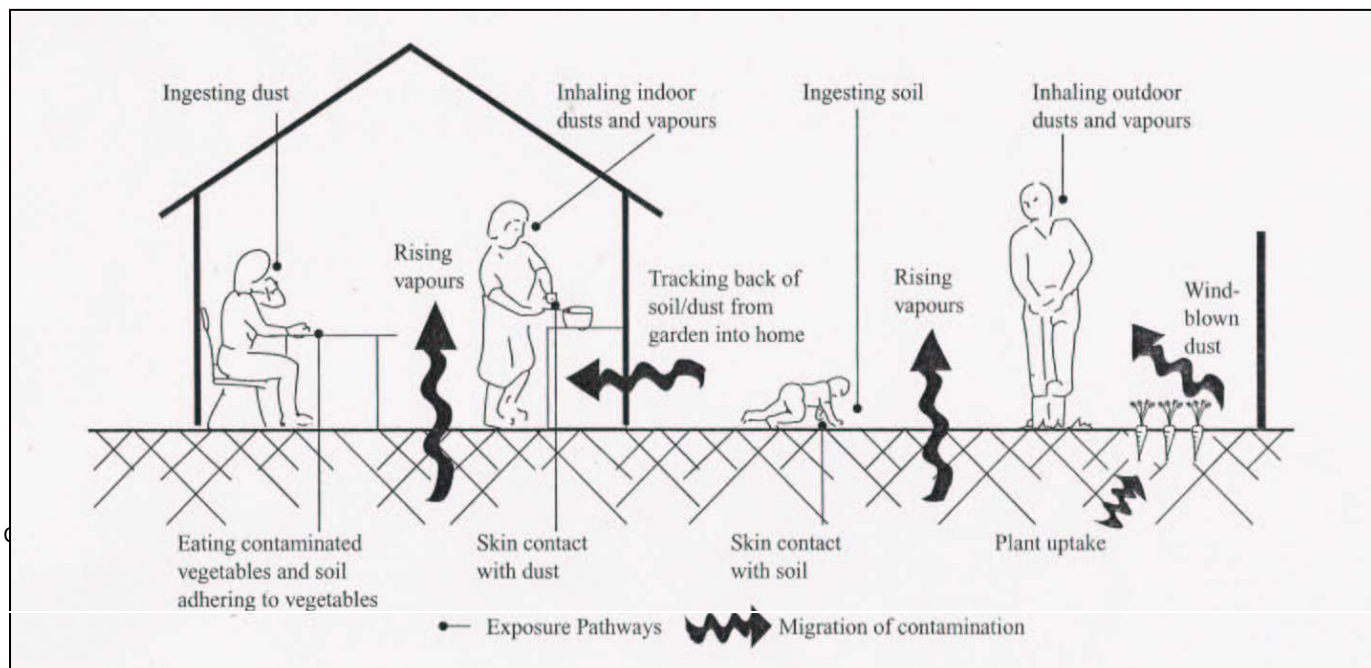
Other guidance/software used in spatial / statistical assessment is provided in:

- 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 according 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 1.04".

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 2.00mbgl 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 v1.04 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).

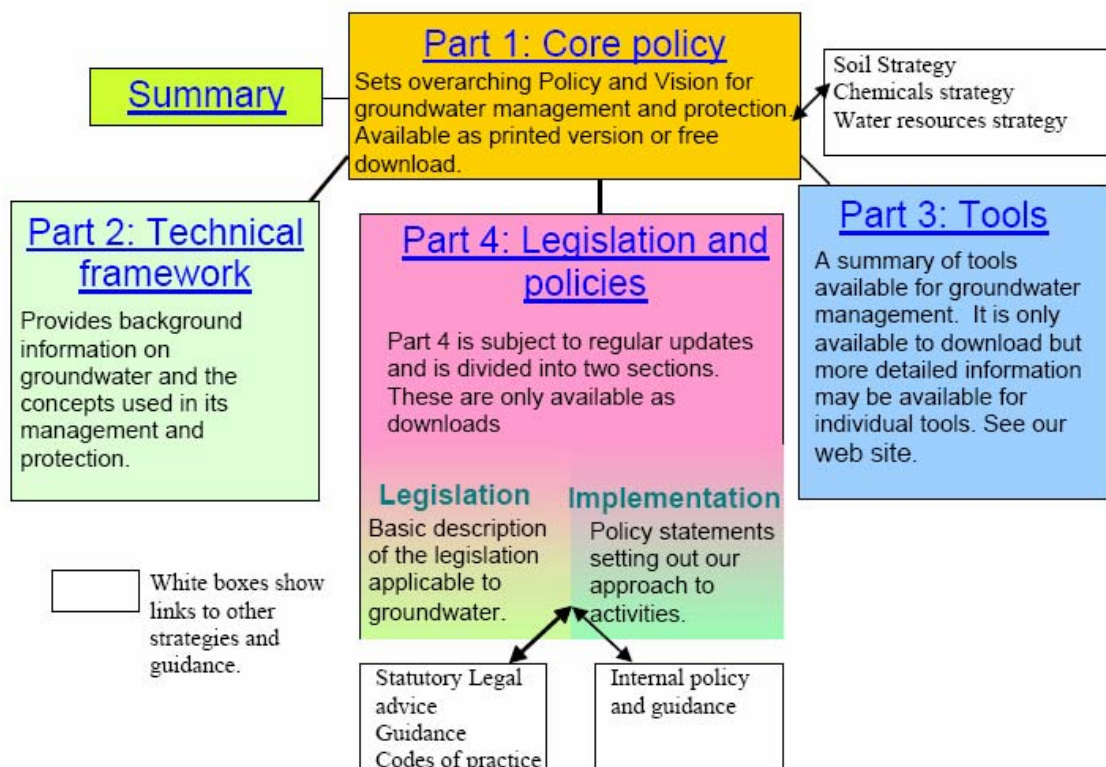
Environment Agency Guidance

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.

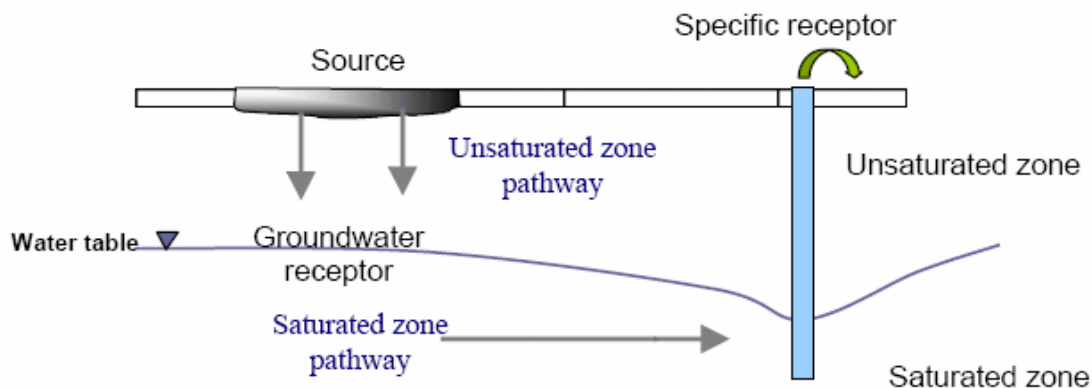
When assessing groundwater impact the Environment Agency advocate the application of their framework methodology "Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination" Environment Agency (2006). The methodology has four levels of assessment as described below:

- 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

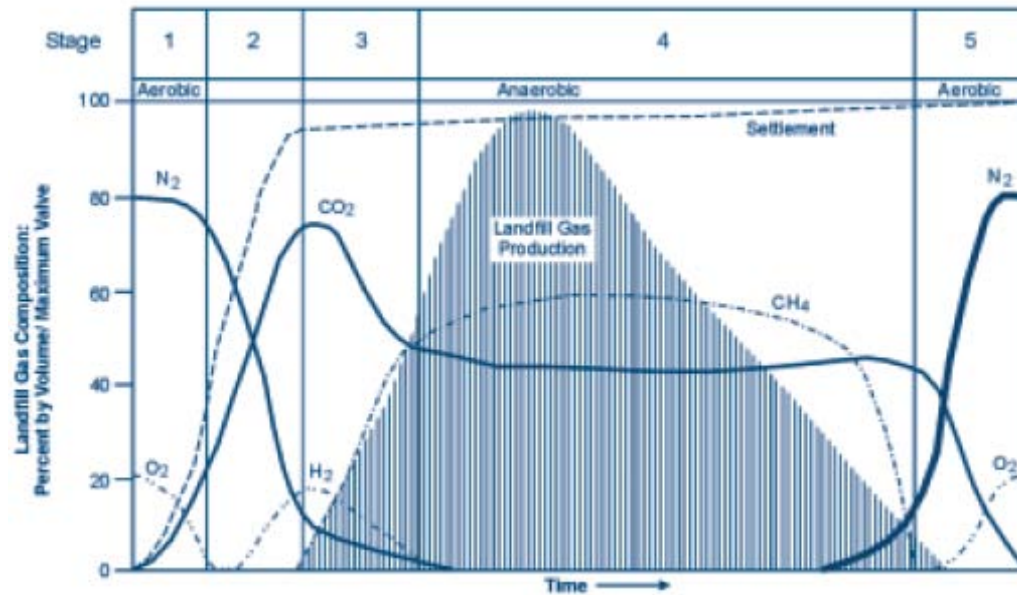
is no simple indicator of the presence of the gas until such a time as explosive limits are reached and an incident occurs. Methane is lighter than air and has a low toxicity. However, at high concentrations it can result in asphyxiation due to oxygen displacement.

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, December 2007) “**Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments**”
This document provides an overview of gas characterisation and assessment. The Standard is intended to be used by designers of gas protection measures and regulators involved in the assessment of design solutions.

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:

CD37d

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: 2007 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 BS8485:2007 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.

BS8485:2007 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 BS8485:2007 Table 3 shown below:
CD37d

PROTECTION ELEMENT / SYSTEM		SCORE	COMMENTS
a) Venting / dilution (See Annex A BS8485)			
Passive sub floor ventilation (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^A Subfloor ventilation with active abstraction/pressurization (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^A Ventilated car park (basement or undercroft)	Very good performance	2.5	<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	
		2.5	
		4	
b) Barriers			
Floor slabs Block and beam floor slab Reinforced concrete ground bearing slab Reinforced concrete ground bearing foundation raft with limited service penetrations that are cast into slab Reinforced concrete cast in situ suspended floor slab with minimal service penetrations and water bars around all slab penetrations and at joints Fully tanked basement		0	<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>
		0.5	
		1.5	
		1.5	
		2	
c) Membranes			
Taped and sealed membrane to reasonable levels of workmanship/in line with current good practice with validation ^{B,C} Proprietary gas resistant membrane to reasonable levels of workmanship /in line with good practice under independent inspection (CQA) ^{B,C} Proprietary gas resistant membrane installed to reasonable levels of workmanship/in line with current good practice under CQA with integrity testing and independent validation		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>
		1	
		2	
d) Monitoring and detection (not applicable to non-managed property, or in isolation)			
Intermittent monitoring using hand held equipment Permanent monitoring and alarm system ^A	Installed in the underfloor venting/dilution system	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>
		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.			

BS8485:2007 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 CLR11 (2004) "Model Procedures for the Management of Land Contamination." The stages of managing remediation are as follows:

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

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

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

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



APPENDIX K: NOTES ON LIMITATIONS

Standard Terms and Conditions of Engagement

Notes on Limitations For Geoenvironmental and Geotechnical Consultancy Services

General

CC GEOTECHNICAL LTD has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from CC GEOTECHNICAL LTD and a charge may be levied against such approval.

CC GEOTECHNICAL LTD accepts no responsibility or liability for:

the consequences of this document being used for any purpose or project other than for which it was commissioned and/or

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 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.

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 the timescale available, and the locations of the exploratory holes may have been restricted to areas unoccupied by the building(s) on the site, and further restricted by the existence of buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues may need to be resolved.

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.

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 number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" of contamination where concentrations may be significantly higher than those actually encountered.

Geoenvironmental Ground Investigations

The investigation of the site has been carried out to provide sufficient information within the agreed scope of the investigation, under the general headings of type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions, to provide 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 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; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.