

**GREEN BUILD MANAGEMENT SERVICES
LIMITED**

**SONALYST,
UNIT 4, BAGLAN INDUSTRIAL PARK, PORT TALBOT SA12
7DJ**

REPORT ON GROUND INVESTIGATION

Contract: 70545-2(00)

Date: August 2019

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REPORT ON GROUND INVESTIGATION

carried out at

**SONALYST,
UNIT 4, BAGLAN INDUSTRIAL PARK, PORT TALBOT SA12 7DJ**

Prepared for

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EXECUTIVE SUMMARY

It is understood that it is proposed to extend the existing industrial unit to the south east and north east with structures similar to the existing portal frame warehouse type construction. On the instructions of Green Build Management Services Ltd, an investigation was undertaken to determine ground conditions to enable foundation and road/hard standing design to be carried out, together with a contamination risk assessment and a review of gas emissions.

The site is situated to the west of Ffordd Baglan, north east of Heol Aberavon, within the Baglan Industrial Park and may be located by Grid Reference SS 753 907.

The site was generally level and was occupied by rough grass with trees and bushes along the north eastern and south eastern boundaries. A portal frame warehouse with parking at the north west of the structure was located immediately west of the site and an access road and a second warehouse was located to the south west.

The 1:50000 British Geological Map Sheet 247 indicates the site to be underlain by Marine or Estuarine Alluvium overlying Lower Pennant Measures.

On the basis of observations made on site together with results of in-situ and laboratory tests, together with empirical correlations, it is considered that the soft clay and peat are unlikely to give an adequate factor of safety against shear failure for conventional spread foundations. Therefore, it is recommended that consideration be given to the adoption of piled foundations.

Guidelines for the design of piles are given in Appendix 5, which may be used with the plot of 'N' value and shear strength with depth included in Figure A5.1. The carrying capacity of piles depends not only on their size and the ground conditions but also on their method of installation. Therefore, it is recommended that specialist Piling Contractors be contacted as to the suitability and carrying capacity of their piles in the ground conditions pertaining to the site.

Piling positions may need to be pre-bored as the Made Ground was very dense and contained cobbles which may affect the installation of piles. Ground water also came up the borehole casing once the gravel was encountered at 13.00m.

It is likely that piles will end bear onto the sand and gravel below 13.00m with little side friction being picked up in the soft clay and peat.

The results of the soil analyses, with the exception of lead, have been compared to the recently published S4ULs (Suitable 4 Use Levels) determined by LQM and CIEH. As the CLEA SGV for lead was withdrawn in 2014, DEFRA have produced C4SLs (Category 4 Screening Levels) for lead and a number of other contaminants. As no S4UL has been produced for lead, the C4SL has been adopted.

The assessment has not identified any significant risks to the proposed development with regard to human health or controlled waters. However, possible risks to plastic water supply pipes have been identified, though only relevant if new potable services are proposed, and also risks associated with the potential ingress of methane gas.

In order to mitigate the risks to plastic water supply pipes from the concentrations of TPH identified within the Made Ground beneath the site, for any new services proposed to be laid within this material, the installation of barrier pipe or selection of an alternative material to plastic may be required. The local water supply company should be consulted for confirmation of the specific requirements for this site.

Gas protection measures may be required for the proposed extensions, in accordance with CS-2. Approval and validation of any such measures should be sought directly from Local Authority Building Control.

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1.0 INTRODUCTION

- 1.1 It is understood that it is proposed to extend the existing industrial unit to the south east and north east with structures similar to the existing portal frame warehouse type construction.
- 1.2 On the instructions of Green Build Management Services Ltd, an investigation was undertaken to determine ground conditions to enable foundation and road/hard standing design to be carried out, together with a contamination risk assessment and a review of gas emissions.
- 1.3 This report should be read in conjunction with the Preliminary Investigation, which was reported under reference 70545-1 dated July 2019.
- 1.4 It is recommended that a copy of this report be submitted to the relevant authorities to enable them to carry out their own site assessments and provide any comments.
- 1.5 This report has been prepared for the sole use of the Client for the purpose described and no extended duty of care to any third party is implied or offered. Third parties using any information contained within this report do so at their own risk.
- 1.6 The comments given in this report and the opinions expressed herein are based on the information received, the conditions encountered during site works, and on the results of tests made in the field and laboratory. However, there may be conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report.
- 1.7 The comments on groundwater conditions are based on observations made at the time the site work was carried out. It should be noted that groundwater levels vary owing to seasonal or other effects.

2.0 SITE SETTING

2.1 Site Location

- 2.1.1 The site is situated to the west of Ffordd Baglan, north east of Heol Aberavon, within the Baglan Industrial Park and may be located by Grid Reference SS 753 907.

2.2 Site Description

- 2.2.1 The proposed extension is located on the north eastern and south eastern sides of the existing building and the area of the site is approximately 0.26 hectares.
- 2.2.2 The site was generally level and was occupied by rough grass with trees and bushes along the north eastern and south eastern boundaries. A portal frame warehouse with parking at the north west of the structure was located immediately west of the site and an access road and a second warehouse was located to the south west.
- 2.2.3 A haulage yard was present north east of the site and Ffordd Baglan was located to the south east and east.

2.3 Geological Setting

- 2.3.1 The 1:50000 British Geological Map Sheet 247 indicates the site to be underlain by Marine or Estuarine Alluvium overlying Lower Pennant Measures. The nearest coal seam indicated on the map was approximately 500m to the north east.
- 2.3.2 Boreholes to the south of the site in the area of the hospital indicate that granular Made Ground consisting mainly of slag was present to 3m which was underlain by soft clay and peat to 12m where very dense sand and gravel was encountered. This information is based upon records provided by the British Geological Survey.

3.0 SUMMARY DESK STUDY FINDINGS

- 3.1 A Preliminary Investigation in the form of a desk study and site reconnaissance was carried out in July 2019 in order to assess the potential hazards on and adjacent to the site and prepare a risk assessment for further consideration.
- 3.2 The site appears to have been vacant from before 1876. The existing industrial unit was built to the west of the site between 1983 and 1988. The site remained vacant being occupied by grassland and trees/bushes along its eastern and southern perimeters.
- 3.3 The Coal Authority Report in Appendix 5 of the Desk Study indicated that the property is not within a surface area that could be affected by past recorded coal mining. No Mine entries are located on or within 20m of the site.
- 3.4 The research has identified the following potential sources of contamination which may form part of a pollutant linkage:
- Contamination associated with fill material placed on the moors prior to 1980
 - Potential gas associated with alluvium and fill material below the site
 - Contamination from the haulage company 55m north of the site
- 3.5 The following scope of works is suggested in order to collect the required data:
- The sinking of boreholes for the recovery of samples for geotechnical and chemical contamination analysis
 - The installation and monitoring of gas and groundwater monitoring standpipes

4.0 SITE WORK

- 4.1 The site work was carried out between 15th and 19th July 2019. The locations of exploratory holes have been planned, where possible, in general accordance with CLR 4, ref. 10.1 and the site work carried out on the basis of the practices set out in BS 10175:2011, ref. 10.2, BS 5930:2015, ref. 10.3, and ISO 1997:2007, ref. 10.4.
- 4.2 Two boreholes, designated BH1 and BH2, were sunk by light cable percussion method, and five trial pits, designated TP01 to TP05, were dug by mechanical excavator at the positions shown on the site plan, Appendix 1, Figure A1.1. The depths of boreholes and trial pits, descriptions of strata encountered and comments on groundwater conditions are given in the borehole and trial pit records, Appendix 2, Figures A2.1 to A2.7.
- 4.3 Representative disturbed and undisturbed samples were taken at the depths shown on the borehole and trial pit records and despatched to the laboratory. Standard (split-barrel and cone) penetration tests, ref. 10.5, were carried out in the boreholes in the various strata to assess the relative density or consistency. The values of penetration resistance are given in the borehole records.
- 4.4 Samples for environmental purposes were collected in amber glass jars and kept in a cool box.
- 4.5 Standpipes were installed in the boreholes as detailed in the table below. The standpipes were installed to measure the amount of harmful gas migrating to the surface. A visual representation of the standpipes is presented on the relevant borehole logs.

Borehole N°	Response Zone (m bgl)	Nominal Pipe Diameter (mm)	Lockable Cover
BH1	1.00 – 3.00	50	Yes
BH2	1.00 – 3.00	50	Yes

- 4.6 The ground levels at the borehole and trial pit locations were not determined.
- 4.7 Groundwater and gas monitoring visits were undertaken on the 24th July, 19th and 22nd August 2019, as detailed in Figure A2.8.

5.0 LABORATORY TESTS

5.1 Geotechnical Testing

5.1.1 Geotechnical soil analysis was undertaken of samples obtained during the investigation as follows:

- 4 No. Water Content Tests
- 4 No. Plasticity Index Tests
- 2 No. Particle Size Distributions (by Wet Sieving)
- 7 No. Quick Undrained Single/Multi-stage Triaxial Tests
- 3 No. pH Values
- 3 No. Sulphate Contents (Water Soluble)
- 1 No. Total Sulphate
- 1 No. Total Sulphur

5.1.2 The laboratory test reports are given in Appendix 3, Figures 70545/1 and 19/07476.

5.2 Chemical Testing

5.2.1 The suite of chemical analyses has been based upon the findings of the preliminary investigation, along with any on-site observations, to investigate the potential sources of contamination identified in the conceptual model. The chemical analyses were carried out on five samples of soil, all of which were representative of Made Ground. Leachate analysis was also conducted on two samples of Made Ground. The nature of the analyses is detailed below:

5.2.2 **Metals Suite** - arsenic, water soluble boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium and zinc.

5.2.3 **Organic Suite** - petroleum hydrocarbons – TPH CWG speciated analysis and EPH basic carbon banded analysis, benzene, toluene, ethylbenzene and xylenes (BTEX), methyl tertiary butyl ether (MTBE), polycyclic aromatic hydrocarbons (PAH) – USEPA 16 suite and phenols.

5.2.4 **Inorganics Suite** – free cyanide (free).

5.2.5 **Others** - pH, organic matter content and asbestos.

5.2.6 **Waste Acceptance Criteria (WAC)** – a full single stage WAC suite was carried out on two samples.

5.2.7 The results of these tests are shown in Appendix 4, Figure 19/07038.

6.0 GROUND CONDITIONS ENCOUNTERED

6.1 Made Ground

- 6.1.1 Made Ground was encountered to the full depths of the trial pits at between 1.20m and 1.50m below ground level. The Made Ground generally consisted of a thin layer of gravelly sand/topsoil overlying brown becoming grey sandy gravel or gravelly sand which was composed of quartz, slag, charcoal and concrete fragments. Occasional concrete cobbles were also encountered in the trial pits.
- 6.1.2 Some soft to stiff sandy gravelly clay with slag and charcoal was encountered from 1.30m to the full depth of TP03 at 1.50m and from 0.80m to 1.00m in TP05.
- 6.1.3 Made Ground was encountered to 3.00m in BH1 and 3.50m in BH2. The Made Ground in the boreholes consisted of soft and firm sandy gravelly clay to 1.20m and 1.40m respectively underlain by very dense grey sand and gravel with occasional cobbles to the full depth of the Made Ground. The gravel and cobbles were generally of sandstone and blast furnace slag.

6.2 Alluvium

- 6.2.1 Below the Made Ground, soft and firm grey silty clay was encountered to 8.50m in BH1 and 7.00m in BH2 where the clay became peaty in BH1 and grey fibrous peat was present to 9.00m in BH2. The peaty clay in BH1 was present to 12.00m where firm grey clay was encountered. The grey clay was also encountered below the peat in BH2 although it was soft in consistency.
- 6.2.2 The soft and firm grey clay continued to 13.00m and 13.50m respectively where very dense sand and gravel with occasional cobbles was encountered. The very dense sand and gravel was present to the full depth of the boreholes at 18.15m and 16.80m below ground level.

6.3 Groundwater

- 6.3.1 Groundwater was encountered at 13.00m deep in BH1 and rose to 7.40m after 20 minutes and stood at 2.90m at the start of drilling the following day. Ground water was encountered at 13.50m in BH2 and rose to 6.50m after 20 minutes.
- 6.3.2 On return visits to the site on the 24th July, 19th and 22nd August 2019, the groundwater stood at depths of between 2.56m and 2.65m in BH1, and between 2.69m and 2.80m in BH2.

7.0 GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS IN RELATION TO THE PROPOSED DEVELOPMENT

7.1 Structural Details

- 7.1.1 It is understood that the proposed development is to consist of an extension to the south east and north east of the existing industrial unit with structures similar to the existing portal frame warehouse type construction. Precise structural details were not available at the time of preparation of this report.

7.2 Assessment of Soil Condition

7.3 Made Ground

- 7.3.1 Standard Penetration Test undertaken in the Made Ground were generally greater than 50 blows/300mm indicating that the Made Ground was very dense. The Standard Penetration Test values are plotted on the profile given in Appendix 5, Figure A5.1.

7.4 Alluvial Clay/Peat

- 7.4.1 Laboratory testing for the soft and firm clay recorded natural moisture contents of between 50% and 56%, liquid limits of between 53% and 59%, plastic limits of 28% and 29% and plasticity indices of between 25% and 31%. The plastic index test results are presented on the plasticity classification chart, Appendix 3, Figure A3.3.
- 7.4.2 The natural moisture contents of the samples were comparable to the liquid limits indicating that the samples were soft or very soft. These results also indicate the clay is of high plasticity and of medium volume change potential as defined by the National House Building Council, ref. 10.6. However, the clay is not over consolidated and is also too deep to be influenced by trees.
- 7.4.3 The peat was non plastic, and the natural moisture content was 380% indicating that the peat was very light weight and saturated with water.
- 7.4.4 Unconsolidated un-drained triaxial compression tests, undertaken on undisturbed samples of grey clay suggest shear strengths to be in the range of 17kPa and 38kPa, averaging 21kPa indicating that the grey clay is very soft and soft.
- 7.4.5 Work undertaken by Stroud, ref. 10.7 determined a relationship between SPT 'N' values and the undrained shear strengths of many clays and soft rocks.

7.4.6 The relationship was of the form:

- $c_u = F_1 \times N$
- $m_v = \frac{1}{F_2 \times N}$
- where
- c_u = Undrained shear strength
- m_v = Coefficient of compressibility
- F_1 and F_2 = Factors

7.4.7 It was determined by Stroud that F_1 varied between 4kPa for material of high plasticity and 6kPa for material of low plasticity. Similarly F_2 varied between 400kPa and 600kPa.

7.4.8 It is considered that for the soft clay encountered on this site a value of $F_1 = 4\text{kPa}$ and $F_2 = 400\text{m}^2/\text{MN}$ would be appropriate.

7.4.9 Standard Penetration Tests were undertaken in the soft clay, recorded 'N' values of between zero and 8, with an average of 5, which when using the correlations and relationships indicated in paragraph 7.3 above suggests c_u values of between Zero and 32kPa, averaging 20kPa.

7.4.10 The above assessments of soil strength have been considered and used within the strength with depth profile given in Appendix 5, Figure A5.1.

7.4.11 On the basis of the unconsolidated un-drained triaxial compression tests and the Standard Penetration Test N values it is considered that the grey clay is too soft for the adoption of shallow spread foundations.

7.4.12 The unconsolidated un-drained triaxial compression test carried out on the peat indicated a shear strength of 96kPa. However, the sample consisted mostly of water and this is not considered to be representative of the strength of the peat.

7.5 Sand and Gravel

7.5.1 Particle size distributions undertaken on bulk samples of sand and gravel from the boreholes indicated a cobble content of 15% and 21%, a gravel content of 59% and 61%, sand content of 19% and 23% and silt/clay content of 1%. The particle size grading indicates the sand and gravel to be well graded.

7.5.2 Standard Penetration Test undertaken in the sand and gravel were all greater than 50 blows/300mm indicating that the sand and gravel was very dense.

7.5.3 The Standard Penetration Test values are plotted on the profile given in Appendix 5, Figure A5.1.

7.6 Foundation Options

- 7.6.1 On the basis of observations made on site together with results of in-situ and laboratory tests, together with empirical correlations, it is considered that the soft clay and peat are unlikely to give an adequate factor of safety against shear failure for conventional spread foundations.
- 7.6.2 Therefore, it is recommended that consideration be given to the adoption of piled foundations. Guidelines for the design of piles are given in Appendix 5, which may be used with the plot of 'N' value and shear strength with depth included in Figure A5.1.
- 7.6.3 The carrying capacity of piles depends not only on their size and the ground conditions but also on their method of installation. Therefore, it is recommended that specialist Piling Contractors be contacted as to the suitability and carrying capacity of their piles in the ground conditions pertaining to the site.
- 7.6.4 Piling positions may need to be pre-bored as the Made Ground was very dense and contained cobbles which may affect the installation of piles. Ground water also came up the borehole casing once the gravel was encountered at 13.00m.
- 7.6.5 It is likely that piles will end bear onto the sand and gravel below 13.00m with little side friction being picked up in the soft clay and peat.

7.7 Ground Floor Slabs

- 7.7.1 On the basis of observations on site together with the results of laboratory tests, it is recommended that the floor slabs should also be placed onto piles.

7.8 Excavations

- 7.8.1 The trial pits were stable for the short time they were open. On the basis of observations on site together with the results of in-situ and laboratory tests, it is considered that shallow excavations to 1.20m are likely to be stable in the short term. However, a watching brief should be maintained, particularly in excavations requiring personnel access, for cobbles and deleterious material in the sides of trial pits which may result in side collapse.
- 7.8.2 On the basis of the site work groundwater should not be expected in shallow excavations for services.
- 7.8.3 The safety of all excavations should be assessed and managed in accordance with Regulation 22 of CDM 2015 Managing Health and Safety in Construction, ref 10.8.

7.9 Road and Hard Standing Design

- 7.9.1 The structural design of a road or hard standing is based on the strength of the subgrade, which is assessed on the California Bearing Ratio, CBR, scale from which the subgrade surface modulus can be estimated. Experience has indicated that the measurement of the in-situ CBR value tends to give unreliable results because of the influence of the moisture content of the materials. In practice, the correlation given by the Highways Agency, ref. 10.9, is usually more appropriate than direct determination of the CBR.
- 7.9.2 The process of design given in the guidance notes requires an estimate of CBR and subgrade stiffness modulus to be made at the design stage and in-situ measurement prior to construction.
- 7.9.3 It is recommended that for formation prepared in the Made Ground a subgrade CBR value of 3% be adopted for design purposes. Any areas of soft or deleterious material in the Made Ground should be excavated and replaced with a properly compacted granular fill. It may be prudent to undertake insitu CBR tests prior to placing the sub-base. The soil descriptions indicate that the Made Ground may be frost susceptible.

7.10 Chemical Attack on Buried Concrete

- 7.10.1 The site has been classified in accordance with BRE Special Digest 1, ref. 10.10, as brownfield without the presence of pyrite and laboratory testing undertaken accordingly. It is recommended that the guidelines given in BRE Special Digest 1, ref. 10.10, be adopted.
- 7.10.2 It is recommended that for conventional shallow foundations the groundwater should be regarded as mobile.
- 7.10.3 On the basis of the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-2. The site conditions would suggest that an ACEC class for the site of AC-2 would be appropriate.

8.0 ENVIRONMENTAL RISK ASSESSMENT IN RELATION TO PROPOSED DEVELOPMENT

8.1 Contaminated Land

8.1.1 The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref. 10.11, which was introduced by the Environment Act 1995, ref. 10.12, as;

8.1.2 ‘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 –

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.’

8.2 Risk Assessment

8.2.1 The definition of contaminated land is based on the principles of risk assessment. Risk is defined as a combination of:

- The probability, or frequency of exposure to a substance with the potential to cause harm, and:
- The seriousness of the consequence.

8.3 Pollutant Linkage

8.3.1 The basis of an environmental risk assessment involves identifying a ‘source’ of contamination, a ‘pathway’ along which the contamination may migrate and a ‘receptor’ at risk from the contamination.

8.3.2 Current legislation defines the various elements of the pollution linkage as:

- A contaminant is a substance, which is in or under the ground and which has the potential to cause harm or to cause pollution of controlled waters.
- A pathway is one or more routes through which a receptor is being exposed to, or affected by, a contaminant, or could be so affected.
- A receptor is either a living organism, an ecological system, a piece of land or property, or controlled water.

8.3.3 A pollutant linkage indicates that all three elements have been identified. The site can only be defined as ‘Contaminated Land’ if a pollutant linkage exists and the contamination meets the criteria in Section 8.1 above.

8.3.4 The guidance proposes a four-stage approach for the assessment of contamination and the associated risks. The four stages are listed below:

- Hazard Identification
- Hazard Assessment
- Risk Assessment
- Risk Evaluation

8.3.5 The hazard identification and hazard assessment have been based upon the Preliminary Investigation and formed the conceptual site model, detailed in our report, reference 70545, dated July 2019.

8.3.6 The risk assessment and evaluation stages are presented in this phase 2 interpretive report, after an intrusive ground investigation has taken place.

8.4 Risk Assessment – Human Health

8.4.1 The proposed development consists of extension of the existing industrial unit to the south east and north east with structures similar to the existing portal frame warehouse type construction. The risk assessment has therefore been based on guidelines for a commercial/industrial end use. Should the proposed development be changed in the future then further risk assessment may be required, particularly should a more sensitive end-use be envisaged.

8.4.2 The results of the soil analyses, with the exception of lead, have been compared to the recently published S4ULs (Suitable 4 Use Levels) determined by LQM and CIEH, ref. 10.15. As the CLEA SGV for lead was withdrawn in 2014, DEFRA have produced C4SLs (Category 4 Screening Levels), ref. 10.17, for lead and a number of other contaminants. As no S4UL has been produced for lead, the C4SL has been adopted.

8.4.3 The Generic Assessment Criteria (GAC) used within this contamination assessment have been tabulated and are detailed within Appendix 6.

8.4.4 The results of chemical analyses have been processed in accordance with recommendations set out in the CIEH and CL:AIRE document ‘Guidance on Comparing Soil Contamination Data with a Critical Concentration’, ref. 10.18. Where the concentrations determined on site are at or below the respective Generic Assessment Criteria, they are considered not to pose a risk and are removed from further consideration, unless otherwise stated.

8.4.5 All of the results were below the GAC.

8.5 Risk Assessment - Asbestos

- 8.5.1 Asbestos including Asbestos Containing Soils (ACS) only presents a risk to health if fibres are released into the air. It is generally assumed that only near surface ACS would contribute airborne fibres. However, in instances where gardens are proposed, then there is a risk that ACS could be exposed to the atmosphere through the action of digging.
- 8.5.2 Although no assessment criteria (AC) has been proposed in the new CIRIA C733, ref. 10.21, Ian Farmer Associates has adopted the view that if asbestos is identified within soil then further sampling and testing should be undertaken to quantify the amount and type of asbestos present.
- 8.5.3 None of the samples tested at this site contained asbestos.

8.6 Risk Assessment - Controlled Waters

- 8.6.1 The site is situated above a Secondary Undifferentiated aquifer relating to the variably permeable superficial deposits of Alluvium, over a Secondary A aquifer relating to the bedrock. The site is not located within a groundwater Source Protection Zone (SPZ).
- 8.6.2 The nearest surface water is an ornamental pond in the grounds of the hospital, located approximately 213m to the south of the site.
- 8.6.3 There are no licensed groundwater or surface water abstractions recorded within 1km of the site.
- 8.6.4 An initial assessment of the risk to controlled waters has been carried out on the basis of the results of leachate analysis undertaken on samples of Made Ground from TP01 and TP05 at depths of 0.50m and 0.60m bgl respectively. The leachate results have been screened against the Water Supply (Water Quality) Regulations 2000, ref. 10.22, and, where no guidance is given in the Water Supply regulations, the freshwater Environmental Quality Standards (EQS), ref. 10.24.
- 8.6.5 It should be noted that there is no TPH guideline parameter within the Water Supply Regulations 2000. As such, the WHO guideline values for TPH in drinking water, 2008, ref. 10.23, have been adopted.
- 8.6.6 The guidance levels used within the controlled waters assessment have been tabulated and are detailed within Appendix 6.
- 8.6.7 Total PAH exceeding the screening value of 0.1µg/l in the Water Supply Regulations was recorded in both samples, with concentrations of 0.89µg/l and 5.19µg/l. However, concentrations of all the indicator compounds listed in the Water Supply Regulations and the EQS, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(123-cd)pyrene, were below laboratory detection limits, and no other elevated concentrations were identified in either of the samples.

8.6.8 It should be noted that the above concentrations are derived from leachate analysis on soil samples and are not an accurate indication of actual concentrations in the groundwater beneath the site, whilst the GAC are based on concentrations at the receptor point, i.e. consumers' taps and are therefore relatively conservative. The recorded concentrations are not significantly elevated, and given the distances to the closest possible receptors, the site is not considered to represent a significant risk of significant harm to controlled waters overall. Furthermore, the site is proposed for continued commercial use with extensive building and hard cover, which will significantly limit the potential for infiltration and therefore the leaching of contaminants within the Made Ground to the underlying aquifer.

8.6.9 Consequently, no further assessment is considered necessary with regard to controlled waters.

8.7 Gas Generation

8.7.1 Gas monitoring visits were undertaken on the 24th July, 19th and 22nd August 2019, with atmospheric pressure ranging between 1011mb and 1023mb. The results of the gas monitoring are included within Appendix 2, Figure A2.8.

8.7.2 Methane concentrations of up to 1.5% by volume (v/v) were recorded during the monitoring, together with carbon dioxide concentrations of up to 0.3% v/v. Near atmospheric oxygen concentrations were recorded ranging from 19.3% to 21.0% v/v.

8.7.3 Concentrations of hydrogen sulphide and carbon monoxide were recorded at below the detection limit of the monitoring equipment.

8.7.4 Flow rates were recorded over a three minute period during the various return monitoring visits. The maximum of the three minute average flows was recorded at less than 0.1l/hr (limit of detection).

8.7.5 In accordance with the methodology published in CIRIA Document C665, ref. 10.37, the maximum recorded values were taken to calculate a Gas Screening Value (GSV) for the site of 0.0015l/hr. However, with recorded concentrations of methane exceeding 1% v/v in BH01, the results indicate the site to be Characteristic Situation (CS) 2 (Appendix 7, Table A7.2).

8.7.6 On the basis of these results, gas protection measures could be required for the proposed extensions. Guidance for the design of gas protection measures is provided in BS8485 (2015), ref. 10.38, see Appendix 7 for further details.

8.7.7 Radon - The BRE guidance on Radon producing areas within the UK, (BR211:2007), indicates that the site lies within an area where radon protective measures are not required.

8.8 Protection of Services

8.8.1 Due to the increasing number of developments being undertaken on potentially contaminated land, the Water Supply Industry has identified the need to protect newly laid water supply pipes. They are likely to impose constraints on the nature of water supply pipes that are to be laid in contaminated land. Current guidance on the selection of materials for water pipes is provided by the UK Water Industry Research Limited, ref. 10.25, which superseded the previous guidance provided by Water Regulations Advisory Scheme, ref. 10.26.

8.8.2 The House Builders Federation, in collaboration with Water UK, ref. 10.27, have subsequently provided guidance, part of which includes a basic risk assessment, which is tabulated in Appendix 6, Figure A6.1, and based on the contamination test results reviewed above. Concentrations of TPH within the Made Ground exceeded the basic risk assessment criteria for plastic pipes in locations TP01 and TP05. Consequently, barrier pipe or selection of an alternative material to plastic is likely to be required for any new potable services proposed on the site. The local water supply company should be consulted for confirmation of the specific requirements for this site.

8.9 Risk Evaluation

8.9.1 The conceptual model formed within the Preliminary Investigation has been updated to reflect the findings of the contamination risk assessment and the revised conceptual model, detailing the relevant pollutant linkages, is tabulated below:

Contamination Sources	Contaminants of Concern	Pathways	Receptor Group
Contamination associated with fill material and nearby haulage company	Organic Compounds TPH	Direct contact	Building Materials or Services Plastic pipes and services
Alluvium and fill material	Methane	- Inhalation - Explosion	- Human Health - Property

8.10 Summary of Risk Evaluation

8.10.1 The above assessment identifies that the ‘source – pathway – receptor’ linkage potentially occurs with TPH impacting upon the identified receptors, though only if new potable water supply services are proposed on the site, and also methane gas. No other pollutant linkages have been proven.

8.11 Waste

8.11.1 An initial assessment of the likely waste classification for any material to be disposed of has been conducted on the basis of the chemical test results obtained as part of the contamination risk assessment.

8.11.2 Two soil samples, both of which were from the Made Ground, were submitted for Waste Acceptance Criteria (WAC) analysis, the results of which are given in Appendix 4, Figure 19/08038 and summarised below:

Location	Depth (m bgl)	Classification	Notes
TP01	0.50	Hazardous	Sue to loss on ignition and Total Organic Carbon (TOC)
TP05	0.60	Hazardous	Sue to loss on ignition and Total Organic Carbon (TOC)

8.11.3 An assessment of the likely waste classification for any material to be disposed of has also been conducted on the basis of the chemical test results obtained as part of the contamination risk assessment.

8.11.4 This assessment has been conducted using the HazWasteOnline™ tool, ref. 10.28, the summary output sheets from which are included within Appendix 4, Figure A4.1.

8.11.5 None of the samples were indicated likely to be classified as hazardous.

8.11.6 All of the samples were initially classified as potentially hazardous due to Hazard Property HP3(i): Flammable. However, maximum TPH concentrations were measured at less than 0.1% and it is unlikely that at these levels materials would be flammable. Therefore, the criteria has been altered to indicate total TPH concentrations less than 500mg/kg (inert soil threshold) in solid samples as non-hazardous.

8.11.7 It should be noted that individual tips might require further analysis prior to the disposal of any material from the site. Any such requirements should be clarified with the tip prior to any further analysis being undertaken

8.11.8 Natural arisings which are not contaminated can be disposed of at an inert landfill based on being classified as a natural soil and a listed waste with no requirement for WAC testing.

9.0 MANAGEMENT OF CONTAMINATION

9.1 Remediation and Verification

- 9.1.1 The risk management framework set out in the Model Procedures for the Management of Land Contamination, CLR 11, ref. 10.29, is applicable to the redevelopment of sites that may be affected by contamination.
- 9.1.2 The risk management process set out in the Model Procedures has three main components:
- Risk assessment
 - Options appraisal
 - Implementation
- 9.1.3 This initial risk assessment has not identified any significant risks to the proposed development with regard to human health or controlled waters. However, possible risks to plastic water supply pipes have been identified, though only relevant if new potable services are proposed, and also risks associated with the potential ingress of methane gas.
- 9.1.4 In order to mitigate the risks to plastic water supply pipes from the concentrations of TPH identified within the Made Ground beneath the site, for any new services proposed to be laid within this material, the installation of barrier pipe or selection of an alternative material to plastic may be required. The local water supply company should be consulted for confirmation of the specific requirements for this site.
- 9.1.5 Gas protection measures may be required for the proposed extensions, in accordance with CS-2. Approval and validation of any such measures should be sought directly from Local Authority Building Control.
- 9.1.6 An important part of the risk management process is identifying and informing all stakeholders with an interest in the outcome of the risk management project. To this end, if the regulators have not yet been contacted with regard to the redevelopment of this site, it is recommended that they be supplied with a copy of both the Preliminary Investigation report and this Phase 2 Ground Investigation report in order to enable liaison to be undertaken with them.
- 9.1.7 Following liaison with the relevant regulatory bodies, a remediation strategy could be formulated, which should incorporate an options appraisal and summarise in detail the chosen remedial approach, along with the verification proposals. The remediation strategy should then be approved by the relevant regulatory authorities prior to implementation.

- 9.1.8 The remediation strategy will need to review methods of reducing or controlling the identified unacceptable risks. This could be done by removing or treating the sources of contamination, removing or modifying the pathways or removing or modifying the behaviour of the receptors, to ensure there is no significant risk of significant harm to either human health or controlled waters from the identified contamination, in relation to the proposed end use.
- 9.1.9 Where remediation is required, a verification report will need to be formulated following implementation of the remediation strategy, which should provide a complete record of all remedial activities conducted on site and include all the data obtained to support the remedial objectives and demonstrate that the remediation has been effective. Any unexpected conditions encountered during the remedial works should also be detailed within the verification report.

9.2 Management of Unidentified Sources of Contamination

- 9.2.1 There is the possibility that sources of contamination may be present on the site, which were not detected during the investigation. Should such contamination be identified or suspected during the site clearance or ground works, these should be dealt with accordingly. A number of options are available for handling this material, which include:
- The removal from site and disposal to a suitably licensed tip of all material suspected of being contaminated. The material would need to be classified prior to disposal.
 - Short-term storage of the suspected material while undertaking verification testing for potential contamination. The storage area should be a contained area to ensure that contamination does not migrate and affect other areas of the site. Depending upon the amounts of material under consideration, this could be either a skip or a lined area.
 - Having a suitably experienced environmental engineer either on-call or with a watching brief for the visual and olfactory assessment of the material, and sampling for verification purposes.

9.3 Consultation

9.3.1 During the development of a site, consultation may be required for a number of reasons with a number of regulatory Authorities. The following provides an indication as to the most likely Authorities with which consultation may be required.

- **Local Authority.** There may be a planning condition regarding contamination and consultation will be required with a designated Contaminated Land Officer within the Environmental Health Department. The Local Authority is generally concerned with human health risks. Some Authorities now require 'Completion Certificates' to be signed off following remediation works.
- **Environment Agency.** Where a site is situated above an aquifer, within a groundwater protection zone or has been designated as a special site, the Environment Agency is likely to be involved to ensure that controlled waters are protected.

9.3.2 Based on the results of any consultation, there may be specific remediation requirements imposed by one or more of the Authorities.

9.4 Risk Management During Site Works

9.4.1 During ground works, some simple measures may have to be put in place to mitigate the risk of any known or previously unidentified contamination affecting the site workers and the environs. The majority of the proposed measures represent good practice for the construction industry and include:

- Informing the site workers of the contamination on site and the potential health effects from exposure.
- Where appropriate, the provision of suitable Personal Protective Equipment (PPE) for workers who may be potentially impacted by working in areas of the contamination.
- Ensuring good hygiene is enforced on site and washing facilities are maintained on the site. Workers are discouraged from smoking, eating or drinking without washing their hands first.
- Dust monitoring, and if necessary, suppression measures should be put into practice where contamination is becoming airborne.

9.4.2 Where contaminated materials are being removed from the site they should be disposed of at a suitably licensed landfill, with a 'duty of care' system in place and maintained throughout the disposal operations.

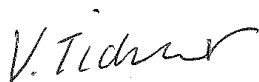
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For and on behalf of Ian Farmer Associates (1998) Limited



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Principal Environmental Engineer

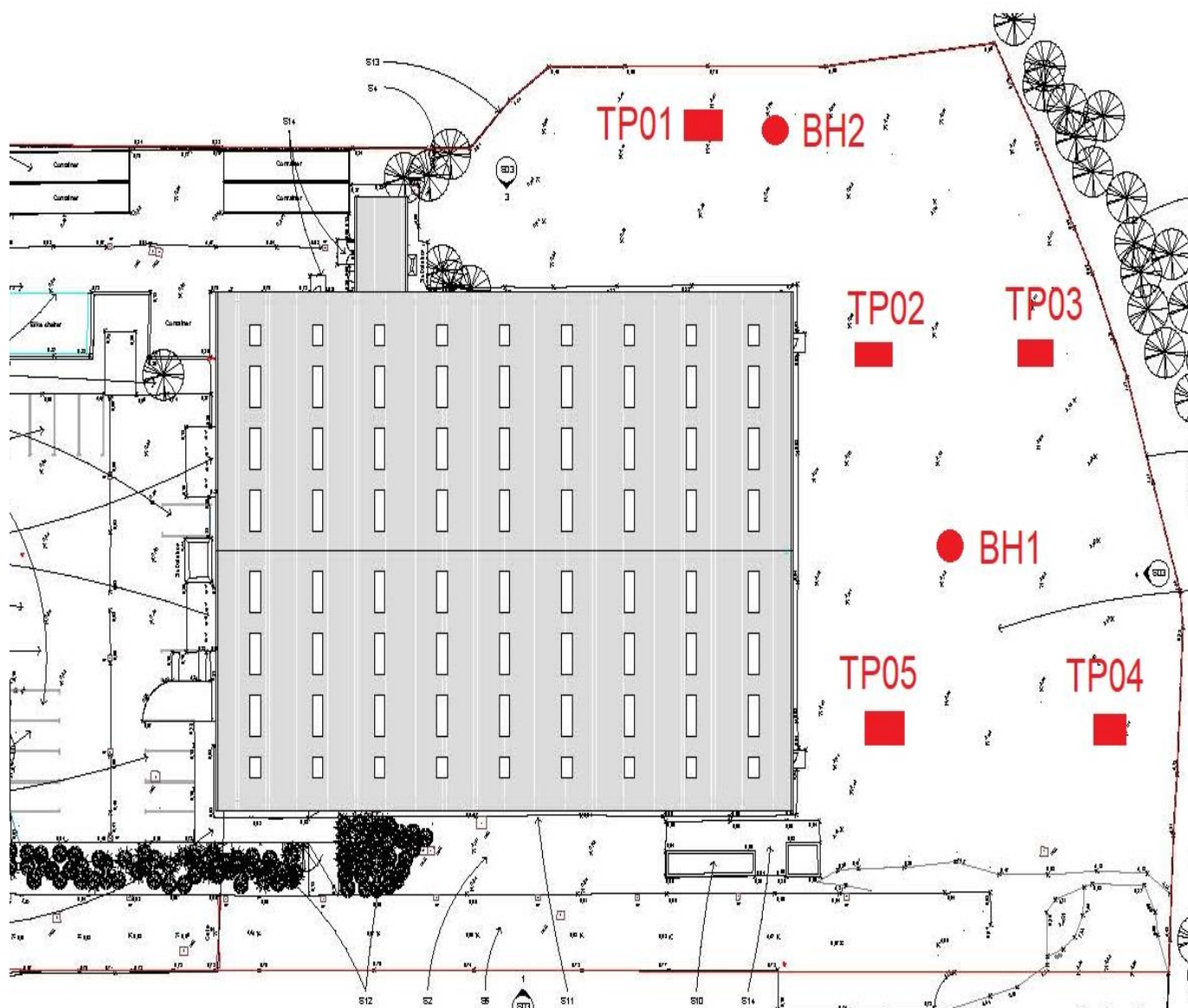


William H Sell
BSc (Hons) FGS
Regional Manager

APPENDIX 1
DRAWINGS

Job No: 70545

Site: Sonalyst, Unit 4, Baglan Industrial Estate



Site Plan

**Figure
A1.1**



APPENDIX 2

SITE WORK

Borehole Log

Borehole No.

BH1

Sheet 1 of 2

Project Name: Baglan

Project No.
70545

Co-ords: -

Hole Type
CP

Location: Baglan Industrial Park

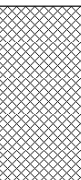
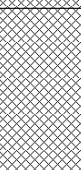
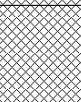
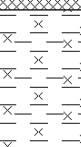
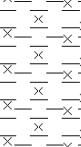
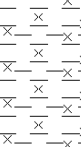
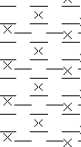
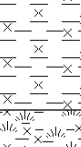
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Client: Greenbuild Management Services

Dates: 15/07/2019 - 17/07/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50 - 1.20	B					MADE GROUND Firm grey brown sandy clay	1
		1.20 1.20	D	50 (25 for 75mm/50 for 85mm)	1.20				
		1.20 - 1.60	B					MADE GROUND Very dense grey fine to coarse sand and gravel with occasional cobbles. Gravel and cobbles of sandstone and blast furnace slag	2
		2.00 2.00	D	50 (25 for 85mm/50 for 90mm)	2.30				
		2.00 - 2.50 2.50 - 3.00	B B					MADE GROUND Grey fine to coarse sand and gravel with soft grey clay and occasional cobbles	3
		3.00 3.00 - 3.50	B B	N=8 (2,2/2,2,2,2)	3.00			Soft grey very silty CLAY	
		3.50 - 4.00	B						
		4.00 - 4.45	UT						4
		4.45 - 4.60 4.60 - 5.00	D B						
		5.00 5.00 - 5.45	D D	N=5 (1,0/1,1,2,1)					5
		5.50 - 6.00	B						
		6.00 - 6.45	UT						6
		6.45 - 6.60	D						
		7.00 - 7.50	B						7
		7.50 7.50 - 7.95	D D	N=7 (1,0/2,1,2,2)					8
		8.50 - 9.00	B		8.50			Soft grey peaty CLAY	
		9.00 - 9.45	UT						9
		9.45 - 9.60	D						
		10.00 - 10.50	B						10
								Continued on next sheet	

Remarks

Ground water encountered at 13.00m and rose to 7.40m after 20 mins. Stood at 2.90m at start of 17/7.
Chiselling from 1.40m to 2.00m 2.25hrs.
Chiselling from 2.20m to 2.50m 1hr.
Chiselling 13.80m to 14.00m 0.75hrs.
Chiselling from 15.50m to 15.70m 0.5hrs.
Chiselling from 17.80m to 18.00m 1hr.

Fig A2.1



Borehole Log

Borehole No.

BH1

Sheet 2 of 2

Project Name: Baglan

Project No.
70545

Co-ords: -

Hole Type
CP

Location: Baglan Industrial Park

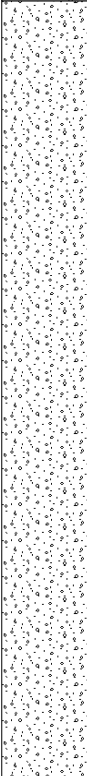
Level:

Scale
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Client: Greenbuild Management Services

Dates: 15/07/2019 - 17/07/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 10.50 - 10.95	D	N=1 (1,0/0,1,0,0)	12.00			Firm grey silty CLAY	11
		11.50 - 12.00	B						
		12.00 - 12.45	UT						
		12.45 - 12.60	D						
		13.00 - 13.50	B		13.00			Very dense grey fine to coarse SAND and GRAVEL with occasional cobbles. Gravel is sub rounded to sub angular sandstone	13
		13.50 13.50 - 14.00	B	50 (25 for 125mm/50 for 135mm)					
		14.50 - 15.00	B						
		15.00 15.00 - 15.50	B	50 (10,15/50 for 150mm)					
		16.00 - 16.50	B		18.15			End of borehole at 18.15 m	16
		16.50 16.50 - 17.00	B	50 (25 for 125mm/50 for 160mm)					
17.50 - 18.00	B								
18.00		50 (25 for 30mm/50 for 65mm)							
								18	
								19	
								20	

Remarks

Ground water encountered at 13.00m and rose to 7.40m after 20 mins. Stood at 2.90m at start of 17/7.
Chiselling from 1.40m to 2.00m 2.25hrs.
Chiselling from 2.20m to 2.50m 1hr.
Chiselling 13.80m to 14.00m 0.75hrs.
Chiselling from 15.50m to 15.70m 0.5hrs.
Chiselling from 17.80m to 18.00m 1hr.

Fig A2.1

Borehole Log

Borehole No.

BH2

Sheet 1 of 2

Project Name: Baglan

Project No.
70545

Co-ords: -

Hole Type
CP

Location: Baglan Industrial Park

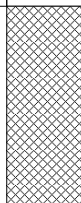
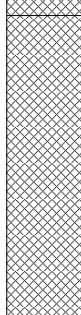
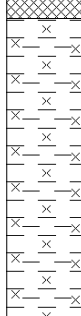
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Scale
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Client: Greenbuild Management Services

Dates: 17/07/2019 - 19/07/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50 - 1.20	B	50 (5,7/50 for 185mm)	1.40			MADE GROUND Soft grey sandy gravelly clay	1
		1.00	D						
		1.20							
		1.20 - 1.60	B	50 (25 for 40mm/50 for 50mm)				MADE GROUND Very dense grey coarse gravel and cobbles of slag. becoming sandy with depth. Mixed with soft clay from 3.00m	2
		2.00	D						
		2.00							
		2.00 - 2.50	B						
		2.50 - 3.00	B						
		3.00		N=17 (4,5/6,6,3,2)					3
		3.00 - 3.50	B						
		3.50 - 4.00	B	N=3 (1,0/1,0,1,1)	3.50			Firm becoming soft by 4.50m grey very silty CLAY	4
		4.00	D						
		4.00 - 4.45	D						
		4.50 - 5.00	B						5
		5.00 - 5.45	UT						
		5.45 - 5.60	D						
		5.60 - 6.00	B						
		6.00		N=0 (1,0/0,0,0,0)					6
		6.00 - 6.45	D						
		7.00 - 7.50	B		7.00			Grey brown fibrous PEAT	7
		7.50 - 7.95	UT						
		7.95	D						
		8.50 - 9.00	B	N=0 (1,0/0,0,0,0)	9.00			Soft grey very silty CLAY	9
		9.00	D						
		9.00 - 9.45	D						
		10.00 - 10.50	B						10

Continued on next sheet

Remarks

Ground water encountered at 13.50m and rose to 6.50m after 20mins.
Chiselling 1.80m to 2.00m 1.25hrs.
Chiselling 2.20m to 2.60m 1.5hrs.

Fig A2.2



Borehole Log

Borehole No.

BH2

Sheet 2 of 2

Project Name: Baglan

Project No.
70545

Co-ords: -

Hole Type
CP

Location: Baglan Industrial Park

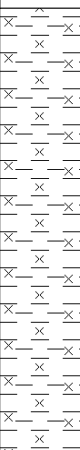
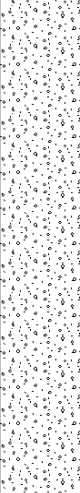
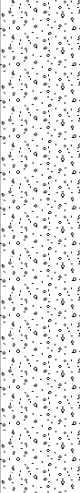
Level:

Scale
1:50

Client: Greenbuild Management Services

Dates: 17/07/2019 - 19/07/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
		Depth (m)	Type	Results								
		10.50 - 10.95	UT	N=6 (1,0/1,2,1,2)	13.00				11			
		10.95	D									
		11.50 - 12.00	B									
		12.00	D									
		12.00										
		13.00 - 13.50	B	N=52 (4,5/52 for 275mm)			13.50				Very dense grey medium to coarse rounded sandstone GRAVEL with occasional cobbles	13
		13.50									Very dense grey fine to coarse SAND and GRAVEL with occasional cobbles. GRavel is sub angular sandstone	14
		13.50 - 14.00	B									
		14.50 - 15.00	B									
		15.00										
15.00 - 15.50	B											
16.00 - 16.50	B	50 (35 for 140mm/50 for 160mm)	16.80			15						
16.50	D											
16.50												
End of borehole at 16.80 m								16				
								17				
								18				
								19				
								20				

Remarks

Ground water encountered at 13.50m and rose to 6.50m after 20mins.
Chiselling 1.80m to 2.00m 1.25hrs.
Chiselling 2.20m to 2.60m 1.5hrs.

Fig A2.2

Trial Pit Log

Trialpit No

TP01

Sheet 1 of 1

Project Name: Baglan

Project No.
70545

Co-ords: -
Level: 0.00

Date
15/07/2019

Location: Baglan Industrial Park

Dimensions
(m):

2

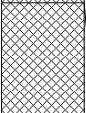
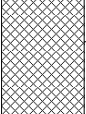
Scale
1:25

Client: Greenbuild Managemnet Services

Depth
1.50

0.8

Logged
GS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES		0.10 0.30	-0.10 -0.30		MADE GROUND. Grass over brown, slightly clayey, gravelly medium dense sand with frequent rootlets. Gravels are fine to coarse, subangular to subrounded quartz. (Topsoil)	
							MADE GROUND. Brown, slightly clayey, very gravelly medium dense sand with frequent rootlets. Gravels are fine to coarse, subangular to subrounded quartz, occasional plastic fragments. Low cobble content; cobbles are concrete.	
							MADE GROUND. Brownish dark grey, sandy, very gravelly, very clayey gravel, with frequent clay pockets. Gravel is fine to coarse, subangular to subrounded quartz, slag, occasional charcoal fragments. Low cobble content; cobbles are concrete.	1
							<i>Below 0.80m: Strong sulphur odour</i>	
	1.50	ES		1.50	-1.50		End of pit at 1.50 m	
								2
								3
								4
								5

Remarks: Dry and stable

Stability: Stable

Fig A2.3

Trial Pit Log

Trialpit No

TP02

Sheet 1 of 1

Project Name: Baglan

Project No.
70545

Co-ords: -
Level: 0.00

Date
15/07/2019

Location: Baglan Industrial Park

Dimensions
(m):

2

Scale
1:25

Client: Greenbuild Managemnet Services

Depth
1.30

0.8

Logged
GS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10			0.10	-0.10		MADE GROUND. Grass over brown, slightly clayey, gravelly, medium dense sand with frequent rootlets. Gravel is fine to coarse, subangular to subrounded quartz. (Topsoil)	
	0.50	ES					MADE GROUND. Brown, slightly clayey, very gravelly medium dense sand with occasional rootlets. Gravel is fine to coarse, subangular to subrounded, quartz, slag, occasional brick and charcoal fragments. Low cobble content; cobbles are concrete.	
	0.80			0.80	-0.80		MADE GROUND. Brownish grey, slightly clayey, very gravelly medium dense sand with occasional clay pockets. Gravel is fine to coarse, subangular to subrounded quartz, slag, frequent charcoal fragments.	1
	1.30	ES		1.30	-1.30		End of pit at 1.30 m	
								2
								3
								4
								5

Remarks: Dry and stable

Stability: Stable

Fig A2.4



Trial Pit Log

Trialpit No

TP03

Sheet 1 of 1

Project Name: Baglan

Project No.
70545

Co-ords: -
Level: 0.00

Date
15/07/2019

Location: Baglan Industrial Park

Dimensions
(m):

2

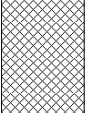
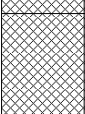
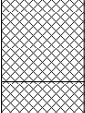
Scale
1:25

Client: Greenbuild Managemnet Services

Depth
1.50

0.8

Logged
GS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES		0.10	-0.10		MADE GROUND. Grass over brown, gravelly, slightly clayey medium dense sand with frequent rootlets. Gravel is fine to coarse, subangular to subrounded quartz, occasional brick fragments. (Topsoil)	
				0.70	-0.70		MADE GROUND. Greyish brown, very gravelly, medium dense sand with occasional rootlets. Gravel is fine to coarse, subangular to subrounded quartz, slag, slate, charcoal fragments. Low cobble content; cobbles are concrete.	
							MADE GROUND. Dark, brownish grey, very gravelly medium dense sand. Gravel is fine to coarse, subangular to subrounded quartz, slag, charcoal fragments and occasional concrete fragments. Low cobble content; cobbles are concrete. <i>Below 0.70m: Strong sulphur odour</i>	1
	1.50	ES		1.30	-1.30		MADE GROUND. Soft to firm brownish grey, occasionally mottled brown, slightly sandy, gravelly clay. Gravel is fine to coarse, subangular to subrounded quartz, slag, charcoal.	
				1.50	-1.50		End of pit at 1.50 m	2
								3
								4
								5

Remarks: Dry and stable

Stability: Stable

Fig A2.5

Trial Pit Log

Trialpit No

TP04

Sheet 1 of 1

Project Name: Baglan

Project No.
70545

Co-ords: -
Level: 0.00

Date
15/07/2019

Location: Baglan Industrial Park

Dimensions
(m):

2

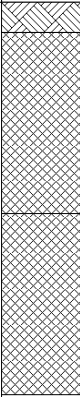
Scale
1:25

Client: Greenbuild Managemnet Services

Depth
1.30

0.8

Logged
GS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.60	ES		0.10	-0.10		MADE GROUND. Grass over greyish brown, very gravelly medium dense sand with frequent rootlets. Gravel is fine to coarse, subangular to subrounded quartz. (Topsoil) MADE GROUND. Greyish brown, sandy gravel. Gravel is fine to coarse, angular to subrounded quartz, charcoal, slag. Low cobble content; cobbles are concrete.
				0.70	-0.70		<u>Below 0.60m: Strong sulphur odour</u> <u>0.60m-0.70m: Light grey sandy gravels</u> MADE GROUND. Dark, greyish brown, slightly clayey, gravelly medium dense sand. Gravel is fine to coarse, angular to subrounded quartz, charcoal, slag, occasional brick and concrete fragments.
	1.30	ES		1.30	-1.30		<u>Below 1.20m: Occasional pockets of grey clay</u> End of pit at 1.30 m

1

2

3

4

5

Remarks: Dry and stable

Stability: Stable

Fig A2.6

Trial Pit Log

Trialpit No

TP05

Sheet 1 of 1

Project Name: Baglan

Project No.
70545

Co-ords: -
Level: 0.00

Date
15/07/2019

Location: Baglan Industrial Park

Dimensions
(m):

2

Scale
1:25

Client: Greenbuild Managemnet Services

Depth
1.20

0.8

Logged
GS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.60	ES		0.10	-0.10		MADE GROUND. Grass over brown, gravelly, slightly clayey medium dense sand with frequent rootlets. Gravel is fine to coarse, subangular to subrounded quartz, occasional brick fragments. (Topsoil)
				0.40	-0.40		MADE GROUND. Greyish brown, sandy gravel with occasional rootlets. Gravel is fine to coarse, angular to subrounded, quartz, charcoal, slag, occasional brick fragments. Low cobble content; cobbles are concrete.
				0.80	-0.80		MADE GROUND. Dark brownish grey, slightly clayey, sandy gravel. Gravel is fine to coarse, angular to subrounded quartz, charcoal, slag, occasional concrete fragments.
	1.20	ES		1.00	-1.00		MADE GROUND. Firm to stiff, dark grey, slightly sandy, gravelly clay. Gravel is fine to coarse, angular to subrounded, quartz, charcoal, slag, concrete fragments.
				1.20	-1.20		Below 0.80m: Strong sulphur odour MADE GROUND. Dark brownish grey, sandy gravel. Gravel is fine to coarse, angular to subrounded quartz, charcoal, slag, concrete fragments. End of pit at 1.20 m

1

2

3

4

5

Remarks: Dry and stable

Stability: Stable

Fig A2.7



70545

Baglan Industrial Park

Date	Location	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Flow (l/h)	Pressure (mb)	Pressure Trend
24/7/19	BH01	0.0	0.0	21.0	0	0	0.0	1012	Stable
24/7/19	BH02	0.0	0.0	21.0	0	0	0.0	1012	Stable
19/8/19	BH01	1.5	0.3	19.3	0	0	0.0	1012	Rising
19/8/19	BH02	0.0	0.0	20.7	0	0	0.0	1011	Rising
22/8/19	BH01	0.3	0.0	19.3	0	0	0.0	1023	Falling
22/8/19	BH02	0.0	0.0	20.6	0	0	0.0	1022	Falling

Date	Location	Depth to Water (m)
24/7/19	BH01	2.65
24/7/19	BH02	2.80
19/8/19	BH01	2.60
19/8/19	BH02	2.69
22/8/19	BH01	2.56
22/8/19	BH02	2.73

**Results of Gas and Ground
Water Monitoring**

**Figure
A2.8**



APPENDIX 2

GENERAL NOTES ON SITE WORKS

A2.1 SITE WORK

A2.1.1 General

Site work is carried out in general accordance with the guidelines given in ISO 1997, 10.4 and BS 5930, ref. 10.3.

A2.1.2 Trial Pits

Shallow trial pits are generally dug by mechanical excavator, however, in difficult access locations or adjacent to structures, such pits may be hand dug. Pits are best used where the ground will stand unsupported and generally, the maximum depth of machine dug pits is 4m to 5m. Where personnel are required to enter pits, it is essential that side support is provided. Entry by personnel into unsupported pits deeper than 1.2m is not allowed for health and safety reasons.

Trial pits allow the in-situ condition of the ground to be examined both laterally and vertically and also allow discontinuities to be recorded. The field record should give the orientation of the pit with details of which face was logged, assessment of stability of sides of pit and groundwater as well as the strata encountered. Photographs of the pit should also be taken.

In-situ testing, such as hand penetrometer, hand vane, Macintosh probe, or similar, can be undertaken in the sides or base of pits while both disturbed and undisturbed samples recovered.

It is generally advisable to backfill the pits as soon as possible, open pits should not be left unattended.

A2.1.3 Light Cable Percussion Boring

For routine soil exploration to depths in excess of 3m, the light cable percussion rig is generally employed for boring through soils and weak rocks, refs 10.3, 10.4. It consists of a powered winch and tripod frame, with running wheels that are permanently attached so that the rig may be towed behind a suitable vehicle. The rig is towed into position and set up using its own winching system.

The locations of services are checked to make sure the borehole is not situated unacceptably near any services. Regardless of the proximity of services, a CAT scan is undertaken at the borehole location and a trial hole dug to 1.20m by hand.

Boreholes are advanced in soil by the percussive action of the cable tool. The force of the cylindrical tool as it is dropped a short distance cuts a plug of cohesive soil that is removed by the tool.

In non-cohesive soils, the borehole is advanced by a 'shell', otherwise known as a 'bailer' or 'sand pump', which incorporates a clack valve. Material is transferred into the shell and retained by the clack valve. The water level in a borehole is maintained above that in the surrounding granular soil to allow for temporary reductions in the head of water as the shell is withdrawn from the borehole. Water should flow from the borehole into the surrounding soil at all times to prevent 'piping' and loosening the soil at the base of the hole. The casing is always advanced with the borehole in granular soil so that material is drawn from the base rather than the borehole sides.

Obstructions to boring are overcome by fitting a serrated chiselling ring to the base of the percussion tool. For large obstructions, a heavy chisel with a hardened cutting edge may have to be used.

Disturbed samples are taken in polythene bags, jars or tubs that are sealed against air or water loss.

Undisturbed samples are generally taken in cohesive materials at changes in strata and at one metre intervals to 5 metres then at 1.5 metre intervals to the full depths of the borehole. The general purpose open-tube sampler is suitable for firm to stiff clays, but is often used to retrieve disturbed samples of weak rocks, soft or hard clay and also clayey sand or silts. This has been adopted for routine use, and usually consists of a 100mm internal diameter tube (U100), which is capable of taking soil samples up to 450mm in length. The undisturbed samples are sealed at each end using micro-crystalline wax to prevent drying.

Standard penetration tests are generally carried out in non-cohesive soils but also in stiff clays and soft rocks at frequencies similar to that of undisturbed sampling.

A2.2 IN-SITU TESTS

A2.2.1 Standard Penetration Test

The Standard Penetration Test is carried out in accordance with the proposals recommended by ISO 1997, ref. 10.4, BS 1377, Part 9, 1990 ref. 10.5.

The standard penetration test, **SPT**, covers the determination of the resistance of soils to the penetration of a split barrel sampler. A 50mm diameter split barrel sampler is driven 450mm into the soil using a 63.5kg hammer with a 760mm drop. The penetration resistance is expressed as the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows to achieve the standard penetration of 300mm is reported as the 'N' value.

The test is generally carried out in fine soils, however, it may also be carried out in coarse granular soils, weak rocks and glacial tills using the same procedure as for the SPT but with a 50mm diameter, 60° apex solid cone replacing the split spoon sampler, **CPT**.

When attempting the standard penetration test in very dense material or weathered rocks it may be necessary to terminate the test before completion to prevent damage to the equipment. In these circumstances it is important to distinguish how the blow count relates to the penetration of the sampler. This may be achieved in the following manner:

- Where the seating drive has been completed, the test drive is terminated if 50 blows are reached before the full penetration of 300mm is achieved. The penetration for 50 blows is recorded and an approximate N value obtained by linear extrapolation of the number of blows for the partial test drive.
- If the seating drive of 150mm is not achieved within the first 25 blows, the penetration after 25 blows is recorded and the test drive then commenced.
- For tests in soft rocks, the test drive should be terminated after 100 blows where the penetration of 300mm has not been achieved.

The N-value obtained from the Standard Penetration Test may be used to assess the relative density of sands and gravels as follows:

Term	SPT N-Value : Blows/300mm Penetration
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

A2.3 SAMPLES

A2.3.1 General

Samples have been recovered and stored in accordance with the guidelines given in ISO 22475-1:2006, ref. 10.30 and BS 5930, ref. 10.3.

The undisturbed samples recovered from the percussive sampler were of varying diameters depending upon the depth taken and the ground conditions encountered.

In accordance with EN ISO 22475, ref. 10.30, and BS 5930, ref. 10.3, the thick walled U100 sample is considered as a Class B sampling technique and will only produce Class 3 to 5 quality samples in accordance with EN 1997-2:2007, ref. 10.4. A similar assumption can be made from samples tested from the percussive window sample probing.

Laboratory strength and consolidation testing can only be carried out on Class 1 quality samples, which can be obtained from a Class A sampling technique, ref. 10.4. This is due to possible disturbance during sampling, giving a weaker strength in testing.

Therefore, values for c_u and m_v derived for use in this report can only be used as guidance and not used to determine the shear strength properties of the clay and is not used to give a descriptive strength in the borehole records.

UT	represents undisturbed 100mm diameter samples taken in thin walled sample tubes, the number of blows to obtain the sample also recorded.
U	represents undisturbed 100mm diameter sample, the number of blows to obtain the sample also recorded.
U fail	indicates undisturbed sample not recovered
E	represents sample recovered in an amber jar, generally for environmental analysis
HV	represents Hand Vane test with equivalent undrained shear strength in kPa.
PP	represents Pocket Penetrometer test with equivalent undrained shear strength in kPa.
CBR	represents California Bearing Ratio test
B	represents large bulk disturbed samples
D	represents small disturbed sample
W	represents water sample
	represents water strike
	represents level to which water rose

A2.4 DESCRIPTION OF SOILS

A2.4.1 General

The procedures and principles given in ISO 14688 Parts 1 and 2, ref. 10.31, supplemented by section 6 of BS 5930, ref. 10.3 have been used in the soil descriptions contained within this report.

APPENDIX 3
LABORATORY TESTS

F.A.O.

Final Test Report - 70545 / 1

Site: Baglan
Job Number: 70545
Originating Client: Greenbuild Management Services
Originating Reference: 70545
Date Sampled: Not Given
Date Scheduled: 31/07/2019
Date Testing Started: 06/08/2019
Date Testing Finished: 12/08/2019

Previous Reports		Amendments	Date Issued

Amendments:

Authorised By:



Tim Robinson
Quality Technician

Report Issue Date: 13/08/2019

Page: 2

Borehole / Trial Pit	Depth (m)	Sample	Natural / Sieved	Natural Water Content %	Sample Passing 425 µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description / Remarks
					Percentage %	Water Content %						
BH1	4.60	B11	Natural	55.6	92	60.0	59	28	31	1.04	CH	Grey silty CLAY
BH1	8.50	B18	Natural	54.5	100	55.0	53	28	25	1.06	CH	Grey silty CLAY
BH2	4.50	B10	Natural	50	100	50.0	55	29	26	0.81	CH	Grey SILT/CLAY
BH2	8.50	B18	Natural	380	100	380.0		NP				Black PEAT



UKAS
TESTING
1164



Site: Baglan

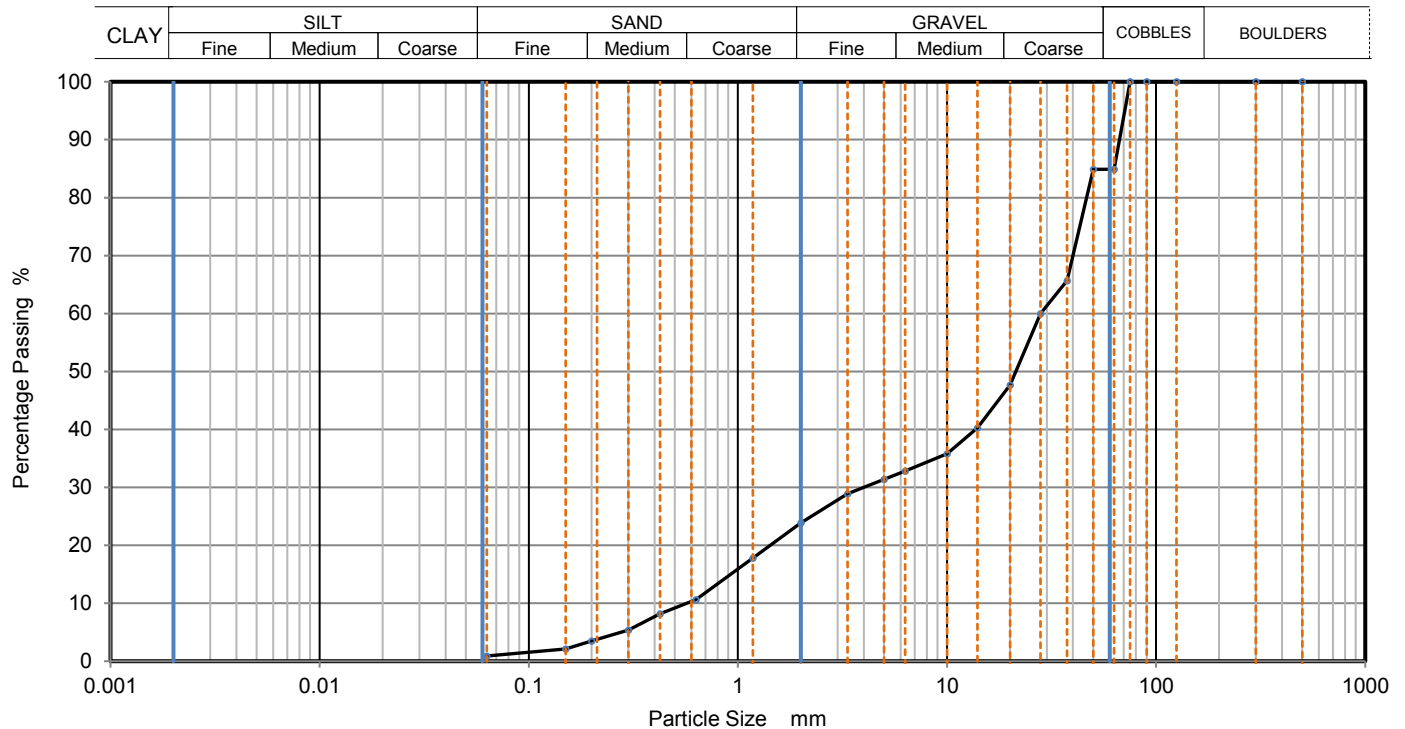
Job Number: 70545

Client: Greenbuild Management Services

Page: 3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH1	16.00	B30	Wet Sieve	Brown sandy GRAVEL



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	85		
50	85		
37.5	66		
28	60		
20	48		
14	40		
10	36		
6.3	33		
5	31		
3.35	29		
2	24		
1.18	18		
0.63	11		
0.425	8		
0.3	5		
0.2	4		
0.15	2		
0.063	1		

Dry Mass of sample, g

4172

Sample Proportions	% dry mass
Very coarse	15
Gravel	61
Sand	23
Fines <0.063mm	1

Grading Analysis		
D100	mm	75
D60	mm	28
D30	mm	4
D10	mm	0.568
Uniformity Coefficient		49
Curvature Coefficient		1

Remarks

Preparation and testing in accordance with BS17892 unless noted below

Method of Preparation: BS EN 17892:Part4:2016, clause 5.2.2 Preparation of samples for wet sieving test

Method of Test: BS EN 17892:Part4:2016, clause 5.2.3 Determination of particle size distribution by wet sieving method



Site: Baglan

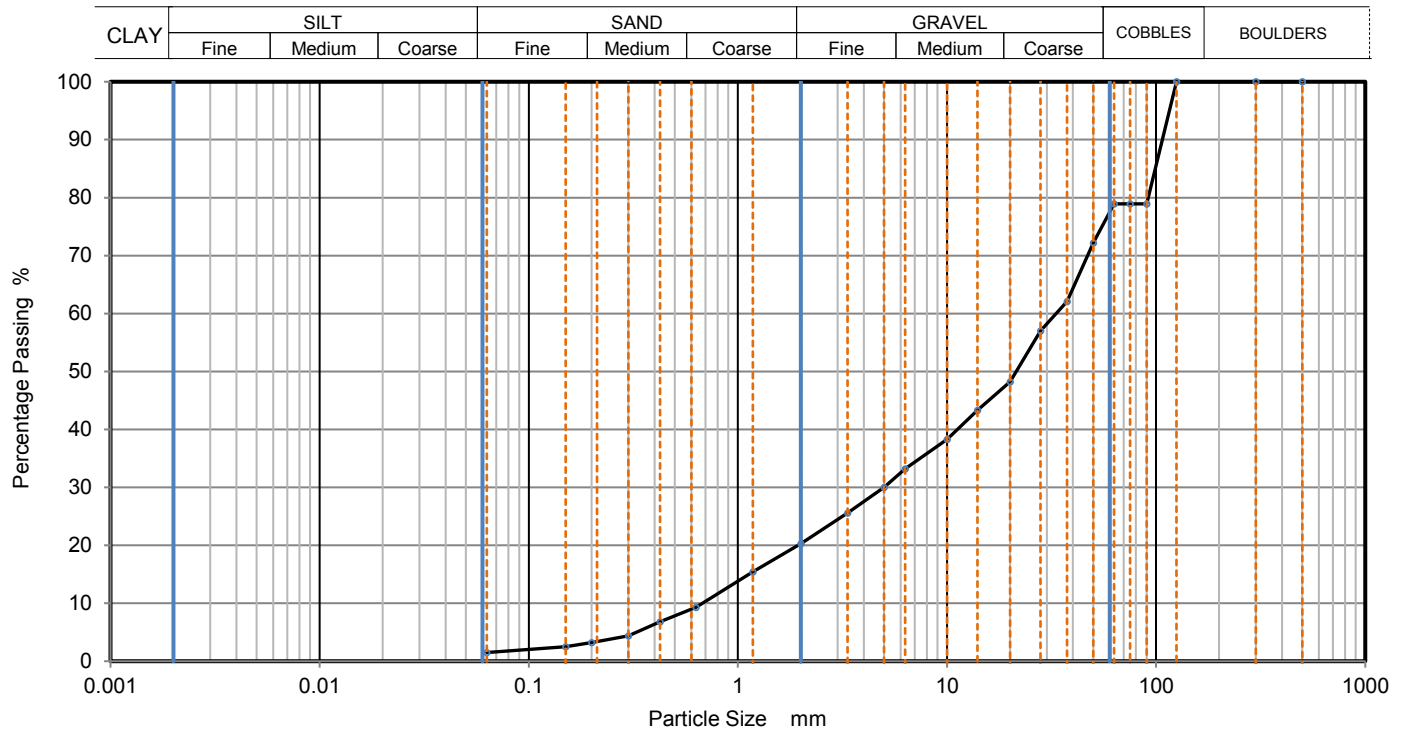
Job Number: 70545

Client: Greenbuild Management Services

Page: 4

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH2	14.50	B27	Wet Sieve	Grey sandy GRAVEL



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	79		
75	79		
63	79		
50	72		
37.5	62		
28	57		
20	48		
14	43		
10	38		
6.3	33		
5	30		
3.35	26		
2	20		
1.18	15		
0.63	9		
0.425	7		
0.3	4		
0.2	3		
0.15	3		
0.063	2		

Dry Mass of sample, g

6652

Sample Proportions	% dry mass
Very coarse	21
Gravel	59
Sand	19
Fines <0.063mm	1

Grading Analysis		
D100	mm	125
D60	mm	33.3
D30	mm	4.98
D10	mm	0.679
Uniformity Coefficient		49
Curvature Coefficient		1.1

Remarks

Preparation and testing in accordance with BS17892 unless noted below

Method of Preparation: BS EN 17892:Part4:2016, clause 5.2.2 Preparation of samples for wet sieving test

Method of Test: BS EN 17892:Part4:2016, clause 5.2.3 Determination of particle size distribution by wet sieving method

Site: Baglan

Job Number: 70545

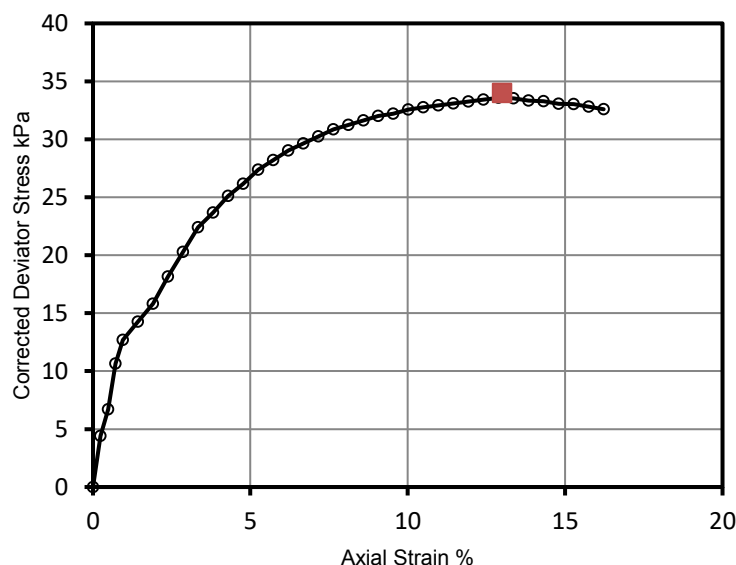
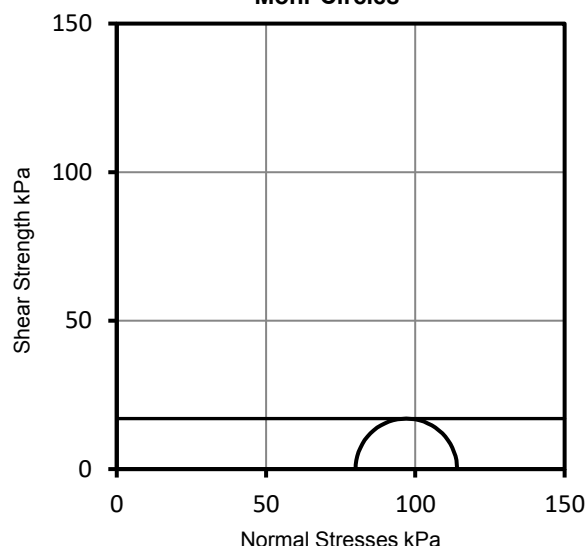
Client: Greenbuild Management Services

Page: 5

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

Borehole / Trial Pit	Depth (m)	Sample	Description
BH1	4.00	UT9	Grey silty CLAY

Initial Sample	Test Number	1
	Original Length (mm)	425.00
	Depth from Top (mm)	75.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		209.58
Diameter (mm)		101.83
Moisture Content (%)		46.80
Bulk Density (Mg/m ³)		1.72
Dry Density (Mg/m ³)		1.17
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.4
Test Results	Cell Pressure (kPa)	80
	Axial Strain (%)	13
	Membrane Corr. (kPa)	0.9
	Deviator Stress, ($\sigma_1 - \sigma_3$)f (kPa)	34
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)$ f (kPa)	17
Mode of Failure		Compound

Deviator Stress v Axial Strain

Mohr Circles


Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

Site: Baglan

Job Number: 70545

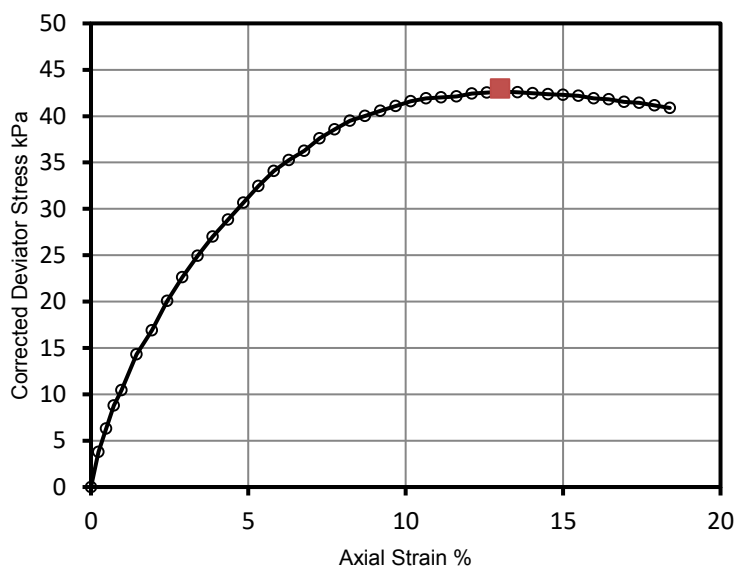
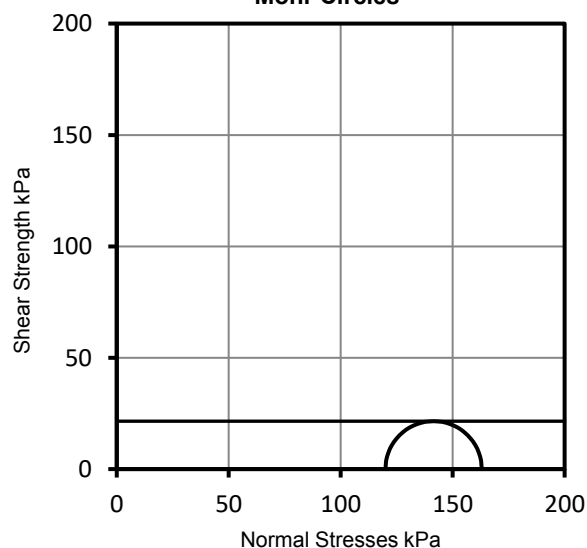
Client: Greenbuild Management Services

Page: 6

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

Borehole / Trial Pit	Depth (m)	Sample	Description
BH1	6.00	UT14	Grey silty CLAY

Initial Sample	Test Number	1
	Original Length (mm)	400.00
	Depth from Top (mm)	105.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		206.65
Diameter (mm)		101.64
Moisture Content (%)		55.90
Bulk Density (Mg/m ³)		1.70
Dry Density (Mg/m ³)		1.09
Membrane Thickness (mm)		0.35
Membrane Type		Latex
Rate of Strain (%/min)		1.5
Test Results	Cell Pressure (kPa)	120
	Axial Strain (%)	13
	Membrane Corr. (kPa)	0.94
	Deviator Stress, ($\sigma_1 - \sigma_3$)f (kPa)	43
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)$ f (kPa)	21
Mode of Failure		Plastic

Deviator Stress v Axial Strain

Mohr Circles


Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Method of Preparation:

BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test:

BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

Site: Baglan

Job Number: 70545

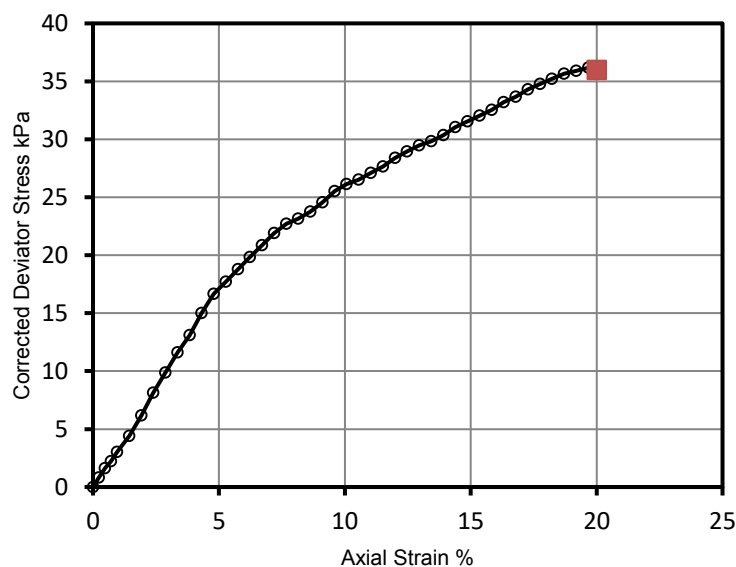
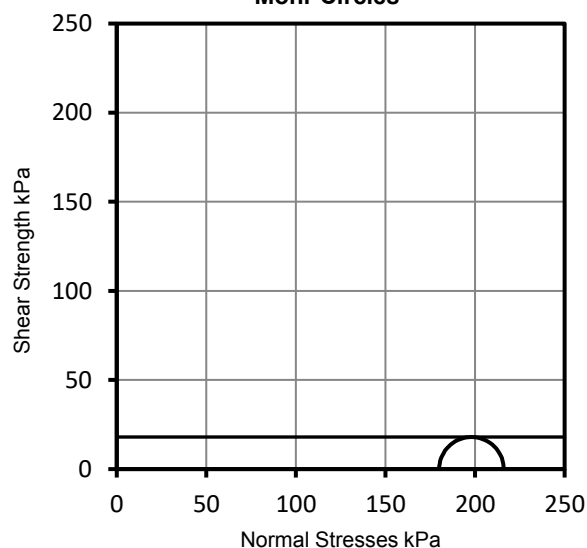
Client: Greenbuild Management Services

Page: 7

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

Borehole / Trial Pit	Depth (m)	Sample	Description
BH1	9.00	UT19	Grey silty CLAY

Initial Sample	Test Number	1
	Original Length (mm)	230.00
	Depth from Top (mm)	10.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		208.44
Diameter (mm)		102.53
Moisture Content (%)		30.30
Bulk Density (Mg/m ³)		1.95
Dry Density (Mg/m ³)		1.50
Membrane Thickness (mm)		0.33
Membrane Type		Latex
Rate of Strain (%/min)		1.4
Test Results	Cell Pressure (kPa)	180
	Axial Strain (%)	20
	Membrane Corr. (kPa)	1.22
	Deviator Stress, ($\sigma_1 - \sigma_3$)f (kPa)	36
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)$ f (kPa)	18
Mode of Failure		Plastic

Deviator Stress v Axial Strain

Mohr Circles


Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Method of Preparation:

BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test:

BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

Site: Baglan

Job Number: 70545

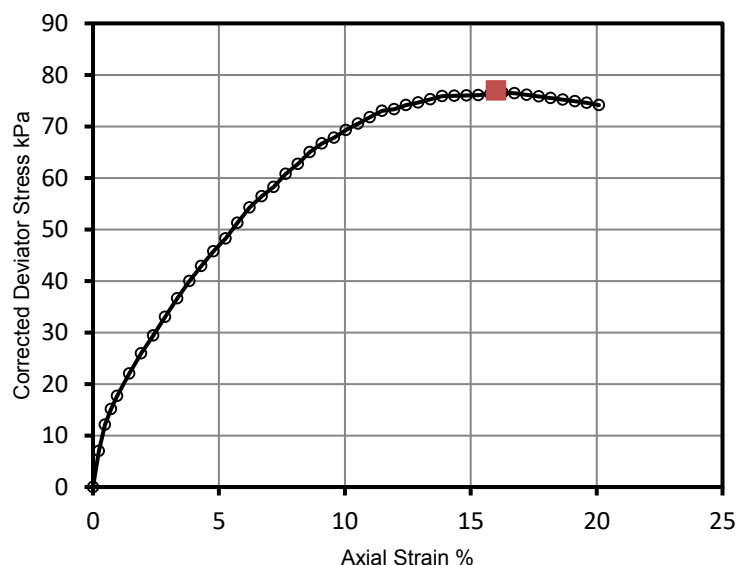
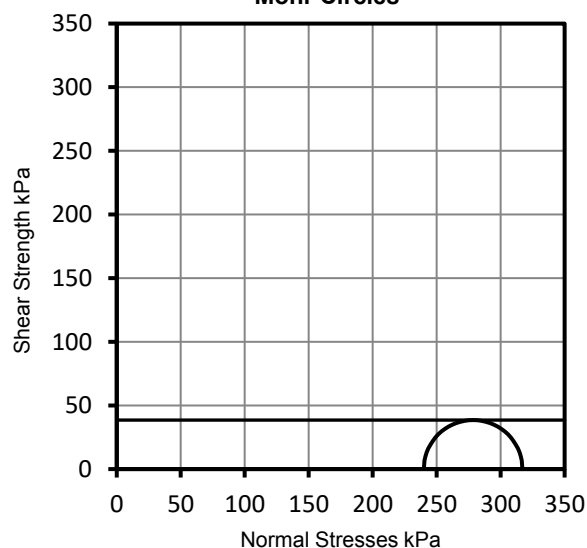
Client: Greenbuild Management Services

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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

Borehole / Trial Pit	Depth (m)	Sample	Description
BH1	12.00	UT24	Grey silty CLAY

Initial Sample	Test Number	1
	Original Length (mm)	430.00
	Depth from Top (mm)	150.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		209.04
Diameter (mm)		103.10
Moisture Content (%)		36.90
Bulk Density (Mg/m ³)		1.80
Dry Density (Mg/m ³)		1.32
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.4
Test Results	Cell Pressure (kPa)	240
	Axial Strain (%)	16
	Membrane Corr. (kPa)	1.07
	Deviator Stress, ($\sigma_1 - \sigma_3$)f (kPa)	77
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)$ f (kPa)	38
Mode of Failure		Plastic

Deviator Stress v Axial Strain

Mohr Circles


Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation:

BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test:

BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

Site: Baglan

Job Number: 70545

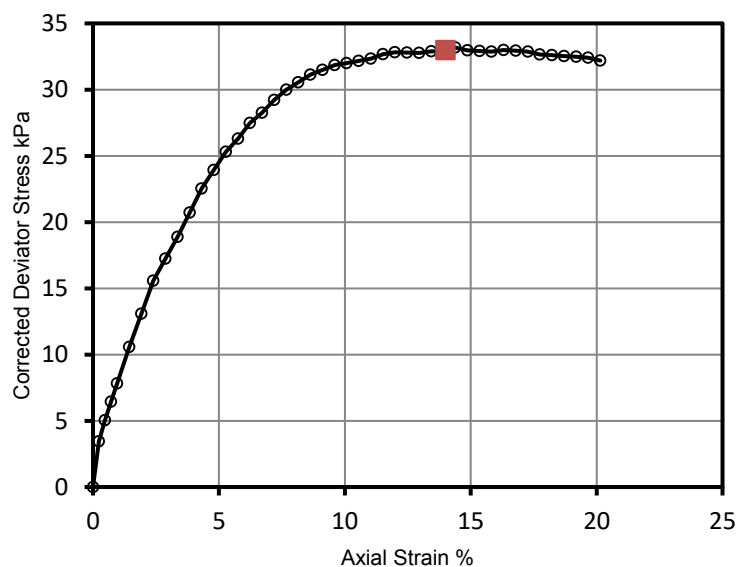
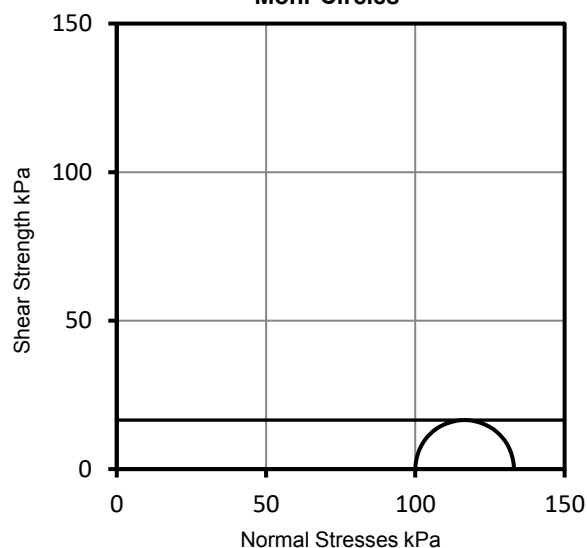
Client: Greenbuild Management Services

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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

Borehole / Trial Pit	Depth (m)	Sample	Description
BH2	5.00	UT11	Grey silty CLAY

Initial Sample	Test Number	1
	Original Length (mm)	400.00
	Depth from Top (mm)	40.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		208.46
Diameter (mm)		103.50
Moisture Content (%)		48.00
Bulk Density (Mg/m ³)		1.70
Dry Density (Mg/m ³)		1.15
Membrane Thickness (mm)		0.36
Membrane Type		Latex
Rate of Strain (%/min)		1.4
Test Results	Cell Pressure (kPa)	100
	Axial Strain (%)	14
	Membrane Corr. (kPa)	1.02
	Deviator Stress, ($\sigma_1 - \sigma_3$)f (kPa)	33
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)$ f (kPa)	17
Mode of Failure		Plastic

Deviator Stress v Axial Strain

Mohr Circles


Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Method of Preparation:

BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test:

BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

Site: Baglan

Job Number: 70545

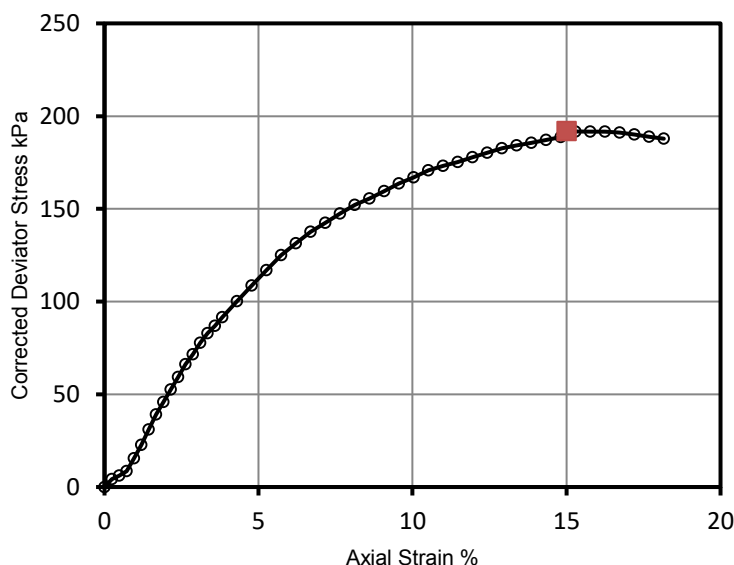
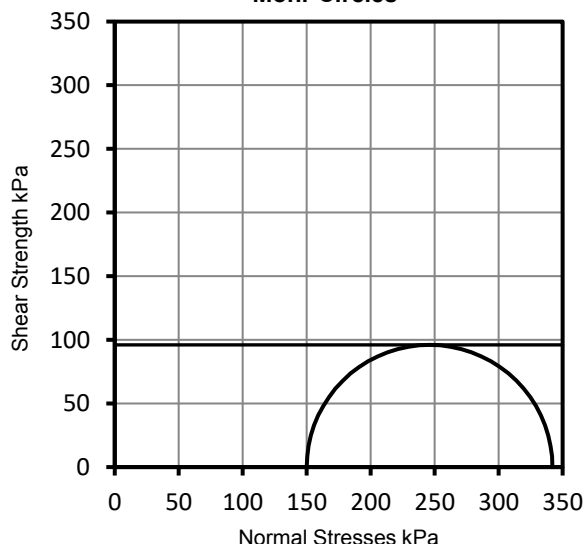
Client: Greenbuild Management Services

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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

Borehole / Trial Pit	Depth (m)	Sample	Description
BH2	7.50	UT16	Black clayey PEAT

Initial Sample	Test Number	1
	Original Length (mm)	400.00
	Depth from Top (mm)	90.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		209.27
Diameter (mm)		102.20
Moisture Content (%)		347.00
Bulk Density (Mg/m ³)		1.02
Dry Density (Mg/m ³)		0.23
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.4
Test Results	Cell Pressure (kPa)	150
	Axial Strain (%)	15
	Membrane Corr. (kPa)	1.03
	Deviator Stress, ($\sigma_1 - \sigma_3$)f (kPa)	192
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)$ f (kPa)	96
	Mode of Failure	Plastic

Deviator Stress v Axial Strain

Mohr Circles


Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation:

BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test:

BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

Site: Baglan

Job Number: 70545

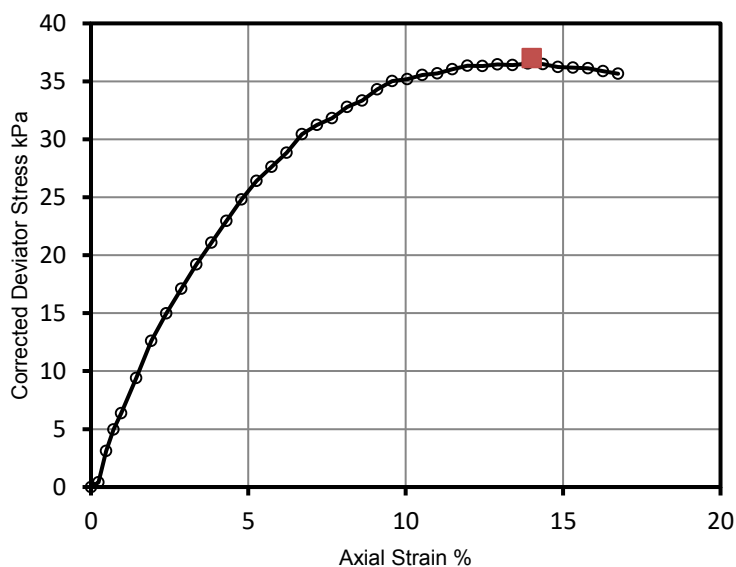
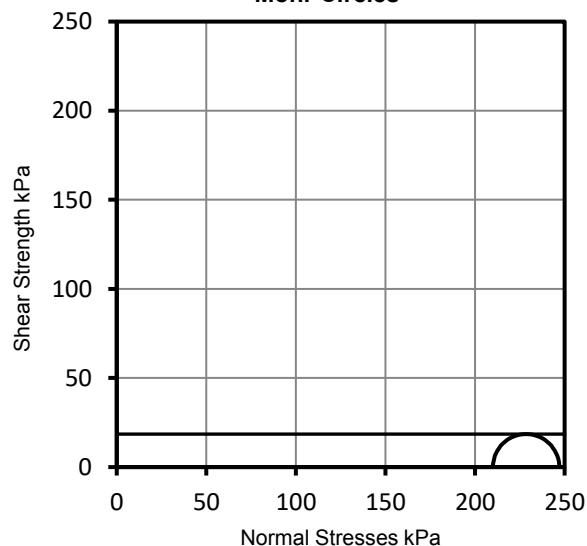
Client: Greenbuild Management Services

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Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

Borehole / Trial Pit	Depth (m)	Sample	Description
BH2	10.50	UT21	Grey silty CLAY

Initial Sample	Test Number	1
	Original Length (mm)	430.00
	Depth from Top (mm)	25.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		209.01
Diameter (mm)		102.12
Moisture Content (%)		32.70
Bulk Density (Mg/m ³)		1.91
Dry Density (Mg/m ³)		1.44
Membrane Thickness (mm)		0.35
Membrane Type		Latex
Rate of Strain (%/min)		1.4
Test Results	Cell Pressure (kPa)	210
	Axial Strain (%)	14
	Membrane Corr. (kPa)	0.98
	Deviator Stress, ($\sigma_1 - \sigma_3$)f (kPa)	37
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)$ f (kPa)	18
Mode of Failure		Plastic

Deviator Stress v Axial Strain

Mohr Circles


Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation:

BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test:

BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)



Final Test Report - 70545 / 1

Site: Baglan
Job Number: 70545
Originating Client: Greenbuild Management Services

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

This test report shall not be reproduced, except in full and only with the written permission of Ian Farmer Associates Ltd.

Samples will be retained for 28 days from date of issue of the final test report before being disposed of, unless we receive written instruction to the contrary.

Report Issue Date: 13/08/2019

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/07476
Issue Number: 1
Date: 15 August, 2019

Client: Ian Farmer Associates (Newcastle)
Unit 4, Faraday Close
Pattinson North Industrial Estate
Washington
Tyne and Wear
NE38 8QJ

Project Manager: Paul Cathcart; washington@ianfarmer.co.uk
Project Name: Baglan
Project Ref: 70545
Order No: 60650
Date Samples Received: 07/08/19
Date Instructions Received: 07/08/19
Date Analysis Completed: 15/08/19

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Iain Haslock
Analytical Consultant

Envirolab Job Number: 19/07476

Client Project Name: Baglan

Client Project Ref: 70545

Lab Sample ID	19/07476/1	19/07476/2	19/07476/3					Units	Limit of Detection	Method ref
Client Sample No	3	13	27							
Client Sample ID	BH1	BH2	BH2							
Depth to Top	1.20	5.60	14.50							
Depth To Bottom										
Date Sampled										
Sample Type	Soil - B	Soil - B	Soil - B							
Sample Matrix Code	4A	5A	4A							
% Stones >10mm _A	59.0	0.2	52.4					% w/w	0.1	A-T-044
pH BRE _D ^{M#}	7.68	7.86	7.42					pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{M#}	181	256	34					mg/l	10	A-T-026s
Sulphate BRE (acid sol) _D ^{M#}	0.30	-	-					% w/w	0.02	A-T-028s
Sulphur BRE (total) _D	0.18	-	-					% w/w	0.01	A-T-024s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921
email. ask@envirolab.co.uk

Client:

Ian Farmer Associates (Newcastle), Unit 4, Faraday Close, Patinson North
Industrial Estate, Washington, Tyne and Wear, NE38 8QJ

Project No:

19/07476

Project:

Baglan

Date Received:

07/08/2019 (am)

Clients Project No: 70545

Cool Box Temperatures (°C): 17.9

Lab Sample ID	19/07476/1	19/07476/2	19/07476/3
Client Sample No	3	13	27
Client Sample ID/Depth	BH1 1.20m	BH2 5.60m	BH2 14.50m
Date Sampled			
Deviation Code			
E (no date)	✓	✓	✓

Key

E (no date) No sampling date provided (all results affected if not provided)

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

PLASTICITY CLASSIFICATION CHART

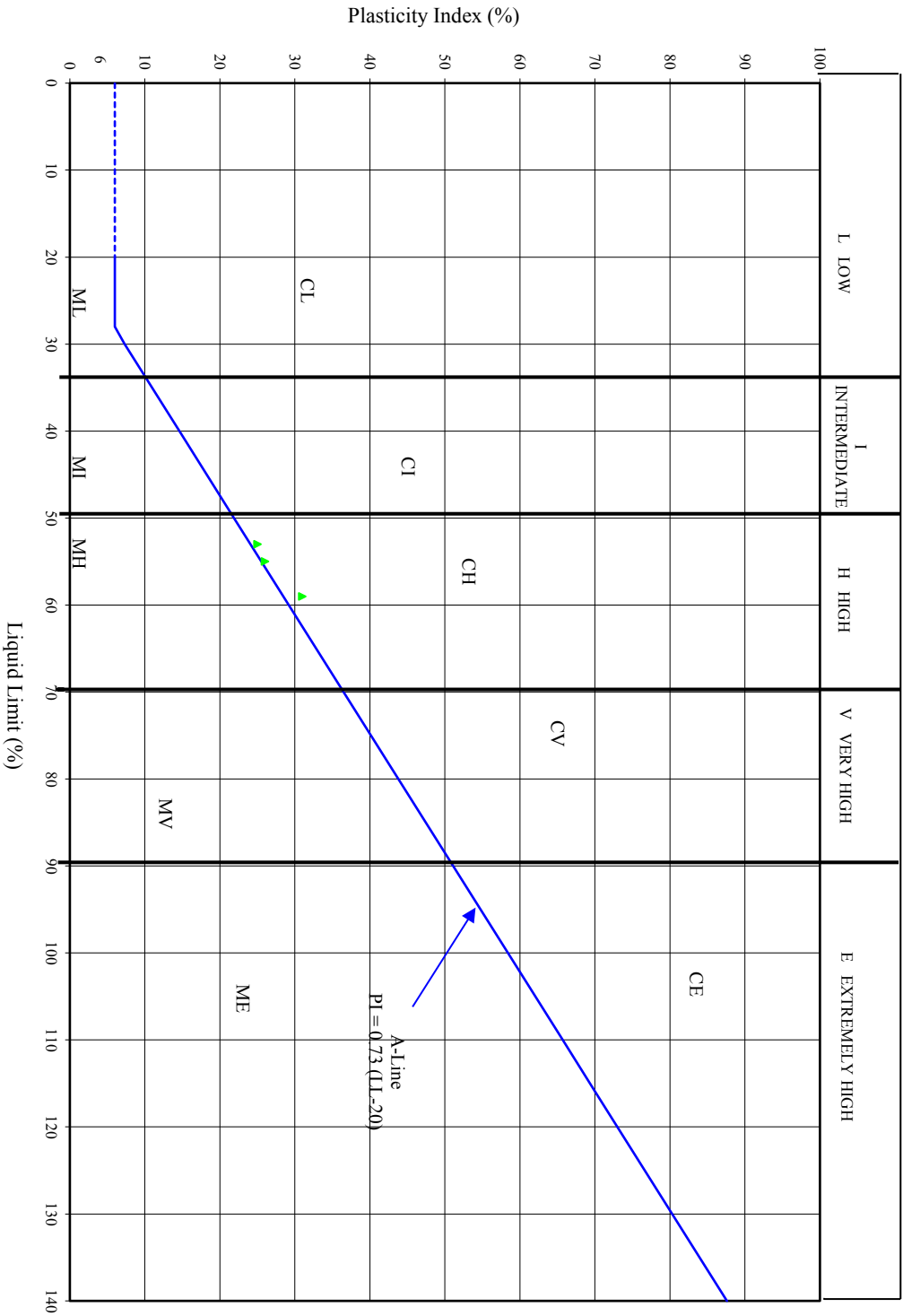
Unit 4, Baglan Industrial Park

Fig no.

A3.1

Job no.

70545



APPENDIX 3

GENERAL NOTES ON LABORATORY TESTS ON SOILS

A3.1 GENERAL

- A3.1.1 Where applicable all tests are carried out in accordance with the relevant British Standard. The laboratory test procedures are given in the laboratory test reports.
- A3.1.2 Any discussion in this report is based on the values and results obtained from the appropriate tests. Due allowance should be made, when considering any result in isolation, of the possible inaccuracy of any such individual result. Details of the accuracy of results are included in this section, where applicable.

A3.2 SOIL CLASSIFICATION

- A3.2.1 Classification of soils is usually undertaken by means of the Plasticity Classification Chart, sometimes called the A-Line Chart. This is graphical plot of PI against LL with the A-Line defined as $PI = 0.73(LL - 20)$.
- A3.2.2 This line is defined from experimental evidence and does not represent a well-defined boundary between soil types, but forms a useful reference datum. When the values of LL and PI for inorganic clays are plotted on the chart they generally lie just above the A-Line in a narrow band parallel to it, while silts and organic clays plot below this line.
- A3.2.3 Clays and silts are divided into five zones of plasticity:
- | | |
|-------------------------------|----------------------|
| Low Plasticity (L) | LL less than 35 |
| Intermediate Plasticity (I) | LL between 35 and 50 |
| High Plasticity (H) | LL between 50 and 70 |
| Very High Plasticity (V) | LL between 70 and 90 |
| Extremely High Plasticity (E) | LL greater than 90 |
- A3.2.4 In general, clays of high plasticity are likely to have a lower permeability, are more compressible and consolidate over a longer period of time under load than clays of low plasticity. Clays of high plasticity are more difficult to compact as fill material.

APPENDIX 4
CHEMICAL TESTS

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/07038
Issue Number: 1
Date: 09 August, 2019

Client: Ian Farmer Associates (Harpenden)
1A Batford Mill
Lower Luton Road
Harpenden
Hertfordshire
UK
AL5 5BZ

Project Manager: Bill Sell/Victoria Tickner
Project Name: Baglan
Project Ref: 70545
Order No: 60646
Date Samples Received: 19/07/19
Date Instructions Received: 24/07/19
Date Analysis Completed: 09/08/19

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Richard Wong
Client Manager

Envirolab Job Number: 19/07038

Client Project Name: Baglan

Client Project Ref: 70545

Lab Sample ID	19/07038/1	19/07038/3	19/07038/5	19/07038/7	19/07038/9			Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1					
Client Sample ID	TP01	TP02	TP03	TP04	TP05					
Depth to Top	0.50	0.50	0.50	0.60	0.60					
Depth To Bottom										
Date Sampled	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19					
Sample Type	Soil - ES	Solid	Solid	Solid	Soil - ES					
Sample Matrix Code	5A	7	7	7	5AE					
% Stones >10mm _A	41.2	<0.1	<0.1	<0.1	17.9			% w/w	0.1	A-T-044
pH _D ^{M#}	8.83	8.22	8.05	9.75	8.56			pH	0.01	A-T-031s
Cyanide (free) _A ^{M#}	<1	-	<1	-	<1			mg/kg	1	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	-	<0.2	-	<0.2			mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	13.5	2.3	1.6	1.6	29.9			% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	4	6	4	<1	4			mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	1.4	<1.0	<1.0	3.6	1.1			mg/kg	1	A-T-027s
Cadmium _D ^{M#}	<0.5	0.7	0.8	<0.5	<0.5			mg/kg	0.5	A-T-024s
Copper _D ^{M#}	19	11	16	4	28			mg/kg	1	A-T-024s
Chromium _D ^{M#}	4	20	69	14	7			mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1			mg/kg	1	A-T-040s
Lead _D ^{M#}	11	15	13	3	16			mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17			mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	18	42	41	15	25			mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	2	<1			mg/kg	1	A-T-024s
Zinc _D ^{M#}	43	76	78	31	72			mg/kg	5	A-T-024s
Leachate Prep BS EN 12457-1 (2:1) (2 no) _A	*	-	-	-	*					A-T-001
Arsenic (leachable) _A [#]	<1	-	-	-	7			µg/l	1	A-T-025w
Boron (leachable) _A [#]	17	-	-	-	307			µg/l	10	A-T-025w
Cadmium (leachable) _A [#]	<1	-	-	-	<1			µg/l	1	A-T-025w
Copper (leachable) _A [#]	<1	-	-	-	6			µg/l	1	A-T-025w
Chromium (leachable) _A [#]	<1	-	-	-	<1			µg/l	1	A-T-025w
Chromium (hexavalent) (leachable) _A	<0.05	-	-	-	<0.05			mg/l	0.05	A-T-040w
Lead (leachable) _A [#]	<1	-	-	-	1			µg/l	1	A-T-025w
Mercury (leachable) _A [#]	<0.1	-	-	-	<0.1			µg/l	0.1	A-T-025w
Nickel (leachable) _A [#]	<1	-	-	-	<1			µg/l	1	A-T-025w
Selenium (leachable) _A [#]	<1	-	-	-	2			µg/l	1	A-T-025w
Zinc (leachable) _A [#]	2	-	-	-	5			µg/l	1	A-T-025w
>C10-C12 (leachable) _A	<10	-	-	-	15			µg/l	10	A-T-007w
>C12-C16 (leachable) _A	<20	-	-	-	<20			µg/l	20	A-T-007w
>C16-C24 (leachable) _A	<20	-	-	-	<20			µg/l	20	A-T-007w
>C24-C36 (leachable) _A	<10	-	-	-	<10			µg/l	10	A-T-007w

Envirolab Job Number: 19/07038

Client Project Name: Baglan

Client Project Ref: 70545

Lab Sample ID	19/07038/1	19/07038/3	19/07038/5	19/07038/7	19/07038/9			Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1					
Client Sample ID	TP01	TP02	TP03	TP04	TP05					
Depth to Top	0.50	0.50	0.50	0.60	0.60					
Depth To Bottom										
Date Sampled	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19					
Sample Type	Soil - ES	Solid	Solid	Solid	Soil - ES					
Sample Matrix Code	5A	7	7	7	5AE					
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	NAD	NAD	NAD					A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A					
EPH Banded 5										
>C10-C12 _A ^{MR}	-	<1	<1	<1	-			mg/kg	1	A-T-007s
>C12-C16 _A ^{MR}	-	4	<2	<2	-			mg/kg	2	A-T-007s
>C16-C24 _A ^{MR}	-	10	3	6	-			mg/kg	2	A-T-007s
>C24-C36 _A ^{MR}	-	12	8	17	-			mg/kg	1	A-T-007s

Envirolab Job Number: 19/07038

Client Project Name: Baglan

Client Project Ref: 70545

Lab Sample ID	19/07038/1	19/07038/3	19/07038/5	19/07038/7	19/07038/9			Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1					
Client Sample ID	TP01	TP02	TP03	TP04	TP05					
Depth to Top	0.50	0.50	0.50	0.60	0.60					
Depth To Bottom										
Date Sampled	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19					
Sample Type	Soil - ES	Solid	Solid	Solid	Soil - ES					
Sample Matrix Code	5A	7	7	7	5AE					
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02	<0.02			mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.10	<0.04	<0.04	<0.04	0.12			mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.06	<0.04	<0.04	<0.04	0.08			mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.13	<0.05	<0.05	<0.05	0.16			mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	<0.05			mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07			mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.15	<0.06	<0.06	<0.06	0.18			mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04			mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	0.15	<0.08	<0.08	<0.08	0.20			mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.02	<0.01	<0.01	<0.01	0.02			mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.04	<0.03	<0.03	<0.03	0.04			mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.04	<0.03	<0.03	<0.03	0.10			mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.23	0.06	0.04	0.04	0.30			mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	0.11	<0.07	<0.07	<0.07	0.15			mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	1.03	<0.08	<0.08	<0.08	1.35			mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/07038

Client Project Name: Baglan

Client Project Ref: 70545

Lab Sample ID	19/07038/1	19/07038/3	19/07038/5	19/07038/7	19/07038/9			Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1					
Client Sample ID	TP01	TP02	TP03	TP04	TP05					
Depth to Top	0.50	0.50	0.50	0.60	0.60					
Depth To Bottom										
Date Sampled	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19					
Sample Type	Soil - ES	Solid	Solid	Solid	Soil - ES					
Sample Matrix Code	5A	7	7	7	5AE					
PAH 16MS (leachable)										
Acenaphthene (leachable) _A	0.19	-	-	-	0.55			µg/l	0.02	A-T-019w
Acenaphthylene (leachable) _A	0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Anthracene (leachable) _A	0.09	-	-	-	0.04			µg/l	0.02	A-T-019w
Benzo(a)anthracene (leachable) _A	<0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Benzo(a)pyrene (leachable) _A	<0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Benzo(b)fluoranthene (leachable) _A	<0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Benzo(ghi)perylene (leachable) _A	<0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Benzo(k)fluoranthene (leachable) _A	<0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Chrysene (leachable) _A	<0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Dibenzo(ah)anthracene (leachable) _A	<0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Fluoranthene (leachable) _A	0.13	-	-	-	0.04			µg/l	0.02	A-T-019w
Fluorene (leachable) _A	0.15	-	-	-	0.16			µg/l	0.02	A-T-019w
Indeno(123-cd)pyrene (leachable) _A	<0.02	-	-	-	<0.02			µg/l	0.02	A-T-019w
Naphthalene (leachable) _A	<0.02	-	-	-	4.22			µg/l	0.02	A-T-019w
Phenanthrene (leachable) _A	0.23	-	-	-	0.15			µg/l	0.02	A-T-019w
Pyrene (leachable) _A	0.08	-	-	-	0.03			µg/l	0.02	A-T-019w
Total PAH 16MS (leachable) _A	0.89	-	-	-	5.19			µg/l	0.02	A-T-019w

Envirolab Job Number: 19/07038

Client Project Name: Baglan

Client Project Ref: 70545

Lab Sample ID	19/07038/1	19/07038/3	19/07038/5	19/07038/7	19/07038/9			Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1					
Client Sample ID	TP01	TP02	TP03	TP04	TP05					
Depth to Top	0.50	0.50	0.50	0.60	0.60					
Depth To Bottom										
Date Sampled	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19	15-Jul-19					
Sample Type	Soil - ES	Solid	Solid	Solid	Soil - ES					
Sample Matrix Code	5A	7	7	7	5AE					
TPH CWG										
Ali >C5-C6 _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	4	-	-	-	7			mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	3	-	-	-	5			mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	4	-	-	-	9			mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	3	-	-	-	6			mg/kg	1	A-T-055s
Ali >C21-C35 _A	6	-	-	-	9			mg/kg	1	A-T-055s
Total Aliphatics _A	18	-	-	-	35			mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	3	-	-	-	5			mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	3	-	-	-	5			mg/kg	1	A-T-055s
Aro >C12-C16 _A	8	-	-	-	18			mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	9	-	-	-	19			mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	15	-	-	-	33			mg/kg	1	A-T-055s
Total Aromatics _A	37	-	-	-	82			mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	55	-	-	-	116			mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.10	-	-	-	<0.10			mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed.

Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921
email. ask@envirolab.co.uk

Client:

Ian Farmer Associates (Harpenden), 1A Batford Mill, Lower Luton Road,
Harpenden, Hertfordshire, UK, AL5 5BZ

Project No:

19/07038

Project:

Baglan

Date Received:

24/07/2019 (am)

Clients Project No: 70545

Cool Box Temperatures (°C): 19.7

Lab Sample ID	19/07038/1	19/07038/3	19/07038/5	19/07038/7	19/07038/9
Client Sample No	1	1	1	1	1
Client Sample ID/Depth	TP01 0.50m	TP02 0.50m	TP03 0.50m	TP04 0.60m	TP05 0.60m
Date Sampled	15/07/19	15/07/19	15/07/19	15/07/19	15/07/19
Deviation Code					
F	✓	✓	✓	✓	✓

Key

F

Maximum holding time exceeded between sampling date and analysis for analytes listed below

HOLDING TIME EXCEEDANCES

Lab Sample ID	19/07038/1	19/07038/3	19/07038/5	19/07038/7	19/07038/9
Client Sample No	1	1	1	1	1
Client Sample ID/Depth	TP01 0.50m	TP02 0.50m	TP03 0.50m	TP04 0.60m	TP05 0.60m
Date Sampled	15/07/19	15/07/19	15/07/19	15/07/19	15/07/19
PAH-16MS	✓	✓	✓	✓	✓
VPHCWG	✓				✓
PAH (total 17)	✓				✓
BTEX (total)	✓				✓

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Final Test Report

Envirolab Job Number: 19/07038
Issue Number: 1

Date: 9-Aug-19

Client: Ian Farmer Associates (Harpenden)
1A Batford Mill
Lower Luton Road
Harpenden
Hertfordshire
UK, AL5 5BZ

Project Manager: Bill Sell/Victoria Tickner
Project Name: Baglan
Project Ref: 70545
Order No: 60646

Date Samples Received: 19-Jul-19
Date Instructions Received: 24-Jul-19
Date Analysis Completed: 9-Aug-19

Notes - Soil analysis

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts

For complex, multi-compound analysis, quality control results do not always fall within chart limits for every compound and we have criteria for reporting in these situations.

If results are in italic font they are associated with such quality control failures and may be unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid

Predominant Matrix Codes: 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample

Secondary Matrix Codes: A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis, NDP indicates No Determination Possible and NAD indicates No Asbestos Detected.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

Prepared by:



Melanie Marshall
Laboratory Coordinator

Approved by:



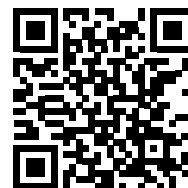
Richard Wong
Client Manager

Sample Details							Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/07038/1						
Client Sample Number				1			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP01						
Depth to Top				0.5						
Depth to Bottom										
Date Sampled				15/07/2019						
Sample Type				Soil - ES						
Sample Matrix Code				5A						
Solid Waste Analysis										
pH (pH Units) _D	A-T-031	N	N	8.83				-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.14				-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.03				-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	N	N	10.1				-	-	10
Total Organic Carbon (%) _D	A-T-032	N	N	7.81				3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	1.1				100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	28				500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007				1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.10				6	-	-
Eluate Analysis				2:1	8:1	2:1	Cumulative 10:1	Limit values for compliance leaching test using		
				mg/l		mg/kg		BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	0.005	0.003	0.010	0.030	0.5	2	25
Barium	A-T-025	N	N	0.047	0.026	0.096	0.280	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.020	0.003	0.041	0.040	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.0005	<0.001	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	30
Nickel	A-T-025	N	N	0.002	0.001	0.003	0.010	0.4	10	40
Lead	A-T-025	N	N	0.002	0.002	0.004	0.020	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	0.001	<0.001	0.003	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.015	0.007	0.031	0.080	4	50	200
Chloride	A-T-026	N	N	3	<1.00	7	<10	800	15000	25000
Fluoride	A-T-026	N	N	0.9	0.3	1.9	3.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	24	4	48	60	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	74	35	151	385	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.01	<0.02	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<20.0	<20.0	<40	<200	500	800	1000
Leach Test Information										
pH (pH Units)	A-T-031	N	N	7.8	7.2					
Conductivity (µS/cm)	A-T-037	N	N	148	71					
Mass Sample (kg)				0.182						
Dry Matter (%)	A-T-044	N	N	96						
Stage 1										
Volume Leachant, L ₂ (l)	A-T-046			0.350						
Filtered Eluate Volume, VE ₁ (l)	A-T-046			0.150						
Stage 2										
Volume Leachant, L ₈ (l)	A-T-046			1.400						
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation										

*Landfill WAC analysis must not be used for hazardous waste classification purposes.
This analysis is only applicable for landfill acceptance and does not give any indication
as to whether a waste may be hazardous or non-hazardous.*

Sample Details							Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/07038/9						
Client Sample Number				1			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP05						
Depth to Top				0.6						
Depth to Bottom										
Date Sampled				15/07/2019						
Sample Type				Soil - ES						
Sample Matrix Code				5AE						
Solid Waste Analysis										
pH (pH Units) _D	A-T-031	N	N	8.56			-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.07			-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	<0.01			-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	N	N	20.3			-	-	10	
Total Organic Carbon (%) _D	A-T-032	N	N	17.3			3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	1.41			100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	47			500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007			1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.10			6	-	-	
Eluate Analysis				2:1	8:1	2:1	Cumulative 10:1	Limit values for compliance leaching test using		
				mg/l		mg/kg		BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.022	0.006	0.046	0.080	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	70
Copper	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.0005	<0.001	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.001	<0.002	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.006	0.004	0.013	0.050	4	50	200
Chloride	A-T-026	N	N	<1.00	<1.00	<2	<10	800	15000	25000
Fluoride	A-T-026	N	N	0.4	0.2	0.9	2.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	65	8	135	132	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	133	34	278	428	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.01	<0.02	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<20.0	<20.0	<40	<200	500	800	1000
Leach Test Information										
pH (pH Units)	A-T-031	N	N	7.7	7.1					
Conductivity (µS/cm)	A-T-037	N	N	266	68					
Mass Sample (kg)				0.191						
Dry Matter (%)	A-T-044	N	N	91.7						
Stage 1										
Volume Leachant, L ₂ (l)	A-T-046			0.350						
Filtered Eluate Volume, VE ₁ (l)	A-T-046			0.150						
Stage 2										
Volume Leachant, L ₈ (l)	A-T-046			1.400						
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation										

Waste Classification Report



C24NZ-8AVHW-PSKTB

Job name

70545 Baglan Industrial Park

Description/Comments

Project

Site

Related Documents

#	Name	Description
None		

Waste Stream Template

Example waste stream template for contaminated soils

Classified by

Name:
Victoria Tickner
Date:
20 Aug 2019 12:31 GMT
Telephone:
01582 460018

Company:
Ian Farmer Associates
1A Baford Mill
Lower Luton Road
Harpenden
AL5 5BZ

Report

Created by: Victoria Tickner
Created date: 20 Aug 2019 12:31 GMT

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	TP01	0.50	Non Hazardous		2
2	TP02	0.50	Non Hazardous		5
3	TP03	0.50	Non Hazardous		7
4	TP04	0.60	Non Hazardous		10
5	TP05	0.60	Non Hazardous		12

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

Classification of sample: TP01

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

Sample details

Sample Name:	LoW Code:
TP01	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% No 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 }	033-003-00-0	215-481-4	1327-53-3	4 mg/kg	1.32	5.281 mg/kg	0.000528 %			
2	boron { diboron trioxide; boric oxide }	005-008-00-8	215-125-8	1303-86-2	1.4 mg/kg	3.22	4.508 mg/kg	0.000451 %			
3	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0	<0.5 mg/kg	1.142	<0.571 mg/kg	<0.0000571 %			<LOD
4	chromium in chromium(III) compounds { chromium(III) oxide }		215-160-9	1308-38-9	4 mg/kg	1.462	5.846 mg/kg	0.000585 %			
5	chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0	<1 mg/kg	1.923	<1.923 mg/kg	<0.000192 %			<LOD
6	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	19 mg/kg	1.126	21.392 mg/kg	0.00214 %			
7	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	11 mg/kg	1.56	17.158 mg/kg	0.0011 %			
8	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	<0.17 mg/kg	1.353	<0.23 mg/kg	<0.000023 %			<LOD
9	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7	18 mg/kg	2.976	53.573 mg/kg	0.00536 %			
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8			<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %			<LOD
11	zinc { zinc chromate }	024-007-00-3			43 mg/kg	2.774	119.288 mg/kg	0.0119 %			
12	TPH (C6 to C40) petroleum group		TPH		55 mg/kg		55 mg/kg	0.0055 %			
13	confirm TPH has NOT arisen from diesel or petrol				☒						
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4	<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	benzene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
	601-020-00-8	200-753-7	71-43-2							
16	toluene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
	601-021-00-3	203-625-9	108-88-3							
17	ethylbenzene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
	601-023-00-4	202-849-4	100-41-4							
18	xylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<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]							
19	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									
20	pH				8.83 pH		8.83 pH	8.83 pH		
			PH							
21	naphthalene				0.04 mg/kg		0.04 mg/kg	0.000004 %		
	601-052-00-2	202-049-5	91-20-3							
22	acenaphthylene				<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
		205-917-1	208-96-8							
23	acenaphthene				<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
		201-469-6	83-32-9							
24	fluorene				0.02 mg/kg		0.02 mg/kg	0.000002 %		
		201-695-5	86-73-7							
25	phenanthrene				0.23 mg/kg		0.23 mg/kg	0.000023 %		
		201-581-5	85-01-8							
26	anthracene				<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
		204-371-1	120-12-7							
27	fluoranthene				0.15 mg/kg		0.15 mg/kg	0.000015 %		
		205-912-4	206-44-0							
28	pyrene				0.11 mg/kg		0.11 mg/kg	0.000011 %		
		204-927-3	129-00-0							
29	benzo[a]anthracene				0.1 mg/kg		0.1 mg/kg	0.00001 %		
	601-033-00-9	200-280-6	56-55-3							
30	chrysene				0.15 mg/kg		0.15 mg/kg	0.000015 %		
	601-048-00-0	205-923-4	218-01-9							
31	benzo[b]fluoranthene				0.13 mg/kg		0.13 mg/kg	0.000013 %		
	601-034-00-4	205-911-9	205-99-2							
32	benzo[k]fluoranthene				<0.07 mg/kg		<0.07 mg/kg	<0.000007 %		<LOD
	601-036-00-5	205-916-6	207-08-9							
33	benzo[a]pyrene; benzo[def]chrysene				0.06 mg/kg		0.06 mg/kg	0.000006 %		
	601-032-00-3	200-028-5	50-32-8							
34	indeno[123-cd]pyrene				0.04 mg/kg		0.04 mg/kg	0.000004 %		
		205-893-2	193-39-5							
35	dibenz[a,h]anthracene				<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
	601-041-00-2	200-181-8	53-70-3							
36	benzo[ghi]perylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-883-8	191-24-2							
37	phenol				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	604-001-00-2	203-632-7	108-95-2							
Total:								0.0285 %		

Key

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

Supplementary Hazardous Property Information

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

Force this Hazardous property to non hazardous because Solid, not liquid. Not deemed flammable at concentrations observed. Inert soil threshold adopted.

Hazard Statements hit:

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

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0055%)

Classification of sample: TP02

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

Sample details

Sample Name:	LoW Code:
TP02	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% No 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 }				6 mg/kg	1.32	7.922 mg/kg	0.000792 %			
	033-003-00-0	215-481-4	1327-53-3								
2	boron { diboron trioxide; boric oxide }				<1 mg/kg	3.22	<3.22 mg/kg	<0.000322 %			<LOD
	005-008-00-8	215-125-8	1303-86-2								
3	cadmium { cadmium oxide }				0.7 mg/kg	1.142	0.8 mg/kg	0.00008 %			
	048-002-00-0	215-146-2	1306-19-0								
4	chromium in chromium(III) compounds { chromium(III) oxide }				20 mg/kg	1.462	29.231 mg/kg	0.00292 %			
		215-160-9	1308-38-9								
5	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1 mg/kg	1.923	<1.923 mg/kg	<0.000192 %			<LOD
	024-001-00-0	215-607-8	1333-82-0								
6	copper { dicopper oxide; copper (I) oxide }				11 mg/kg	1.126	12.385 mg/kg	0.00124 %			
	029-002-00-X	215-270-7	1317-39-1								
7	lead { lead chromate }			1	15 mg/kg	1.56	23.397 mg/kg	0.0015 %			
	082-004-00-2	231-846-0	7758-97-6								
8	mercury { mercury dichloride }				<0.17 mg/kg	1.353	<0.23 mg/kg	<0.000023 %			<LOD
	080-010-00-X	231-299-8	7487-94-7								
9	nickel { nickel chromate }				42 mg/kg	2.976	125.003 mg/kg	0.0125 %			
	028-035-00-7	238-766-5	14721-18-7								
10	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										
11	zinc { zinc chromate }				76 mg/kg	2.774	210.835 mg/kg	0.0211 %			
	024-007-00-3										
12	TPH (C6 to C40) petroleum group		TPH		26 mg/kg		26 mg/kg	0.0026 %			
13	confirm TPH has NOT arisen from diesel or petrol				☒						
14	pH		PH		8.22 pH		8.22 pH	8.22 pH			
15	naphthalene				<0.03 mg/kg		<0.03 mg/kg	<0.000003 %			<LOD
	601-052-00-2	202-049-5	91-20-3								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
16	acenaphthylene	205-917-1	208-96-8		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
17	acenaphthene	201-469-6	83-32-9		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
18	fluorene	201-695-5	86-73-7		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
19	phenanthrene	201-581-5	85-01-8		0.06 mg/kg		0.06 mg/kg	0.000006 %		
20	anthracene	204-371-1	120-12-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
21	fluoranthene	205-912-4	206-44-0		<0.08 mg/kg		<0.08 mg/kg	<0.000008 %		<LOD
22	pyrene	204-927-3	129-00-0		<0.07 mg/kg		<0.07 mg/kg	<0.000007 %		<LOD
23	benzo[a]anthracene	601-033-00-9	200-280-6		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
24	chrysene	601-048-00-0	205-923-4		<0.06 mg/kg		<0.06 mg/kg	<0.000006 %		<LOD
25	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
26	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.07 mg/kg		<0.07 mg/kg	<0.000007 %		<LOD
27	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
28	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %		<LOD
29	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
30	benzo[ghi]perylene	205-883-8	191-24-2		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
Total:								0.0436 %		

Key

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

Supplementary Hazardous Property Information

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

Force this Hazardous property to non hazardous because Solid, not liquid. Not deemed flammable at concentrations observed. Inert soil threshold adopted.

Hazard Statements hit:

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

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0026%)

Classification of sample: TP03

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

Sample details

Sample Name:	LoW Code:
TP03	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% No 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 }				4 mg/kg	1.32	5.281 mg/kg	0.000528 %		
	033-003-00-0	215-481-4	1327-53-3							
2	boron { diboron trioxide; boric oxide }				<1 mg/kg	3.22	<3.22 mg/kg	<0.000322 %		<LOD
	005-008-00-8	215-125-8	1303-86-2							
3	cadmium { cadmium oxide }				0.8 mg/kg	1.142	0.914 mg/kg	0.0000914 %		
	048-002-00-0	215-146-2	1306-19-0							
4	chromium in chromium(III) compounds { chromium(III) oxide }				69 mg/kg	1.462	100.847 mg/kg	0.0101 %		
		215-160-9	1308-38-9							
5	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1 mg/kg	1.923	<1.923 mg/kg	<0.000192 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
6	copper { dicopper oxide; copper (I) oxide }				16 mg/kg	1.126	18.014 mg/kg	0.0018 %		
	029-002-00-X	215-270-7	1317-39-1							
7	lead { lead chromate }			1	13 mg/kg	1.56	20.278 mg/kg	0.0013 %		
	082-004-00-2	231-846-0	7758-97-6							
8	mercury { mercury dichloride }				<0.17 mg/kg	1.353	<0.23 mg/kg	<0.000023 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
9	nickel { nickel chromate }				41 mg/kg	2.976	122.027 mg/kg	0.0122 %		
	028-035-00-7	238-766-5	14721-18-7							
10	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									
11	zinc { zinc chromate }				78 mg/kg	2.774	216.383 mg/kg	0.0216 %		
	024-007-00-3									
12	TPH (C6 to C40) petroleum group		TPH		11 mg/kg		11 mg/kg	0.0011 %		
13	confirm TPH has NOT arisen from diesel or petrol				☒					

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
14	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										
15	pH				8.05 pH		8.05 pH	8.05 pH			
			PH								
16	naphthalene				<0.03 mg/kg		<0.03 mg/kg	<0.000003 %			<LOD
	601-052-00-2	202-049-5	91-20-3								
17	acenaphthylene				<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
		205-917-1	208-96-8								
18	acenaphthene				<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
		201-469-6	83-32-9								
19	fluorene				<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
		201-695-5	86-73-7								
20	phenanthrene				0.04 mg/kg		0.04 mg/kg	0.000004 %			
		201-581-5	85-01-8								
21	anthracene				<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
		204-371-1	120-12-7								
22	fluoranthene				<0.08 mg/kg		<0.08 mg/kg	<0.000008 %			<LOD
		205-912-4	206-44-0								
23	pyrene				<0.07 mg/kg		<0.07 mg/kg	<0.000007 %			<LOD
		204-927-3	129-00-0								
24	benzo[a]anthracene				<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
	601-033-00-9	200-280-6	56-55-3								
25	chrysene				<0.06 mg/kg		<0.06 mg/kg	<0.000006 %			<LOD
	601-048-00-0	205-923-4	218-01-9								
26	benzo[b]fluoranthene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
	601-034-00-4	205-911-9	205-99-2								
27	benzo[k]fluoranthene				<0.07 mg/kg		<0.07 mg/kg	<0.000007 %			<LOD
	601-036-00-5	205-916-6	207-08-9								
28	benzo[a]pyrene; benzo[def]chrysene				<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
	601-032-00-3	200-028-5	50-32-8								
29	indeno[123-cd]pyrene				<0.03 mg/kg		<0.03 mg/kg	<0.000003 %			<LOD
		205-893-2	193-39-5								
30	dibenz[a,h]anthracene				<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
	601-041-00-2	200-181-8	53-70-3								
31	benzo[ghi]perylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
		205-883-8	191-24-2								
32	phenol				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %			<LOD
	604-001-00-2	203-632-7	108-95-2								
Total:									0.0498 %		

Key

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

Supplementary Hazardous Property Information

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

Force this Hazardous property to non hazardous because Solid, not liquid. Not deemed flammable at concentrations observed. Inert soil threshold adopted.

Hazard Statements hit:

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

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0011%)

Classification of sample: TP04

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

Sample details

Sample Name:	LoW Code:
TP04	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.60 m	Entry:
	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No 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 }	033-003-00-0	215-481-4	1327-53-3	<1 mg/kg	1.32	<1.32 mg/kg		<0.000132 %		<LOD
2	boron { diboron trioxide; boric oxide }	005-008-00-8	215-125-8	1303-86-2	3.6 mg/kg	3.22	11.592 mg/kg		0.00116 %		
3	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0	<0.5 mg/kg	1.142	<0.571 mg/kg		<0.0000571 %		<LOD
4	chromium in chromium(III) compounds { chromium(III) oxide }		215-160-9	1308-38-9	14 mg/kg	1.462	20.462 mg/kg		0.00205 %		
5	chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0	<1 mg/kg	1.923	<1.923 mg/kg		<0.000192 %		<LOD
6	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	4 mg/kg	1.126	4.504 mg/kg		0.00045 %		
7	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	3 mg/kg	1.56	4.679 mg/kg		0.0003 %		
8	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	<0.17 mg/kg	1.353	<0.23 mg/kg		<0.000023 %		<LOD
9	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7	15 mg/kg	2.976	44.644 mg/kg		0.00446 %		
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8			2 mg/kg	2.554	5.107 mg/kg		0.000511 %		
11	zinc { zinc chromate }	024-007-00-3			31 mg/kg	2.774	85.999 mg/kg		0.0086 %		
12	TPH (C6 to C40) petroleum group			TPH	23 mg/kg		23 mg/kg		0.0023 %		
13	confirm TPH has NOT arisen from diesel or petrol				☒						
14	pH			PH	9.75 pH		9.75 pH		9.75 pH		
15	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.03 mg/kg		<0.03 mg/kg		<0.000003 %		<LOD

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
16	acenaphthylene	205-917-1	208-96-8		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
17	acenaphthene	201-469-6	83-32-9		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
18	fluorene	201-695-5	86-73-7		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
19	phenanthrene	201-581-5	85-01-8		0.04 mg/kg		0.04 mg/kg	0.000004 %			
20	anthracene	204-371-1	120-12-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
21	fluoranthene	205-912-4	206-44-0		<0.08 mg/kg		<0.08 mg/kg	<0.000008 %			<LOD
22	pyrene	204-927-3	129-00-0		<0.07 mg/kg		<0.07 mg/kg	<0.000007 %			<LOD
23	benzo[a]anthracene	601-033-00-9	200-280-6		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
24	chrysene	601-048-00-0	205-923-4		<0.06 mg/kg		<0.06 mg/kg	<0.000006 %			<LOD
25	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
26	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.07 mg/kg		<0.07 mg/kg	<0.000007 %			<LOD
27	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
28	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %			<LOD
29	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
30	benzo[ghi]perylene	205-883-8	191-24-2		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
Total:									0.0203 %		

Key

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

Supplementary Hazardous Property Information

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

Force this Hazardous property to non hazardous because Solid, not liquid. Not deemed flammable at concentrations observed. Inert soil threshold adopted.

Hazard Statements hit:

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

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0023%)

Classification of sample: TP05

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

Sample details

Sample Name:	LoW Code:
TP05	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.60 m	Entry:
	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No 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 }	033-003-00-0	215-481-4	1327-53-3	4 mg/kg	1.32	5.281 mg/kg	0.000528 %			
2	boron { diboron trioxide; boric oxide }	005-008-00-8	215-125-8	1303-86-2	1.1 mg/kg	3.22	3.542 mg/kg	0.000354 %			
3	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0	<0.5 mg/kg	1.142	<0.571 mg/kg	<0.0000571 %			<LOD
4	chromium in chromium(III) compounds { chromium(III) oxide }		215-160-9	1308-38-9	7 mg/kg	1.462	10.231 mg/kg	0.00102 %			
5	chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0	<1 mg/kg	1.923	<1.923 mg/kg	<0.000192 %			<LOD
6	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	28 mg/kg	1.126	31.525 mg/kg	0.00315 %			
7	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	16 mg/kg	1.56	24.957 mg/kg	0.0016 %			
8	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	<0.17 mg/kg	1.353	<0.23 mg/kg	<0.000023 %			<LOD
9	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7	25 mg/kg	2.976	74.407 mg/kg	0.00744 %			
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8			<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %			<LOD
11	zinc { zinc chromate }	024-007-00-3			72 mg/kg	2.774	199.739 mg/kg	0.02 %			
12	TPH (C6 to C40) petroleum group		TPH		116 mg/kg		116 mg/kg	0.0116 %			
13	confirm TPH has NOT arisen from diesel or petrol				☒						
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4	<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	benzene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
	601-020-00-8	200-753-7	71-43-2							
16	toluene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
	601-021-00-3	203-625-9	108-88-3							
17	ethylbenzene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
	601-023-00-4	202-849-4	100-41-4							
18	xylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<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]							
19	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									
20	pH				8.56 pH		8.56 pH	8.56 pH		
			PH							
21	naphthalene				0.1 mg/kg		0.1 mg/kg	0.00001 %		
	601-052-00-2	202-049-5	91-20-3							
22	acenaphthylene				<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
		205-917-1	208-96-8							
23	acenaphthene				<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
		201-469-6	83-32-9							
24	fluorene				0.02 mg/kg		0.02 mg/kg	0.000002 %		
		201-695-5	86-73-7							
25	phenanthrene				0.3 mg/kg		0.3 mg/kg	0.00003 %		
		201-581-5	85-01-8							
26	anthracene				<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
		204-371-1	120-12-7							
27	fluoranthene				0.2 mg/kg		0.2 mg/kg	0.00002 %		
		205-912-4	206-44-0							
28	pyrene				0.15 mg/kg		0.15 mg/kg	0.000015 %		
		204-927-3	129-00-0							
29	benzo[a]anthracene				0.12 mg/kg		0.12 mg/kg	0.000012 %		
	601-033-00-9	200-280-6	56-55-3							
30	chrysene				0.18 mg/kg		0.18 mg/kg	0.000018 %		
	601-048-00-0	205-923-4	218-01-9							
31	benzo[b]fluoranthene				0.16 mg/kg		0.16 mg/kg	0.000016 %		
	601-034-00-4	205-911-9	205-99-2							
32	benzo[k]fluoranthene				<0.07 mg/kg		<0.07 mg/kg	<0.000007 %		<LOD
	601-036-00-5	205-916-6	207-08-9							
33	benzo[a]pyrene; benzo[def]chrysene				0.08 mg/kg		0.08 mg/kg	0.000008 %		
	601-032-00-3	200-028-5	50-32-8							
34	indeno[123-cd]pyrene				0.04 mg/kg		0.04 mg/kg	0.000004 %		
		205-893-2	193-39-5							
35	dibenz[a,h]anthracene				<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
	601-041-00-2	200-181-8	53-70-3							
36	benzo[ghi]perylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-883-8	191-24-2							
37	phenol				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	604-001-00-2	203-632-7	108-95-2							
Total:								0.0466 %		

Key

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

Supplementary Hazardous Property Information

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

Force this Hazardous property to non hazardous because Solid, not liquid. Not deemed flammable at concentrations observed. Inert soil threshold adopted.

Hazard Statements hit:

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

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0116%)

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 Jul 2015

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

■ **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 May 2015

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

■ **confirm TPH has NOT arisen from diesel or petrol**

Description/Comments: Chapter 3, section 4b requires a positive confirmation for benzo[a]pyrene to be used as a marker in evaluating Carc. 1B; H350 (HP 7) and Muta. 1B; H340 (HP 11)

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: None.

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

CLP index number: 601-023-00-4

Description/Comments:

Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)

Additional Hazard Statement(s): Carc. 2 H351

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

03 Jun 2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2B (77) 2000

■ **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

Description/Comments: Conversion factor based on a worst case compound: sodium cyanide

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

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

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

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

■ **pH** (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

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 Jul 2015

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 Jul 2015

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 Aug 2015
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 Aug 2015
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 Jul 2015
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 Aug 2015
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 Aug 2015
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 Aug 2015
Hazard Statements: Carc. 2 H351

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

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

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

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

boron {diboron trioxide; boric oxide}

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

cadmium {cadmium oxide}

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

chromium in chromium(III) compounds {chromium(III) oxide}

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

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

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

copper {dicopper oxide; copper (I) oxide}

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

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

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

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

zinc {zinc chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

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

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

Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition v1.1, May 2018**

HazWasteOnline Classification Engine Version: 2019.231.3945.7989 (19 Aug 2019)

HazWasteOnline Database: 2019.231.3945.7989 (19 Aug 2019)

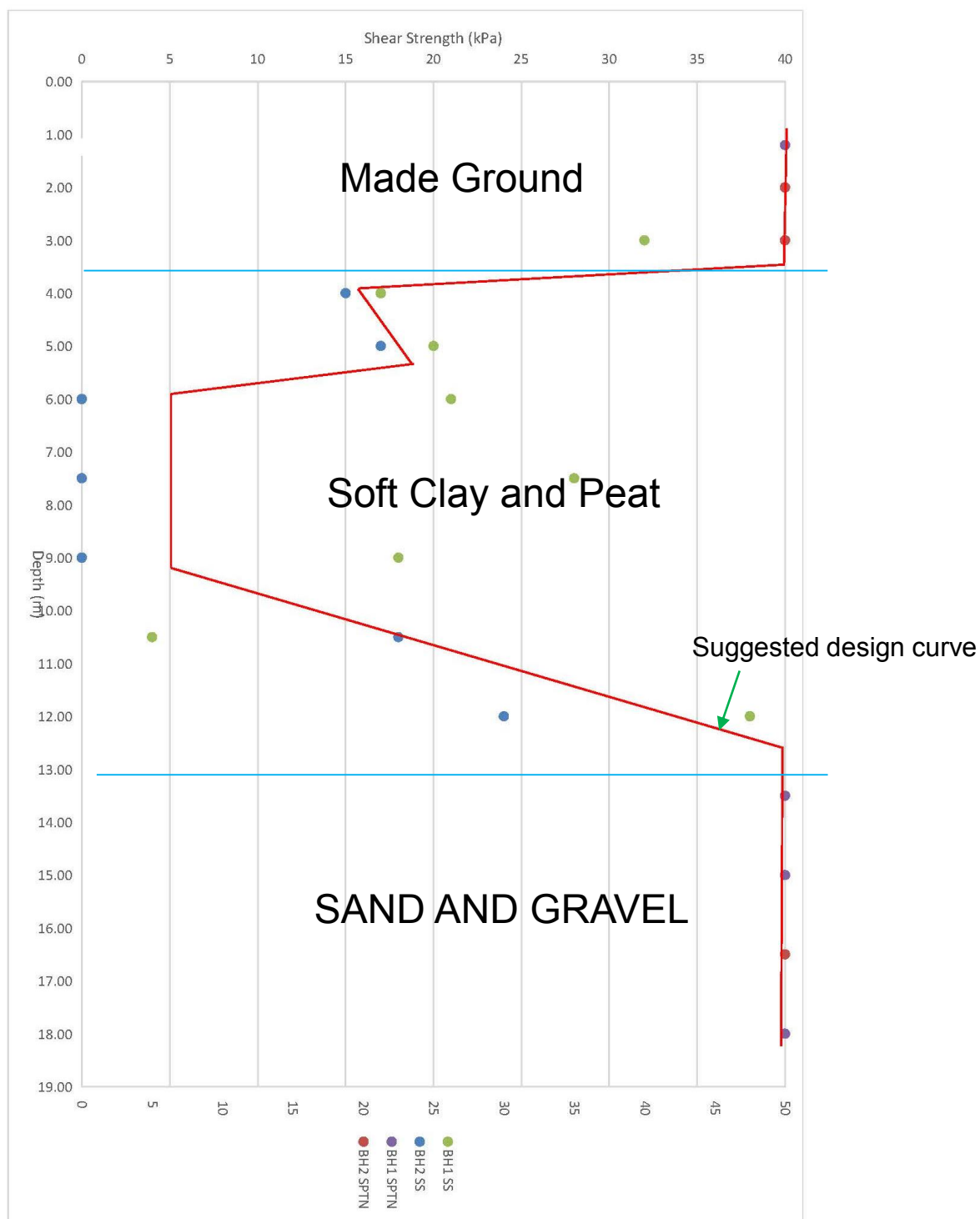
This classification utilises the following guidance and legislation:

WM3 v1.1 - Waste Classification - 1st Edition v1.1 - May 2018
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
HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017
13th ATP - Regulation (EU) 2018/1480 of 4 October 2018
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 5
DESIGN CONSIDERATIONS

Job No: 70545

Site: Sonalyst, Unit 4, Baglan Industrial Estate



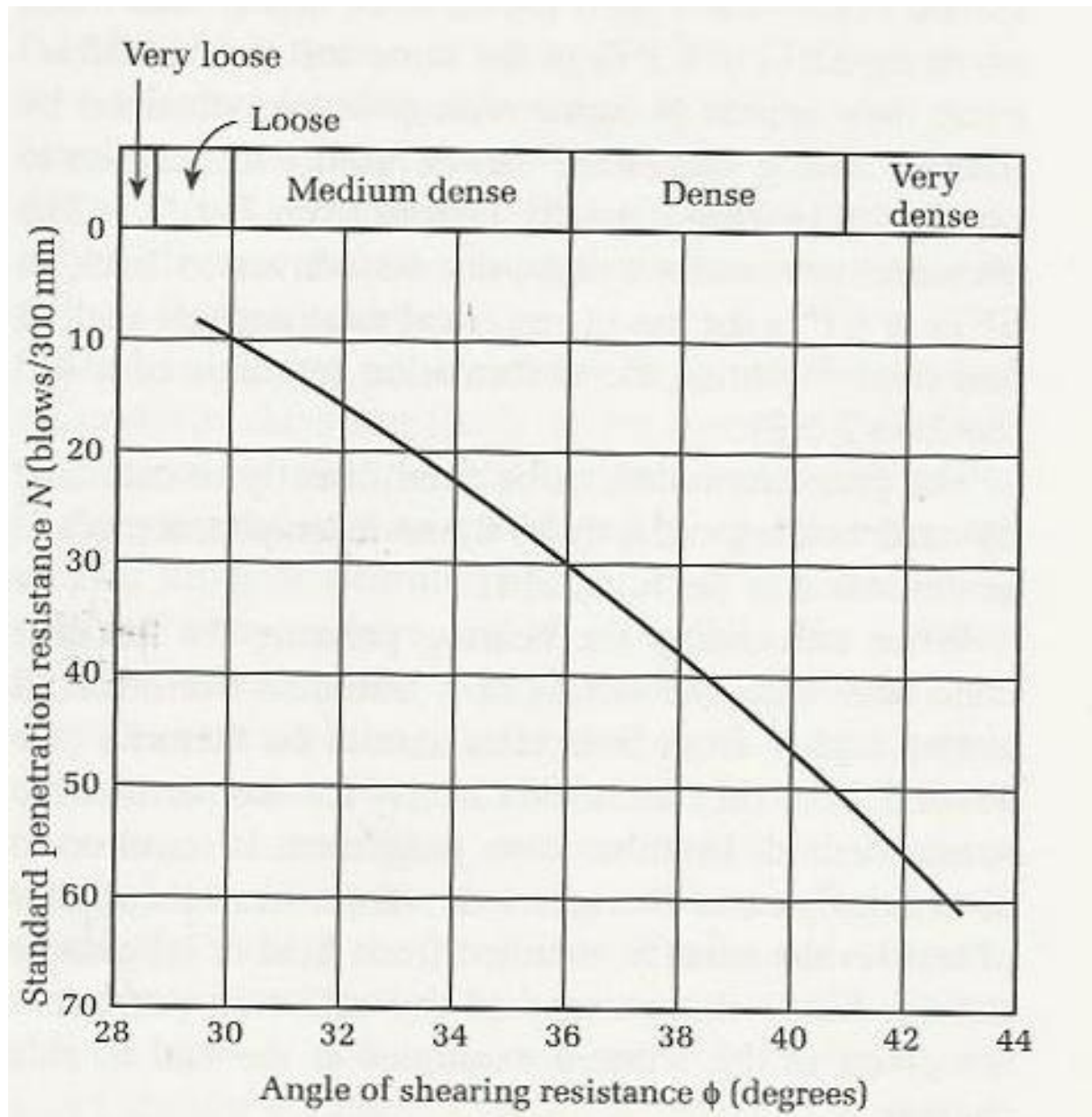
**Plot of SPT N Value and
Shear Strength with depth**

**Figure
A5.1**



Job No: 70545

Site: Unit 4, Baglan Industrial Park



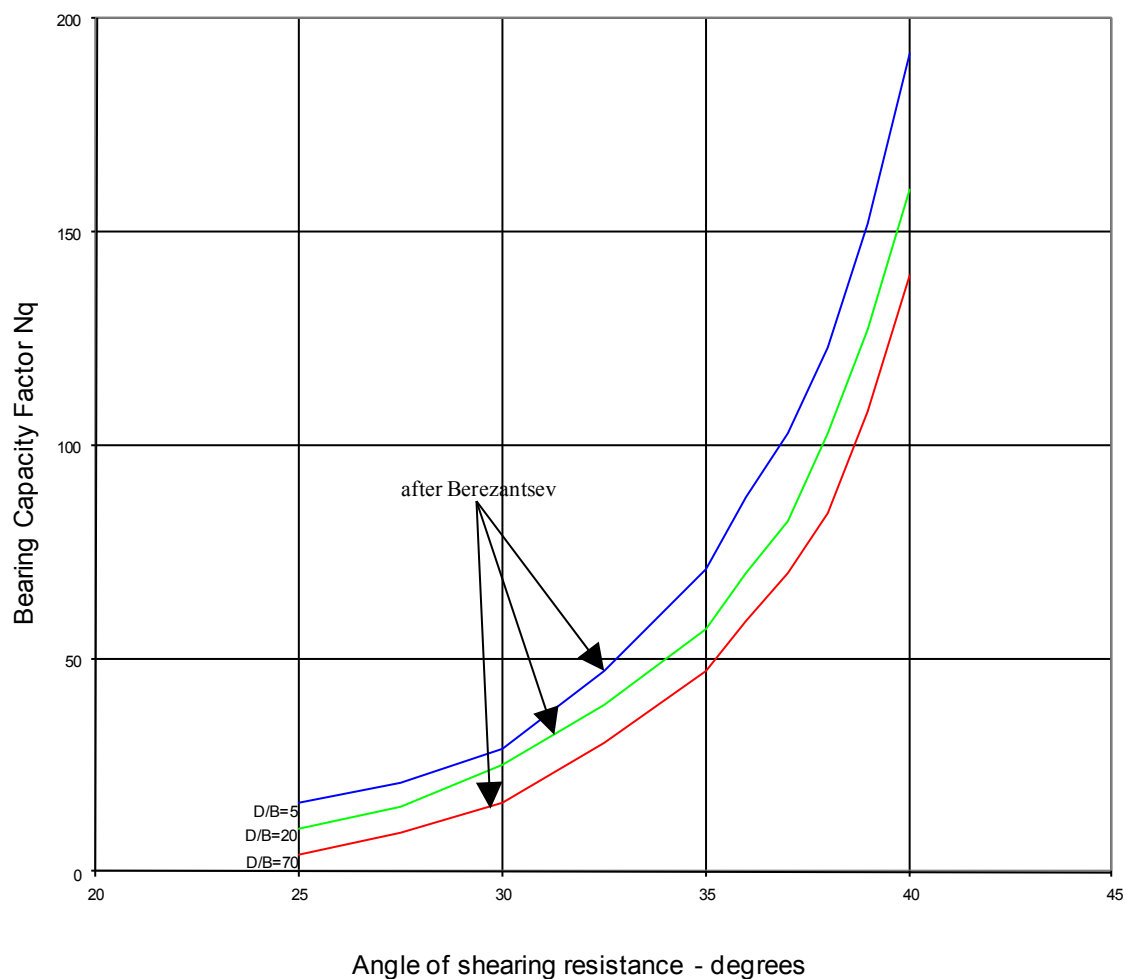
Angle of Shearing Resistance

**Figure
A5.2**



Job No: 70545

Site: Unit 4, Baglan Industrial Park



D = Penetration of bearing stratum
B = Pile diameter or least width

Bearing Capacity Factor

**Figure
A5.3**



APPENDIX 5

GUIDELINES FOR THE DESIGN OF PILES

FIRST APPROXIMATION OF WORKING LOAD

A5.1 GENERAL

The ultimate carrying capacity, Q_u , of a particular pile is taken as the sum of the ultimate shaft friction resistance, Q_s , and the ultimate end bearing resistance, Q_b . This may be expressed as follows:-

$$\begin{aligned} Q_u &= Q_s + Q_b \\ &= f.A_s + q.A_b \end{aligned}$$

where f = unit shaft resistance
 A_s = embedded surface area of pile
 q = unit end bearing resistance
 A_b = effective cross-sectional area of pile base

A5.2 COHESIVE SOILS

A5.2.1 Shaft Resistance

The ultimate shaft resistance, f , for piles in both compression or tension in cohesive soils is determined by applying a factor to the undrained shear strength, C_s , which exists in the soils along the embedded length of the pile, and is given by:-

$$f = \alpha.C_s$$

Where α is an adhesion factor, which for straight-shafted bored piles may be taken as 0.45 to 0.60.

Ultimate unit shaft friction should not exceed 100kPa.

A5.2.2 End Bearing

For piles terminating in cohesive soils, the ultimate unit end bearing resistance q , is given by:-

$$q = N_c.C_b$$

where C_b is the undrained shear strength at the base of the pile
and N_c is a bearing capacity factor

The value of N_c for a cohesive material is variable, depending on the depth of the penetration of the pile into the bearing stratum. Generally, N_c could be taken to have a value of 9, except in the case of large diameter short piles where a lesser value should be used.

A5.3 COHESIONLESS SOILS

A5.3.1 Shaft Resistance

For piles driven in cohesionless soils the ultimate unit shaft resistance, f , may be calculated using the following method, which gives:-

$$f = 0.5\gamma' (D+d) K_s \tan \delta$$

where

γ'	=	average effective unit weight of soil surrounding the pile
D	=	depth to the pile toe or to the base of the granular stratum whichever is the lesser
d	=	depth to the top of the granular stratum
δ	=	angle of friction between pile and soil (see below)
K_s	=	a coefficient (see below)

VALUES OF K_s AND δ

Pile Type	δ	K_s		
		Relative Density		Tension Piles
		Low	High	
Steel	20°	0.5	1.5	0.5
Concrete	0.75 ϕ	1.0	2.0	0.5

The value of ϕ may be interpreted from standard penetration tests, see Figure A5.2.

For bored and cast-in-place piles, $\delta = 22^\circ$ and $K_s = 1$ should be used to allow for loosening of the soil during boring.

It has been found that the ultimate unit shaft resistance does not exceed 100kPa and therefore this value should not be exceeded in design.

A5.3.2 End Bearing

The unit ultimate end bearing resistance (q) of piles in cohesionless soils may be calculated as follows:-

$$q = \gamma' \cdot D \cdot N_q$$

where γ' = average effective unit weight of soil surrounding the pile

D = depth to pile toe

N_q = bearing capacity factor

Values for N_q , where piles penetrate the bearing stratum by more than five diameters, are given in Figure A5.3. In addition, the ultimate unit base resistance should not exceed a value of 11,000kPa. For bored and cast-in-place piles the value of N_q used should correspond to loose soil conditions.

A5.4 FACTORS OF SAFETY

A5.4.1 Cohesive and Non-cohesive Soils

For cohesive and non-cohesive soils a factor of safety of 3 may be used to obtain the allowable or safe carrying capacity of piles from the ultimate carrying capacity.

APPENDIX 6
CONTAMINATION ASSESSMENT

APPENDIX 6

GENERAL NOTES ON CONTAMINATION ASSESSMENT

A6.1 STATUTORY FRAMEWORK AND DEFINITIONS

A6.1.1 The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref. 10.11, which was introduced by the Environment Act 1995, ref. 10.12;

‘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.’

A6.1.2 The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, ref. 10.29 was published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by DEFRA and the Environment Agency and updated version of CLR 9 and 10 were produced in the form of Science Reports SR2, ref. 10.19 and SR3, ref. 10.13.

A6.1.3 In establishing whether a site fulfils the statutory definition of ‘contaminated land’ it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A6.1.4 A ‘pollutant linkage’ may be defined as the link between a contaminant ‘source’ and a ‘receptor’ by means of a ‘pathway’.

A6.2 ASSESSMENT METHODOLOGY

A6.2.1 The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

- A6.2.2 Stages 1 and 2 develop a '*conceptual model*' based upon information collated from desk based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2, ref. 10.32. The formation of a conceptual model is an iterative process and as such, it should be updated and refined throughout each stage of the project to reflect any additional information obtained.
- A6.2.3 The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3, ref. 10.33. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. CLR 8, ref. 10.34, together with specific DoE 'Industry Profiles' provides guidance on the nature of contaminants relating to specific industrial processes. Although CLR 8 has been withdrawn, no replacement guidance has been published that lists the contaminants likely to be present on contaminated sites and as such the guidance relating to this issue of CLR 8 is considered to still be relevant.
- A6.2.4 If potential pollutant linkages are identified within the conceptual model, a Phase 2 site investigation and report will be recommended. The investigation should be planned in general accordance with CLR 4, ref. 10.1. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the conceptual model can be updated and relevant pollutant linkages can be identified.
- A6.2.5 A two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.
- A6.2.6 All site works should be in general accordance with the British Standards, BS 5930:1999, ref. 10.3, ISO 1997, ref. 10.4 and BS 10175:2001, ref. 10.2.
- A6.2.7 The generic contamination risk assessment screens the results of the chemical analysis against generic guidance values which are dependent on the proposed end-use of the development.
- A6.2.8 The end-use may be defined as one of the following ref. 10.17;
- Residential with homegrown produce – domestic low rise and low density housing with gardens where vegetable may be grown for home consumption
 - Residential without homegrown produce – domestic low density and low density housing where no gardens are present.
 - Allotments – specific areas where vegetables are grown for home consumption.
 - Public open space in close proximity to residential housing – includes the predominantly grassed area adjacent to high density housing and the central green area around which houses are developed. This land-use includes the smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting.

- Public open space in use as general parkland – provided for recreational use and may be used for family visits and picnics, children’s play area, sports grounds and dog walking.
- Commercial – industrial premises where there is limited exposure to soil.

A6.2.9 Exposure pathways for each type of end-use are given below:

Standard Land Use	Oral Routes			Dermal Routes		Inhalation Routes			
	Direct soil & dust ingestion	Consumption of homegrown produce	Soil attached to homegrown produce	Indoor	Outdoor	Indoor dust	Outdoor dust	Indoor vapour	Outdoor vapour
Residential with homegrown produce	✓	✓	✓	✓	✓	✓	✓	✓	✓
Residential without homegrown produce	✓	X	X	✓	✓	✓	✓	✓	✓
Allotments	✓	✓	✓	X	✓	X	✓	✓	✓
Public open space – adjacent to dwellings	✓	X	X	✓	✓	✓	✓	X	✓
Public open space – parkland	✓	X	X	X	✓	X	✓	X	✓
Commercial	✓	X	X	✓	X	✓	X	✓	X

A6.2.10 Soils will be compared to Suitable 4 Use Levels (S4ULs) published by LQM ref. 10.15 Assessment Criteria. However, no S4UL has been produced for lead and, therefore, the DEFRA C4SL has been adopted ref. 10.17. Where no S4UL or C4SL is available, the assessment criteria (AC) are generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.071, ref. 10.16. Toxicological and physico-chemical/fate and transport data used to generate the AC has been derived from a hierarchy of data sources as follows:

1. Environment Agency or Department of Environment Food and Rural Affairs (DEFRA) documents;
2. Other documents produced by UK Government or state organisations;
3. European institution documents;
4. International organisation documents;
5. Foreign government institutions.

A6.2.11 In the case of the majority of contaminants considered, the toxicological data has been drawn from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), ref. 10.14, where available. Where no TOX report is available reference has been made to the health criteria values, derived for use in Land Quality Press (2006), ref. 10.20, as this is considered to represent a peer reviewed data source. Similarly, fate and transport data has been derived in the first instance from Environment Agency (2003), ref. 10.35 and for contaminants not considered in this document the fate and transport data used in previous versions of the CLEA model has been used.

- A6.2.12 Chemical laboratory test results are processed as follows. Analysis of the results is conducted, as detailed in CIEH and CL:AIRE 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', ref. 10.15. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.
- A6.2.13 Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.
- A6.2.14 The risk evaluation will address the potential pollutant linkages between an identified source of contamination and the likely receptors both on and off site.
- A6.2.15 The potential receptors include:
- 1) Humans – current site occupants, construction workers, future site users and neighbouring site users.
 - 2) Controlled Waters – surface water and groundwater resources
 - 3) Plants – current and future site vegetation
 - 4) Building materials
- A6.2.16 The potential hazards to be considered in relation to contamination are:
- a) Ingestion and inhalation.
 - b) Uptake of contaminants via cultivated vegetables.
 - c) Dermal contact
 - d) Phytotoxicity (the prevention or inhibition of plant growth)
 - e) Contamination of water resources
 - f) Chemical attack on building materials and services
 - g) Fire and explosion
- A6.2.17 Dependent on the outcome of the initial, generic contamination risk assessment, further detailed assessment of the identified risks may be required.

A6.3 Generic Guidance Values Used Within Contamination Risk Assessment

Commercial End Use

Commercial	Determinant	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Primary Data Source
		1% SOM	2.5% SOM	6% SOM	
PAH	Acenaphthene	84000	97000	100000	LQM/CIEH S4UL
	Acenaphthylene	83000	97000	100000	LQM/CIEH S4UL
	Anthracene	520000	540000	540000	LQM/CIEH S4UL
	Benzo(a)anthracene	170	170	180	LQM/CIEH S4UL
	Benzo(a)pyrene	35	35	36	LQM/CIEH S4UL
	Benzo(b)fluoranthene	44	44	45	LQM/CIEH S4UL
	Benzo(ghi)perylene	3900	4000	4000	LQM/CIEH S4UL
	Benzo(k)fluoranthene	1200	1200	1200	LQM/CIEH S4UL
	Chrysene	350	350	350	LQM/CIEH S4UL
	Dibenzo(ah)anthracene	3.5	3.6	3.6	LQM/CIEH S4UL
	Fluoranthene	23000	23000	23000	LQM/CIEH S4UL
	Fluorene	63000	68000	71000	LQM/CIEH S4UL
	Indeno(123-cd)pyrene	500	510	510	LQM/CIEH S4UL
	Naphthalene	190	460	1100	LQM/CIEH S4UL
	Phenanthrene	22000	22000	23000	LQM/CIEH S4UL
	Pyrene	54000	54000	54000	LQM/CIEH S4UL
Other Organics	Phenol	760	1500	3200	LQM/CIEH S4UL
Metals	Arsenic	640	640	640	LQM/CIEH S4UL
	Beryllium	12	12	12	LQM/CIEH S4UL
	Boron	240000	240000	240000	LQM/CIEH S4UL
	Cadmium	190	190	190	LQM/CIEH S4UL
	Chromium (III)	8600	8600	8600	LQM/CIEH S4UL
	Chromium (VI)	49	49	49	LQM/CIEH S4UL
	Copper	68000	68000	68000	LQM/CIEH S4UL
	Lead	2330	2330	2330	DEFRA C4SL
	Mercury	58	58	58	LQM/CIEH S4UL
	Nickel	980	980	980	LQM/CIEH S4UL
	Selenium	12000	12000	12000	LQM/CIEH S4UL
	Vanadium	9000	9000	9000	LQM/CIEH S4UL
	Zinc	730000	730000	730000	LQM/CIEH S4UL

Commercial	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Primary Data Source
	1% SOM	2.5% SOM	6% SOM	
Aliphatic				
EC 5-6	3200 (304)	5900 (558)	12000 (1150)	LQM/CIEH S4UL
EC >6-8	7800 (144)	17000 (322)	40000 (736)	LQM/CIEH S4UL
EC >8-10	2000 (78)	4800 (190)	11000 (451)	LQM/CIEH S4UL
EC >10-12	9700 (48)	23000 (118)	47000 (283)	LQM/CIEH S4UL
EC >12-16	59000 (24)	82000 (59)	90000 (142)	LQM/CIEH S4UL
EC >16-35	1600000	1700000	1800000	LQM/CIEH S4UL
EC >35-44	1600000	1700000	1800000	LQM/CIEH S4UL
Aromatic				
EC 5-7 (benzene)	26000 (1220)	46000 (2260)	86000 (4710)	LQM/CIEH S4UL
EC >7-8 (toluene)	56000 (869)	110000 (1920)	180000 (4360)	LQM/CIEH S4UL
EC >8-10	3500 (613)	8100 (1500)	17000 (3580)	LQM/CIEH S4UL
EC >10-12	16000 (364)	28000 (899)	34000 (2150)	LQM/CIEH S4UL
EC >12-16	36000 (169)	37000	38000	LQM/CIEH S4UL
EC >16-21	28000	28000	28000	LQM/CIEH S4UL
EC >21-35	28000	8000	28000	LQM/CIEH S4UL
EC >35-44	28000	28000	28000	LQM/CIEH S4UL
Aliphatic and Aromatic				
EC >44-70	28000	28000	28000	LQM/CIEH S4UL
BTEX				
Benzene	27	47	90	LQM/CIEH S4UL
Toluene	56000	110000	180000	LQM/CIEH S4UL
Ethylbenzene	5700	13000	27000	LQM/CIEH S4UL
m/p Xylenes	5900	14000	30000	LQM/CIEH S4UL
o Xylene	17000	24000	33000	LQM/CIEH S4UL

SOM = Soil Organic Matter

Values in brackets indicate the vapour saturation limit where this is exceeded by the GAC or SGV

A6.4 Guidance Values Used For Assessment of Risk To Controlled Waters

Contaminant	Units	EQS Freshwater ¹	EQS Saltwater ¹	Water Supply ⁵
Alachlor	ug/l	0.7	0.7	
Abamectin	ug/l	0.03	0.01	
Acrylamide	ug/l			0.1
Aluminium	ug/l	10 ³	25	200
Ammonia (unionised)	ug/l	15	21 ²	
Ammonium (as NH4)	mg/l			0.5
Anthracene	ug/l	0.4	0.4	
Antimony	ug/l			5
Arsenic	ug/l	50 ²	25 ²	10
Atrazine	ug/l	2	2	
Azamethiphos	ug/l	0.05	0.05	
Barium	ug/l			1000
Benzene	ug/l	50	50	1
Benzyl-butyl-phthalate	ug/l	7.5 ²	0.75 ²	
Boron	mg/l	2	7	1
Brominated Diphenylether	ug/l	0.0005 ²	0.0005 ²	
Bromine	ug/l	5	10	
Bromoxynil	ug/l	1000	1000	
Cadmium	ug/l	0.45 ³	0.2 ²	5
Calcium	mg/l			250
Carbon Tetrachloride	ug/l	12 ²	12 ²	
Carbendazin	ug/l	0.15 ²	-	
C10-C13 Chloroalkanes	ug/l	1.4	1.4	
Chlorenvinphos	ug/l	0.3	0.3	
Chlorpyrifos (Chlorpyrifos-ether)	ug/l	0.1	0.1	
Chlorothalonil	ug/l	0.035 ²	-	
Cyclodiene Pesticides (aldrin, Dieldrin, Endrin, Isodrin)	ug/l	Σ=0.01 ²	Σ=0.005 ²	
Chloride	mg/l	250	-	400
Chlorpropham	ug/l	40	40	
Chlortoluron	ug/l	20	-	
Chromium III	ug/l	4.7 ²	-	50
Chromium VI	ug/l	3.4 ²	0.6 ²	
Cobalt	ug/l	100	100	
Copper	ug/l	1 ²	3.76 ²	2000
Coumaphos	ug/l	0.1	0.1	
Cyanide (hydrogen cyanide)	ug/l	1 ²	1 ²	50
Cypermethrin	ug/l	0.1 ²	0.1 ²	
Cyfluthrin	ug/l	0.001	0.001	
1,2-Dichloroethane	ug/l			3
2,4-Dichlorophenoxyacetic acid (2,4-D)	ug/l	0.3 ²	0.3 ²	
2,4-Dichlorophenol	ug/l	4.2 ²	0.042 ²	
3,4-Dichloroaniline	ug/l	0.2 ²	0.2 ²	
DDT (total)	ug/l	0.025 ²	0.025 ²	
Diazinon	ug/l	0.01 ²	0.01 ²	
Dibutylphthalate (DBP)	ug/l	40	40	
Dichlorobenzenes (all isomers)	ug/l	200	200	
para, para-DDT	ug/l	0.01 ²	0.01 ²	
Diethylphthalate (DEP)	ug/l	1000	1000	
Dimethylphthalate (DMP)	ug/l	4000	4000	
Diethylphthalate (DOP)	ug/l	40	40	
Dimethoate	ug/l	0.48 ²	0.48 ²	
Diflubenzuron	ug/l	0.015	0.1	
Doromectin	ug/l	0.01	0.01	
Diuron	ug/l	1.8	1.8	
Endosulfan	ug/l	0.01	0.004	
Epichlorohydrin	ug/l			0.1
EDTA	ug/l	4000	4000	
Ethylbenzene	ug/l	200	200	
Fenchlorphos	ug/l	0.1	0.1	
Flucofuron	ug/l	1	1	
Fluoride	mg/l	3 ⁴	15	1.5
Fluoranthene	ug/l	1	1	
Formaldehyde	ug/l	50	-	

Contaminant	Units	EQS Freshwater ¹	EQS Saltwater ¹	Water Supply ⁵
Glyphosate	ug/l	196 ²	196 ²	
Hexachlorobenzene	ug/l	0.05	0.05	
Hexachlorobutadiene	ug/l	0.6	0.6	
Hexachlorocyclohexane (lindane)	ug/l	0.04	0.02	
Hydrogen Sulphide	ug/l	1	10	
Ioxynil	ug/l	100	100	
Iron	ug/l	1000 ²	1000 ²	200
Isoproturon	ug/l	1	1	
Ivermectin	ug/l	0.001	0.001	
Kjeldahl Nitrogen (as N)	mg/l			1
Lead	ug/l	7.2 ²	7.2 ²	10
Linuron	ug/l	0.5 ²	0.5 ²	
Malachite Green	ug/l	100	100	
Magnesium	mg/l			50
Manganese	ug/l	123 ²	-	50
Mecoprop	ug/l	18 ²	18 ²	
Methiocarb	ug/l	0.01 ²	-	
Mancozeb	ug/l	20	20	
Maneb	ug/l	30	30	
MCPA	ug/l	120 ³	800	
Methylphenols	ug/l	300	300	
Mevinphos	ug/l	0.02	-	
Monochlorophenols	ug/l	250	250	
Mercury	ug/l	0.07	0.07	1
Naphthalene	ug/l	2.4 ²	1.2 ²	
Nickel	ug/l	20 ²	20 ²	20
NTA	ug/l	10000	30000	
Nitrate (as N)	mg/l			50
Nitrite (as NO ₂)	mg/l			0.5
Nonylphenol (4-nonylphenol)	ug/l	2	2	
Oils/hydrocarbons	ug/l			10
Pendimethalin	ug/l	0.3 ²	-	
Permethrin	ug/l	0.001 ²	0.0002 ²	
Polycyclic Aromatic Hydrocarbons (PAH)	ug/l			0.1
- Benzo(a)pyrene	ug/l	0.1	0.1	0.01
- Benzo(b)fluoranthene	ug/l	Σ=0.03 ²	Σ=0.03 ²	
- Benzo(k)fluoranthene	ug/l			
- Benzo(ghi)perylene	ug/l	Σ=0.002 ²	Σ=0.002	
- Indeno(123-cd)perylene	ug/l			
Pentachlorobenzene	ug/l	0.007 ²	0.0007 ²	
Pentachlorophenol	ug/l	1	1	
Pesticides (individual)	ug/l			0.1
- Aldrin	ug/l			0.03
- Dieldrin	ug/l			0.03
- Heptachlor	ug/l			0.03
- Heptachlor epoxide	ug/l			0.03
Pesticides (total)	ug/l			0.5
Phenol	ug/l	7.7 ²	7.7 ²	0.5
PCSDs	ug/l	0.05	0.05	
Pirimicarb	ug/l	5	5	
Pendimethalin	ug/l	6	6	
Primaphos-methyl	ug/l	0.05	0.05	
Prochloraz	ug/l	40	40	
Propetamphos	ug/l	0.1	0.1	
Propyzamide	ug/l	1000	1000	
Phosphorous	ug/l			2200
Potassium	mg/l			12
Selenium	ug/l			10
Silver	ug/l	0.1	1	10
Simazine	ug/l	4	4	
Styrene	ug/l	500	500	
Sulcofuron	ug/l	25	25	
Sulphate	mg/l	400	-	250
Surfactants (as lauryl sulphate)	ug/l			200
Tecnazene	ug/l	10	10	
Tetrachloromethane (PCM)	ug/l	2.5 ²	2.5 ²	3

Contaminant	Units	EQS Freshwater ¹	EQS Saltwater ¹	Water Supply ⁵
Tetrachloroethylene (PCE)	ug/l	10 ²	10 ²	10
Tetrachloroethane	ug/l	140 ²	-	
Trichloroethylene (TCE)	ug/l	10 ²	10 ²	10
Thiabendazole	ug/l	50	50	
Tin (inorganic)	ug/l	25 ²	10 ²	
Trihalomethanes	ug/l			100
Trichlorobenzenes	ug/l	0.4 ²	0.4 ²	
Toluene	ug/l	74 ²	74 ²	
Tributyl phosphate	ug/l	500	500	
Tributyltin	ug/l	0.0015	0.0015	
Trifluralin	ug/l	0.03 ²	0.03 ²	
Vanadium	ug/l	20 ⁴	100	
Vinyl chloride	ug/l			0.5
Zinc	ug/l	11.9 ²	7.9 ²	5000

¹ MAC – Maximum Allowed Concentration

² AA – Average Annualised

³ Dependant on pH

⁴ Dependant on water hardness

⁵ For sample taken at consumers' taps

Total Petroleum Hydrocarbons (TPH)	Guideline Value (ug/l)	Source
- Aliphatic EC5-EC6	15000	WHO (2008) ¹
- Aliphatic >EC6-EC8	15000	
- Aliphatic >EC8-EC10	300	
- Aliphatic >EC10-EC12	300	
- Aliphatic >EC12-EC16	300	
- Aliphatic >EC16-EC21	-	
- Aliphatic >EC21-EC35	-	
- Aromatic EC5-EC6	10 (benzene)	
- Aromatic >EC6-EC8	700 (toluene)	
- Aromatic >EC8-EC10	300 (ethylbenzene) 500 (xylenes)	
- Aromatic >EC10-EC12	90	
- Aromatic >EC12-EC16	90	
- Aromatic >EC16-EC21	90	
- Aromatic >EC21-EC35	90	

¹ As referenced in CL:AIRE (2017)

Test Group	Testing Required?	PE Threshold	Metal Pipe/ Barrier Pipe	Limit of Detection	UKAS Accredited	Maximum concentration at proposed pipeline depth See Note [2]	Maximum site concentration See Note [3]	Locations and depths where concentrations exceed proposed pipeline threshold
Total VOCs	Where PRA has identified land potentially affected by contamination	0.5	Pass					
Total BTEX & MTBE		0.1	Pass	0.01-0.1	Y		<0.1	
Total SVOCs (excluding PAHs and those substance marked with an *)		2	Pass					
EC5-EC10 aliphatic & aromatic hydrocarbons		2	Pass	0.01-1	Y		13	TP01 at 0.50m bgl TP05 at 0.60m bgl
EC10-EC16 aliphatic & aromatic hydrocarbons		10	Pass	1-2	Y		37	
EC16-EC40 aliphatic & aromatic hydrocarbons		500	Pass	1-2	Y		67	
Phenols (from SVOC analysis)		2	Pass	0.2	Y		<0.2	
Cresols & chlorinated phenols (from SVOC analysis)	2	Pass	Pass					
Ethers*	Only where identified	0.5	Pass					
Nitrobenzene*		0.5	Pass					
Ketones*		0.5	Pass					
Aldehydes*		0.5	Pass					
Amines*		Fail	Pass					
Corrosive		Pass	See Note[1]	-	Y		9.75	
All concentrations in mg/kg								
Note [1] Threshold: For wrapped steel, corrosive if pH<7 and conductivity >400uS/cm. For wrapped ductile iron corrosive if pH<5, Eh not neutral and conductivity >400uS/cm. For copper, corrosive if pH<5 or >8 and Eh positive.								
Note [2] Water pipes are normally laid at 0.75-1.35m below finished ground level.								
Note [3] Also state if liquid free product is present in soil or groundwater.								
								Job No: 70545
Sonalyst, Unit 4, Baglan Industrial Park, Port Talbot, SA12 7DJ								Fig. No: A6.1

APPENDIX 7
GAS GENERATION

APPENDIX 7

GENERAL NOTES ON GAS GENERATION

A7.1 GENERAL

- A7.1.1 In the past, a series of guidance documents were published by CIRIA, ref. 10.36, providing advice on hazards associated with methane. This earlier guidance was consolidated in CIRIA Document C659 to provide a risk based approach to gas contaminated land. This was subsequently re-issued as CIRIA Document C665, ref. 10.37. In 2015, British Standard, BS8485, ref. 10.38, dealing with ground gas was published. It is recommended that guidance in C665 and BS8485 is adopted to provide a consistent approach in dealing with ground gas contamination, the principal details being as follows.
- A7.1.2 This guidance is based on a similar approach to that for dealing with contaminated soil. The presence of hazardous gases could be deemed to be the 'source' in a 'pollutant linkage' that could lead to the conclusion that significant harm is or could be caused to people, buildings or the environment. In such circumstances the land could be deemed 'contaminated', ref. 10.11.
- A7.1.3 Should a potential source of gas be identified in the conceptual model, a gas risk assessment should be carried out, sufficient to demonstrate to the local authority that the proposals mitigate any hazards associated with ground gas. The authority enforces compliance with Approved Document Part C of the Building Regulations, ref. 10.39.
- A7.1.4 The following is a summary of the key points from the guidance and should not be taken in isolation, thus a full understanding can only be made by reading the guidance documents in full.

A7.2 APPROACH

- A7.2.1 A flow chart detailing the approach to assessing and characterising a site is given in BS8485, Figure 3. This may be summarised as follows.
- Undertake Preliminary Investigation (desk study and site reconnaissance);
 - Develop Conceptual Site Model (CSM);
 - Design and undertake Ground Investigation;
 - Refine CSM;
 - Calculate hazardous gas flow rate for methane and carbon dioxide;
 - Assess Gas Screening Value (GSV);
 - Assign Characteristic Situation (CS);
 - Design gas protective measures based on CS.

A7.3 POLLUTANT LINKAGE ASSESSMENT

- A7.3.1 A pollutant linkage assessment is presented in Appendix 3 of the Preliminary Investigation Report.
- A7.3.2 Using the risk model in the desk study, the pollutant linkage can be identified and a preliminary estimate of risk undertaken. If there is no relevant pollutant linkage identified there is no risk. If there is a very low risk, it is likely that no further assessment is required. If further assessment is necessary, then gas monitoring is required.

A7.4 SITE MONITORING

- A7.4.1 For sites with low generation potential, giving consistently low concentrations of soil gas under the worst-case conditions, a limited programme of monitoring would be appropriate. Where high or variable concentrations are anticipated or recorded, an extended programme of monitoring would be appropriate. The following guideline has been proposed, ref. 10.41.

Table A7.1

Sensitivity of development	Generation potential of source					
		Very low	Low	Moderate	High	Very high
	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 minimum number of readings and second number is minimum period in months, for example 4/1 – Four sets of readings over 1 month.
2. At least two sets of readings must be at low and falling atmospheric pressure (but not restricted to periods below <1000mb) known as worst case conditions (see Boyle and Witherington, 2006).
3. The frequency and period stated are considered to represent typical minimum requirements. Depending on specific circumstances fewer or additional readings may be required (e.g. any such variation subject to site specific justification). * The NHBC guidance is also recommending these periods/frequency of monitoring (Boyle and Witherington, 2006)
4. Historical data can be used as part of the data set.
5. Not all sites will require gas monitoring however, this would need to be confirmed with demonstrable evidence.
6. Placing high sensitivity end use on a high hazard site is not normally acceptable unless the source is removed or treated to reduce its gassing potential. Under such circumstances long-term monitoring may not be appropriate or required.

- A7.4.2 Before taking any readings, zero the instrument, record atmospheric pressure and temperature.
- A7.4.3 Gas flow should be recorded, giving the range of pressures, ensuring positive or negative flow is recorded.
- A7.4.4 Record gas levels, recording peak and steady. Where steady state not obtained within 3 minutes, record change in concentration, where concentrations are decreasing, always record peak value. For very high concentrations, record for longer period of up to 10 minutes.

A7.5 ASSESSMENT OF RISK AND RECOMMENDATIONS

- A7.5.1 The main method of characterising a site is the method described by Wilson and Card, ref. 10.42 and is termed Situation A. This can be used for all types of development except conventional low-rise housing with suspended ground floor and ventilated underfloor void.
- A7.5.2 Low rise housing, Situation B, was developed by Boyle and Witherington, ref. 10.43 and was developed for the NHBC for classifying gassing sites for houses with suspended ground floor slab with ventilated void.
- A7.5.3 Although the Code of Practice, ref. 10.38, assesses the characteristic gas situation as CIRIA recommend for Situation A, see **Table A7.2** below, their solution for gas protection systems is different, see section A7.10.

A7.6 SITUATION A - ASSESSMENT

- A7.6.1 This system proposed by Wilson and Card, ref. 10.42 was originally developed in CIRIA Report 149, ref. 10.36.
- A7.6.2 The method uses both gas concentrations and borehole flow rate for methane and carbon dioxide to define a Characteristic Situation for a site.
- A7.6.3 Gas Screening Value (litre/hr) = borehole flow rate (litre/hr) x (gas concentration (%))/100. The GSV is determined for methane and carbon dioxide and the worst case adopted. The Characteristic Situation can then be determined from the table below. The GSV can be exceeded if the conceptual model indicates it is safe to do so, and other factors may lead to a change in the Characteristic Situation.
- A7.6.4 This method of site characterisation is also given in BS8485, ref. 10.38, and is summarised below.

Table A7.2

Characteristic Situation	Risk Classification	Gas screening value (CH ₄ or CO ₂ (1/hr) ¹	Additional factors	Typical source of generation
1	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	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	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
4	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	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
6	Very high risk	>70		Recent landfill site

Notes

1. Site characterisation should be based on gas monitoring of concentrations and borehole flow rates for the minimum periods defined in Table A7.1
2. Source of gas and generation potential/performance must be identified.
3. If there is no detectable flow use the limit of detection of the instrument.

A7.7 SITUATION A – SOLUTION

A7.7.1 Appropriate gas protection measures should be selected based on the CS and building type, which are used to produce a minimum level of gas protection (score) in the range 0 to 7.5, as summarised in the following tables, ref. 10.38.

A7.7.2 Guidance on radon and VOCs is given in Annex G and Annex H of BS8485.

A7.7.3 When the minimum gas protection score has been determined for the building as a whole, or for each part of the building, then a combination of two or more of the following three types of protection measures should be used to achieve that score.

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present;
- Ventilation measures; and
- Gas resistant membrane.

Table A7.3

	Building Types			
	Type A	Type B	Type C	Type D
Ownership	Private	Private or commercial/ public, possible multiple	Commercial/public	Commercial/ industrial
Control (change of use, structural alterations, ventilation)	None	Some but not all	Full	Full
Room sizes	Small	Small/ medium	Small to large	Large industrial/ retail park style

Table A7.4

CS	Minimum Gas Protection Score (Points)			
	High Risk	Medium Risk		Low Risk
	Type A Building	Type B Building	Type C Building	Type D Building
1	0	0	0	0
2	3.5	3.5	2.5	1.5
3	4.5	4	3	2.5
4	6.5 ^A	5.5 ^A	4.5	3.5
5	– ^B	6.5 ^A	5.5	4.5
6	– ^B	– ^B	7.5	6.5

^A Residential buildings should not be built on CS4 or higher sites 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.

^B The gas hazard is too high for this empirical method to be used to define the gas protection measures.

A7.7.4 Having determined the minimum gas protection score for the building, or each different part of the building, the element or combination of elements to achieve that required score should be chosen from those listed in the guidance, ref. 10.38, Table 5, Table 6 and Table 7. No more than one element from each type/table should be combined to achieve the recommended gas protection score.

A7.7.5 Details of the acceptable measures and corresponding scores are given in BS8485, ref. 10.38, which should be referred to for completion of the assessment and design.

A7.7.6 The following stages are not included within the scope of services provided by Ian Farmer Associates, however, details of the design may be included in a Remediation Method Statement (RMS) for a site.

- Detailed design;
- Implementation;
- Validation.

A7.8 SITUATION B -ASSESSMENT

- A7.8.1 The NHBC has developed a characterisation system that is similar to Situation A but is specific to low-rise housing development with a clear ventilated underfloor void. The gas emission rates are compared to generic ‘Traffic Lights’.
- A7.8.2 The Traffic Lights include a Typical Maximum Concentration that is used for initial screening purposes. Where the Typical Maximum Concentration is exceeded the risk-based Gas Screening Value, GSV, should be adopted. The GSVs are determined for the ‘model’ low rise development and where they differ from this model, the GSV should be reassessed, ref. 10.37.
- A7.8.3 The calculations should be made for both methane and carbon dioxide, and the worst case adopted. The GSV is only a guideline.

Table A7.5

Traffic light	Methane		Carbon dioxide	
	Typical maximum concentration ² (% v/v)	Gas screening value (GSV) ³ (litres per hour)	Typical maximum concentration ² (% v/v)	Gas screening value (GSV) ^{1,2} (litres per hour)
Green				
Amber 1	1	0.16	5	0.78
Amber 2	5	0.63	10	1.56
Red	20	1.56	30	3.13

- Generic GSVs are based on guidance contained within latest revision of Department of the Environment and the Welsh Office (2004 edition) “The Building Regulations: Approved Document C” and used a sub-floor void of 150mm thickness.
- The Typical Maximum Concentrations can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional judgement will be required, based on a thorough understanding of the gas-regime identified at the site where monitoring in the worst temporal conditions has occurred.
- The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

A7.9 SITUATION B – SOLUTION

- A7.9.1 On the basis of this Traffic Light classification the following protection should be applied to low-rise housing.

Table A7.6

Traffic Light Classification	Protection measures required
Green	Negligible gas regime identified and gas protection measures are not considered necessary.
Amber 1	Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.
Amber 2	Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. A specialist contractor should always fit membranes. As with Amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided.
Red	High gas regime identified. It is considered that standard residential housing would not normally be acceptable without a further Gas Risk Assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.

A7.10 CODE OF PRACTICE – SOLUTIONS

- A7.10.1 The Characteristic Gas Situation is determined in a similar manner to that recommended by CIRIA, see **Table A7.2** above.
- A7.10.2 Having selected the Characteristic Gas Situation, the appropriate gas protection could be selected for the building. The tables below give a guide as to the relative performance of the various designs and systems.
- A7.10.3 A guidance value for the required gas protection, in the range 0 to 7 should be obtained from **Table A7.7** below. Then, a combination of ventilation and/or barrier system should be chosen from **Table A7.8** to meet that requirement.

Table A7.7

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
			6 ^{E)}	5	4
				7	6

NOTE: Traffic light indications are taken from NHBC Report no.: 10627-R01 (04) [3] and are mainly applicable to low-rise residential housing. 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 an 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 protection scheme.

A7.10.4 Having determined the appropriate guidance value from **Table A7.7**, an element or combination of elements from a), b), c) or d) in **Table A7.8**, should be chosen to achieve the required level of protection.

Table A7.8

PROTECTION ELEMENT/SYSTEM		SCORE	COMMENTS
a) Venting/dilution			
Passive sub floor ventilation (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^{A)}	Very good performance	2.5	<i>Ventilation performance in accordance with Annex A, ref. 10.38</i>
	Good performance	1	<i>If passive ventilation is poor this is generally unacceptable and some form of active system will be required</i>
Subfloor ventilation with active abstraction/pressurization (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^{A)}		2.5	<i>There have to be robust management systems in place to ensure the continued maintenance of any ventilation system. Active ventilation can always be designed to meet good performance. Mechanically assisted systems come in two main forms: extraction and positive pressurization.</i>
Ventilated car park (basement or undercroft)		4	<i>Assumes car park is vented to deal with car exhaust fumes, designed to Building Regulations Document F and IstructE guidance</i>
b) Barriers			
Floor slabs			
Block and beam floor slab		0	<i>It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum. Breached in floor slabs such as joints have to be effectively sealed against gas ingress in order to maintain these performances</i>
Reinforced concrete ground bearing floor slab		0.5	
Reinforced concrete ground bearing foundation raft with limited service penetrations that are cast into slab		1.5	
Reinforced concrete cast in situ suspended slab with minimal service penetrations and water bars around all slab penetrations and at joints		1.5	
Fully tanked basement		2	

PROTECTION ELEMENT/SYSTEM		SCORE	COMMENTS
c) Membranes			
Taped and sealed membrane to reasonable levels of workmanship/in line with current good practice with validation ^{B), C)}		0.5	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation, and the integrity of joints
Proprietary gas resistant membrane to reasonable levels of workmanship/in line with current good practice under independent inspection (CQA) ^{B), C)}		1	
Proprietary gas resistant membrane installed to reasonable levels of workmanship/in line with current good practice under CQA with integrity testing and independent validation		2	
d) Monitoring and detection (not applicable to non-managed property, or in isolation)			
Intermittent monitoring using hand held equipment		0.5	Where fitted, permanent monitoring systems ought to be installed in the underfloor venting/dilution system in the first instance but can also be provided within the occupied space as a fail-safe.
Permanent monitoring and alarm system ^{A)}	Installed in the underfloor venting/ dilution system	2	
	Installed in the building	1	
e) Pathway intervention			
Pathway intervention		-	This can consist of site protection measures for off-site or on-site sources (see Annex A, ref. 10.38)
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 1200 g DPM material is to function as a gas barrier it should be installed according to BRE 414, ref. 10.40 being taped and sealed to all penetrations.

C) Polymeric Materials >1200g can be used to improve confidence in the barrier. Remember that their gas resistance is little more than the standard 1200g (proportional to thickness) but their physical properties mean that they are more robust and resistant to site damage.