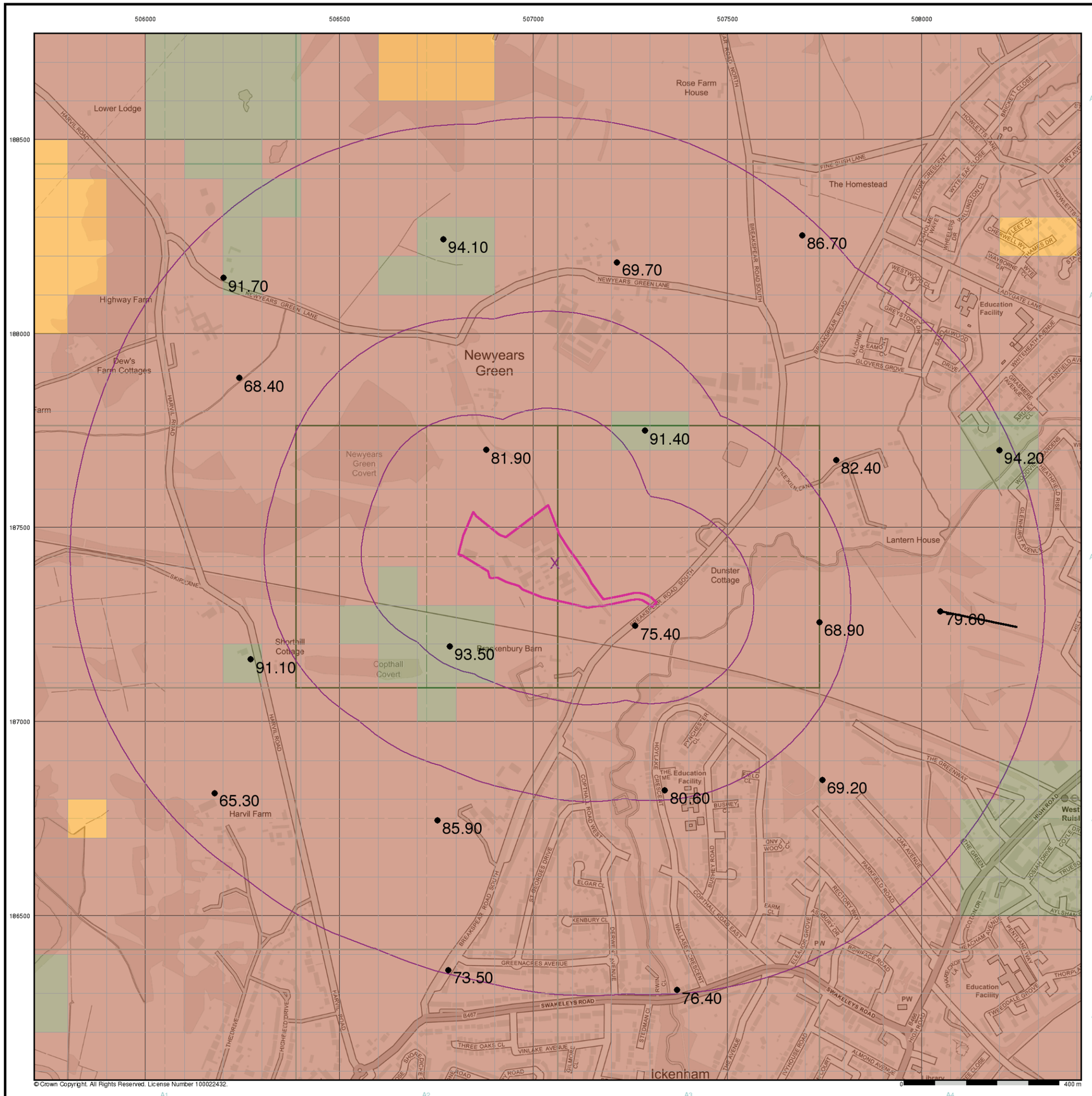


Johnson Poole & Bloomer Consultants

GEO-ENVIRONMENTAL & MINERALS

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

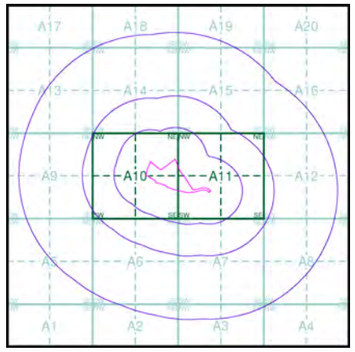
Urban Soil Chemistry Chromium

● BGS Urban Soil Chemistry Measured Concentration Values (mg/kg)

Chromium Concentrations mg/kg

- < 20
- 20 - 40
- 40 - 60
- 60 - 90
- 90 - 120
- 120 - 180
- > 180

Urban Soil Chemistry Chromium - Slice A



Order Details

Order Details:	292242936_1_1
Customer Ref:	WB307
National Grid Reference:	507060, 187410
Slice:	A
Site Area (Ha):	5.17
Search buffer (m):	1000

Site Details

M S D Animal Health, Breakspear Road South, Harefield, UXBRIDGE, UB9 6LS

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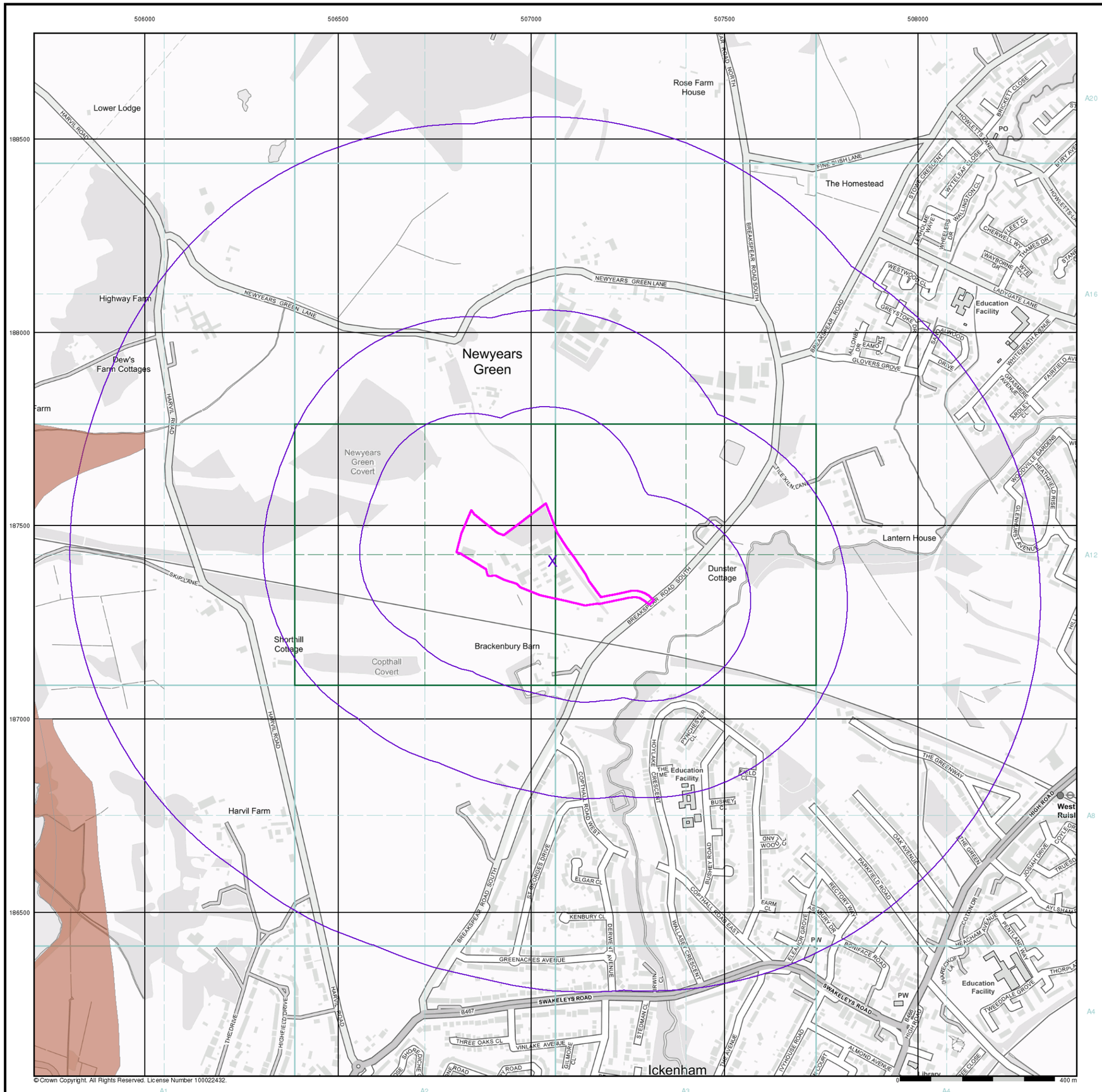


Johnson Poole & Bloomer Consultants
GEO-ENVIRONMENTAL & MINERALS

General

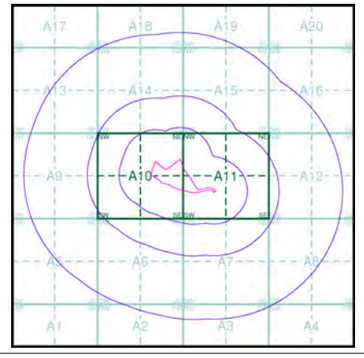
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Chromium

Chromium Concentrations mg/kg

- < 20
- 20 - 40
- 40 - 60
- 60 - 90
- 90 - 120
- 120 - 180
- > 180

Estimated Soil Chemistry Chromium - Slice A



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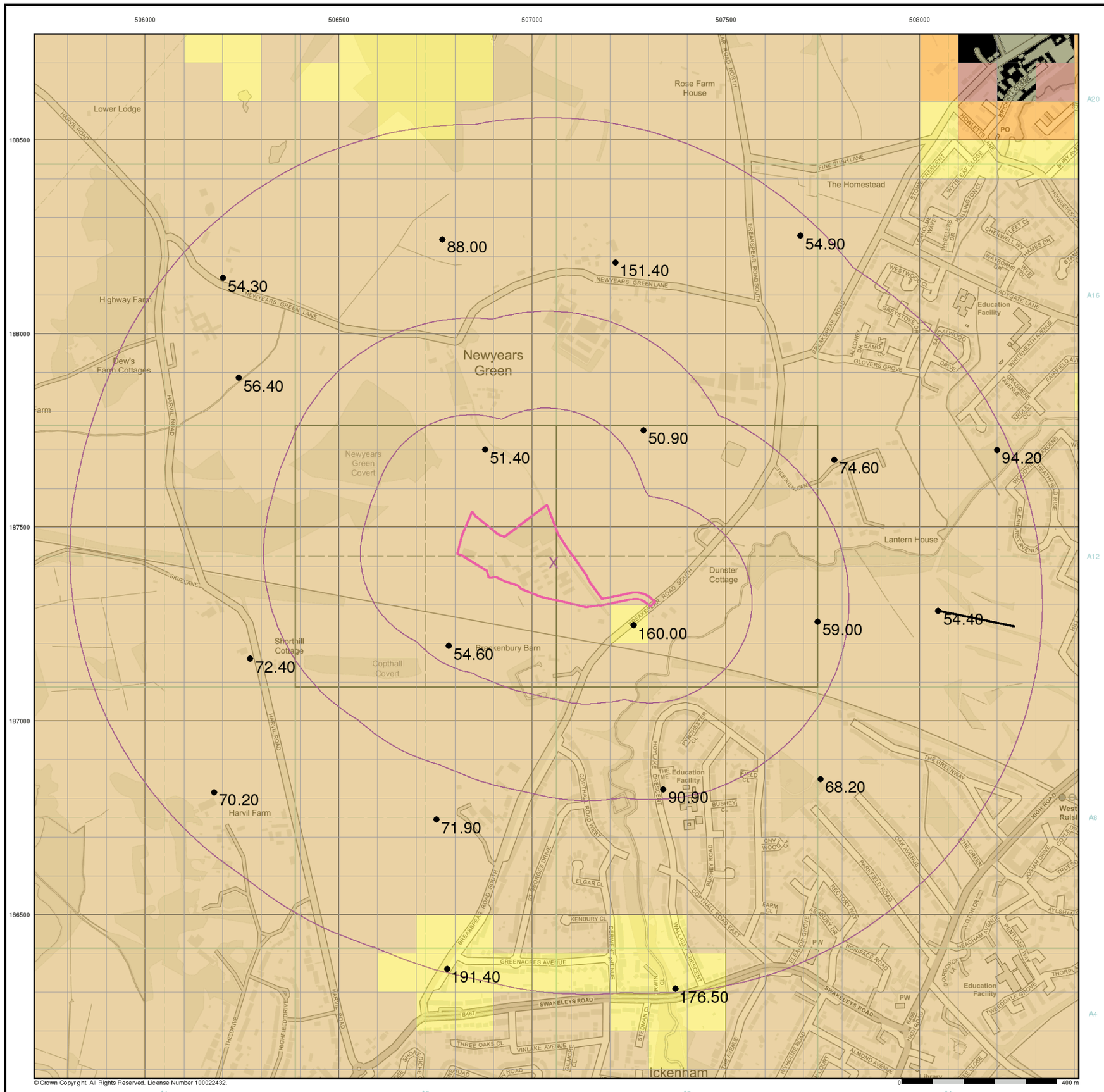

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GEO-ENVIRONMENTAL & MINERALS

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

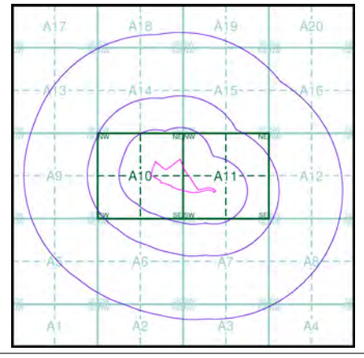
Urban Soil Chemistry Lead

● BGS Urban Soil Chemistry Measured Concentration Values (mg/kg)

Lead Concentrations mg/kg

< 150
150 - 300
300 - 600
600 - 900
> 900

Urban Soil Chemistry Lead - Slice A



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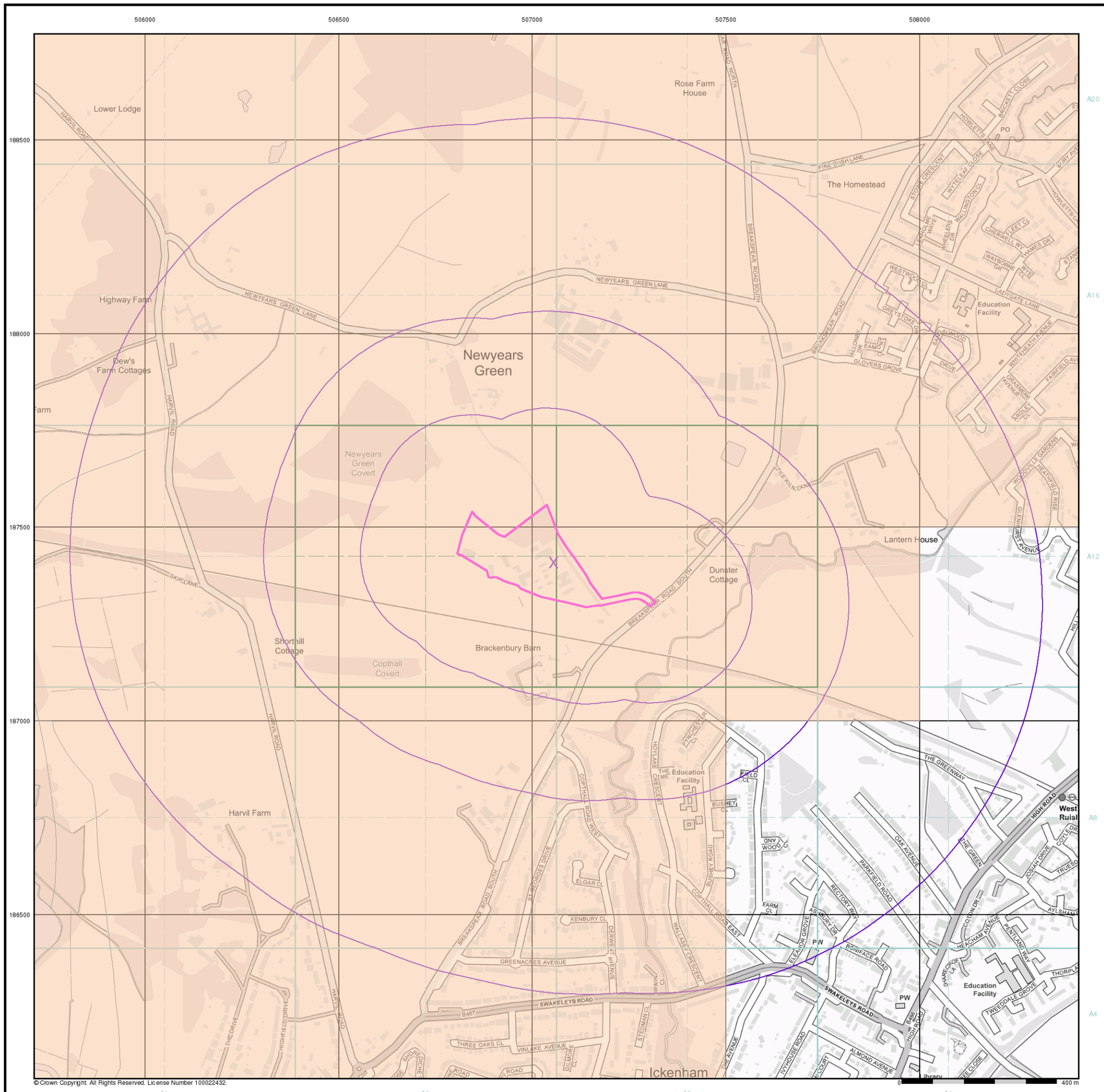

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GEO-ENVIRONMENTAL & MINERALS

General

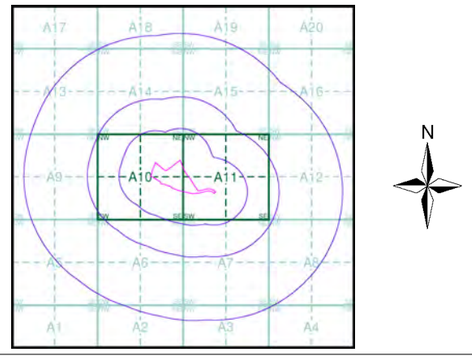
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Lead

Lead Concentrations mg/kg

- <100 mg/kg
- 100 - 200
- 200 - 300
- 300 - 600
- 600 - 1200
- >1200

Estimated Soil Chemistry Lead - Slice A



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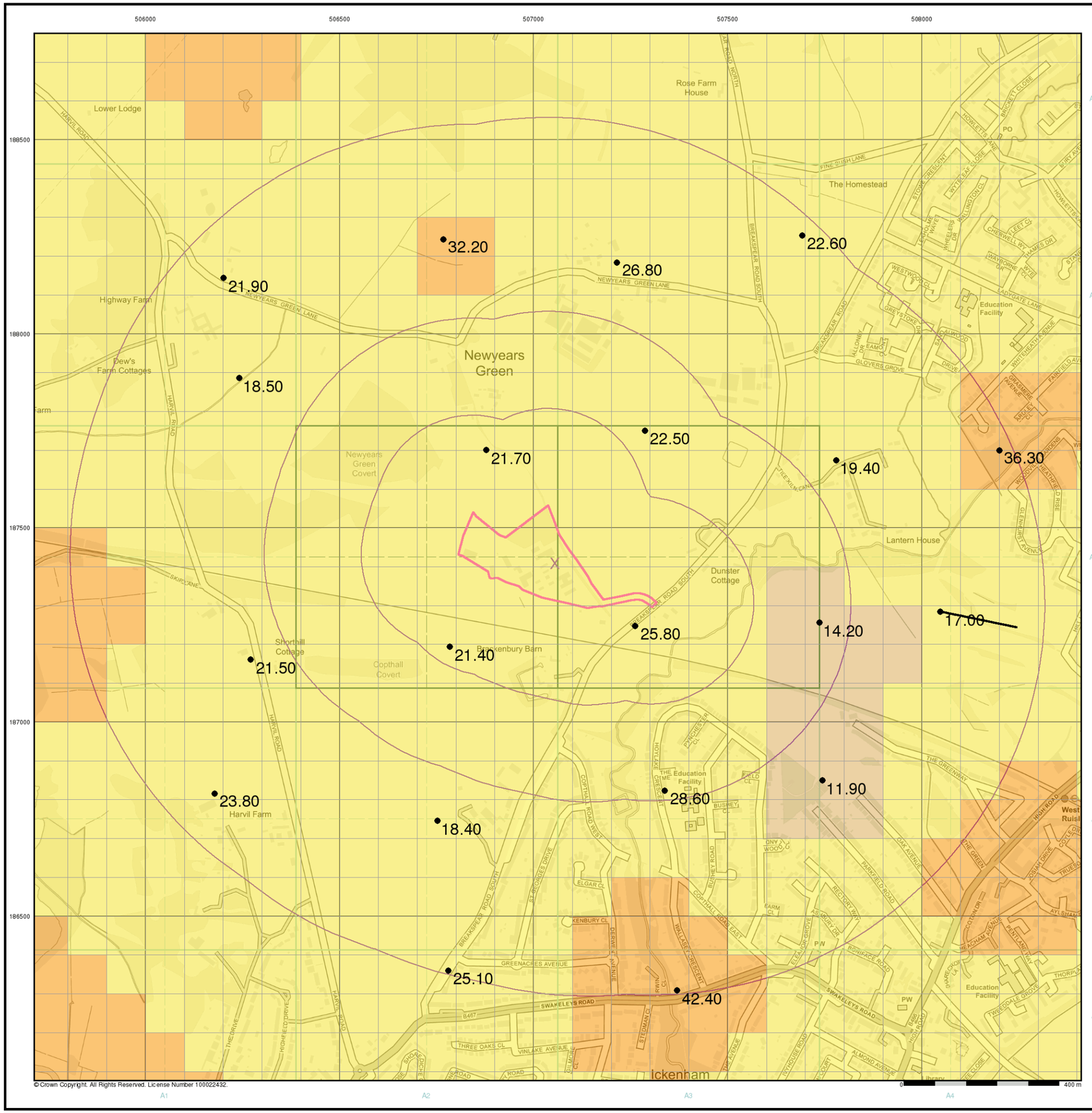


Johnson Poole & Bloomer Consultants
GEO-ENVIRONMENTAL & MINERALS

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

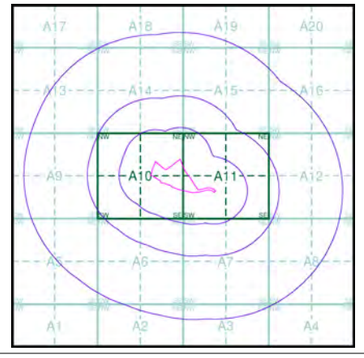
Urban Soil Chemistry Nickel

● BGS Urban Soil Chemistry Measured Concentration Values (mg/kg)

Nickel Concentrations mg/kg

- < 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 80
- 80 - 100
- > 100

Urban Soil Chemistry Nickel - Slice A



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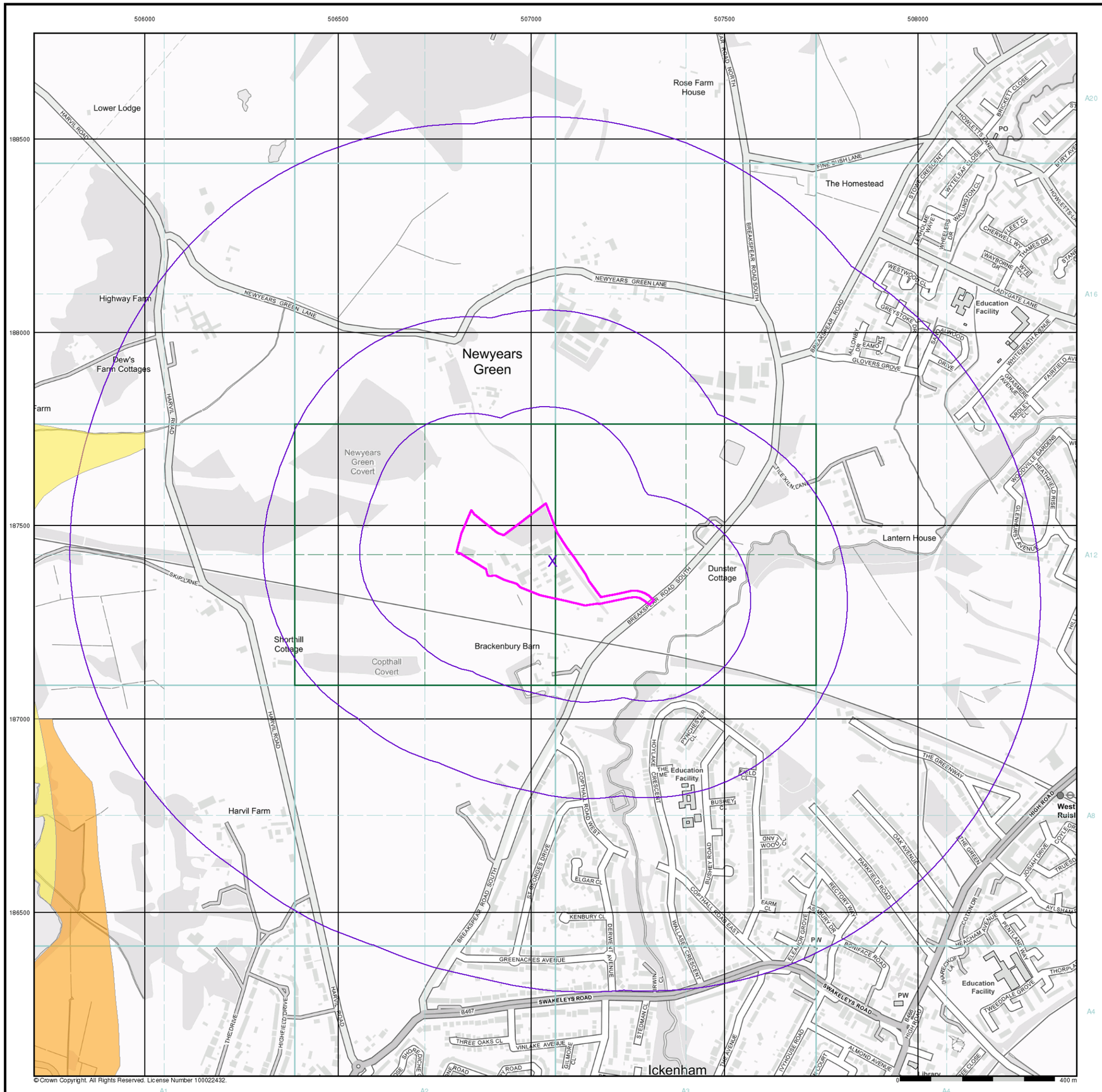


Johnson Poole & Bloomer Consultants

GEO-ENVIRONMENTAL & MINERALS

General

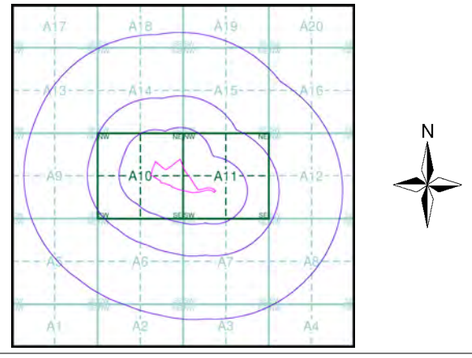
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Nickel

Nickel Concentrations mg/kg

- < 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 80
- 80 - 100
- > 100

Estimated Soil Chemistry Nickel - Slice A



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Appendix 7 Johnson Poole & Bloomer Risk Assessment Methodology

METHODOLOGY FOR EXPOSURE ASSESSMENT

The following is a general statement of JPB's methodology for investigating and assessing potentially contaminated sites for the purposes of identifying constraints posed by contamination issues. There is a large body of authoritative technical guidance in this field and it would not be either appropriate or worthwhile for this methodology to repeat verbatim that guidance, and the methodology does not seek to do so. Each site will be different, with different constraints and challenges and site specific investigation and assessment details for individual sites are given within the text of each report. The following text provides an informative summary of the methodology JPB generally apply to such sites.

Regulatory Framework

The assessment of potentially contaminated sites and the associated risk to the proposed development is dependent on a number of factors namely; the intended site end use, distribution and level of contamination, characteristics of the soil (i.e. pH, permeability) the groundwater regime and the sensitivity of the surrounding area. An analysis of the interaction between these various factors allows a decision to be made with regard to the extent of any remedial measures required for the development.

The contaminated land provision of the Environment Protection Act 1990, inserted by Section 57 of the Environment Act 1995, came into force in July 2000. In May 2006 the Scottish Executive issued a revised Statutory Guidance Edition 2 (SE/2000/43). Within this "Contaminated Land" is defined as

> *"any land .....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 the water environment is being, or is likely to be caused;"*
>
> In addition *"the questions*
>
> *a) what harm or pollutant of the water environment is likely to be regarded as significant*
> *b) whether the possibility of the significant harm or significant pollution of all the water environment being considered significant"*

In addition, PAN 33 is affected by this and embodies a "suitable for use approach" for land for development, which requires remediation only where there are unacceptable risks to health and the environment depends on the current and proposed end use.

In addition, the guidance requires a significant contaminant linkage to be present which includes;

- A source (pollutant)
- A pathway
- A receptor

JPB have therefore developed a risk assessment approach based on this philosophy, the methodology used is represented diagrammatically in the attached flow chart.

Stage 1 - Preliminary risk assessment-

Desk Study

The methodology utilised for desk studies follows the specifications outlined in CLR2 "Guidance on Preliminary Site Inspection of Contaminated Land", CLR6 "Prioritisation and Categorisation Procedure for Sites which May be Contaminated", CLR11 Model Procedures for the Management of Land Contamination, DEFRA/EA 2004, Contaminated Land Risk Assessment, CIRIA C552 and BS 10175 "Investigation of Potentially Contaminated Sites – Code of Practice", BSI.

During the study, documentary research will include an examination of the Ordnance Survey maps for details regarding previous site and adjacent land uses. Similarly, the available geological maps will be examined to determine the geological/hydrogeological conditions beneath and adjacent to the site. In addition, regional memoirs will be consulted together with mine abandonment plan data and any available borehole records, in order to assess the mining conditions. The assessment also takes cognisance of the information contained in the guidance documents "Risk Based Approach to Development Management – Resources for Developers" published by the Coal Authority and CIRIA SP32 "Construction over Abandoned Mineworkings".

A walkover survey will be carried out to determine the existing site conditions and operations. In addition, a photographic record of the site is taken during the walkover survey.

Information will also be obtained from the SEPA, BGS and Coal Authority websites and other authoritative online resources and from a review of in-house information. A report of environmental database information may also be obtained.

Conceptual Site Model

A Conceptual Site Model (CSM), which describes how potential chemical sources at the site could contribute to increased levels of risk to potentially sensitive receptors, is developed at an early stage and constantly reassessed in light of investigative findings. CSMs are generated in accordance with Guide to Good Practice for the Development of Conceptual Models and the Selection and Application of Mathematical Models of Contaminant Transport Processes in the Subsurface - National Groundwater & Contaminated Land Centre report NC/99/38/2 – Environment Agency 2001.

The first step in developing such a model is to identify whether there are potential hazards which may pose a risk on the site through desk top research and professional judgement. In addition, information regarding the site-specific environmental setting including geology, hydrogeology, hydrology etc, is gathered in order to assess the potential exposure pathways which are likely to exist and the location of humans and environmental resources which could be impacted by the site.

Following this desk-based study and the development of an initial CSM (ICSM), a site investigation is designed in order to determine whether any potentially significant contaminant linkages actually exist on the site. The information gathered during the investigation is then used to revise the ICSM and as the basis of the risk assessment process. While any investigation strategy will be specific to each site the following general comments can be made.

Design of Site Investigations

JPB design and implement site investigations cognisant of the guidance given in BS10175. Care is taken to target investigations at potentially contaminated locations identified in the ICSM from researches and from site visits or other available information. In addition, during the performance of investigations locations are refocused in the light of known site conditions. Further investigations are also undertaken at randomly selected locations resulting in a mixture of random and targeted investigation locations.

The requirement for adequate site coverage is a key consideration at the design stage and the number and type of investigation locations is determined by the available information, the brief and the requirements of the guidance given in CLR4 and R & D Publication Report P5-066/TR Secondary Model Procedure for the development of Appropriate Soil Sampling Strategies for Land Contamination. BS10175 indicates that in order to provide adequate site coverage a sampling grid of between 10m and 25m should normally be applied for a main investigation, for example where a residential development is considered. Where the ICSM indicates there to be no potential source of contamination on the site, or other land uses are envisaged, JPB consider that a wider grid, for example 50m spacing, may be adopted.

Site Zoning

Some sites may need to be divided into geographical sectors where, for example, historical land uses differ or the type of development varies across the site in accordance with R & D Technical Report P5-066/TR. Good practice guidance describes averaging areas as "areas of soil to which a receptor is exposed or which otherwise contributes to the creation of hazardous conditions". Where made ground material is contaminated at variable concentrations, but within a single geological unit, JPB consider that this unit can be adopted as an averaging area for the purposes of making an assessment of human health risks. However, where measured contamination concentrations include statistical outliers of high concentration, where different historical land uses have resulted in different patterns of contamination or where there is a clear distribution of higher contaminant concentrations in one sector of the site, averaging areas are chosen to reflect this contaminant distribution. Single high contaminant concentrations may indicate the presence of "hotspots" which may merit closer scrutiny or additional investigation.

Site Coverage

Investigation locations such as trial pits and boreholes are positioned to provide adequate site coverage, where access is available and avoiding existing services. Boreholes are situated at a mixture of targeted and random locations at the site where access is possible.

During the investigation the sampling strategy in CLR 4 "Sampling strategies for contaminated land" together with the guidance given in R & D Publication Report P5-066/TR is followed. The rationale behind the sampling strategy given in the R & D publication is:

Depth of sample	Rationale
0-0.5	To assess ▪ Human/animal intake arising from ingestion and dermal contact. ▪ Potential for wind entrainment leading to inhalation (of contaminated soils and dusts) or deposition onto neighbouring land. ▪ Surface water run-off (e.g. due to flash flooding). ▪ Uptake by shallow rooting plants (e.g. crops, ornamental and wild species). ▪ Surface leaching to groundwater.
0.5m in made or natural ground	To assess ▪ Intake via ingestion/inhalation/dermal contact from "abnormal" (or unpredicted) excavation (e.g. children digging dens) or for other purposes such as swimming pools, ponds house extensions). ▪ Uptake by deep rooting shrubs and trees. ▪ Intake by, or arising from, the activities of burrowing animals. ▪ Intake arsing from construction / maintenance of buildings and services for example. ▪ Foundations (usually within 2m of formation level). ▪ Water supply pipes, telecommunications, gas & power (0.5-1m of final formation level). ▪ Sewers (from 0.5 > 1m of final formation level). To locate perched water or groundwater. To confirm depth of made ground. To locate possible lateral pathways for gas or vapour migration in made ground. To establish extent of any leaching of soluble constituents from superficial soils. To detect "deep" contaminants (e.g. gas generating materials, leachable materials, dense solvents located on top of an impermeable stratum). To obtain information of "background" soil properties. To locate "natural" lateral migration pathways.

Samples are generally taken at shallow depth, then at where relevant changes are noted in materials with depth. Where any made ground is thick and relatively uniform samples are taken at least every 0.5m to 1.0m. Where organic contamination is observed within made ground, a sample of natural soil is generally taken from beneath each made ground horizon where the base is proven. Samples are recovered from each trial pit. Samples are recovered at these regular intervals with additional samples of any atypical horizons also taken. It should be noted that there will always be the possibility of additional unrecorded conditions outwith the sampling points. Samples obtained are stored within appropriate containers and dispatched for analysis within 24 hours of sampling.

Attempts are made to recover water samples from all of the boreholes at which standpipes are installed. Each borehole is extensively purged to a volume in excess of three times the well volume, where feasible, using a submersible mini-whale pump or bailer. Purging before sampling allows a more representative water sample of groundwater to be obtained and ensures that any water initially present in the boreholes is removed as this may have been chemically altered due to reaction with air or with installation materials. Water samples are transferred to appropriate containers before being transported to the testing laboratory in cooled conditions.

Testing parameters scheduled on soil and water samples are based on historical and current operations information and their importance in relation to health risks, phytotoxicity, impact on the water environment, protection of building materials, services and structures from chemical attack and potential impact on the quality of potable water supplies. Where possible chemical testing is targeted at locations at the site where particular contaminants are anticipated, with additional testing scheduled to give horizontal and vertical site coverage. Selection of test parameters is performed on a site specific basis as described in the text of each investigation report.

Stage 2 Generic Quantitative Risk Assessment

The next stage of the site-specific assessment is to perform a Stage 2 risk assessment using the information gathered during the site investigation to determine the actual nature and extent of contamination, evaluating the data using conservative generic criteria to determine whether any recorded levels of contaminants could be potentially of concern.

Stage 2 Criteria

The Stage 2 generic quantitative assessment of risks to human health, property, ecology, surface water and ground water considers the potential for exposure based on comparison of the results to conservative generic criteria.

Human Health Risks

DEFRA and the Environment Agency including; Soil Guideline Values (SGVs) derived using the CLEA model and the methodology described in EA Science Report SC050021/SR3, EA CLEA science reports and the associated TOX and SGV series of reports. In addition, JPB have adopted S4UL values published by LQM/CIEH and GAC values published by EIC/AGS/CL:AIRE as GACs and, where other suitable values are not available, GACs derived by JPB generated using the CLEA model and in accordance with the above guidance.

The Contaminated Land Exposure Assessment (CLEA) model was developed for the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency. The model estimates child and adult exposures to soil contaminants for those potentially living, working and/or playing on contaminated sites over long time periods and has been used to produce the Soil Guideline Values for the UK, first published in 2002. The guidance was updated following the “Way Forward” process, and the revised technical guidance and SGVs above published in 2009.

The CLEA model used to derive generic criteria has undergone a number of updates, the model used for the derivation of current published criteria; SGVs, S4ULs, EIC/AGS/CL:AIRE was Version 1.06. S4ULs were, however, derived using some exposure parameters amended in the light of the C4SL project (see below).

The CLEA model calculates GACs which represent doses “without appreciable health risk” or “minimal human health risk” depending on whether a contaminant is a threshold or non-threshold substance. An update (version 1.071) was released in 2015, and includes the library data sets from the DEFRA research project SP1010 (Development of Category 4 Screening Levels (C4SLs) for assessment of land affected by contamination), allowing the derivation of generic criteria characterised as representing “low” levels of risk.

In addition, CLEA 1.071 continues to allow the derivation of GACs which represent doses "without appreciable health risk" or "minimal human health risk". This procedure has been adopted to calculate JPB derived GACs using CLEA 1.071. JPB derived criteria are based on conservative assumptions including; the development of small terraced houses on the site, a soil organic matter content of 1% and pH value of 7.

C4SLs represent a higher, but still low, level of risk than SGVs, S4ULs, EIC/AGS/CL:AIRE or JPB GACs. Although they represent different levels of risk, JPB consider that both C4SLs and other JPB GACs are appropriately protective generic criteria for assessing contaminated land for the following reasons. S4ULs, EIC/AGS/CL:AIRE and JPB GACs have been derived in accordance with technical guidance and a risk assessment model which are scientifically based and have been published by authoritative bodies. C4SLs have been confirmed to represent levels of risk which are lower than is required to meet the definition of "contaminated land" ("Simplification of the contaminated land regime", Impact Assessment: Defra 1133). Their use is also endorsed by DEFRA in their Policy Companion Document to the SP1010 project which states that C4SLs "are intended to be more pragmatic (whilst still strongly precautionary) compared to existing generic screening levels".

Where available C4SL values have been adopted as JPB GACs. However, to date only a limited number of HCVs for C4SL have been published and consequently a limited number of contaminants have published C4SLs. As selecting an appropriate C4SL HCV requires specialist toxicological competences, JPB have not derived HCV for additional contaminants. Where a published C4SL is not available for a particular contaminant, JPB have adopted a GAC derived using the CLEA model and based on "without appreciable health risk" or "minimal human health risk" risk levels. Where an S4UL or EIC/AGS/CL:AIRE value is available it has been adopted as a GAC, where no C4SL, S4UL or EIC/AGS/CL:AIRE GAC is available, JPB GAC derived in accordance with the above guidance have been adopted.

Annex E of SP1010 indicates that in order to apply the benzo(a)pyrene surrogate approach and C4SL used in the above guidance, the assumptions made in its derivation must be verified, in particular the PAH profile in the site soils must be similar to the test material used in the toxicological study on which the C4SL HCV is based. To assess the PAH profile in the test soil samples, JPB calculate the ratio of seven other genotoxic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene), relative to benzo(a)pyrene, to ensure the site soil PAH profile is similar to the test material used in the study. The ratios relative to benzo(a)pyrene must fit within the upper and lower limits detailed in Table 2.5 and Figure 2.1 of Annex E.

These ratios are calculated for soils at each site and the result appended to the report. It should be noted that PAH ratios are calculated for samples with appreciable PAH contents, as the above ratio test does not work correctly where some genotoxic PAH concentrations are near or below laboratory reporting limits as ratios become skewed by zero or "less than reporting limit" values.

Phytotoxic Risks

To assess the site's potential for phytotoxicity JPB refer to the MAFF/DoE document "Review of the Rules for Sewage Sludge Application to Agricultural Land – Soil Fertility Aspects of Potentially Toxic Elements" in the absence of other definitive phytotoxic screening levels. This document is authoritative and scientifically based, it sets out total concentrations of various metallic elements which shouldn't be exceeded in order to maintain soil fertility and avoid toxicity. Therefore, it is considered that these limits can be applied to contaminated land and other situations, e.g. they have been adopted by DEFRA in its "Soil Code" and by the Forestry Commission. It should be noted that plant growth can also be significantly affected by many other factors including: pH, nutrient availability, soil texture and structure, temperature, moisture content and aeration. In addition, reference has been made to "Soil Code" (MAFF 1998), and CLR2, "Guidance on Preliminary Site Inspection of Contaminated Land".

Structures and Services

Where structures or services are considered to be viable receptors, risks are assessed using contemporary best practice guidance given in documents published by the Building Research Establishment (BRE), CIRIA, Water Research Council (WRc), UKWIR, the HSE and other relevant organisations.

Risks posed to buildings and services due to aggressive soil sulphate, chloride and pH conditions are assessed using the guidance given in BRE Special Digest 1 (2005), Concrete in aggressive ground.

Water Supply Pipes

Risks posed by soil and groundwater contaminant concentrations to water supply pipes are assessed in accordance with the UK Water Industry Research (UKWIR) document, "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites", UKWIR report reference 10/WM/03/21, 2010. This guidance identifies the chemicals present in soils which can either permeate pipes or impact on their integrity by causing swelling, cracking and degradation or corrosion. The main focus is, therefore, on organic contaminants and on the soil's conductivity, pH and redox potential. Due cognisance is also taken of the requirements and guidance issued by utility companies.

UKWIR guidance states that where a site has been greenfield and no chemicals have been historically or currently stored or used on it (or part of the site meets these criteria), no restriction is made on the type of water pipes which can be used on the site (or part of the site as appropriate). Direct communication between JPB and Scottish Water (SW) indicates that SW will not require intrusive investigations on sites which have been greenfield throughout their history, providing supporting documentary evidence is supplied.

Where investigations are required, samples are obtained from locations on site as identified in the site ICSM. Where the route of water supply pipes is known, sample locations during investigations would include locations on or within 15m either side of the route, otherwise investigation coverage for the whole site is as described previously in this methodology, as recommended in section 2.5.5 of the UKWIR report and in SW guidance.

Selected soil samples are tested for the parameters recommended in the UKWIR guidance; VOCs (including TIC), SVOCs (including TIC), amines, petroleum hydrocarbons (including "mineral oils"), conductivity, pH value and redox potential. Results of analyses are collated and compound group concentrations summed as described in section 2.7.9 of the UKWIR guidance, these sums are adopted as Representative Contaminant Concentrations (RCCs). The maximum concentration recorded at the site (or if appropriate within a particular site zone) for each substance is used for summing and tabulation, this is a conservative assumption.

The RCCs are compared with the UKWIR threshold values for polyethylene (PE) and polyvinylchloride (PVC pipes) detailed in Table 3.1 of the UKWIR, which have been adopted as JPB GACs. Exceedence of a single GAC indicates PE or PVC pipework is not appropriate and other pipe materials should be selected. Consideration of the corrosive properties of soils is also required where PE, PVC or barrier pipes are not selected as appropriate. The comparison of RCCs with GACs and the other criteria in Table 3.1 of the UKWIR guidance results in a list of pipe materials which would be suitable in terms of chemical properties, a preferred selection can then be made on the basis of cost, appropriateness etc. or the choice of specific materials to be used made by the engineer/developer. Further recommendations on standards and specifications for water supply pipes and fittings for various pipe materials are given in Part 4 of the UKWIR guidance.

Combustibility

Where potentially combustible materials are encountered the following assessment methodology is adopted. Despite the potential for combustion in many sites characterised by carbonaceous materials, the number of recorded instances of actual combustion are very few and there has been no definitive study of the phenomena. Consequently, there are no commonly accepted criteria for comprehensively assessing and dealing with the risk of spontaneous combustion. The ICRCL Guidance Note 61/84 "notes on fire hazards of contaminated land" suggests that there is an unacceptable risk of combustion if the material has a Calorific Value in excess of 10 MJ/kg or perhaps only 7 MJ/kg.

However, a paper presented at the Fourth Mineral Waste Utilisation Symposium related to the Utilisation of Coal Refuse for Highway Base or Sub-base Material. In this paper it states that "low permeability values are desirable in order to reduce air circulation and the potential for spontaneous combustion". It then goes on to suggest that "proper compaction of coal refuse reduces air voids to less than 10% and the potential for spontaneous combustion is substantially reduced".

There is an imprecise relationship between Loss on Ignition and Calorific Value but previous comparisons by JPB have indicated 10 MJ/kg to be roughly equivalent to 30% Loss on Ignition and 7 MJ/kg to be roughly equivalent to 23% Loss on Ignition.

JPB adopts the following guidelines:

i) combustion may be induced and supported only if the Loss on Ignition value exceeds about 20% and the Calorific Value exceeds 7 MJ/kg.

ii) carbonaceous material needs to be of some bulk ie thicker than 1 metre and greater than 10 m^3 in volume.

iii) spontaneous combustion should not occur in thoroughly compacted material to which air is excluded.

Water Environment

Current SEPA guidance described in document WAT-PS-10-01: Assigning Groundwater Assessment Criteria for Pollutant Inputs (Live Document) notes that for land contamination four receptors were to be assessed, if identified as being present, namely; surface water; groundwater abstraction, groundwater resource, and groundwater dependant terrestrial ecosystem (GWDTE or wetland). Routine leachability testing is carried out for water soluble contaminants in order to determine if there is a threat from soil borne contaminants to ground and surface waters.

For the protection of surface waters and groundwater resources the concentration of each contaminant in soil leachates, groundwaters and surface waters are compared against relevant assessment limits. The assessment limits may be a UK Drinking Water Standard (UKDWS), Resource Protection Value (RPV) or EQS depending on the nature of the receptor which is being considered to potentially be at risk. In addition, reference is made to SEPA guidance document WAT-SG-53: Supporting Guidance, Environmental Standards for Discharges to Surface Waters, The Scotland River Basin District (Standards) Directions 2014, UKTAG's m-BAT tool and SEPA's River Basin Management Plans.

Where no assessment limit has been provided by SEPA, other limits may be adopted such as WHO Drinking Water Guidelines, US EPA National Primary Drinking Water Regulations or the laboratory's minimum reporting limit (MRL).

Stage 2 Risk Evaluation

Stage 2 risk-based guidance levels such as GACs are conservative generic values against which measured contaminant concentrations can be compared. Where measured concentrations are found to be below these screening criteria then the contamination identified is not considered to pose a significant risk. The guidance used to evaluate investigation data is chosen to be relevant for the particular risk and receptor being assessed as well as being applicable to the legislative issues of concern. Where measured concentrations of contaminants exceed generic criteria, the risks posed by the contaminants of concern are considered more fully in a Stage 3 risk assessment. Where no generic criteria are available or a substance, an automatic Stage 3 assessment is carried out if the contaminant is present above laboratory reporting limits.

Stage 2 criteria adopted by JPB for risk assessments are included in reports. If any of the appropriate criteria contained in these documents are exceeded, the conclusion is that significant risk could exist and that a further assessment (Stage 3) is warranted in order to calculate the potential levels of risk. This process, therefore, focuses on the contaminants of concern and can, if necessary, inform any further investigations which may be required for more detailed examination.

Derivation of JPB Human Health Criteria

Assessment of risks to human health

Each contaminant exceeding Stage 2 criteria is examined for its potential to cause harm. Consideration is then given to the significant contaminant linkages which are plausible for the identified hazards, i.e. whether a contaminant can conceivably come into contact with a specified receptor group. It is possible that a contaminant may be deemed a hazard due to its presence above screening criteria but ultimately not constitute a risk as no viable pathway exists between the source and the receptor. The relative sensitivity of all potential receptors identified is quantitatively assessed using the data obtained during the desk study and site investigation phases.

The risk to human health is determined using an exposure assessment, an estimate of potential doses of the chemicals in exposed individuals via the pathways identified in the ICSM. This focuses on a hypothetical individual within each exposed population and involves the use of models which incorporate assumptions regarding human behaviour and physiological attributes. The assumptions are made in a “worst case” or “reasonable worst case” manner to provide estimates of dose which are unlikely to be exceeded by receptors at or in the vicinity of the site. The main focus of the exposure assessment is the estimation of long-term (chronic) dose levels from repeated exposure to chemicals in the soil and groundwater. In some cases, for example cyanides, acute exposure is also considered. Exposure to each chemical is estimated for each viable pathway and for any potential sensitive receptors.

The purpose of the human health assessment is to identify the levels of exposure to contaminants which, if not exceeded, do not cause unacceptable adverse health effects. The subject of human health assessments is covered in depth in the DEFRA/EA Science reports to which the reader is referred for further background information, however, a short review is given below.

Health Criteria Values

Human health assessment criteria are derived by comparing the estimated exposure of critical receptors to the contaminants with Health Criteria Values (HCVs). HCV represent a tolerable or minimal risk to health from chronic exposure to these contaminants or, in the case of C4SLs, a “low” risk level. Acute health risks must be assessed separately. Health Criteria Values are derived through the collation and review of toxicological data and its subsequent use in the derivation of soil contaminant intakes that are considered to be protective of human health. These intakes are guidelines to a risk assessor on the level of long-term human exposure to individual chemicals in soil that are tolerable or pose a minimal risk, or in the case of C4SLs pose a low but acceptable risk. HCVs are established from a review of the evidence from occupational and environmental epidemiological studies, animal studies and from scientific understanding of the mechanisms of absorption, transport, metabolism and toxicity of chemicals within the human body.

The derivation of HCVs for tolerable or minimal risks is described in detail within EA Science report-SC050021/SR2. The derivation of HCVs representing low risks used to derive C4SLs is described in DEFRA report SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination.

Contaminants generally exhibit two possible types of toxicity, threshold toxicity and non-threshold toxicity. For contaminants which exhibit threshold toxicity there is some, non-zero, measurable amount of exposure (dose) that is required before a biological threshold is breached and an adverse health effect is produced. However, in some cases the toxicological mechanism responsible for producing the adverse effect is such that there is no basis to assume a threshold exists. This is most notably the case for genotoxic carcinogens. The biological mechanisms by which these types of chemicals cause damage to DNA and genetic material means that any exposure to these chemicals, no matter how small, will carry some level of risk. The theoretical basis for this is that one 'hit' on DNA can produce a mutation that may eventually lead to a tumour. It is, therefore, not possible to identify the threshold with any confidence. Hence, the prudent assumption is made that such compounds do not have a threshold. It should be noted that not all carcinogens are genotoxic, some may exhibit a threshold, and whether a contaminant is a threshold or non-threshold substance should be determined by a review of the available toxicological evidence.

HCVs for Tolerable or Minimal Risk

HCVs for tolerable risk levels for threshold substances are referred to in the UK as Tolerable Daily Intakes (TDIs), some other authorities or organisations derive similar criteria such as Reference Doses (RfDs) or Provisional Tolerable Weekly Intakes (PTWIs). These values are in principle similar and can be thought of as "safe" levels of exposure at which adverse effects are not likely to occur, although some conversion or further consideration may be required before adoption of values from other jurisdictions in the UK context. These health criteria are typically derived by applying "safety" or "uncertainty" factors to intake levels observed to have little or no effects in humans or animals.

Exposure to receptors will occur not just from soil-borne contamination but also from intakes of food, water and air. Where a contaminant is a threshold substance these background intakes of a contaminant must, therefore, be calculated and subtracted from the TDI, to calculate the intake of the contaminant which could be tolerated from exposure to soil contamination alone (this quantity is the TDSI – Tolerable Daily Soil Intake), in addition to normal background exposure. This background intake is the Mean Daily Intake (MDI). Where information is not available on intake levels of contaminants or where the MDI exceeds the TDI, the Science report-SC050021/SR3 states that the TDSI should be set in the model to be 50% of the TDI.

DEFRA/EA have adopted the Index Dose (ID) as the HCV for minimal risk levels for non-threshold substances, which can be considered to present a minimal human health risk from exposure to soil contaminants. For non-threshold contaminants background intake is not considered as there is no "safe level". In addition, application of the ALARP (As Low As Reasonably Practicable) principle for these substances means that intake should be reduced to as low a level as practicable, that this principle is being adopted by the competent authorities for intakes from food, water and air and that actions are being taken to reduce these other intakes.

There are a number of sources of toxicity criteria and background exposure levels which include Department of the Environment, Food and Rural Affairs (DEFRA); World Health Organisation (WHO); the US Environmental Protection Agency (US EPA) IRIS (Integrated Risk Information System) and other published scientific literature. Where available the definitive UK toxicological and background exposure levels published in the DEFRA/EA/SEPA CLEA TOX reports, under the advice of the Department of Health and The Food Standards Agency, are used as the primary source. However, as authoritative UK based information is available for only a limited number of substances, health criteria and other model input data has been sourced from non-UK published information. The methodology outlined in Science report-SC050021/SR2 has been used to derive HCVs where an authoritative UK HCV has not been published.

HCVs for Low Risk

HCVs for low levels of risk are known as LLTC, LLTC used in deriving C4SLs adopted by JPB have been derived as described in DEFRA report SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. The assumptions and decisions used to derive LLTC are discussed in the above document. The overall LLTC derivation methodology described contains several elements which are similar to or, conversely, differ from, those used to derive "minimal risk" HCVs. Key aspects of the similarities and differences between the approaches are summarised in Table 2.4 of the above document.

General Approach to Risk Estimation

Stage 2 generic criteria have been selected from published values or derived by JPB as described above. JPB derived GACs using the CLEA 1.071 model where sufficiently reliable UK authoritative or peer-reviewed input data (including HCVs) is available. In the first instance the model input values published by DEFRA/EA, derived by Land Quality Management (LQM) in association with the Chartered Institute of Environmental Health (CIEH) and data published in Environment Industry Commission (EIC)/CL:AIRE Report: Soil Generic Assessment Criteria for Human Health Risk Assessment have been used for JPB derived GAC if available. Both the CLEA model and C4SL methodology derive GACs for use when considering the risk to human health from chronic exposure to toxic metals, metalloids and organic substances in soil. The assessment criteria represent contaminant concentrations in soils, which if exceeded on site may be indicative of unacceptable risks to human health. It is envisaged that these methodologies can also be used as a tool during either the detailed quantitative risk assessment or the risk management process.

These methodologies adopt the risk-based source-pathway-receptor contaminant linkage framework and a deterministic methodology. The exposure pathways considered are direct ingestion of soil and dust, direct dermal contact with contaminated soil, consumption of home grown or allotment vegetables, ingestion of soil attached to such vegetables, inhalation of soil vapours outdoors and inhalation of soil vapours indoors. The CLEA model used in both methodologies is intended to reflect and be compliant with the guidance in DEFRA/EA Science Reports.

Where input data from the above sources is not available, data published by other organisations has been used. It should be noted that the toxicological data available for particular substances in many cases is very limited and incomplete. In order to adopt a relatively consistent approach, where authoritative or peer reviewed UK data is not available, data has been obtained primarily from USEPA and Dutch RIVM report sources as these sources offer a wide range of expert reviewed parameter values such as health criteria values, physical and chemical property data for commonly encountered soil contaminants.

Risks posed by Polychlorinated biphenyls (PCBs) in soil

For risk assessment purposes PCB congeners are divided into two groups; (1) dioxin-like PCBs and (2) non-dioxin like PCBs. Dioxin-like PCBs have similar structures and toxic mechanisms to dioxins and furans and so are assessed together with dioxin and furans. Non-dioxin like PCBs have a different toxic end point to dioxin-like PCBs and must, therefore, be assessed separately.

If the criteria set out in the SGV report are fulfilled, the PCB test results can be directly compared with the SGV given in the report. However, SGVs relate to background PCB levels where a site source is absent, and this limits the applicability of the SGV.

Where the assumptions required for the use of the SGV are not met, dioxin-like PCBs are assessed using the SGV worksheets for the standard land uses. Where site specific dioxin and furan data is not available, the median urban or rural dioxin and furan values given in the SGV report are used to account for "background" concentrations of these substances. A hazard index (HI) is calculated using the worksheet and if the HI is >1, then dioxin-like PCBs may pose a risk to human health receptors in the scenario being considered.

A specific methodology to assess risks posed by non-dioxin like PCBs has not yet been published by EA/DEFRA, however, JPB have adopted the current UK methodology used to assess other organic compounds. This involves selecting a list of target compounds, a TDI and other input data and using the CLEA model to derive GACs. PCBs are typically present as mixtures. The most persistent and toxic non-dioxin-like PCBs are present at their highest concentrations in PCB mixture aroclor 1254. The 7 ICES list indicator PCBs make up about 50% of aroclor 1254. JPB, therefore, compare the sum of these indicator PCBs with the assessment criteria. The criteria are derived using a TDI for aroclor 1254 and other input data using the CLEA model. The TDI is adjusted to account for the percentage of the 7 ICES compounds present in aroclor 1254. If the sum of the soil concentrations of the 7 ICES exceeds the GAC, then non-dioxin-like PCBs may pose a risk to human health receptors in the scenario being considered.

Therefore, if either the dioxin-like PCB or non-dioxin-like PCB assessment indicates the presence of a risk, remediation may be required or a further assessment may be proposed.

Risks posed by Cyanides in soil

Cyanide compounds exhibit both acute and chronic toxicity, although it should be recognised that complex cyanides are much less toxic than free cyanides. There is currently no UK SGV available to assess chronic cyanide toxicity, although a review of the toxicology of cyanide has been published (DEFRA CLR TOX 5 report).

Criteria derived to be protective of chronic cyanide exposure exceed those derived to be protective of acute exposure to both types of cyanide. Therefore, the criteria derived for acute exposure to free and complex cyanides have been conservatively adopted to be protective of receptors.

The Environment Agency has not published guidance on the assessment of risks due to acute exposure to cyanide compounds. However, HPA publications indicate that hydrogen cyanide and its solutions may be fatal following acute exposure via all intake routes (ingestion, inhalation and dermal). The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) published a nominal acute reference dose (ARfD) based on the lowest reported acute lethal dose. JPB have derived assessment criteria for free and complex cyanides in soils based on the above ARfD, exceedence of which is considered to pose a risk to sensitive site receptors.

Stage 3 Detailed Quantitative Risk Assessment

Representative Contaminant Concentrations and Site Specific Assessment Criteria

To merit a Stage 3 assessment concentrations of contaminants will have exceeded Stage 2 criteria, or there are no available Stage 2 criteria. At this stage the chemical dose to potentially exposed human receptors are calculated, incorporating site specific data together with conservative health assumptions where necessary to derive Site Specific Assessment Criteria (SSACs). Data evaluation and statistical procedures are used to derive representative contaminant concentrations (RCC) for contaminants of concern in the relevant averaging areas of sites. RCCs are compared with SSACs at the risk evaluation stage in order to determine their significance. This process effectively reduces the conservatism of the Stage 2 assessment and provides a site specific assessment at Stage 3.

At Stage 2 all soil contaminant concentrations are compared with GACs. At Stage 3 RCCs are calculated and used for comparison with assessment criteria. Depending on the nature of the data the RCC may consist of either the maximum concentration recorded or a 95% Upper Confidence Limit (UCL95). Where small data sets are available, or where point source contamination such as hydrocarbon spillages are present, statistical analysis is not appropriate and the maximum contaminant concentration recorded is adopted as the RCC. Where larger data sets are available statistical analysis may be performed to derive an RCC where appropriate. Where RCCs exceed assessment criteria this indicates that the contaminant poses a human health risk and that remedial actions may be required to prevent actual harm. As an initial assessment, JPB generally alter only specific pH and %SOM values and the development type to generate SSACs. Should a more detailed DQRA assessment be merited, a more extensive re-examination of data inputs may be undertaken.

Statistical analysis is carried out in accordance with the methodology outlined in guidance given in CL:AIRE/CIEH Publication, "Guidance on Comparing Soil Contamination Data with a Critical Concentration". A number of statistical tools may be used for deriving UCL95 values, JPB principally use ProUCL, a software package developed by the US EPA for this purpose. In general, RCC values are selected as follows;

- Determine if there is sufficient data for statistical analysis, if not the maximum concentration is selected as the RCC;
- If data is sufficient the data set for each contaminant is tested for distribution type (normal distribution, lognormal etc.);
- The data set for each contaminant is tested for the presence of outliers, and these are considered for removal or inclusion in further calculations;
- An appropriate UCL95 is calculated, based on the distribution type and revised data set, and this is used as the RCC.

Consideration of whether outliers represent potential contaminant hotpots is also undertaken.

Lead risks are assessed using a C4SL value derived using a model which uses the geometric mean of blood lead levels as one of its input parameters. For this reason, the log transformation of soil lead concentrations across a site is required prior to deriving the RCC.

Stage 3 JPB Risk Estimation Practice

JPB's Stage 3 assessment practice is to calculate SSACs, incorporating site specific data together with conservative health assumptions where necessary. This effectively reduces the conservatism of the Stage 2 assessment and provides a site specific assessment. Depending on the contaminant linkages identified in the conceptual site model and on the nature of contamination identified during site investigations, particular risk assessment tools are selected which are considered to be appropriate to assess risks to human health under the existing site conditions.

The CLEA model used has been designed to comply with current UK DEFRA guidance on the assessment of contaminants on land and where possible this is JPB's risk assessment tool of choice. Health criteria, toxicological, physical and chemical data are input for each contaminant for the land use envisaged. The model derives a Site-Specific Assessment Criteria (SSAC) for the contaminant which, if exceeded, would represent a human health risk to the sensitive receptor. The basis of the CLEA models are more fully discussed in the CLEA software manual and DEFRA report SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination respectively.

The CLEA model used to derive SGVs, C4SLs, GACs and SSACs includes inhalation of outdoor and indoor dust pathways where appropriate. Inhalation pathways are most important in driving risk assessments where inhalation HCVs are low or where inhalation exposure is high. Where a Stage 3 assessment is required, the inhalation SSACs may be presented in JPB's reports to allow further consideration of these pathways and any remedial actions which may be required.

On completion of contemporary developments, the amount of bare soil exposed is generally limited to localised landscaping. This is considered to be minimal as a proportion of the site area and given that clean topsoil will generally be placed to provide a suitable rooting horizon during development, this pathway will be usually be broken by this cover for most inorganic contaminants and, therefore, JPB do not assess this further. An additional degree of conservatism is build into the assessment here as the overall SSACs still have these pathways included. However, where volatile organic contaminants are present, such as BTEX or naphthalene, these substances may potentially migrate through clean cover and, if present at sufficiently high concentrations, may require the introduction of protective measures such as the installation of membranes in solums of buildings etc. to prevent unacceptable exposure to receptors via vapour migration and inhalation. The generation of dust during site works may also expose site operatives or the occupiers of adjacent properties to health risks and should be managed by the provision of appropriate PPE and adoption of appropriate site practices as described in CIRIA document 132 "A guide for safe working on contaminated sites".

Stage 3 Assessment of Risk to Other Receptors

The ecological risk assessment is carried out with respect to both on-site and off-site ecologically sensitive receptors. A review of information can indicate whether any nearby ecologically sensitive areas are likely to be impacted by on-site derived contamination; a comparison of contaminant levels found in the on-site ecologically sensitive areas can also be made with the UK Environmental Quality Standards for the protection of wildlife.

Contaminants which are at concentrations in excess of the Stage 2 screening criteria are determined to present a potential risk to the water environment and these contaminants therefore require assessment at a Stage 3 level. The purpose is to ascertain if the concentrations create a risk. It is important to consider factors such as the background groundwater quality, the sporadic nature of the perched groundwater and the separation of the site from the regional groundwater by an aquiclude.

The most significant receptors in the water environment assessment are generally considered to be the local shallow and deep groundwater and local surface waters. At some sites there is the potential for contaminants detected on-site to detrimentally affect off-site water receptors. Deeper (bedrock) groundwater resources may be important in some areas, or where groundwater may be abstracted for use. The significance of the risk to these receptors is assessed by considering, either conceptually or using groundwater models, the potential effects contaminants may have to groundwater and surface water receptors.

Stage 3 Evaluation of Risks to Groundwater and Surface Waters

An assessment of the potential for both contaminated soil and groundwater to affect the quality of water resources is undertaken in accordance with current SEPA guidance described in document WAT-PS-10-01: Assigning Groundwater Assessment Criteria for Pollutant Inputs (Live Document). This notes that for land contamination four receptor groups are to be assessed, if identified as being present, namely; surface water, groundwater abstraction, groundwater resource and groundwater dependant terrestrial ecosystem (GWDTE or wetland). Each receptor is considered in turn at the in ICSM stage, and investigations scoped to examine these linkages where necessary.

At Stage 2 the potential linkages identified in the ICSM are re-examined in the light of investigation findings, and only the viable linkages are considered further. Where relevant, recorded soil leachate, groundwater and surface water contaminant results are compared with GACs selected as described in the above guidance, dependant on the receptor being considered (e.g. UKDWS would be used where a water abstraction was the receptor). Where exceedences of GACs occur a Stage 3 assessment is undertaken.

In the Stage 3 Risk Assessment - Water Environment a re-examination of the ICSM is undertaken with respect to water environment receptors on the basis of site investigation data. Where a potential linkage remains, a back calculation is undertaken for the recorded soil leachate and/or groundwater concentration exceedences in accordance with the guidance in document WAT-PS-10-01 using the EA's Remedial Targets Methodology (RTM) and the associated Remedial Targets Worksheet hydrogeological modelling tool. After applying a dilution factor and where appropriate, degradation, the theoretical concentration of each contaminant at an assessment point is compared against the relevant assessment limit at that assessment point.

The assessment limit may be a UK Drinking Water Standard (UKDWS), Resource Protection Value (RPV) or EQS depending on the nature of the receptor which is being considered to be potentially at risk. The assessment point is the point at which assessment limit must be met. For the purposes of risk assessment, the assessment point is selected to be the nearest surface water course for surface water receptors, the site boundary (or 50m downgradient of the site boundary or 250m in a sewered urban environment) for the future groundwater resource receptors or in the raw water prior to any treatment this might receive for current abstractions. It should be noted that in contrast the SEPA guidance defines a compliance point as a "real" sampling point to demonstrate that inputs are acceptable. A compliance point may be the same location as the assessment point or between the source and receptor.

In addition, where required the Remedial Targets Worksheet can be used to calculate soil remedial targets which can be used to determine whether soil contaminant levels on site require remedial actions to prevent impact to water environment receptors.

For the above calculations it is assumed that leachate is theoretically produced by water infiltration from rainfall into site groundwater which can then migrate off site. In this case the leachate migrates through permeable strata until it enters a theoretical deeper groundwater. The remedial target which is calculated represents the maximum concentration of that particular contaminant which can be allowed at the assessment point or at its location on the site in the case of soil remedial targets. If concentrations are recorded above remedial targets, then theoretically by the time impacted groundwater has migrated to the assessment point it will be above the relevant assessment limit for that contaminant and remedial measures would be necessary.

Other analytical, numerical and probabilistic groundwater models are available to aid in the quantitative assessment of contaminated waters, the suitability of each which can be determined upon completion of site assessment and project requirements.

RISK-BASED CONCLUSIONS

The comparison of the estimated risks with the appropriate criteria indicates whether;

1) the site presents an insignificant risk based on the analysis; or,

2) there is a potential risk to health or the environment.

Where a risk has been identified remedial strategies can then be developed in order to break any source-pathway-receptor linkage. Strategies may include; source removal, breaking the pathway from the source to the receptor or choosing developments in which sensitive receptors are not included in areas where the risk exists.

As described above a number of remedial strategies can be adopted for a site and JPB select the most appropriate strategy for remediation on a site specific basis. One commonly adopted practice is to break the contaminant linkages by the introduction of clean capping materials. JPB have adopted, where appropriate, the BRE/DTI/NHBC/AGS document as a decision making tool to aid the design of remedial actions. This provides a research and data-based approach to designing cover systems rather than the use of professional judgement alone. It is, however, emphasised this document is used by JPB in the context of professional judgement and experience and a knowledge of site conditions.

As at the time of investigations the concentrations of contaminants present in material to be imported for capping may not be known, a conservative approach in which the imported material is assumed to have a contaminant concentration of 75% of the target guideline value is adopted. The spreadsheet which accompanies the document contains a viability check graph which indicates whether the capping layer calculated is acceptable or whether further consideration is required as to the effectiveness of the cover system proposed. JPB's procedure is to ensure that the effectiveness of the cover system is adequate for the site conditions encountered. Where these are exceeded more stringent remedial actions are recommended. JPB consider that this methodology provides a consistent, scientifically based rationale for designing cover systems in the vast majority of sites we encounter. Where more extreme conditions are encountered, or where there are specific site requirements, these issues will be considered on a site specific basis in order to be protective of receptors at the proposed development.

Specific measures are proposed where asbestos fibres or materials are recorded to be present and are to be retained, encapsulated on site. The recommended design of the environmental capping reflects the magnitude of the risks posed by the different types, concentrations and conditions of asbestos materials recorded to be present.

Remediation Strategy

Before any works can be carried out on site a Remediation Strategy is prepared in accordance with the “Model Procedures for the Management of Land Contamination” (CLR11) and the EA document “Verification of Remediation of Land Contamination”. JPB integrate the requirements for the various stages of remediation works in Remediation Strategy, Implementation and Verification Plan documents.

Ground Gas Assessment Methodology

Introduction

The assessment of ground gas as a potential constraint to development has been the subject of a great deal of research and published guidance. Broadly speaking ground gas can be a concern for several reasons; flammable gases may cause an explosion, build up of gases within poorly ventilated areas may lead to asphyxia or toxic gases may cause harm to those exposed to them. In general, we consider principally methane and carbon dioxide levels, however the presence of other gases such as carbon monoxide, hydrogen sulphide, petroleum vapours etc may also be considered where appropriate. Some physical properties of ground gases are tabulated below.

Gas	Explosive Range	Density of 20ºC	Toxicity % by volume in air*
Methane	5-15% by vol	0.72 kg/m^3	30 (low)
Carbon dioxide	N/A	1.98kg/m^3	0.5 (high)
Carbon monoxide	12.5-74.2% by vol	1.25kg/m^3	0.02 (high)
Hydrogen sulphide	4.2-46% by vol	1.54kg/m^3	0.001 (high)

* short term occupational exposure limits. The long term occupational exposure limit for carbon monoxide is 30ppm and for hydrogen sulphide is 5ppm.

These ground gases may originate from many sources including; mine workings, organic sediments, landfilling, biodegradable materials in made ground on brownfield sites, petroleum hydrocarbons or other site specific sources. The gas concentrations measured are the result of volatile emissions and the microbial degradation of organic materials. The processes by which materials degrade to form ground gases are discussed more fully in EA's Guidance on the Management of Landfill Gas, LFTGN 03, 2004.

Data Requirements and ICSM

JPB's overall methodology for ground gas assessments is summarised in the attached flow chart. In order to assess the degree of risk to receptors we must first develop an initial conceptual site model (ICSM) of the site which can identify the various sources and receptors and any potential pathways by which they may be linked. This process can be undertaken as part of the development of an ICSM for the site for contaminants other than gases. If a potential contaminant linkage is identified for ground gas, site investigations to confirm the nature and extent of ground gases will be required. Guidance on how these site investigations should be undertaken is given in B5930 - Code of Practice for Site Investigations, BS10175 - Investigation of Potentially Contaminated Sites, CIRIA Reports 103 (Vol II) and 150 (Methane Investigation Strategies), CIRIA C665 and BS8485 and other published guidance including the VOC handbook and CIRIA C735.

Investigation methodologies which have been used to measure gas concentrations include spike probe surveys, sinking of boreholes with monitoring standpipes installed and flux boxes. Spike probe surveys are considered to be unreliable for the following reasons: limited depth, spikes into an aerobic layer in an open hole underestimate methane levels and spike probes may not intercept the gas source.

JPB, therefore, generally commission the sinking of boreholes with standpipes to characterise the gas regimes at sites. Where access is restricted, a window sampler is used to install standpipes. The number and position of bores and well response zones are carefully chosen in order to maximise the information to be obtained to fully characterise the site. Table 4.2 in CIRIA C665, reproduced below, gives some guidance on the spacing of wells, which should be interpreted in conjunction with the associated text of that paper ad in the light of actual site conditions.

Gas Hazard	Typical Examples	Sensitivity of end use	Initial nominal spacing of gas monitoring wells[1,2]
High	Domestic landfill sites	High[3]	Very close (<25m)
		Moderate	Close (25-50m)
		Low	Close (25-50m)
Moderate	Older domestic landfills disused shallow mine workings[4]	High	Close/very close (<25m -50m)
		Moderate	Close (25-50m)
		Low	Close/wide (25-75m)
Low	Made ground with limited degradable material, organic clays of limited thickness	High	Close (25-50m)
		Moderate	Wide (50-75m)
		Low	Wide/very wide (50->75m)

1 The initial spacing may need to be reduced if anomalous results indicate this is necessary to give a robust indication of the gas regime below a site. To prove the absence of gas, closer spacings may be required.

2 The spacing assumes relatively uniform ground conditions and the gas source present below a site. The spacing will need to be reduced if ground conditions are varied or if the investigation is trying to assess migration patterns from off site.

3 Placing high-sensitivity end use on a high gas hazard site is not normally acceptable unless the source is removed or treated to reduce gassing potential.

4 Petrol stations and other sources of vapours are most likely to be classified as gas hazard "Moderate" however site specific assessment would be required.

Three bores with standpipes and four sets of readings should be considered an absolute minimum for even the smallest of sites.

Flux boxes can be used to measure surface gas emission rates but do not take into account a deeper source of gas generation. Flux boxes can be used to confirm that a capping layer above a source and the surface has been effective. It should be noted that methane levels at the surface may underestimate ground gas levels as aerobic conditions at the near surface will deplete methane concentrations.

Guidance on the measurement of gas levels at bores is given in the above documents, however, in general a peak gas reading is taken followed by readings at 30 second intervals until a steady state is reached. This allows the assessor to determine how quickly the ground gas is replenished. Flow rate is generally measured first followed by methane/carbon dioxide levels. In addition, atmospheric pressure, weather, date and any other relevant information is recorded.

Flow rates can be positive or negative, they are generally negative where ambient atmospheric pressure is high or where falling groundwater levels reduce pressures in bores. Flow rates between -0.4 and 0.4 L/h indicate that there is probably no overall flow. The length of the monitoring period and frequency of monitoring will vary from site to site depending on the sensitivity of development, geology of the site, the level of risk and other factors. Typical minimum periods and monitoring frequencies are given in Table 5.5 of CIRIA C665. Generally, JPB undertake six visits over 12 weeks for sites proposed for residential development.

Continuous gas monitoring at boreholes over a period of several weeks can also sometimes be utilised to clarify the type of gas generation sources present and levels of risk posed by ground gases at some sites.

The degree of monitoring required must enable the assessor to measure or predict the reasonable worst case gas regime.

Risk Assessment

Having obtained factual data from the investigation the ground gas regime can be assessed in a tiered approach. In the past guidance such as Waste Management Paper 27 recommended a highly conservative precautionary principle, i.e. no development within 250m of a landfill site. This approach was seen as anti-development and does not take into account the site conditions, whether a risk exists at the site for the development proposed, the level of risk and whether if can be mitigated by design. More recent approaches characterise the site and the risk and base recommendations on this assessment. Various reports and standards have recently been published to update the guidance on ground gas assessment and this JPB methodology uses the philosophy outlined in these. These include CIRIA C665 "Assessing risks posed by hazardous ground gases to buildings"), NHBC Report No. 10627-R01(04) "Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present" and British Standard BS8485 "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings".

Tier 1 assessment

Following the completion of investigations, the assessor reviews the ICSM in the light of site investigation data and identifies any intact contaminant linkages. If intact contaminant linkages exist a Tier 1 risk assessment is performed using generic screening criteria to determine whether a risk exists. JPB use the following screening levels: **Methane <1% by volume in bores and Carbon dioxide <5% by volume in boreholes.**

These values are derived from Waste Management Paper 27, 1% methane by volume represents 20% of methane's lower explosive limit of 5% by volume, 5% carbon dioxide relates to the known health effects of exposure to this gas. Both screening concentrations are detailed in the Building Regulations Approved Document C (2004) and BRE Report "Construction of New Buildings as Gas Contaminated Land" (BR 212).

A limit to gas flow rates for the above trigger values is inferred by the table given below where the limiting borehole gas volume flows for CH_4 and CO_2 are <0.07L/hr for characteristic situation 1. These are equivalent to **a limiting borehole flow rate of 7L/h for CH_4 at 1% by volume and 1.4L/h for CO_2 at 5% by volume.** The above Tier 1 trigger values are only valid, therefore, if these volume flows are not exceeded. Where these volume flows are exceeded a Tier 2 assessment should be undertaken.

Guidelines on screening levels for hydrogen sulphide and other trace gases are given in the VOC Handbook, CIRIA RP711. Other information on VOCs is available in EA Technical Guidance on Management of Landfill Gas (2004) and in the vapour models used in the CLEA model for contamination land assessments.

If these screening concentrations are not exceeded then no significant risk exists and no further action is required. Where screening concentrations are exceeded a Tier 2 assessment is performed.

Tier 2 assessment

Where Tier 1 generic screening concentrations are exceeded a Tier 2 assessment is performed using the Wilson and Card (1999) approach as outlined in CIRIA C665. Each site is classified into a "characteristic situation" based on the maximum methane and carbon dioxide concentrations measured. These measurements combined with the maximum borehole flow rate are used to calculate the gas screening value.

Gas screening value (L/hr) = gas concentration (% by volume) x borehole flow rate (L/hr).

(N.B. gas screening value is also known as "site characteristic hazardous gas flow rate (Q_{hgs}) in BS8485)

For example, for a borehole flow rate of 1.5 L/h and a methane concentration of 20% the gas screening value = 1.5 x 20/100 = 0.3 L/h.

Gas screening value rates for methane and carbon dioxide can be compared with Table 8.5 of CIRIA C665 “Assessing risks posed by hazardous ground gases to buildings” or Tables 14.1 of NHBC Report No. 10627-R01(04) “Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present”, reproduced below, to determine a characteristic situation for the site.

Table 8.5 Modified Wilson & Card Classification (CIRIA Report C665)
NB Use for most scenarios other than low rise housing with a ventilated underfloor void (min 150mm)

Characteristic Situation (CIRIA R149)	Comparable classification in DETR et al (1999)	Risk classification	Gas Screening Value (GSV) CH_4 or CO_2 (L/hr)[1]	Additional Limiting Factors	Typical Source of generation.
1	A	Very low risk	<0.07	Typically methane <1% by volume and/or carbon dioxide < 5%. Otherwise consider increase to Situation 2.	Natural soils with low organic content. “Typical” made ground
2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70L/hr. Otherwise increase to characteristic situation 3	Natural soil, high peat/organic content. “Typical” made ground
3	C	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protection measures	Mineworking – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	E	High risk	<70		Mineworkings unflooded inactive
6	F	Very high risk	>70		Recent landfill site

Table 14.1 Gas Risk Assessment (Traffic Lights) NHBC Report No. 10627-R01(04)
NB To be used for low rise housing with a ventilated underfloor void (min 150mm)

Traffic Light	Methane[1]		Carbon Dioxide[1]	
	Typical max conc.[5] (% by vol)	Gas screening value [2,4,6] (L/hr)	Typical max conc. [5] (% by vol)	Gas screening value [2,3,4,5] (L/hr)
Green	1	0.13	5	0.78
Amber 1	5	0.63	10	1.60
Amber 2	20	1.60	30	3.10
Red				

Protective measures can then be selected for the site buildings based on the Characteristic Situation and the type of development proposed (building types A-D, Table 3 BS8485) using the guidance and scoring system given in BS8485 and its annexes. Protective measures for new buildings can then be designed which are appropriate to the types and magnitude of the risks posed.

Radon

Radon is a naturally occurring radioactive gas that is formed from the decay of uranium and radium present in some types of rocks. It can migrate through cracks and fissures into the soil and by this route into buildings.

Radon can accumulate inside structures over the long term posing a risk to health. Long term exposure increases the risk of developing lung cancer, in a building with high levels of radon, long-term exposure can increase the risk to the point where preventative action is necessary.

For this reason section 3.2 of the Technical Handbook Guidance, which sets functional standards for Scottish buildings under the Building (Scotland) Act 2003, was revised in 2011 to ensure that “every building must be designed and constructed in such a way that there will not be a threat to the health of people in or around the building due to the emission and containment of radon gas”. This document provides guidance on how the risks posed by radon should be assessed. JPB’s methodology for assessing risks posed by radon follows that guidance and this methodology is outlined below.

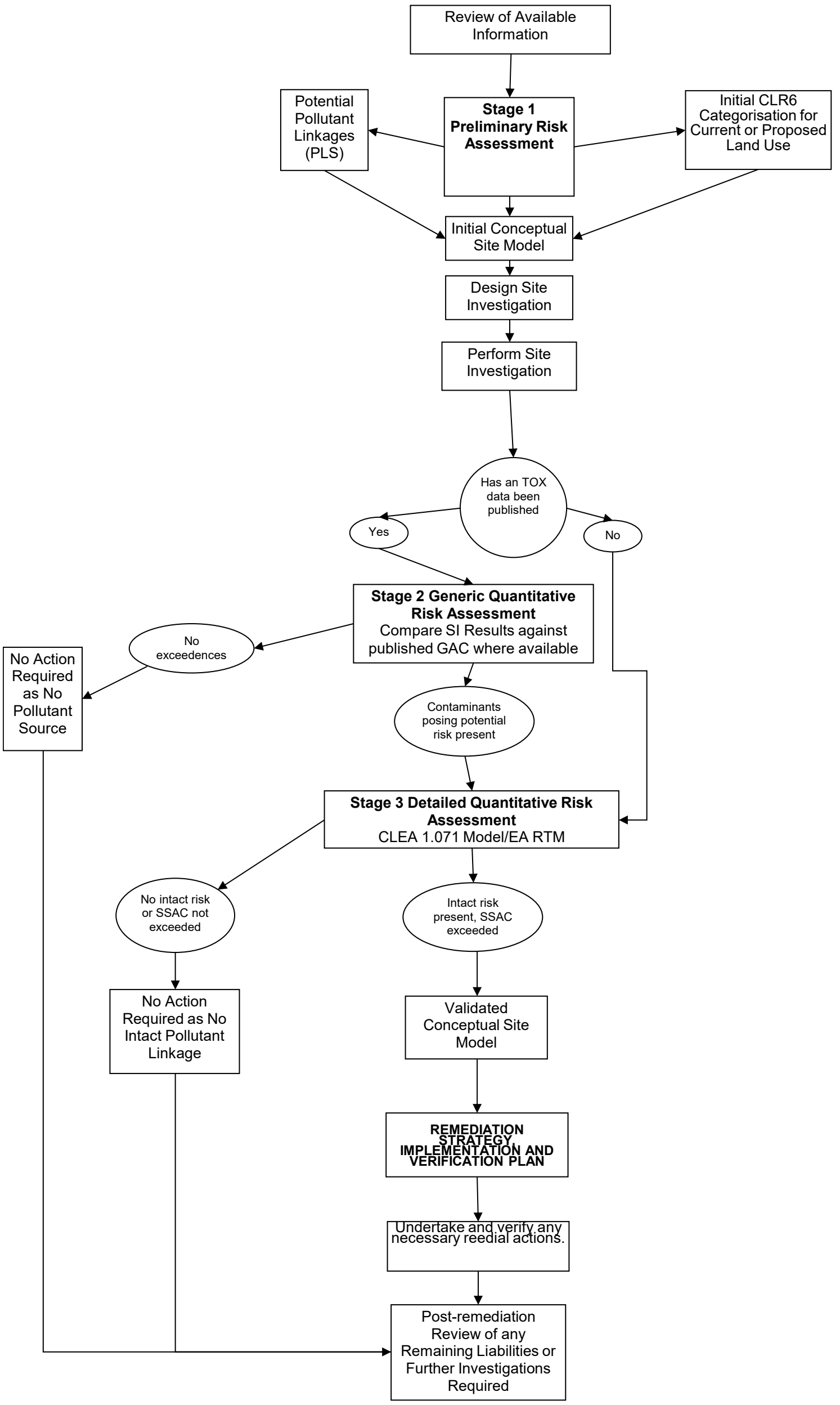
The location of the site is pinpointed on maps published in Appendix A of BRE BR 211. These maps were the result the result of a joint project between The Health Protection Agency (HPA) and the British Geological Society who prepared detailed maps of radon potential in Scotland by testing radon levels in houses. Depending on the level of risk within the geographical grid square within which the development lies, maps indicate whether; no protection measures are required, basic radon protection measures are required or full radon protection measures are required.

Where the site is indicated to be within an area within which radon protection is required, a further assessment of the risks posed by radon is undertaken. The BR211 Appendix A maps provide information on a large scale, and whole grid squares are categorised based on the worst conditions within the grid square, rather than for a specific site or smaller geographical area. Where the BR211 Appendix A map indicates there is a possibility that radon may pose a risk (or it is unclear), more detailed HPA/BGS mapping data is obtained and the site is assessed accordingly.

If the more detailed report indicates that the site is located on ground where radon protection measures are required, protective measures are recommended. Radon protective measures are recommended in accordance with the guidance contained in BRE Report BR211 “Radon: Protective measures for new buildings”. BRE have also confirmed to JPB that, where gas protection measures are being installed to provide protection against ground gases such as methane and carbon dioxide for CS-2 conditions or above, these measures will also provide adequate protection from risks posed by radon.

It should be noted that this approach has been adopted as monitoring radon concentrations in the ground prior to construction is not considered to be a valid methodology for assessing risks posed by radon in buildings. This is because it is difficult to equate the concentrations of radon measured in boreholes with levels inside houses, as many factors can influence the actual indoor air radon concentration experienced, including; radon generation rates, geology, construction details, ventilation rates, seasonal factors, occupant behaviour etc. Similarly, for newly constructed buildings it is impractical to determine indoor air radon concentrations over the recommended three month monitoring period and the results measured in unoccupied properties would not, in any case, be a valid assessment of conditions in occupied houses.

JPB Risk Assessment Methodology Flow Chart



Appendix 8 **Trial Pit Logs – Johnson Poole & Bloomer – April 2022**

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Trial Pit Number: TP01
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions:** 0.7m x 2.3m **Ground Level (mOD):** 45.98	**Client:** Keltbray Holdings Limited **Job Number:** WB307-01
	Location (dGPS): 507099.42, 187316.64 **Dates:** 06/04/2022	**Engineer:** DOP **Sheet:** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				45.73	(0.25) 0.25	TOPSOIL: Grass over brown very clayey slightly gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fie to coarse flint with fine rootlets.		
0.50	B				(1.25)	MADE GROUND: Firm brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded flint, chalk and occasional brick fragment with occaisonal cobbles of brick.		
1.20	HSV 48.67kPa		42, 44, 60/Av. 48.67					
1.50	HSV 33kPa		32, 32, 35/Av. 33.00	44.48	1.50	Soft orangish brown slightly silty slightly sandy CLAY.		
1.60	D				(0.50)			
2.00	HSV 48kPa		45, 48, 51/Av. 48.00	43.98	2.00	Firm light grey mottled orangish brown silty slightly sandy CLAY.		
2.40	HSV 72.67kPa		74, 74, 70/Av. 72.67		(1.10)	Becomes stiff and friable with extremely weak weathered mudstone and chalk gravels below 2.5m bgl.		
				42.88	3.10	Complete at 3.10m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP01

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP02
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.7m x 2.3m	**Ground Level (mOD)** 46.22	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 507113.80, 187325.05	**Dates** 04/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	ES			45.92	(0.30) 0.30	TOPSOIL: Grass over brown very clayey slightly gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fie to coarse flint with fine rootlets.		
0.50 0.50	HSV 55.67kPa B		55, 55, 57/Av. 55.67		(1.00)	MADE GROUND: Firm orangish brown mottled light grey slightly silty slightly sandy CLAY.		
				44.92	1.30	Plastic attentuation tank encountered at 1.3m depth.		
						Complete at 1.30m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit terminated at 1.3m bgl due to presence of plastic attenuation tank.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP02

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP03
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.8m x 2.5m	**Ground Level (mOD)**	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS)	**Dates** 06/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL: Grass over very clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint and chalk with fine rootlets.		
					(0.40) 0.60	Probably MADE GROUND: Brown very clayey sandy sub-angular to sub-rounded fine to coarse GRAVEL of flint and quartz with fine rootlets.		
0.60 0.70	HSV 59.67kPa B		60, 64, 55/Av. 59.67			Firm orangish brown mottled light grey slightly silty slightly sandy CLAY.		
					(1.40)			
1.50 1.50	HSV 45.33kPa D		44, 40, 52/Av. 45.33			Becomes firm, locally stiff, sandy from below 1.8m bgl.		
					2.00	Stiff friable orangish brown mottled light grey slightly silty slightly sandy CLAY.		
2.50 2.50	HSV 92kPa B		88, 86, 102/Av. 92.00		(1.20)			
						Extremely weak weathered mudstone gravels present below 2.9m bgl.		
					3.20	Complete at 3.20m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP03

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP04
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.3m	**Ground Level (mOD)** 47.90	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 507044.35, 187346.02	**Dates** 06/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				47.84	0.06			
					(0.16)	MADE GROUND: Tarmacadam.		
				47.68	0.22			
					(0.18)	MADE GROUND: Concrete.		
0.30	ES			47.50	0.40			
0.45	D					MADE GROUND: Orangish brown slightly clayey veyr gravelly fine to coarse SAND. Gravel is very angular to sub-rounded fine to coarse brick fragment, flint and concrete with abundant cobbles of brick.		
0.60	HSV 49kPa		56, 39, 52/Av. 49.00		(0.60)			
1.00	B			46.90	1.00			
1.10	HSV 33kPa		32, 33, 34/Av. 33.00		(0.50)	Probably MADE GROUND: Firm, locally soft, blueish grey slightly silty CLAY. Slighty organic odour. (Probably reworked natural)		
				46.40	1.50			
1.60	HSV 54.67kPa		48, 56, 60/Av. 54.67			Soft orangish brown mottled light grey slightly silty slightly sandy CLAY.		
					(1.00)	Firm orangish brown friable orangish brown mottled light grey slightly silty sandy CLAY. Becomes firm to stiff below 2.0m bgl.		
2.20	HSV 77.33kPa		78, 76, 78/Av. 77.33					
				45.40	2.50			
					(0.60)	Firm, locally soft, orangish brown mottled grey slightly silty sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak chalk.		
3.00	D			44.80	3.10			
					(0.20)			
				44.60	3.30	Firm to stiff orangish brown mottled grey slightly silty sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak chalk.		
						Complete at 3.30m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP04

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP05
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.7m x 2.3m	**Ground Level (mOD)** 47.93	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 507020.05, 187324.11	**Dates** 06/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				47.73	(0.20) 0.20	TOPSOIL: Grass over very clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint, quartz, brick fragment and wood with fine rootlets.		
0.60	D				(0.70)	MADE GROUND: Brown very gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint, mudstone and occasional brick fragment.		
1.00	HSV 67.33kPa		58, 71, 73/Av. 67.33	47.03	0.90	Firm orangish brown slightly silty slightly sandy CLAY.		
1.20	B				(0.50)			
1.50	HSV 39.67kPa		32, 42, 45/Av. 39.67	46.53	1.40	Soft orangish brown mottled light grey slightly silty slightly sandy CLAY.		
					(0.60)			
2.10	HSV 57.67kPa		64, 53, 56/Av. 57.67	45.93	2.00	Firm friable orangish brown mottled light grey slightly silty sandy CLAY with occasional chalk gravels.		
					(1.10)			
2.70	B					Becomes locally stiff below below 2.7m bgl.		
				44.83	3.10	Becomes stiff below 3.0m bgl.		
						Complete at 3.10m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP05

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP06
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.3m	**Ground Level (mOD)** 50.63	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 507023.70, 187389.92	**Dates** 05/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				50.43	(0.20) 0.20	MADE GROUND: Concrete.		
				50.23	(0.20) 0.40	MADE GROUND: Brown very sandy very angular to sub-angular fine to coarse GRAVEL of brick fragment, concrete and sandstone.		
0.50	ES		Water strike(1) at 0.65m.		(0.40)			▽1
				49.83	0.80	MADE GROUND: Blackish grey soft to firm slightly sandy slightly gravelly CLAY. Gravel is angular to sub-angular fine to coarse brick fragment and flint with occasional cobbles of brick. Organic odour.		
1.00 1.00	HSV 40.67kPa D		38, 45, 39/Av. 40.67		(1.00)			
1.50	HSV 50.67kPa		45, 52, 55/Av. 50.67			Firm, locally soft, orangish brown slightly silty slightly sandy CLAY. Becomes firm below 1.0m bgl.		
				48.83	1.80	Firm, locally stiff, orangish brown sandy CLAY.		
2.00	HSV 72.67kPa		84, 69, 65/Av. 72.67					
2.50 2.50	HSV 67.67kPa B		69, 74, 60/Av. 67.67		(1.60)			
				47.23	3.40	Complete at 3.40m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Slight groundwater seepage encountered at 0.65m bgl.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP06

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP07
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.2m	**Ground Level (mOD)** 50.41	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 507053.71, 187401.28	**Dates** 05/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				50.31	0.10	MADE GROUND: Tarmacadam.		
0.20	ES				(0.50)	MADE GROUND: Brown very gravelly fine to coarse SAND. Gravel is very angular to sub-angular fine to coarse brick fragments, concrete and sandstone with occasional cobbles of brick.		
				49.81	0.60			
1.00	D				(0.60)	MADE GROUND: Very soft brown slightly silty veyr sandy slightly gravelly CLAY with occasional fine rootlets. Gravel is very angular fine to coarse of brick fragment, ceramic and sandstone. Old ceramic drain encountered at 1.1m bgl.		
1.50 1.50	HSV 135kPa B			49.21	1.20			
				48.61	(0.60) 1.80	Very stiff brown mottled light grey slightly silty slightly sandy CLAY.		
2.00	HSV 69kPa		66, 78, 63/Av. 69.00			Firm orangish brown sandy CLAY.		
					(1.00)			
2.60	HSV 78.67kPa		81, 79, 76/Av. 78.67			Firm, locally stiff, below 2.5m bgl.		
				47.61	2.80	Complete at 2.80m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP07

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP08
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.4m	**Ground Level (mOD)** 51.54	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 507026.31, 187415.49	**Dates** 05/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				51.34	(0.20) 0.20	MADE GROUND: Concrete.		
0.30	ES			51.04	(0.30) 0.50	MADE GROUND: Dark brown, yellowish brown and light grey slightly clayey fine to coarse SAND and angular to sub-angular fine to coarse GRAVEL of concrete, brick fragment, sandstone and flint with frequent cobbles of brick.		
0.70 0.70	HSV 53.67kPa B		52, 55, 54/Av. 53.67	50.94	0.60	MADE GROUND: Firm blackish grey silty slightly sandy slightly gravelly CLAY. Gravel is angular to sub-angular fine to coarse brick fragment, concrete, flint and sandstone. Organic odour.		
					(1.60)			
1.50 1.50	HSV 73.33kPa D		75, 76, 69/Av. 73.33			Firm, locally soft, orangish brown mottled light grey slightly silty slightly sandy CLAY. Firm below 0.9m bgl. Becomes friable below 1.6m bgl.		
2.20	HSV 72.33kPa		65, 78, 74/Av. 72.33	49.34	2.20	Firm, locally stiff, friable orangish brown mottled light grey slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak weathered mudstone.		
2.60	HSV 76.67kPa		78, 76, 76/Av. 76.67		(1.20)	Becomes stiff below 2.8m bgl.		
3.20	HSV 93kPa		90, 89, 100/Av. 93.00	48.14	3.40	Complete at 3.40m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP08

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP09
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.2m	**Ground Level (mOD)** 52.91	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 507021.28, 187444.71	**Dates** 05/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				52.61	(0.30) 0.30	TOPSOIL: Grass over brown very clayey slightly gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint with fine rootlets.		
0.50 0.50	HSV 55.67kPa B		56, 46, 65/Av. 55.67		(0.70)	Firm brown slightly sandy gravelly CLAY. Gravel is sub-rounded fine to coarse flint.		
				51.91	1.00			
1.10 1.10	HSV 60.33kPa D		56, 60, 65/Av. 60.33			Firm brown mottled light grey slightly sandy CLAY.		
						Firm, locally stiff, below 1.5m bgl.		
1.70	HSV 69kPa		65, 71, 71/Av. 69.00		(1.60)			
						Becoming stiff below 2.0m bgl.		
2.50	D			50.31	2.60			
2.80	HSV 94kPa		96, 100, 86/Av. 94.00		(0.70)	Stiff, locally firm, friable orangish brown mottled light grey slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak weathered mudstone.		
				49.61	3.30			
						Complete at 3.30m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP09

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP10
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.2m	**Ground Level (mOD)** 54.79	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 506978.44, 187431.85	**Dates** 04/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	TOPSOIL: Grass over brown very clayey slightly gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded flint and wood with fine to coarse rootlets.		
0.20	ES			54.39	0.40			
0.60	HSV 42.67kPa		40, 40, 48/Av. 42.67			Firm brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse chalk and fine rootlets.		
0.80	B				(1.10)			
1.00	HSV 65.67kPa		65, 68, 64/Av. 65.67					
				53.29	1.50			
1.70	HSV 135kPa					Stiff becoming very stiff greyish brown slightly sandy CLAY.		
					(0.70)			
				52.59	2.20			
2.20	HSV 86.33kPa		81, 86, 92/Av. 86.33			Stiff brown mottled light grey friable slightly sandy CLAY with occasional extremely weak weathered mudstone gravels.		
2.30	D							
					(1.40)			
				51.19	3.60			
3.60	HSV 81.67kPa		82, 80, 83/Av. 81.67			Complete at 3.60m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP10

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP11
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.2m	**Ground Level (mOD)** 53.78	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 506970.93, 187417.84	**Dates** 05/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				53.63	(0.15) 0.15	TOPSOIL: Dark brown very clayey silty gravelly fine to coarse SAND. Gravel is angular to sub-angular fine to coarse flint with fine rootlets.		
0.30	ES				(0.65)			
				52.98	0.80	MADE GROUND: Firm, locally soft, dark brown mottled orangish brown sandy gravelly CLAY. Gravel is very angular to sub-rounded fine to coarse brick fragment, breezeblock fragment, plastic and concrete with cobbles and boulders of building stone. Large mesh bag at 0.2m bgl. Plastic sheet at 0.6m bgl.		
1.20 1.30	HSV 52kPa B		48, 55, 53/Av. 52.00		(1.20)			
1.80	HSV 73kPa		70, 69, 80/Av. 73.00			Firm orangish brown slightly silty slightly sandy CLAY. Firm, locally stiff, below 1.6m bgl.		
				51.78	2.00	Firm, locally stiff, orangish brown slightly silty sandy CLAY.		
					(0.70)			
2.70	HSV 85kPa		79, 86, 90/Av. 85.00	51.08	2.70	Stiff friable orangish brown slightly silty sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak weathered mudstone.		
					(0.60)			
				50.48	3.30	Complete at 3.30m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP11

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP12
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.2m	**Ground Level (mOD)** 52.04	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 506984.20, 187392.39	**Dates** 05/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				51.79	(0.25) 0.25	TOPSOIL: Dark brown very clayey silty gravelly fine to coarse SAND. Gravel is angular to sub-angular fine to coarse flint with fine rootlets.		
0.30	ES			51.69	0.35	MADE GROUND: Brown very clayey gravelly fine to coarse SAND. Gravel is angular to sub-angular fine to coarse brick fragment, concrete and flint.		
0.50	HSV 40.33kPa		38, 48, 35/Av. 40.33		(1.65)	Soft becoming firm orangish brown mottled light grey slightly silty slightly sandy CLAY.		
1.50 1.50	HSV 62kPa D		64, 68, 54/Av. 62.00	50.04	2.00	Firm, locally stiff, orangish brown mottled light grey slightly silty slightly sandy CLAY.		
2.70 2.90 3.00	HSV 80.33kPa HSV 98kPa D s		84, 78, 79/Av. 80.33 100, 104, 90/Av. 98.00	49.14	(0.90) 2.90	Stiff friable orangish brown mottled light grey slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak weathered mudstone.		
				48.64	(0.50) 3.40	Stiff, locally very stiff, below 3.0m bgl.		
						Complete at 3.40m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP12

Johnson Poole & Bloomer

Site	Trial Pit Number
Breakspear Road South, Ickenham	TP13

Machine : JCB 3CX Method : Trial Pit	Dimensions 0.6m x 2.3m	Ground Level (mOD) 48.74	Client Keltbray Holdings Limited	Job Number WB307-01
	Location (dGPS) 507003.03, 187335.78	Dates 06/04/2022	Engineer DOP	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				48.49	(0.25) 0.25	TOPSOIL: Grass over very clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint, quartz, chalk and wood with fine rootlets.		
0.50	B				(0.65)	Probably MADE GROUND: Firm orangish brown slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-rounded fine to coarse flint (Probably reworked natural material).		
0.70	HSV 60.33kPa		59, 61, 61/Av. 60.33	47.84	0.90			
1.10 1.10	HSV 49.67kPa D		51, 49, 49/Av. 49.67		(0.70)	Firm orangish brown mottled light grey slightly silty slightly sandy CLAY.		
				47.14	1.60			
1.70	HSV 41.67kPa		40, 42, 43/Av. 41.67		(0.40)	Soft, locally firm, orangish brown mottled light grey silty sandy CLAY.		
				46.74	2.00			
2.10	HSV 83.33kPa		82, 85, 83/Av. 83.33			Stiff light grey mottled orangish brown slightly silty slightly sandy CLAY. Becomes friable with extremely weak weathered mudstone gravels below 2.2m bgl.		
					(1.30)	Extremely weak chalk gravels present below 2.6m bgl.		
				45.44	3.30			
						Complete at 3.30m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP13

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP14
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 1.2m x 2.2m	**Ground Level (mOD)** 54.27	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 506941.37, 187422.99	**Dates** 05/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				54.07	(0.20) 0.20	TOPSOIL: Dark brown very clayey silty gravelly fine to coarse SAND. Gravel is angular to sub-angular fine to coarse flint with fine rootlets.		
0.30	ES			53.77	(0.30) 0.50	MADE GROUND: Greyish brown very clayey very gravelly fine to coarse SAND. Gravel is very angular to sub-rounded fine to coarse concrete, brick fragment and flint with occasional cobbles of concrete. Cable encountered at 0.3m bgl.		
0.75	B				(0.60)			
1.10	HSV 57kPa		55, 58, 58/Av. 57.00	53.17	1.10	MADE GROUND: Brown very clayey slightly sandy sub-rounded to rounded fine to coarse GRAVEL of flint and quartz with flint cobbles.		
					(0.90)			
				52.27	2.00	Firm orangish brown mottled grey slightly silty slightly sandy CLAY.		
2.00	HSV 68.67kPa		60, 78, 68/Av. 68.67			Firm, locally stiff, friable orangish brown mottled grey slightly silty sandy CLAY. Becomes stiff with extremely weak weathered mudstone gravels below 2.3m bgl.		
					(1.00)			
2.80	D			51.27	3.00	Complete at 3.00m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Dead electricity cable encountered at 0.3m bgl.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP14

Johnson Poole & Bloomer

Site	Trial Pit Number
Breakspear Road South, Ickenham	TP15

Machine : JCB 3CX Method : Trial Pit	Dimensions 0.6m x 2.3m	Ground Level (mOD)	Client Keltbray Holdings Limited	Job Number WB307-01
	Location (dGPS)	Dates 06/04/2022	Engineer DOP	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL: Grass over very clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint and chalk with fine rootlets.		
0.30	B				(0.30) 0.50	MADE GROUND: Soft to firm brown sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse flint, quartz and rare brick fragment with fine rootlets.		
0.80	HSV 46.67kPa		44, 48, 48/Av. 46.67					
1.00	B				(1.20)	Firm orangish brown mottled light grey slightly silty slightly sandy CLAY.		
						Firm, locally stiff, below 1.5m bgl.		
1.60	HSV 72.67kPa		66, 80, 72/Av. 72.67		1.70	Firm, locally stiff, organish brown mottled light grey slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak weathered mudstone.		
2.20	D				(1.70)	Frequent cobbles of extremely weak weathered mudstone below 2.8m bgl.		
					3.40	Complete at 3.40m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP15

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP16
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.2m	**Ground Level (mOD)** 54.81	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 506896.02, 187449.88	**Dates** 04/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	TOPSOIL: Grass over very clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint and chalk with fine rootlets.		
				54.41	0.40			
0.70 0.70	HSV 47.33kPa D		45, 47, 50/Av. 47.33			Firm orangish brown mottled light grey slightly silty slighty sandy CLAY.		
					(1.60)			
1.50 1.50	HSV 66.67kPa B		65, 65, 70/Av. 66.67					
				52.81	2.00			
2.20	HSV 75.33kPa		74, 74, 78/Av. 75.33			Firm, locally stiff orangish brown mottled light grey friable slightly silty slightly sandy CLAY.		
					(0.80)			
2.60 2.60	HSV 75kPa D		78, 74, 73/Av. 75.00	52.01	2.80			
						Stiff oranigsh brown mottled light grey friable slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak weathered mudstone.		
					(0.90)			
3.60	HSV 91.67kPa		95, 86, 94/Av. 91.67	51.11	3.70			
						Complete at 3.70m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP16

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP17
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.3m	**Ground Level (mOD)** 55.27	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 506863.61, 187418.75	**Dates** 05/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				55.07	(0.20) 0.20	MADE GROUND: Concrete.		
0.30	ES			54.82	(0.25) 0.45	MADE GROUND: Light brown very sandy angular to sub-angular GRAVEL of limestone, sandstone, quartz and occasional brick fragment. (sub-base) Plastic membrane at 0.2m bgl.		
0.50	HSV 96kPa		98, 90, 100/Av. 96.00	54.57	(0.25) 0.70			
1.00	HSV 51kPa		46, 55, 52/Av. 51.00			Probably MADE GROUND: Stiff to very stiff dark greyish brown slightly silty slightly sandy CLAY. (probably reworked natural) Hessien lining at 0.45m bgl.		
1.00	B				(1.30)	Firm orangish brown mottled light grey slightly silty slightly sandy CLAY.		
2.00	HSV 75.33kPa		70, 72, 84/Av. 75.33	53.27	2.00	Firm, locally stiff, orangish friable orangish brown mottled light grey slightly silty sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak weathered mudstone.		
2.20	HSV 83.33kPa		82, 74, 94/Av. 83.33		(1.10)	Stiff, locally very stiff, below 2.8m bgl.		
				52.17	3.10	Complete at 3.10m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP17

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP18
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.2m	**Ground Level (mOD)** 56.24	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 506860.64, 187454.67	**Dates** 04/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	TOPSOIL: Grass over very clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint and chalk with fine rootlets.		
				55.84	0.40			
					(0.60)	Probably MADE GROUND: Firm brown slightly sandy CLAY with occasional chalk and flint gravels. (Probably reworked natural material)		
0.80	HSV 55.33kPa		48, 58, 60/Av. 55.33					
0.80	B			55.24	1.00	Firm brown slightly sandy CLAY.		
					(1.00)			
1.70	HSV 52.33kPa		52, 52, 53/Av. 52.33					
1.70	D			54.24	2.00	Firm becoming stiff brown mottled light greay friable silty sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremely weak weathered mudstone.		
2.20	HSV 78kPa		78, 78, 78/Av. 78.00					
					(1.50)			
3.00	HSV 78kPa		78, 78, 78/Av. 78.00					
3.20	D			52.74	3.50	Complete at 3.50m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP18

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP19
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.4m	**Ground Level (mOD)** 57.51	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 506829.04, 187464.00	**Dates** 04/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	TOPSOIL: Grass over very clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse flint and chalk with fine rootlets.		
0.30	ES			57.11	0.40			
0.50	HSV 54.33kPa		53, 53, 57/Av. 54.33			Probably MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk and flint. (Probably reworked natural material)		
0.50	B				(0.60)			
				56.51	1.00			
						Firm brown slightly sandy CLAY.		
1.50	D							
1.70	HSV 53.67kPa		50, 53, 58/Av. 53.67		(1.60)			
						Becomes firm, locally stiff, below 2.0m bgl.		
2.20	HSV 67.67kPa		65, 65, 73/Av. 67.67					
				54.91	2.60			
2.60	HSV 83kPa		83, 83, 83/Av. 83.00			Firm to stiff grey mottled brown friable slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse of highly weathered extremely weak mudstone.		
2.90	HSV 84.67kPa		80, 85, 89/Av. 84.67		(0.50)			
3.00	D			54.41	3.10			
						Complete at 3.10m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP19

Johnson Poole & Bloomer

Site Breakspear Road South, Ickenham			**Trial Pit Number** TP20
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m x 2.2m	**Ground Level (mOD)** 45.17	**Client** Keltbray Holdings Limited	**Job Number** WB307-01
	Location (dGPS) 507142.70, 187316.64	**Dates** 04/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL: Grass over clayey gravelly fine to coarse SAND. Gravel is sub-angular fine to coarse brick fragment, flint and sandstone with fine rootlets.		
				44.87	0.30			
0.50	ES				(0.80)	MADE GROUND: Firm, locally soft, brown mottled grey silty, slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse flint. (Reworked natural material)		
0.80	HSV 37kPa		35, 38, 38/Av. 37.00					
				44.07	1.10	Firm orangish brown mottled light grey silty sandy CLAY.		
1.60 1.60	HSV 53.67kPa B		46, 55, 60/Av. 53.67		(1.70)			
2.20	HSV 36kPa		35, 38, 35/Av. 36.00			Becomes firm, locally stiff, below 2.2m bgl.		
2.60 2.60 2.70	HSV 59.33kPa D HSV 71kPa		50, 68, 60/Av. 59.33 65, 70, 78/Av. 71.00	42.37	2.80	Complete at 2.80m		

Remarks

Trial pit cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during excavation.
Trial pit generally remained stable during excavation.
Trial pit backfilled with arisings upon completion.

Scale (approx)	Logged By	Figure No.
1:50	DOP	WB307-01.TP20

Appendix 9 **In-situ California Bearing Ratio Test Results – Terra Tek – April 2022**

TERRA TEK
SITE INVESTIGATION & LABORATORY SERVICES

Johnson Poole & Bloomer Consultants
Unit 8
Shaw House
Two Woods Lane
Brierley Hill
DY5 1TA
For the attention of Mr. David Pacheco

Report No: C7605
Issue No 01

LABORATORY TEST REPORT

Project Name	**BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE**		
Project Number	**C7605**	Date samples received	
Your Ref		Date written instructions received	07/03/2022
Purchase Order	20220222	Date testing commenced	05/04/2022

Please find enclosed the results as summarised below

Item No	Test Quantity	Description	ISO 17025 Accredited
10.05	18	Insitu CBR	Yes

Remarks :

Issued by : J Hopkins Date of Issue : 08/04/2022

Approved Signatories : 08/04/2022

J.Hopkins (Laboratory Coordinator), M D Brown (Senior Quality Manager), R Norris (Supervisor)

Key to symbols used in this report
S/C : Testing was sub-contracted

Unless we are notified to the contrary, samples will be disposed after a period of one month from this date.
The results reported relate to samples received in the laboratory only.
All results contained in this report are provisional unless signed by an approved signatory
This report should not be reproduced except in full without the written approval of the laboratory.
Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory.
Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation.
Feedback on the this report may be left via our website terratek.co.uk/feedback

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TERRA TEK
Site Investigation & Laboratory Services

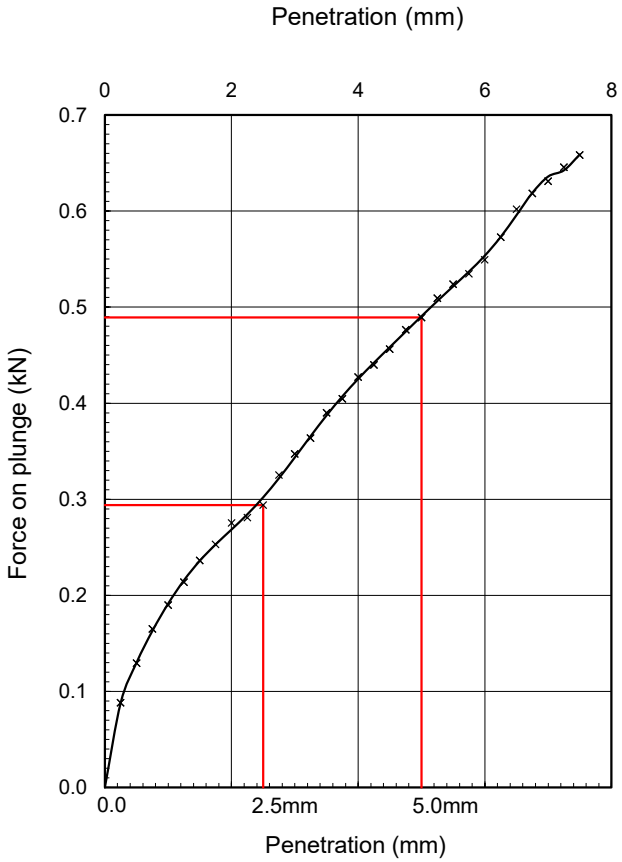
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
		Test No.	Test 1 CBR 08
Client	Johnson Poole & Bloomer Consultants	Date	05/04/2022
Engineer	Johnson Poole & Bloomer Consultants	Depth (m)	0.50

Description: Dark olive brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 28 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 2.4%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
BS1377 : Part 9 : 1990 Clause 4.3

Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

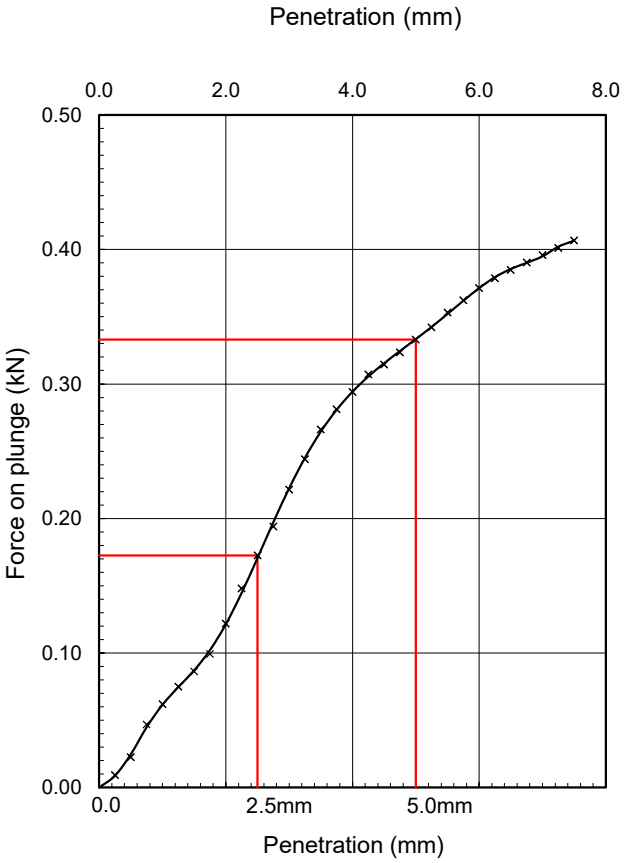
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
		Test No.	Test 10 CBR 11
Client	Johnson Poole & Bloomer Consultants	Date	05/04/2022
Engineer	Johnson Poole & Bloomer Consultants	Depth (m)	0.85

Description: Brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 30 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 1.7%



Originator	Checked & Approved
	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
BS1377 : Part 9 : 1990 Clause 4.3

Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE
Client	Johnson Poole & Bloomer Consultants
Engineer	Johnson Poole & Bloomer Consultants

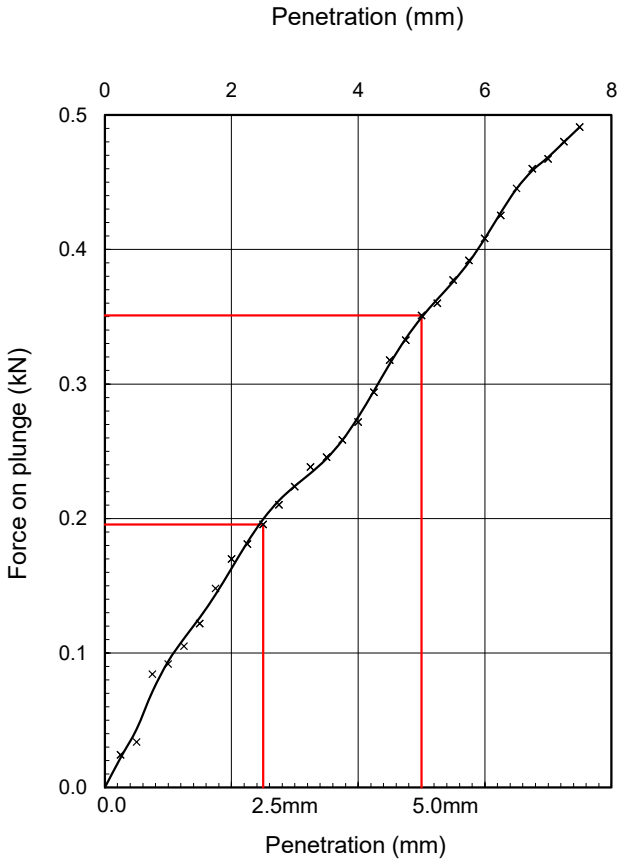
Contract No	**C7605**
Test No.	Test 11 CBR 16
Date	05/04/2022
Depth (m)	0.50

Description: Brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 29 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 1.8%



Originator	Checked & Approved
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Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

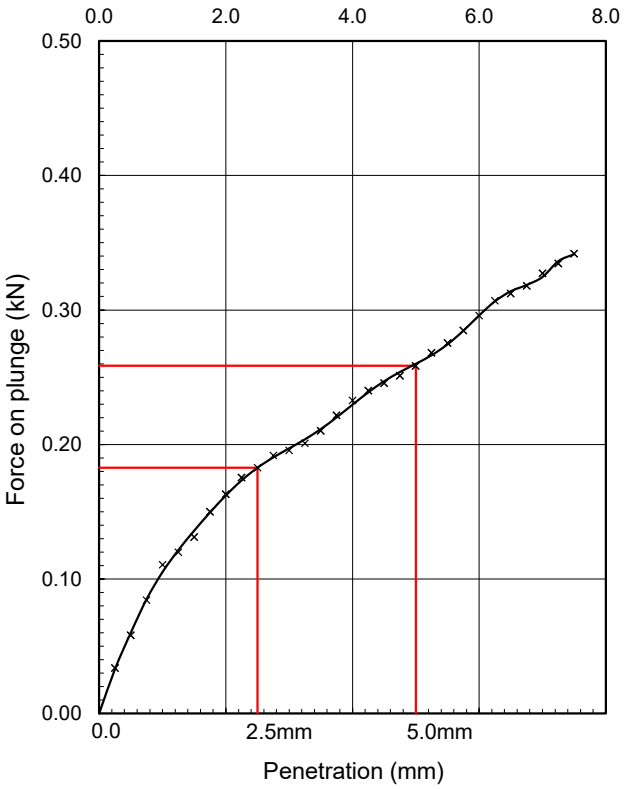
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
		Test No.	Test 12 CBR 20
Client	Johnson Poole & Bloomer Consultants	Date	05/04/2022
Engineer	Johnson Poole & Bloomer Consultants	Depth (m)	0.45

Description: Brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 31 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 1.4%



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TERRA TEK
Site Investigation & Laboratory Services

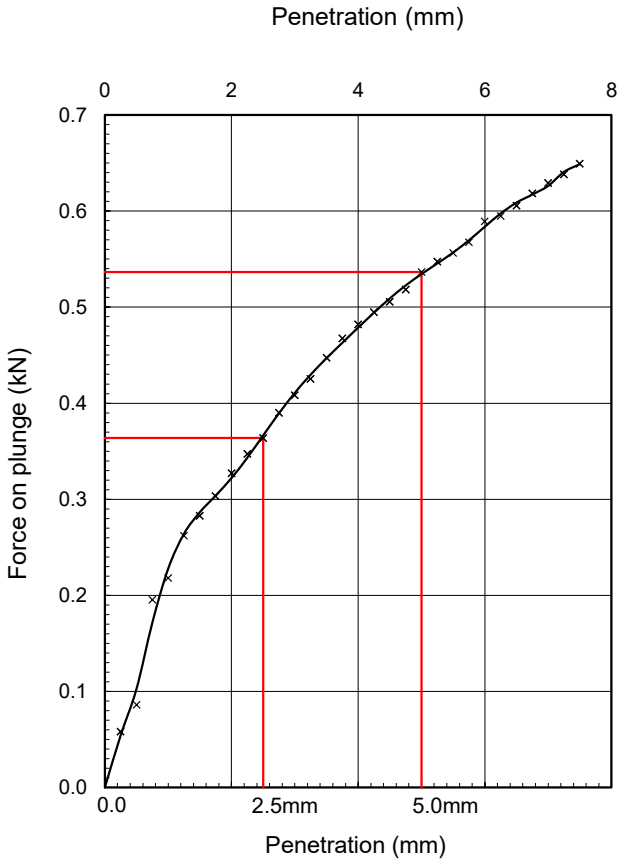
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
		Test No.	Test 13 CBR 2
Client	Johnson Poole & Bloomer Consultants	Date	05/04/2022
Engineer	Johnson Poole & Bloomer Consultants	Depth (m)	0.50

Description: Brown mottled dark brown slightly gravelly slightly sandy CLAY. Gravel is fine.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 22 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 2.8%



Originator	Checked & Approved
HL	08/04/2022

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TERRA TEK
Site Investigation & Laboratory Services

Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE
Client	Johnson Poole & Bloomer Consultants
Engineer	Johnson Poole & Bloomer Consultants

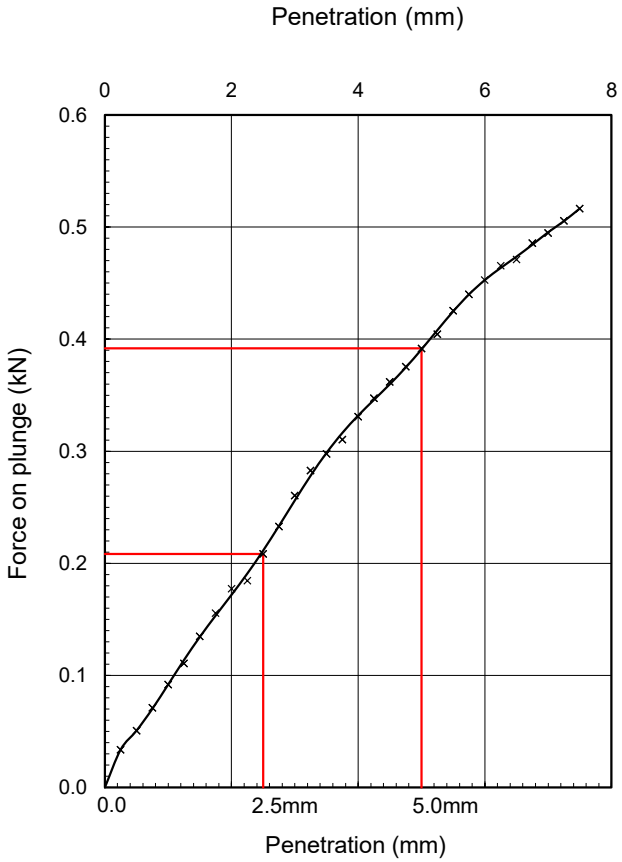
Contract No	**C7605**
Test No.	Test 14 CBR 1
Date	05/04/2022
Depth (m)	0.50

Description: Brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 24 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 2.0%



Originator	Checked & Approved
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Unit 2 Springfield Road, Chesham, Bucks, HP51PW
Lab Project No C7605 : 08/04/2022 11:19:01

TERRA TEK
Site Investigation & Laboratory Services

Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE
Client	Johnson Poole & Bloomer Consultants
Engineer	Johnson Poole & Bloomer Consultants

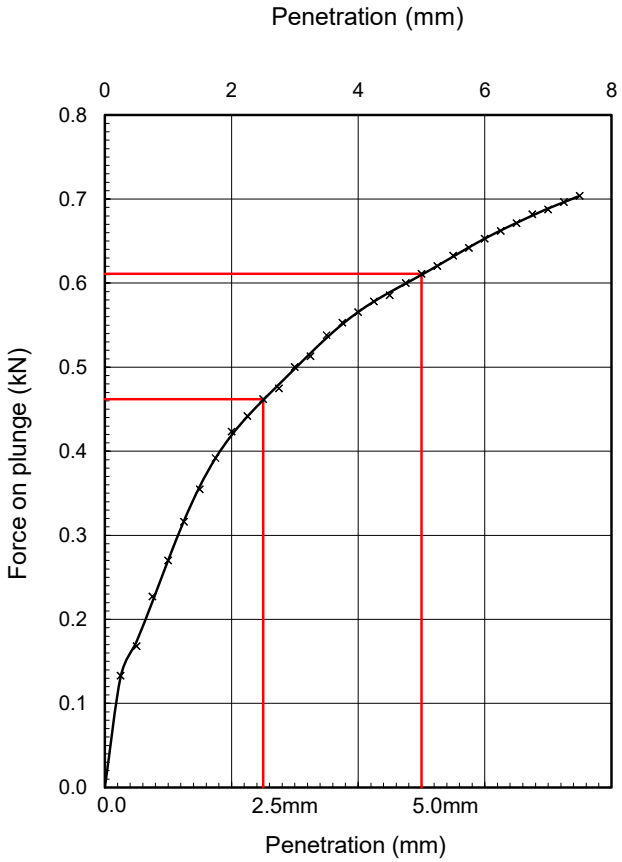
Contract No	**C7605**
Test No.	Test 15 CBR 4
Date	06/04/2022
Depth (m)	0.50

Description: Dark olive slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 22 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 3.5%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
BS1377 : Part 9 : 1990 Clause 4.3

Unit 2 Springfield Road, Chesham, Bucks, HP51PW
Lab Project No C7605 : 08/04/2022 11:25:08

TERRA TEK
Site Investigation & Laboratory Services

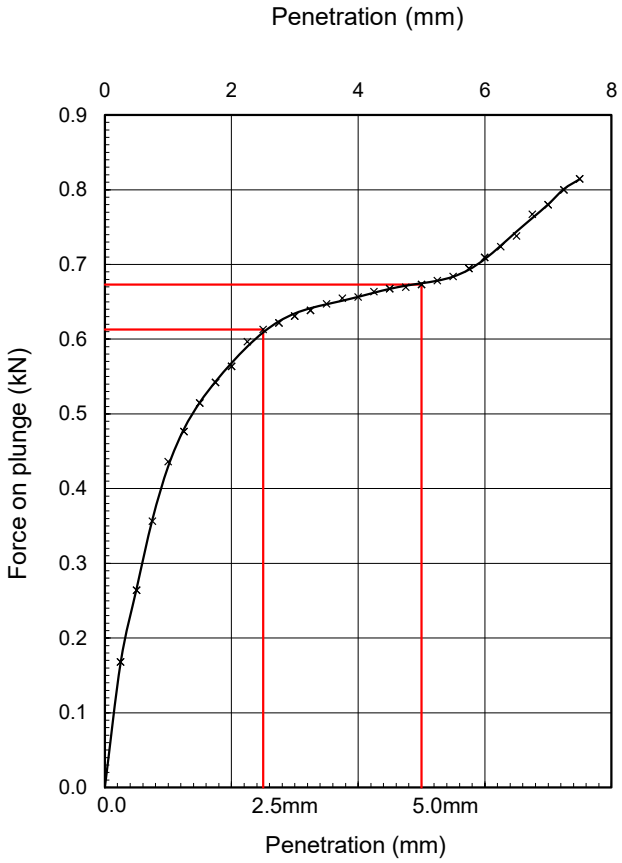
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
		Test No.	Test 16 CBR 05
Client	Johnson Poole & Bloomer Consultants	Date	06/04/2022
Engineer	Johnson Poole & Bloomer Consultants	Depth (m)	0.50

Description: Brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 20 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 4.6%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
BS1377 : Part 9 : 1990 Clause 4.3

Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

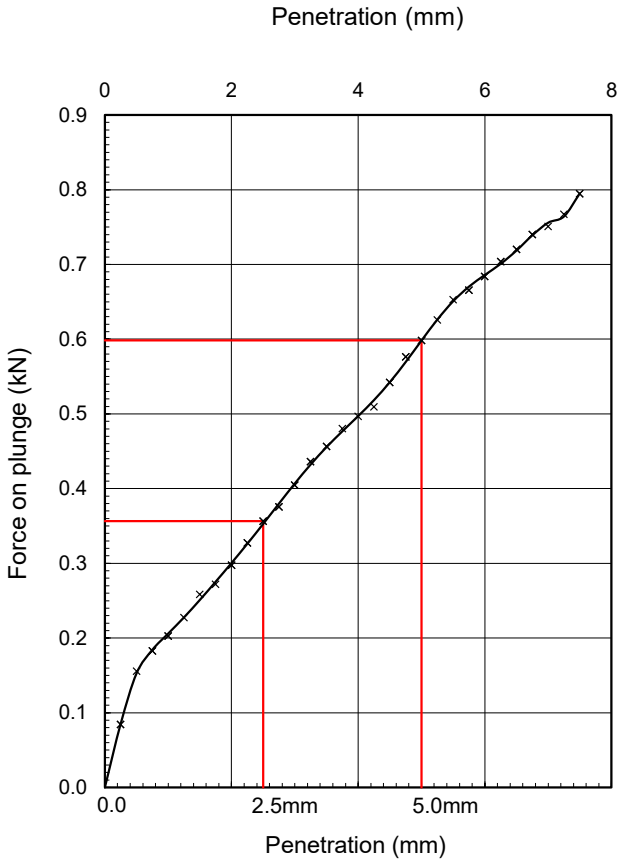
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
		Test No.	Test 17 CBR 13
Client	Johnson Poole & Bloomer Consultants	Date	06/04/2022
Engineer	Johnson Poole & Bloomer Consultants	Depth (m)	0.50

Description: Brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 21 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 3.0%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
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Unit 2 Springfield Road, Chesham, Bucks, HP51PW
Lab Project No C7605 : 08/04/2022 11:19:26

TERRA TEK
Site Investigation & Laboratory Services

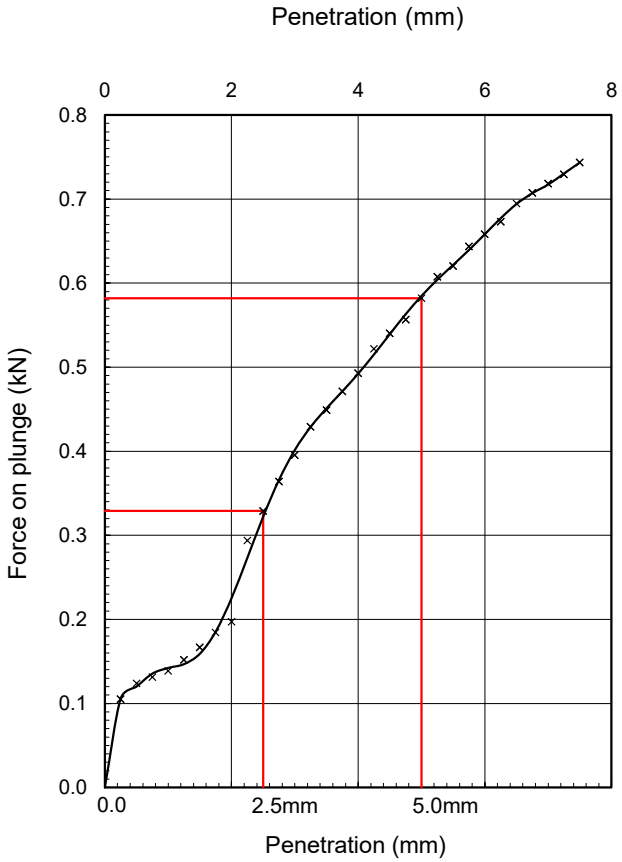
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
Client	Johnson Poole & Bloomer Consultants	Test No.	Test 18 CBR 15
Engineer	Johnson Poole & Bloomer Consultants	Date	06/04/2022
		Depth (m)	0.45

Description: Brown slightly gravelly slightly sandy CLAY. Gravel is fine.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 32 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 2.9%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
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Unit 2 Springfield Road, Chesham, Bucks, HP51PW
Lab Project No C7605 : 08/04/2022 11:19:35

TERRA TEK
Site Investigation & Laboratory Services

Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE
Client	Johnson Poole & Bloomer Consultants
Engineer	Johnson Poole & Bloomer Consultants

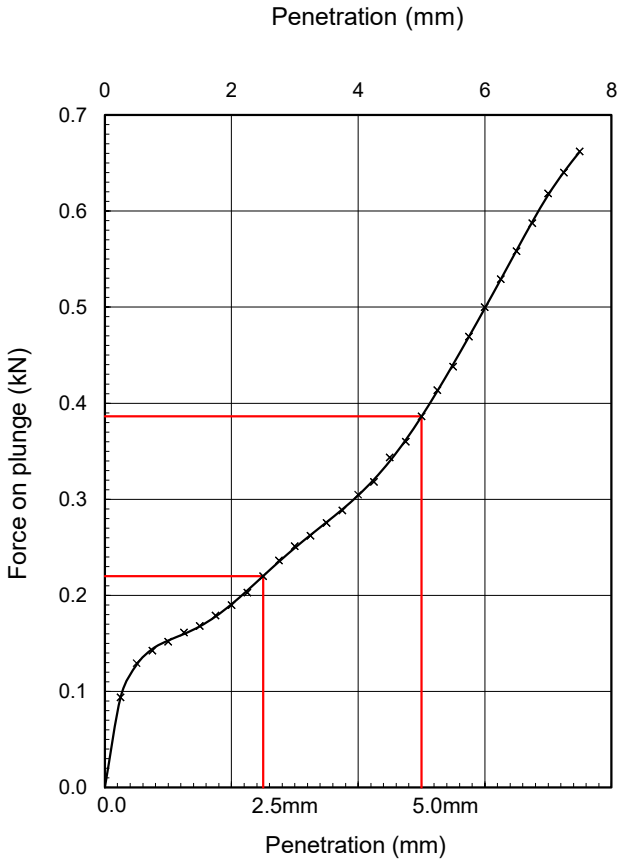
Contract No	**C7605**
Test No.	Test 2 CBR 07
Date	05/04/2022
Depth (m)	0.50

Description: Brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 15 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 1.9%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
BS1377 : Part 9 : 1990 Clause 4.3

Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE
Client	Johnson Poole & Bloomer Consultants
Engineer	Johnson Poole & Bloomer Consultants

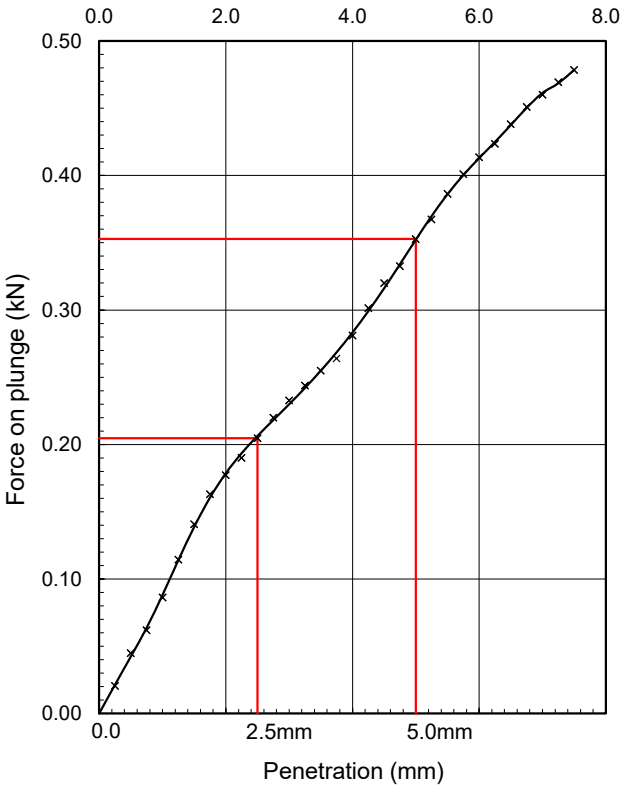
Contract No	**C7605**
Test No.	Test 3 CBR 06
Date	05/04/2022
Depth (m)	0.55

Description: Dark olive slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 27 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 1.8%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
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Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE
Client	Johnson Poole & Bloomer Consultants
Engineer	Johnson Poole & Bloomer Consultants

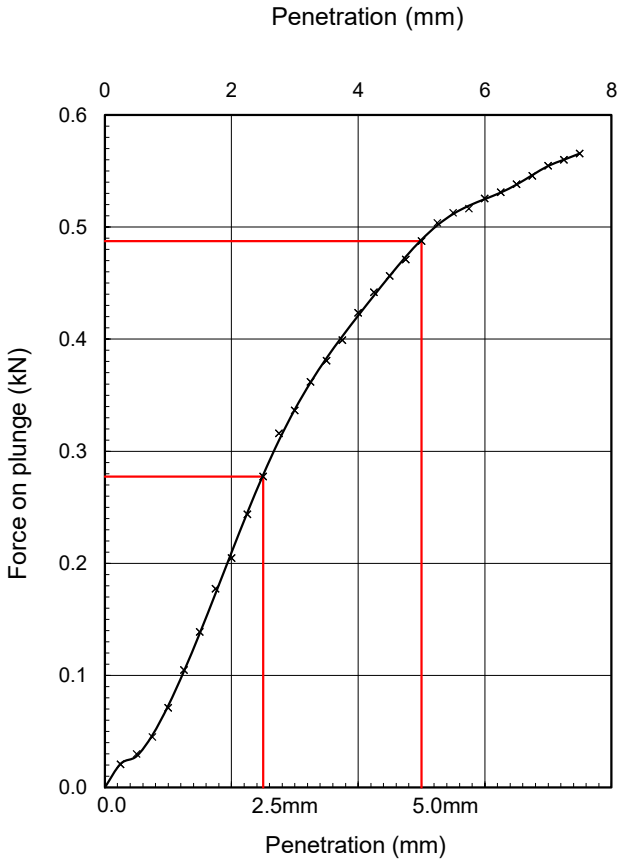
Contract No	**C7605**
Test No.	Test 4 CBR 10
Date	05/04/2022
Depth (m)	0.45

Description: Brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 32 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 2.4%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
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Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

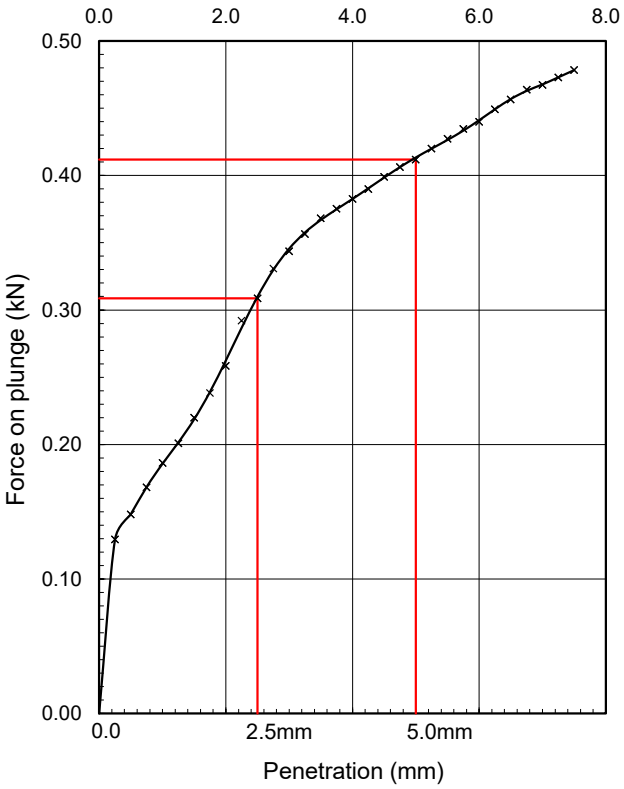
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
Client	Johnson Poole & Bloomer Consultants	Test No.	Test 5 CBR 12
Engineer	Johnson Poole & Bloomer Consultants	Date	05/04/2022
		Depth (m)	0.50

Description: Brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 32 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 2.3%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
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Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

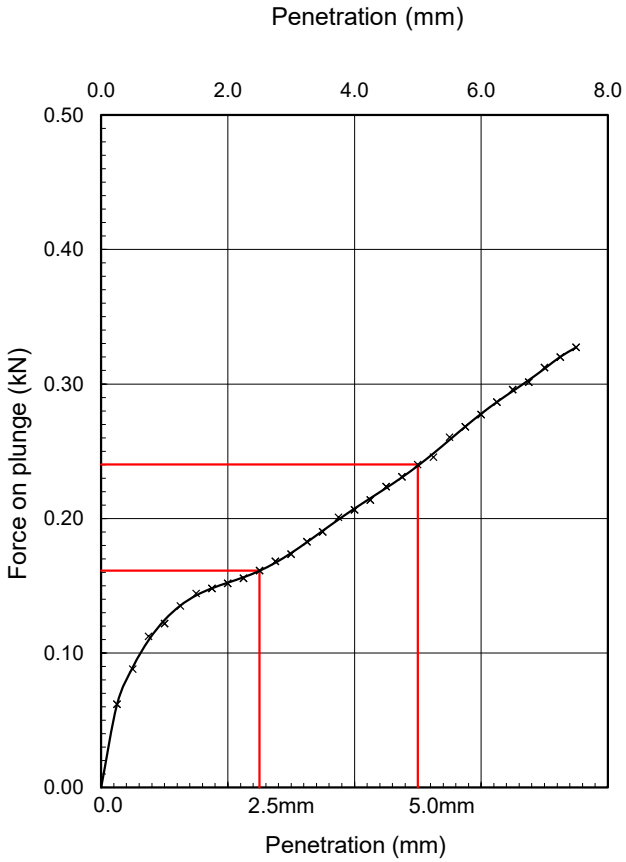
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
		Test No.	Test 6 CBR 14
Client	Johnson Poole & Bloomer Consultants	Date	05/04/2022
Engineer	Johnson Poole & Bloomer Consultants	Depth (m)	0.50

Description: Dark brown slightly gravelly slightly sandy CLAY. Gravel is fine.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 36 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 1.2%



Originator	Checked & Approved
HL	08/04/2022

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Unit 2 Springfield Road, Chesham, Bucks, HP51PW
Lab Project No C7605 : 08/04/2022 11:20:21

TERRA TEK
Site Investigation & Laboratory Services

Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE
Client	Johnson Poole & Bloomer Consultants
Engineer	Johnson Poole & Bloomer Consultants

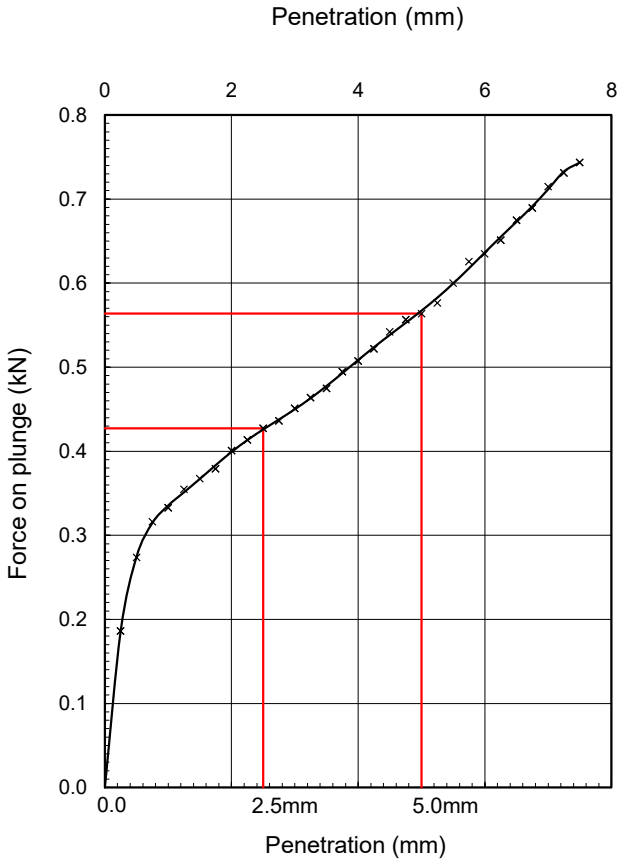
Contract No	**C7605**
Test No.	Test 7 CBR 17
Date	05/04/2022
Depth (m)	0.55

Description: Dark olive brown slightly sndy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 22 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 3.2%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
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Unit 2 Springfield Road, Chesham, Bucks, HP51PW
Lab Project No C7605 : 08/04/2022 11:20:31

TERRA TEK
Site Investigation & Laboratory Services

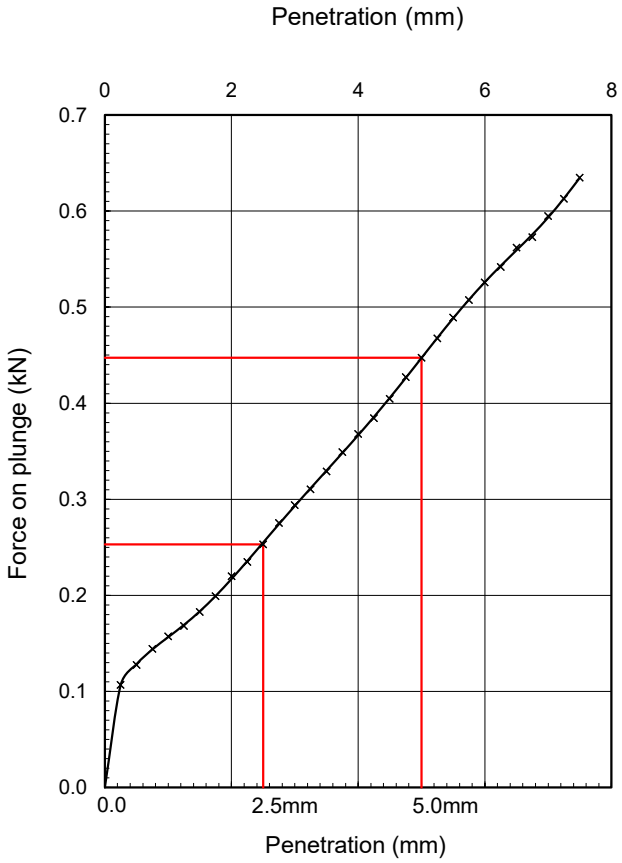
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
Client	Johnson Poole & Bloomer Consultants	Test No.	Test 8 CBR 19
Engineer	Johnson Poole & Bloomer Consultants	Date	05/04/2022
		Depth (m)	0.50

Description: Brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 24 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 2.2%



Originator	Checked & Approved
	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
BS1377 : Part 9 : 1990 Clause 4.3

Unit 2 Springfield Road, Chesham, Bucks, HP51PW

TERRA TEK
Site Investigation & Laboratory Services

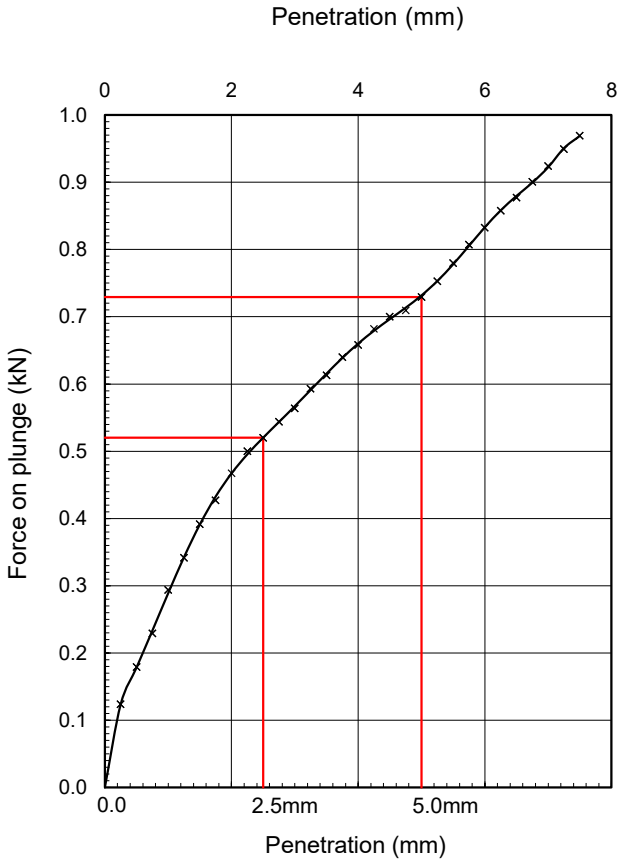
Site	BREAKSPEAR ROAD SOUTH, ICKENHAM, NEWYEARS GREEN, UXBRIDGE	**Contract No**	**C7605**
Client	Johnson Poole & Bloomer Consultants	Test No.	Test 9 CBR 18
Engineer	Johnson Poole & Bloomer Consultants	Date	05/04/2022
		Depth (m)	0.45

Description: Brown slightly sandy CLAY.

Test Conditions:
Surcharge 4 kg Equivalent 1 kPa
Moisture content beneath plunger: 26 %

Note: No particles larger than 20mm found beneath the plunger

CBR Value: 3.9%



Originator	Checked & Approved
HL	08/04/2022

IN-SITU CALIFORNIA BEARING RATIO
BS1377 : Part 9 : 1990 Clause 4.3

Unit 2 Springfield Road, Chesham, Bucks, HP51PW

Appendix 10 Windowless Sampler Borehole Logs – Johnson Poole & Bloomer – April 2022

Johnson Poole & Bloomer

Site	Number
Breakspear Road South, Ickenham	WS01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		49.26	Keltbray Holdings Limited	WB307-01
	Location (dGPS) 507083.07, 187397.20	**Dates** 07/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.30)	TOPSOIL: Grass over dark brown very clayey slightly gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse quartz, flint, rare brick fragment and clinker with fine rootlets.			
0.20	ES			48.96	0.30				
					(0.60)				
0.90	HSV 54kPa		60, 50, 52/Av. 54.00	48.36	0.90	Soft to firm brown slightly silty slightly gravelly CLAY. Gravel is rounded fine to coarse flint and occasional fine rootlets.			
1.00-1.45	SPT N=7		1,1/1,2,2,2						
1.40-1.50	D					Firm orangish brown slightly silty slightly sandy CLAY.			
1.50	HSV 75.33kPa		70, 78, 78/Av. 75.33			Firm, locally stiff, below 1.5m bgl.			
					(1.80)	Becomes sandy below 1.8m bgl.			
2.00-2.45	SPT N=11		2,2/2,2,3,4			Occasional chalk and flint gravels present below 2.0m bgl.			
				46.56	2.70				
					(0.15)	Brown very clayey silty fine to coarse SAND.			
				46.41	2.85				
3.00-3.45	SPT N=15		2,2/2,3,4,6			Firm becoming stiff orangish brown mottled light grey slightly silty sandy CLAY with occasional fine to medium chalk gravel.			
3.50-3.60	D					Becomes very stiff with red staining below 3.5m bgl.			
					(2.15)				
4.00-4.45	SPT N=19		2,3/3,4,6,6						
				44.26	5.00				
5.00-5.45	SPT N=24		3,3/4,6,6,8			Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling
Borehole installed with 50mm ID HDP standpipe to 5.0m. Slotted SP from 1.0m to 5.0m with gravel fill.
Plain SP from 1.0m to 0.3m with bentonite seal. Concrete from 0.3m bgl to surface with a lockable flush security cover fitted.

Scale (approx)	Logged By
1:50	DOP

Figure No. WB307-01.WS01

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS02

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		48.82	Keltbray Holdings Limited	WB307-01
	Location (dGPS) 507063.36, 187381.20	**Dates** 07/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.30)	TOPSOIL: Grass over dark brown very clayey slightly gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse quartz, flint, rare brick fragment and clinker with fine rootlets.			
				48.52	0.30				
					(0.60)	Soft brown slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse flint with fine rootlets.			
0.90	HSV 49.67kPa		48, 52, 49/Av. 49.67	47.92	0.90				
0.90-1.00	ES								
1.00-1.45	SPT N=7		1,1/1,2,2,2						
1.20-1.30	D				(0.90)	Soft becoming firm orangish brown slightly silty slightly sandy CLAY with occasional sub-rounded fine to coarse flint.			
1.70	HSV 45.33kPa		45, 45, 46/Av. 45.33	47.02	1.80				
					(0.20)	Soft dark brown silty sandy CLAY.			
2.00-2.45	SPT N=9		1,1/2,2,2,3	46.82	2.00				
2.00-2.20	D				(0.40)	Firm orangish brown mottled light grey slightly silty slightly sandy CLAY.			
				46.42	2.40				
2.60	HSV 72kPa		64, 78, 74/Av. 72.00			Stiff orangish brown mottled light grey CLAY with occasional gravels of chalk.			
3.00-3.45	SPT N=18		2,2/3,4,4,7			Becomes very stiff below 3.2m bgl.			
						Red staining below 3.5m bgl.			
					(2.60)				
4.00-4.45	SPT N=23		2,3/4,6,6,7						
5.00-5.45	SPT N=28		3,4/5,5,8,10	43.82	5.00	Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling
Borehole backfilled with materials arising upon completion.

Scale (approx)	Logged By
1:50	DOP

Figure No. WB307-01.WS02

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS03

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		50.50	Keltbray Holdings Limited	WB307-01
	Location (dGPS): 507066.52, 187412.44	**Dates**: 07/04/2022	**Engineer**: DOP	**Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				50.34	(0.16) 0.16	MADE GROUND: Tarmacadam.			
				50.20	(0.14) 0.30	MADE GROUND: Brown clayey sandy angular to sub-angular fine to coarse GRAVEL of limestone, concrete and tarmac fragments.			
0.40-0.50	ES				(0.70)				
0.80	HSV 24kPa		23, 24, 25/Av. 24.00			Soft, locally firm, blueish grey slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse flint with occasional fine rootlets. Slight organic odour.			
1.00-1.45	SPT N=8		1,1/2,2,2,2	49.50	1.00				
1.40	HSV 46kPa		44, 44, 50/Av. 46.00			Firm orangish brown slightly silty slightly sandy CLAY with occasional sub-angular fine to coarse gravel of chalk.			
1.80-2.00	D				(1.20)				
1.90	HSV 55kPa		65, 50, 50/Av. 55.00						
2.00-2.45	SPT N=11		2,2/2,2,3,4	48.30	2.20				
2.50	HSV 77.67kPa		84, 70, 79/Av. 77.67			Stiff orangish brown silty sandy CLAY with occasional sub-angular fine to coarse gravel of chalk.			
2.80-3.00	D				(1.30)				
3.00-3.45	SPT N=16		2,2/3,4,4,5						
				47.00	3.50	Medium dense brown clayey very silty fine to coarse SAND.			
3.60-3.80	D								
4.00-4.45	SPT N=16		2,3/3,3,5,5		(1.30)	Pockets of silty very sandy CLAY present between 4.0m and 4.8m bgl.			
				45.70	4.80				
				45.50	(0.20) 5.00	Very stiff light grey mottled orangish brown slightly silty slightly sandy gravelly CLAY. Gravel is sub-angular fine to coarse chalk.			
5.00-5.45	SPT N=41		6,6/8,9,10,14			Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling
Borehole backfilled with materials arising upon completion.

Scale (approx)	Logged By
1:50	DOP

Figure No. WB307-01.WS03

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS04

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		52.55	Keltbray Holdings Limited	WB307-01
	Location (dGPS) 507044.67, 187455.49	**Dates** 07/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.40)	TOPSOIL: Grass over dark brown very clayey sandy slightly gravelly fine to coarse SAND. Gravel is sub-angular fine to coarse flint with fine rootlets			
0.20-0.40	ES			52.15	0.40				
				52.05	0.50	MADE GROUND: Reddish brown brick COBBLE.			
0.80-0.90	D								
0.90	HSV 43.33kPa		40, 51, 39/Av. 43.33		(1.00)	Soft becoming firm orangish brown mottled light grey slightly silty slightly sandy CLAY.			
1.00-1.45	SPT N=8		1,2/2,2,2,2						
1.30	HSV 93.67kPa		90, 100, 91/Av. 93.67			Becomes stiff below 1.3m bgl.			
				51.05	1.50	Very stiff orangish brown mottled light grey slightly silty slightly sandy CLAY.			
1.80-1.90	D								
2.00-2.45	SPT N=28		3,4/4,7,7,10						
					(2.50)				
3.00-3.45	SPT N=30		3,4/5,7,9,9			Becomes sandy below 3.0m bgl.			
				48.55	4.00	Stiff becoming very stiff orangish brown mottled light grey slightly silty very sandy CLAY.			
4.00-4.45	SPT N=17		2,2/3,4,5,5		(1.00)				
						Chalk gravels present below 4.7m bgl.			
5.00-5.45	SPT N=28		2,3/4,6,8,10	47.55	5.00	Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling
Borehole backfilled with materials arising upon completion.

Scale (approx)	Logged By
1:50	DOP

Figure No. WB307-01.WS04

Johnson Poole & Bloomer

Site	Number
Breakspear Road South, Ickenham	WS05

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		50.26	Keltbray Holdings Limited	WB307-01
	Location (dGPS) 507027.81, 187377.98	**Dates** 07/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				50.08	(0.18) 0.18	MADE GROUND: Concrete.			
0.30-0.50	ES			50.01	0.25 (0.35)	MADE GROUND: Reddish brown very angular COBBLES of brick and metal rebar.			
0.80	HSV 49.67kPa		42, 61, 46/Av. 49.67	49.66	0.60 (0.60)	MADE GROUND: Brown slightly clayey very gravelly fine to coarse SAND. Gravel is very angular to sub-angular fine to coarse brick fragment, concrete, sandstone, ceramic and rare metal.			
1.00-1.45	SPT N=4		1,1/1,0,2,1						
1.00-1.10	D			49.06	1.20 (0.80)	Firm blueish grey slightly sandy CLAY with rare sub-rounded fine to coarse gravels of flint. Slight organic odour.			
1.50	HSV 42.67kPa		40, 40, 48/Av. 42.67						
2.00-2.45	SPT N=12		2,2/3,2,3,4	48.26	2.00 (0.70)	Soft becoming firm orangish brown mottled light grey slightly silty slightly sandy CLAY. Firm, locally stiff orangish brown mottled light grey slightly silty sandy CLAY.			
2.50	HSV 67.33kPa		50, 68, 84/Av. 67.33						
3.00-3.45	SPT N=16		2,3/4,4,4,4	47.56	2.70 (0.30)	Firm orangish brown mottled light grey sandy gravelly CLAY. Gravel is sub-angular fine to coarse chalk and flint.			
3.20-4.00	B			47.26	3.00 (0.20)	Soft orangish brown silty very sandy CLAY.			
				47.06	3.20 (0.80)	Firm brown very silty very sandy CLAY with rare sub-angular fine to coarse chalk gravel.			
4.00-4.45	SPT N=12		2,1/2,2,3,5	46.26	4.00 (1.00)	Stiff becoming very stiff light grey mottled orangish brown silty sandy slightly gravelly CLAY. Gravel is sub-rounded fine to coarse chalk and flint.			
5.00-5.45	SPT N=18		2,2/4,4,4,6	45.26	5.00	Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling.
Borehole installed with 50mm ID HDP standpipe to 5.0m. Slotted SP from 1.0m to 5.0m with gravel fill.
Plain SP from 1.0m to 0.3m with bentonite seal. Concrete from 0.3m bgl to surface with a lockable flush security cover fitted.

Scale (approx)	Logged By
1:50	DOP

Figure No. WB307-01.WS05

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS06

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		50.06	Keltbray Holdings Limited	WB307-01
	Location (dGPS): 506992.09, 187358.696	**Dates**: 08/04/2022	**Engineer**: DOP	**Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				49.86	(0.20) 0.20	TOPSOIL: Grass over dark brown very clayey gravelly fine to coarse SAND. Gravel is very angular fine to coarse brick fragments, flint and quartz with fine rootlets.			
				49.46	(0.40) 0.60	Probably MADE GROUND: Firm orangish brown slightly silty slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse flint with fine rootlets. (Probably reworked natural)			
0.90	HSV 44.33kPa		45, 40, 48/Av. 44.33						
0.90-1.00	ES				(0.90)				
1.00-1.45	SPT N=12		1,1/1,3,4,4						
				48.56	1.50	Firm orangish brown slightly silty slightly sandy CLAY.			
1.60	HSV 92.67kPa		82, 94, 102/Av. 92.67			Stiff orangish brown slightly silty slightly sandy CLAY.			
1.80-2.00	D								
2.00-2.45	SPT N=11		2,2/2,3,3,3		(1.25)				
2.50	HSV 69.67kPa		75, 56, 78/Av. 69.67						
2.80-3.00	D			47.31	2.75	Stiff orangish brown slightly silty sandy slightly gravelly CLAY. Gravel is sub-rounded fine to coarse chalk.			
3.00-3.45	SPT N=16		2,3/3,3,5,5		(0.45)				
3.20-4.00	B			46.86	3.20	Firm brown silty very sandy CLAY.			
					(1.00)				
4.00-4.45	SPT N=14		2,2/3,3,4,4						
				45.86	4.20	Stiff becoming very stiff orangish brown mottled light grey slightly silty slightly sandy CLAY.			
4.50	HSV 81.33kPa		84, 78, 82/Av. 81.33		(0.80)				
5.00-5.45	SPT N=22		2,2/4,5,6,7	45.06	5.00	Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling.
Borehole backfilled with materials arising upon completion.

Scale (approx)	Logged By
1:50	DOP

Figure No. wb307-01.WS06

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS07

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		51.35	Keltbray Holdings Limited	WB307-01
	Location (dGPS) 507002.37, 187391.91	**Dates** 07/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				51.00	(0.35) 0.35	TOPSOIL: Grass over dark brown very clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded flint.			
					(0.55)	Soft orangish brown mottled light grey slightly silty slightly sandy CLAY.			
0.80	HSV 30kPa		28, 30, 32/Av. 30.00	50.45	0.90				
0.80-1.00	ES					Firm reddish brown slightly silty slightly sandy CLAY.			
1.00-1.45	SPT N=8		1,1/1,2,2,3		(0.60)				
1.40	HSV 57kPa		55, 54, 62/Av. 57.00	49.85	1.50				
1.80-1.90	D					Stiff reddish brown mottled orangish brown and light grey slightly silty slightly sandy CLAY with occasional sub-rounded fine to coarse chalk gravel.			
2.00-2.45	SPT N=16		3,3/3,4,4,5						
2.40	HSV 68.33kPa		62, 75, 68/Av. 68.33						
3.00-3.45	SPT N=21		3,3/3,5,6,7		(3.50)				
3.50	HSV 60kPa		54, 62, 64/Av. 60.00			Becomes brown and very sandy, with some pockets of very clayey fine to coarse SAND below 3.4m bgl.			
3.50-3.60	D								
4.00-4.45	SPT N=20		2,3/3,5,5,7			Chalk gravel present beneath 4.6m bgl.			
5.00-5.45	SPT N=26		4,4/6,6,6,8	46.35	5.00	Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling.
Borehole backfilled with materials arising upon completion.

Scale (approx)	Logged By
1:50	DOP

Figure No. WB307-01.WS07

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS08

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		52.35	Keltbray Holdings Limited	WB307-01
	Location (dGPS) 506955.093, 187381.559	**Dates** 08/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20-0.30	ES			51.95	(0.40) 0.40	TOPSOIL: Grass over dark brown very clayey slightly gravelly fine to coarse SAND. Gravel is sub-angular fine to coarse flint.			
0.90 1.00-1.45 1.00-1.20	HSV 55kPa SPT N=8 ES		45, 65, 55/Av. 55.00 1,1/2,2,2,2		(1.30)	Firm orangish brown slightly silty slightly sandy gravelly CLAY. Gravel is sub-rounded fine to coarse of flint and occasional chalk.			
1.80 1.80-1.90 2.00-2.45	HSV 40kPa D SPT N=14		35, 50, 35/Av. 40.00 2,2/3,3,4,4	50.65	1.70 (0.80)	Soft becoming firm slightly silty slightly sandy CLAY.			
2.50	HSV 58.33kPa		60, 65, 50/Av. 58.33	49.85	2.50	Firm becoming stiff orangish brown mottled light grey slightly silty slightly sandy CLAY with occasional chalk gravels.			
3.00-3.45 3.10-3.20	SPT N=16 D		2,2/3,4,4,5						
3.50	HSV 81.67kPa		79, 80, 86/Av. 81.67		(2.20)				
4.00-4.45	SPT N=16		2,2/3,3,5,5						
4.50	HSV 82.33kPa		85, 83, 79/Av. 82.33	47.65	4.70				
				47.55	4.80	Brown very clayey silty fine to medium SAND.			
5.00-5.45	SPT N=15		3,3/3,4,4,4	47.35	(0.20) 5.00	Stiff orangish brown mottled light grey slightly silty slightly sandy CLAY with occasional chalk gravels.			
						Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling
Borehole installed with 50mm ID HDP standpipe to 5.0m. Slotted SP from 1.0m to 5.0m with gravel fill.
Plain SP from 1.0m to 0.3m with bentonite seal. Concrete from 0.3m bgl to surface with a lockable flush security cover fitted.

Scale (approx)	Logged By
1:50	DOP

Figure No. wb307-01.WS08

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS09

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		53.59	Keltbray Holdings Limited	WB307-01
	Location (dGPS): 506945.766, 187416.724	**Dates**: 08/04/2022	**Engineer**: DOP	**Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				53.44	(0.15) 0.15	TOPSOIL: Grass over dark brown very clayey slightly gravelly fine to coarse SAND. Gravel is sub-angular fine to coarse flint and brick fragments.			
0.20-0.30	ES			53.19	(0.25) 0.40				
				52.99	(0.20) 0.60	MADE GROUND: Soft to firm slightly silty slightly sandy CLAY with fine rootlets and occasional coal fragments. (Reworked natural)			
0.90	HSV 45.33kPa		38, 42, 56/Av. 45.33	52.69	(0.30) 0.90				
1.00-1.45	SPT N=10		1,2/2,2,3,3			MADE GROUND: Brown and grey sandy sub-angular to sub-rounded fine to coarse GRAVEL of flint, quartz and occasional brick fragment.			
1.00-1.20	D					Soft orangish brown slightly silty slightly sandy CLAY.			
1.50	HSV 70kPa		65, 70, 75/Av. 70.00			Firm becoming stiff orangish brown mottled light grey slightly silty slightly sandy CLAY with occasional gravels of chalk.			
2.00-2.45	SPT N=11		2,2/2,2,3,4						
2.50	HSV 87.33kPa		84, 88, 90/Av. 87.33						
2.50-2.70	D				(3.80)				
3.00-3.45	SPT N=12		2,2/2,2,3,5			Becomes sandy below 3.5m bgl.			
4.00-4.45	SPT N=20		3,3/3,5,6,6						
				48.89	4.70	Very stiff orangish brown mottled light grey slightly silty slightly sandy CLAY with occasional gravels of chalk.			
					(0.30)				
5.00-5.45	SPT N=22		3,3/4,5,6,7	48.59	5.00				
						Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling.
Borehole backfilled with materials arising upon completion.

Scale (approx)	Logged By
1:50	DOP

Figure No. wb307-01.WS09

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS10

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		53.27	Keltbray Holdings Limited	WB307-01
	Location (dGPS) 506909.734, 187392.718	**Dates** 08/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				53.07	(0.20) 0.20	TOPSOIL: Grass over soft to firm dark brown silty sandy CLAY with occasional gravels of flint and chalk.			
0.40-0.50	ES			52.67	(0.40) 0.60	MADE GROUND: Firm orangish brown slightly silty sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse flint, rootlets and flint with occasional brick fragment and clinker.			
0.70	HSV 46.67kPa		44, 50, 46/Av. 46.67						
0.80-0.90	D								
1.00-1.45	SPT N=7		1,1/1,1,2,3			Firm orangish brown mottled light grey slightly silty slightly sandy CLAY with occasional flint and chalk gravels.			
1.50	HSV 61.67kPa		66, 60, 59/Av. 61.67						
2.00-2.45	SPT N=10		2,2/2,2,3,3						
2.40	HSV 58.67kPa		60, 56, 60/Av. 58.67						
					(4.40)				
3.00-3.45	SPT N=9		1,1/1,2,3,3			Becomes stiff below 3.0m bgl.			
3.40	HSV 58kPa		56, 62, 56/Av. 58.00						
4.00-4.45	SPT N=10		1,2/2,2,2,4			Becomes stiff, locally very stiff, below 4.5m bgl.			
4.90-5.00	D					Pyrite crystal at 4.9m bgl.			
5.00-5.45	SPT N=15		2,2/3,3,4,5	48.27	5.00	Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling.
Borehole backfilled with materials arising upon completion.

Scale (approx)	Logged By
1:50	DOP

Figure No. wb307-01.WS10

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS11

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		57.61	Keltbray Holdings Limited	WB307-01
	Location (dGPS) 506814.151, 187439.661	**Dates** 08/04/2022	**Engineer** DOP	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.30)	TOPSOIL: Grass over soft to firm dark brown silty sandy CLAY with occasional gravels of flint and chalk.			
0.40-0.50	ES			57.31	0.30				
					(0.80)	Probably MADE GROUND: Soft, locally firm, orangish brown silty slightly gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk with fine rootlets and occasional coal fragments (Reworked natural material).			
0.90	HSV 33.33kPa		30, 38, 32/Av. 33.33						
1.00-1.45	SPT N=6		1,1/1,1,2,2	56.51	1.10				
1.50	HSV 47.67kPa		48, 52, 43/Av. 47.67			Soft becoming firm orangish brown mottled light grey slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse extremely weak weathered mudstone and occasional flint and chalk.			
1.80-2.00	D				(1.40)				
2.00-2.45	SPT N=17		2,3/3,4,4,6						
2.50	HSV 77.67kPa		75, 82, 76/Av. 77.67	55.11	2.50	Stiff becoming very stiff orangish brown mottled light grey slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to coarse extremelely weak weathered mudstone and occasional chalk.			
3.00-3.45	SPT N=25		2,3/4,6,7,8						
3.50	HSV 87kPa		85, 80, 96/Av. 87.00						
3.70-3.90	D				(2.50)				
4.00-4.45	SPT N=24		3,4/4,6,6,8						
5.00-5.45	SPT N=27		3,3/5,6,8,8	52.61	5.00	Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling.
Borehole installed with 50mm ID HDP standpipe to 5.0m. Slotted SP from 1.0m to 5.0m with gravel fill.
Plain SP from 1.0m to 0.3m with bentonite seal. Concrete from 0.3m bgl to surface with a lockable flush security cover fitted.

Scale (approx)	Logged By
1:50	DOP

Figure No. wb307-01.WS11

Johnson Poole & Bloomer	Site: Breakspear Road South, Ickenham	Number: WS12

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler		55.45	Keltbray Holdings Limited	WB307-01
	Location (dGPS): 506867.489, 187442.429	**Dates**: 08/04/2022	**Engineer**: DOP	**Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.30)	TOPSOIL: Grass over dark brown very clayey silty gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded flint and sandstone with occasional brick fragment.			
				55.15	0.30				
0.40-0.50	ES				(0.40)				
				54.75	0.70	MADE GROUND: Firm brown slightly silty slightly sandy CLAY with occasional flint gravels and fine rootlets. (Reworked natural).			
0.90 1.00-1.45	HSV 54kPa SPT N=6		56, 54, 52/Av. 54.00 1,1/1,1,2,2			Firm orangish brown slightly silty slightly sandy slightly gravelly CLAY. Gravel is sub-angular rounded fine to coarse flint and chalk. Poor recovery between 1.0m and 2.0m bgl.			
					(2.30)				
2.00-2.45 2.10	SPT N=14 HSV 63.67kPa		2,2/3,3,4,4 74, 60, 57/Av. 63.67						
2.50-2.60	D					Locall soft at between 2.4m and 2.8m bgl.			
2.90 3.00-3.45	HSV 63.33kPa SPT N=11		62, 64, 64/Av. 63.33 1,1/2,2,3,4	52.45	3.00	Stiff becoming very stiff orangish brown mottled light grey slightly silty sandy CLAY.			
3.60	HSV 84kPa		80, 86, 86/Av. 84.00						
					(2.00)				
4.00-4.45 4.00-4.20	SPT N=14 D		2,2/2,4,4,4			Occasional pyrite crystals between 4.0m and 5.0m bgl.			
5.00-5.45	SPT N=21		3,3/4,4,6,7	50.45	5.00	Complete at 5.00m			

Remarks
Borehole location cleared for services by Midland Surveys Ltd using specialist CAT scanning and GPR equipment.
Groundwater was not encountered during drilling.
Borehole backfilled with materials arising upon completion.

Scale (approx)	Logged By
1:50	DOP

Figure No. wb307-01.WS12

Appendix 11 Geotechnical Test Results – I2 Analytical – May 2022

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	07/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

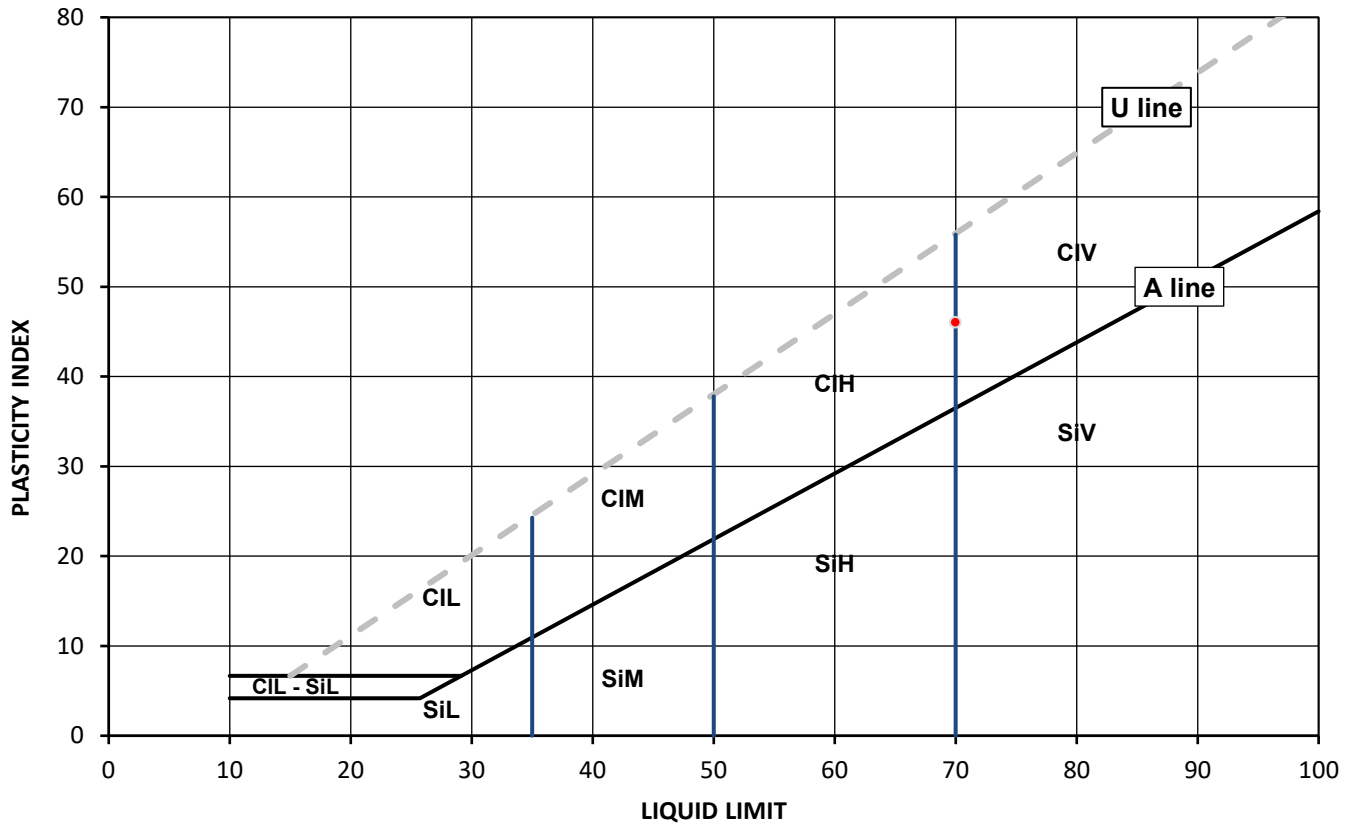
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240680	Depth Top [m]:	1.40
Hole No.:	WS01	Depth Base [m]:	1.50
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
29	70	24	46	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: Dudzinska Anna

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 12/05/2022

GF 232.12

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

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UKAS TESTING 4041

Environmental Science

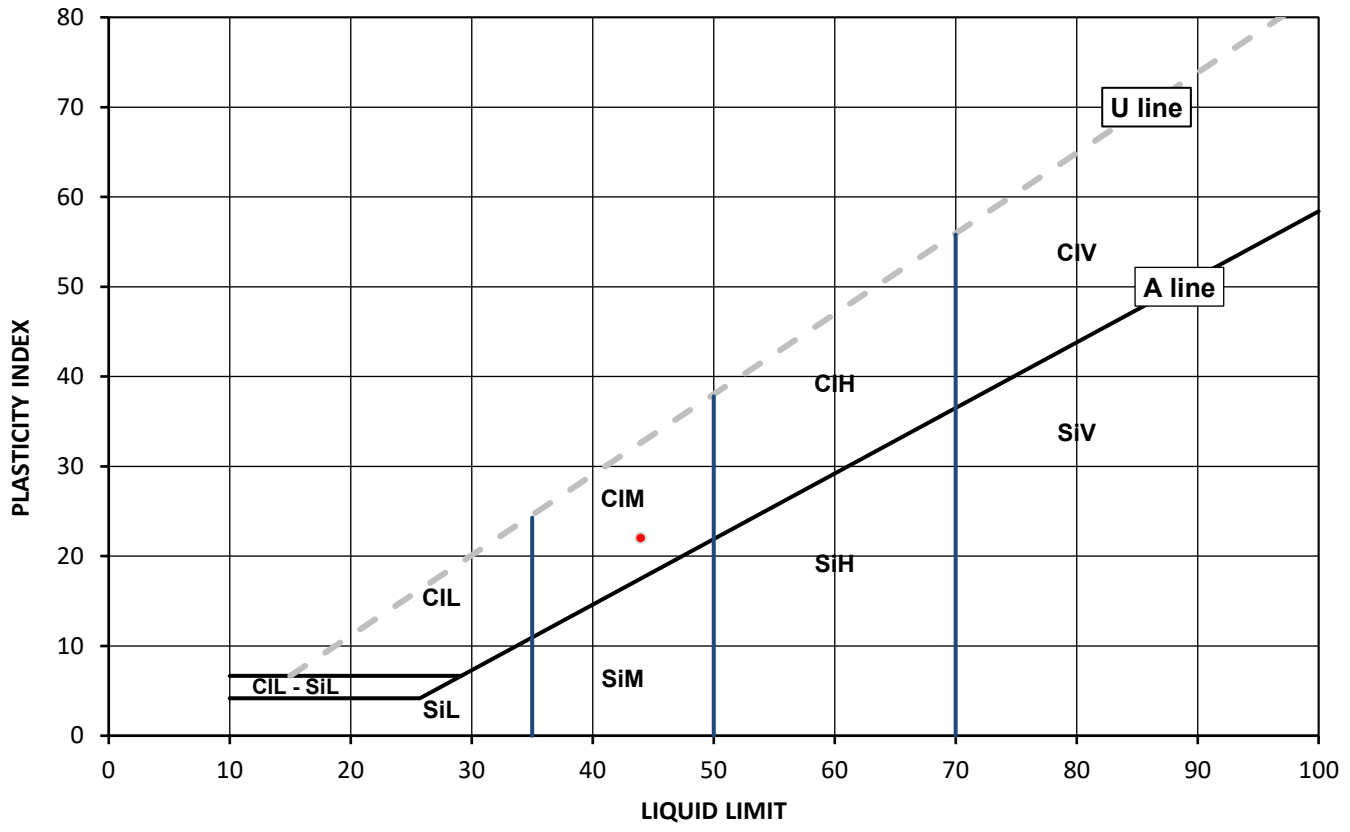
Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	07/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	10/05/2022
Site Address:	Ickenham	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240681	Depth Top [m]:	2.00
Hole No.:	WS02	Depth Base [m]:	2.20
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brownish grey gravelly sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
8.4	44	22	22	60



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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Date Reported: 12/05/2022

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Environmental Science

Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	07/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

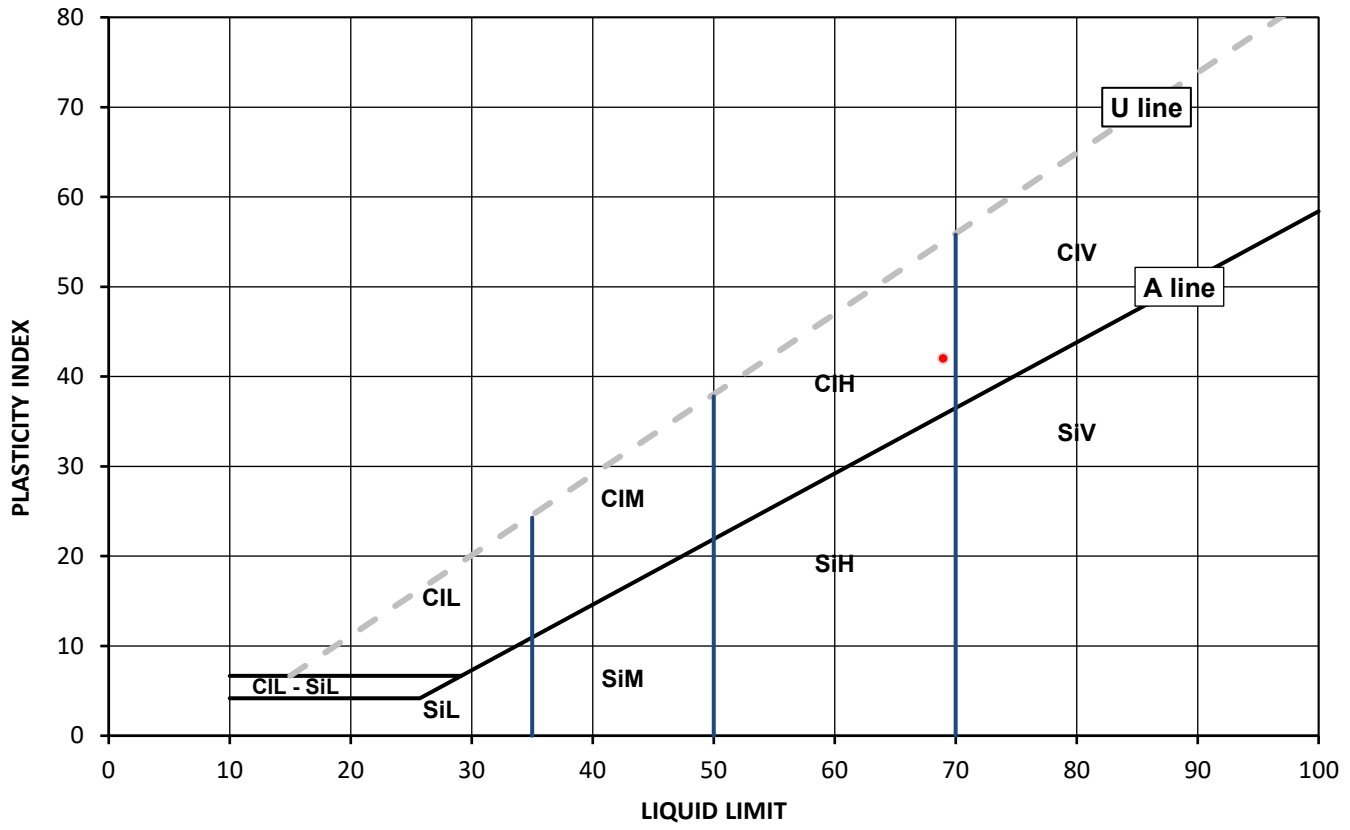
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240683	Depth Top [m]:	1.80
Hole No.:	WS07	Depth Base [m]:	1.90
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
26	69	27	42	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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Anna Dudzinska
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Date Reported: 12/05/2022

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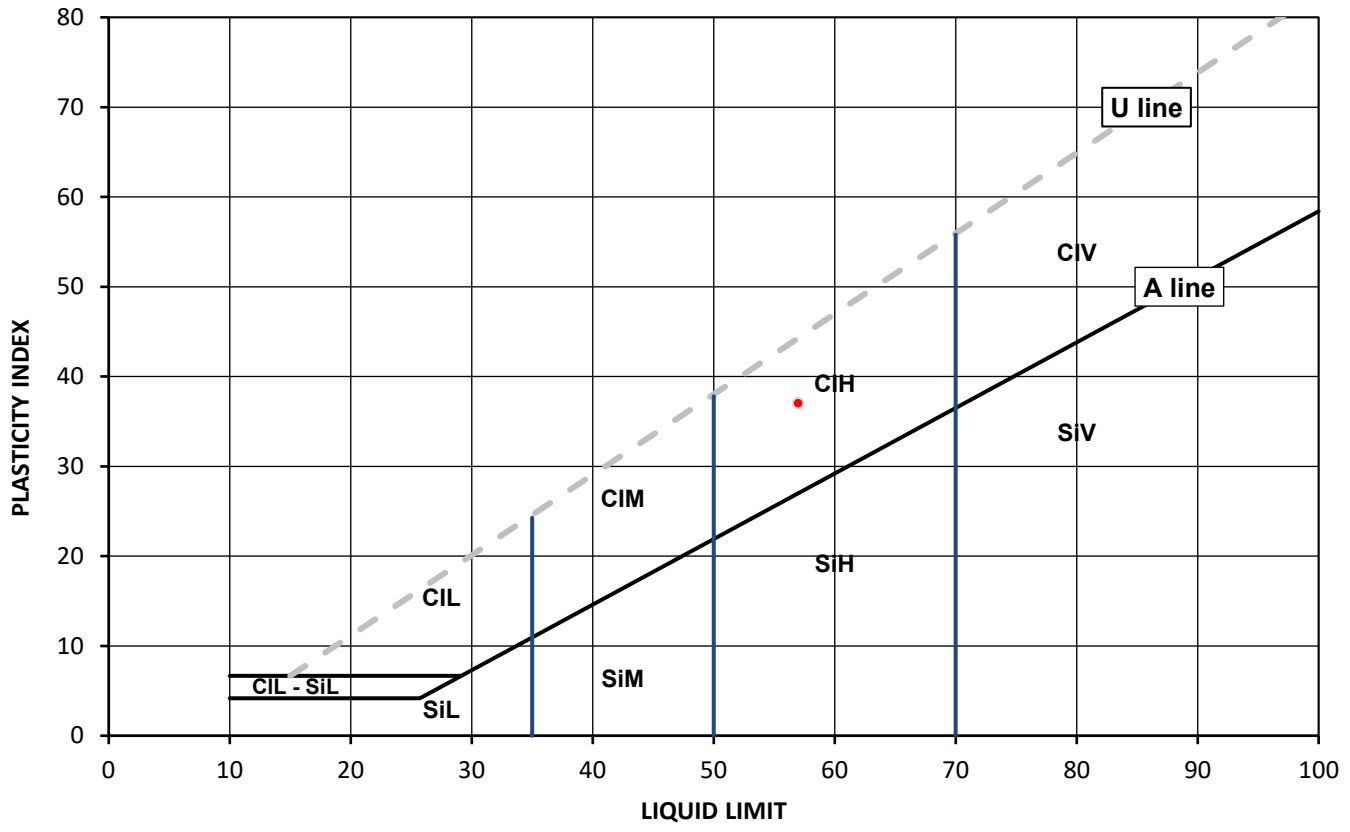
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	07/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240684	Depth Top [m]:	3.50
Hole No.:	WS07	Depth Base [m]:	3.60
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown slightly sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
20	57	20	37	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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UKAS TESTING 4041

Environmental Science

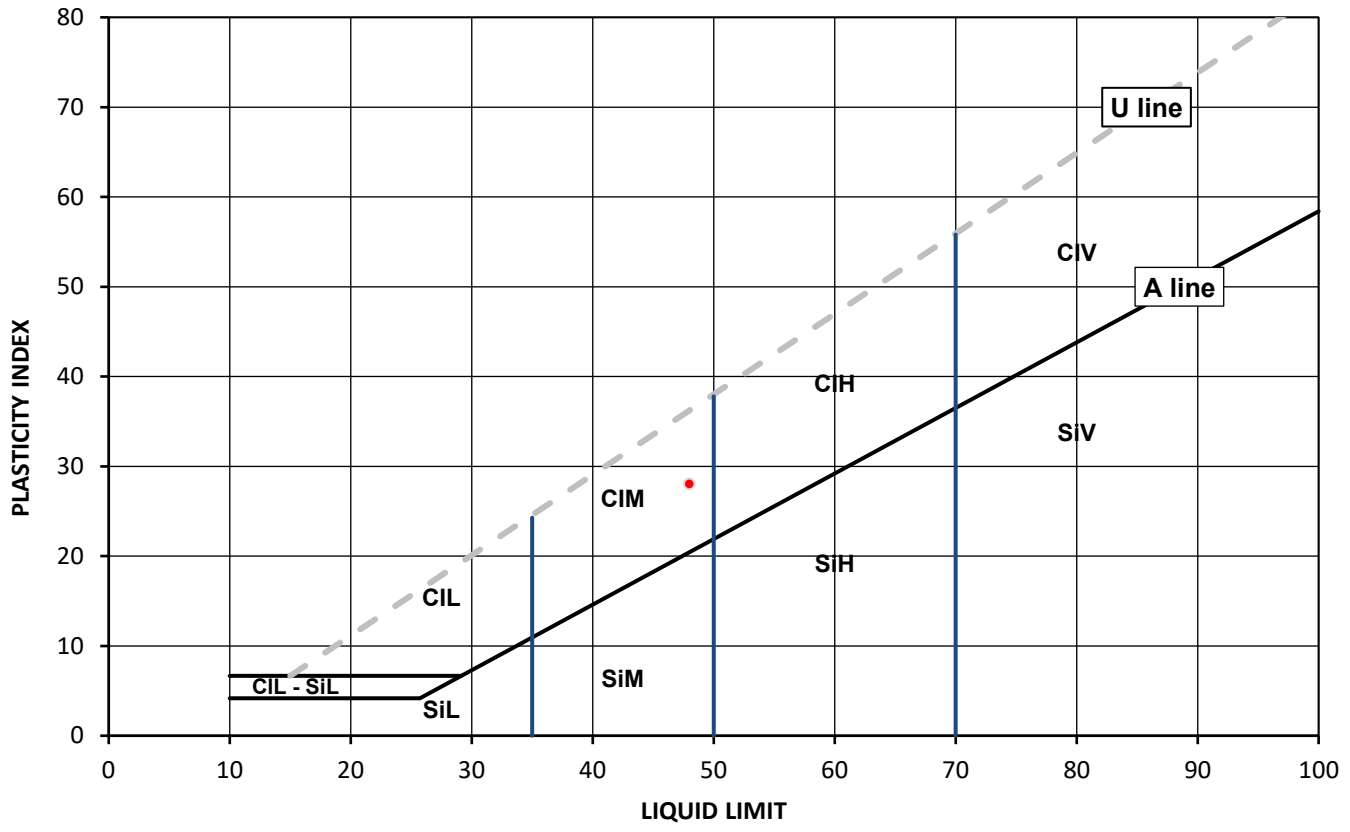
Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	07/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240685	Depth Top [m]:	2.80
Hole No.:	WS03	Depth Base [m]:	3.00
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown slightly sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
20	48	20	28	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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UKAS TESTING 4041

Environmental Science

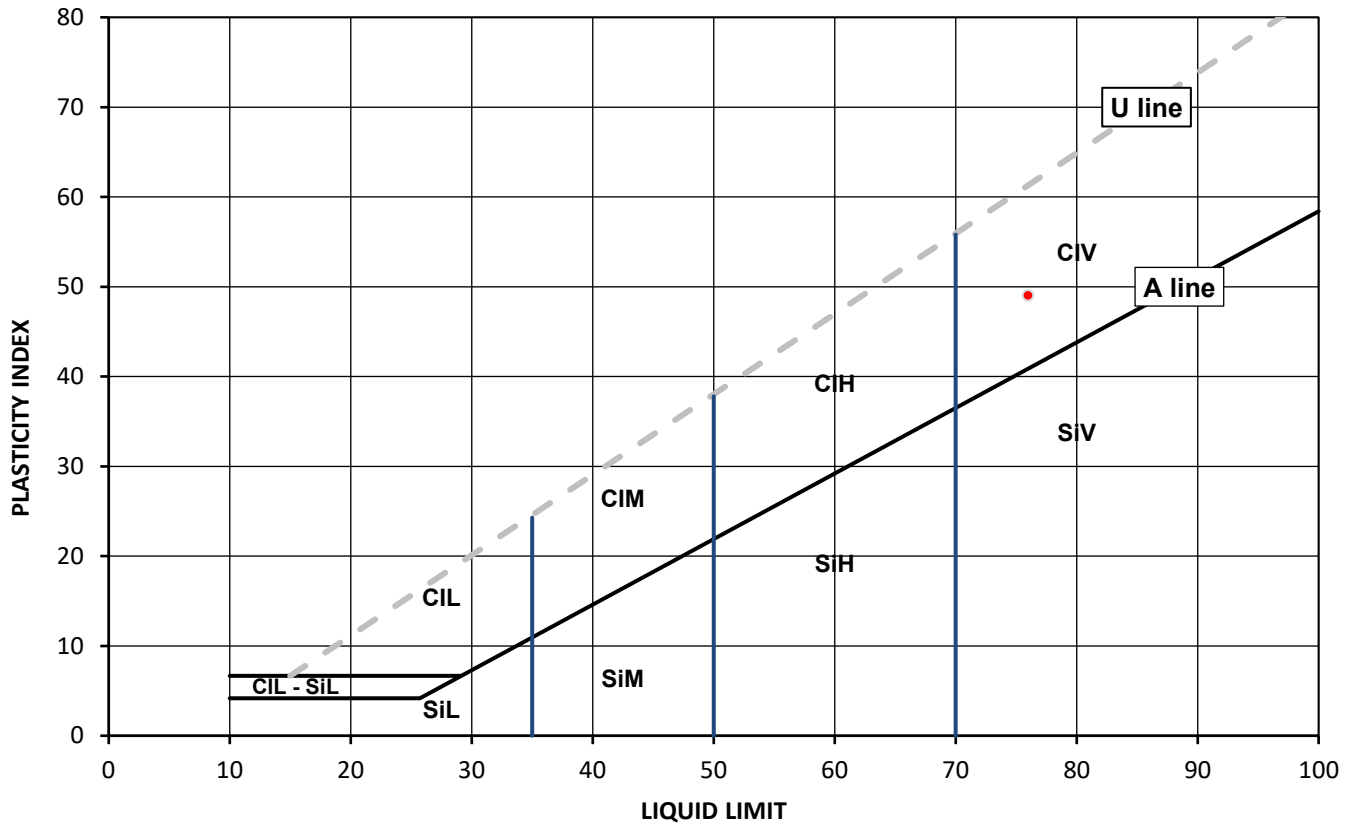
Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	07/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240686	Depth Top [m]:	0.80
Hole No.:	WS04	Depth Base [m]:	0.90
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Light brown CLAY		
Sample Preparation:	Tested in natural condition		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
29	76	27	49	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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Anna Dudzinska
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for and on behalf of i2 Analytical Ltd

Date Reported: 12/05/2022

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UKAS TESTING 4041

Environmental Science

Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	07/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

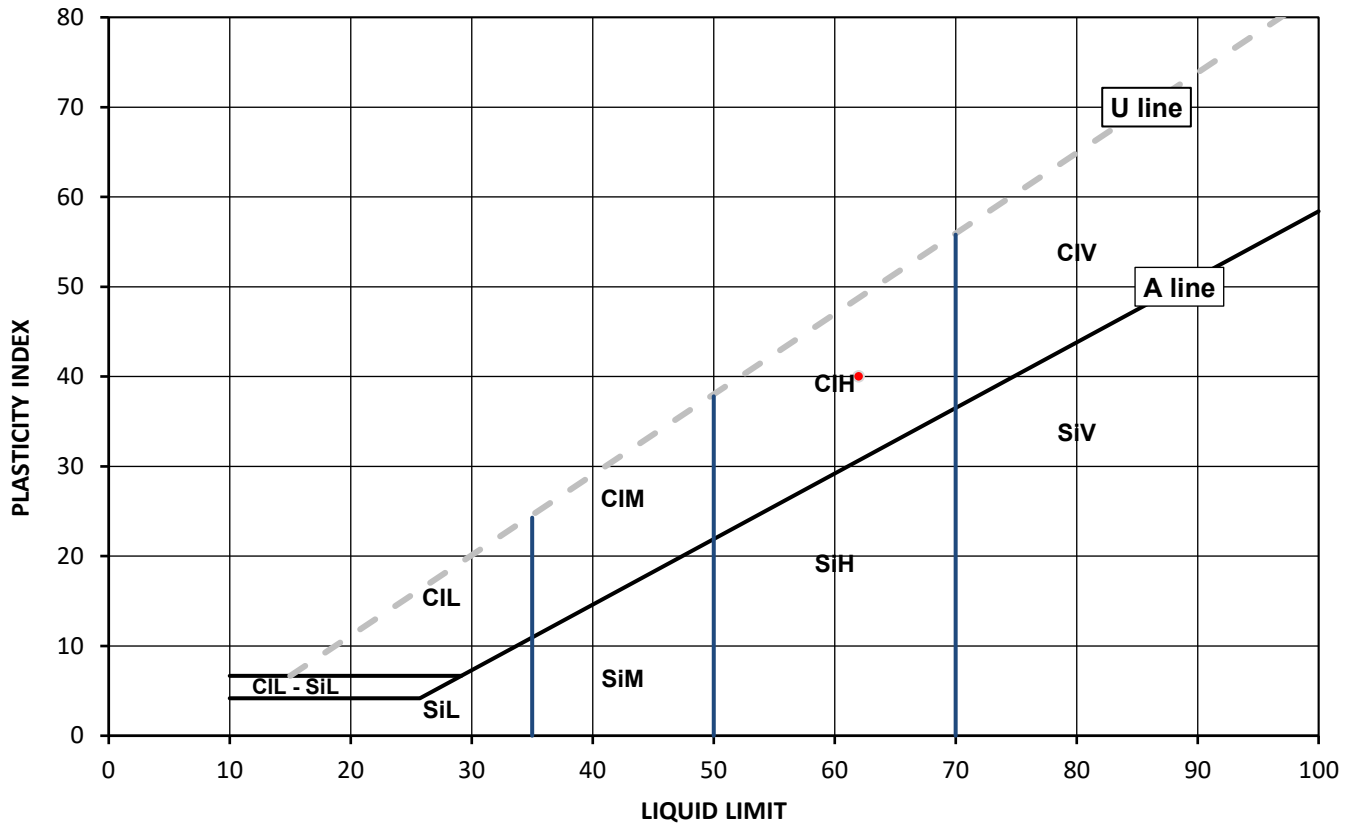
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240687	Depth Top [m]:	1.80
Hole No.:	WS04	Depth Base [m]:	1.90
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
27	62	22	40	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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UKAS TESTING 4041

Environmental Science

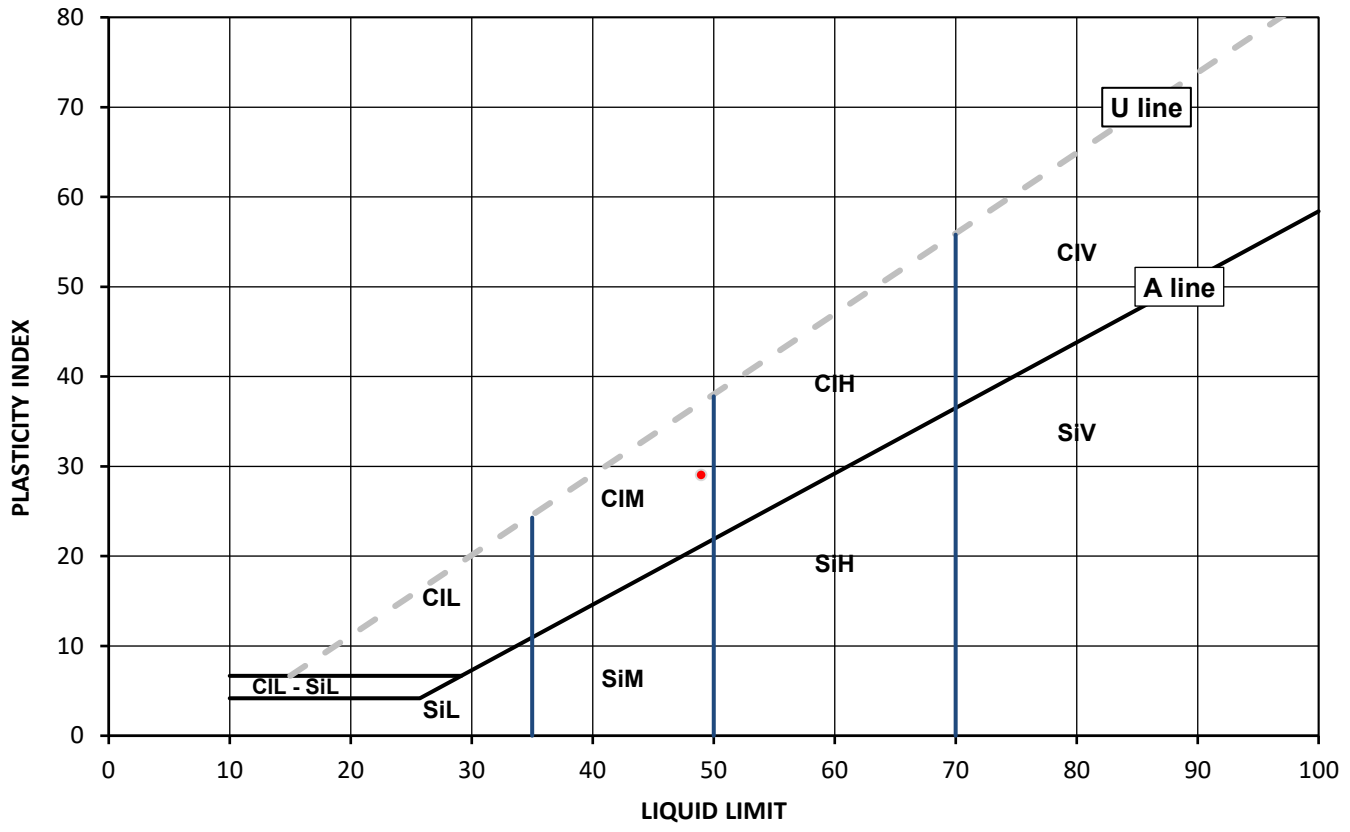
Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	08/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240688	Depth Top [m]:	2.80
Hole No.:	WS06	Depth Base [m]:	3.00
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Light brown slightly sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
24	49	20	29	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
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Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	08/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

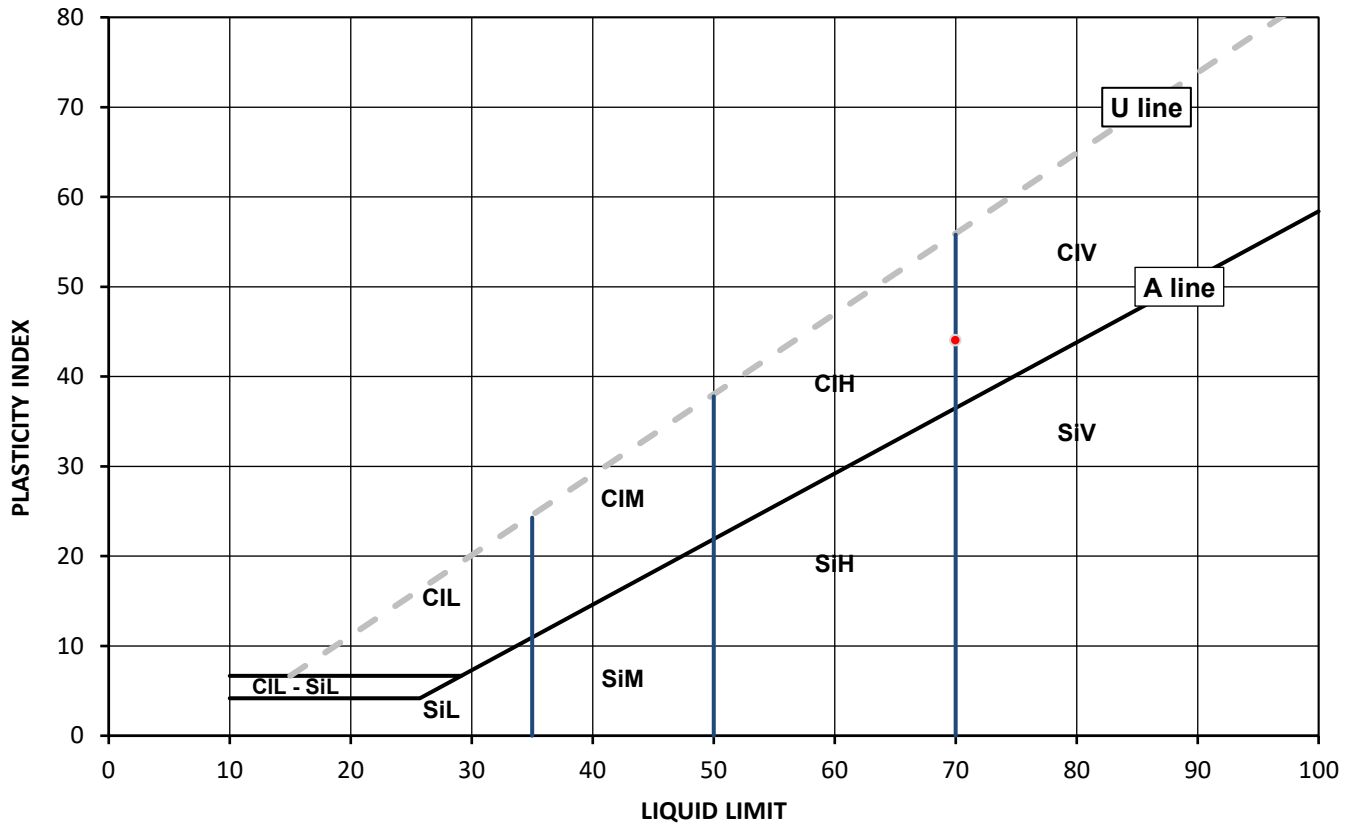
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240690	Depth Top [m]:	1.80
Hole No.:	WS08	Depth Base [m]:	1.90
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Light brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
29	70	26	44	100



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		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
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Note: Water Content by BS 1377-2: 1990: Clause 3.2

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Environmental Science

Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	08/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

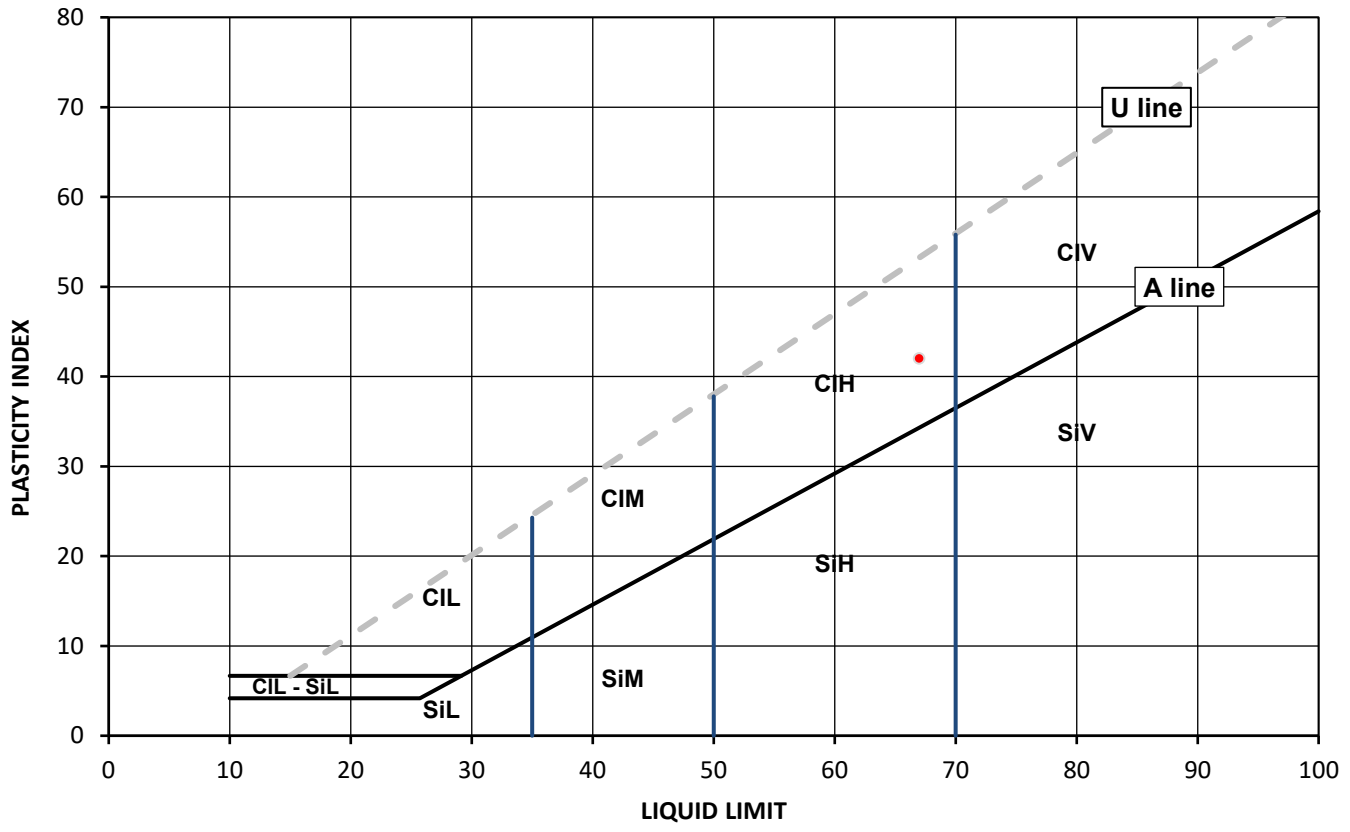
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240691	Depth Top [m]:	3.10
Hole No.:	WS08	Depth Base [m]:	3.20
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
27	67	25	42	100



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		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
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Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	08/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

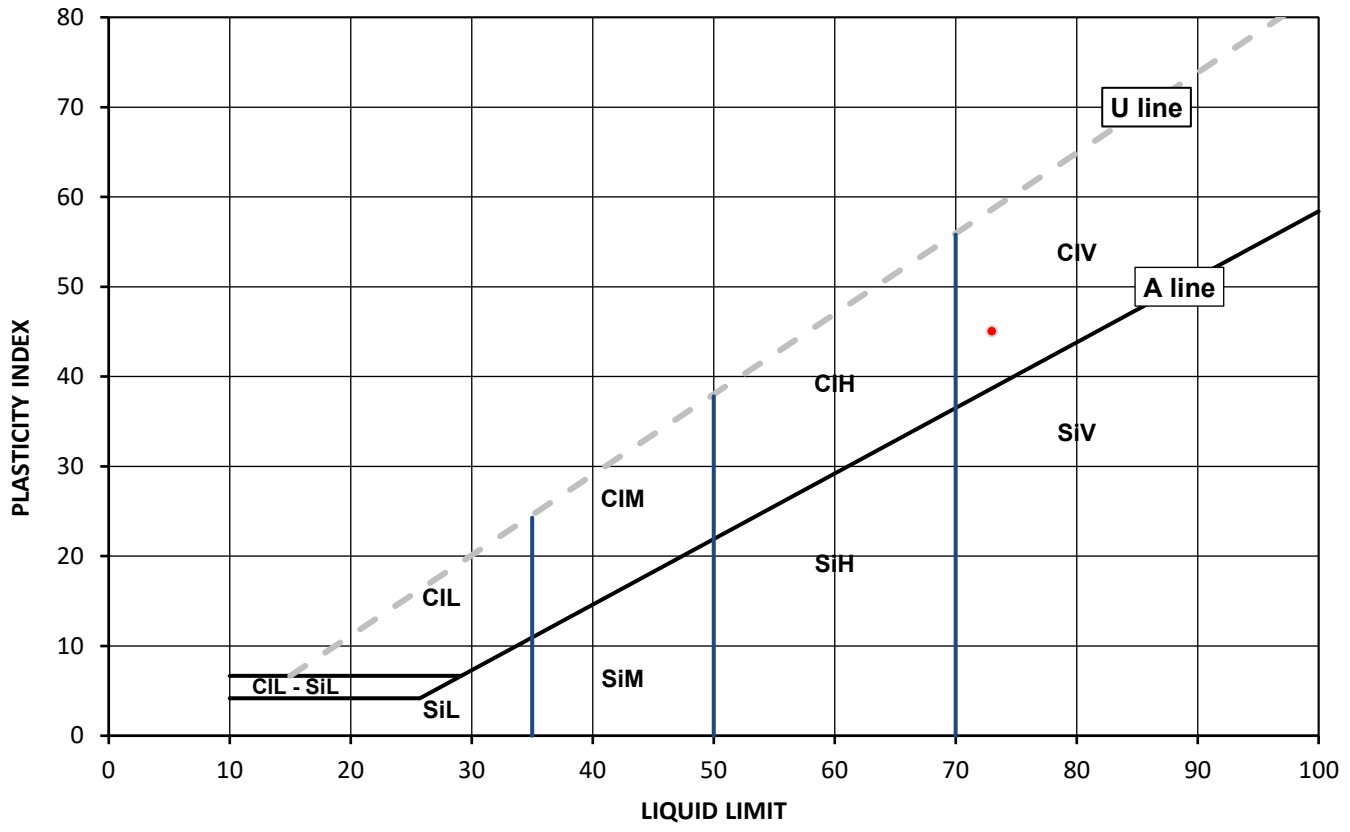
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240692	Depth Top [m]:	1.00
Hole No.:	WS09	Depth Base [m]:	1.20
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
29	73	28	45	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: Dudzinska Anna

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 12/05/2022

GF 232.12

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	08/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

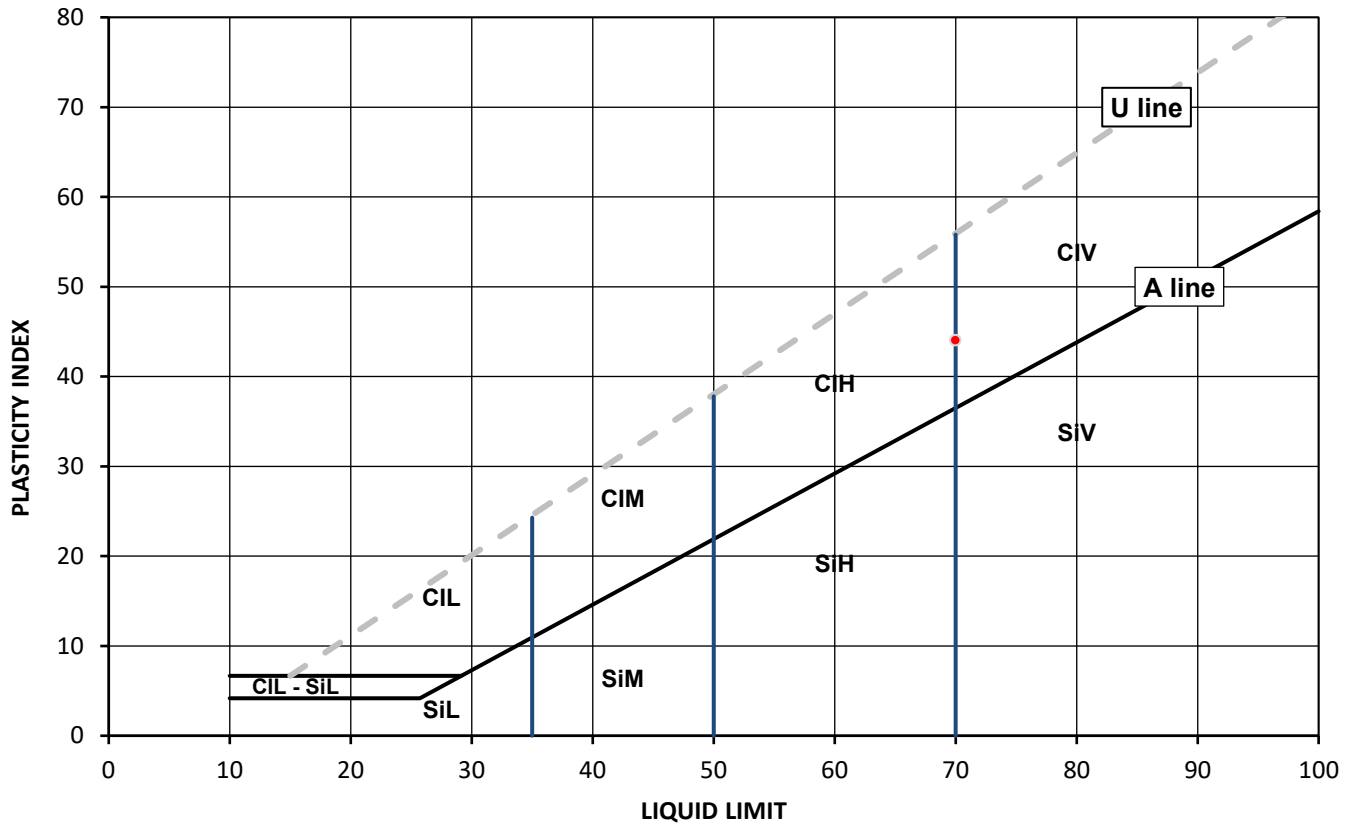
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240693	Depth Top [m]:	2.50
Hole No.:	WS09	Depth Base [m]:	2.70
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
29	70	26	44	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: Dudzinska Anna

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 12/05/2022

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	08/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

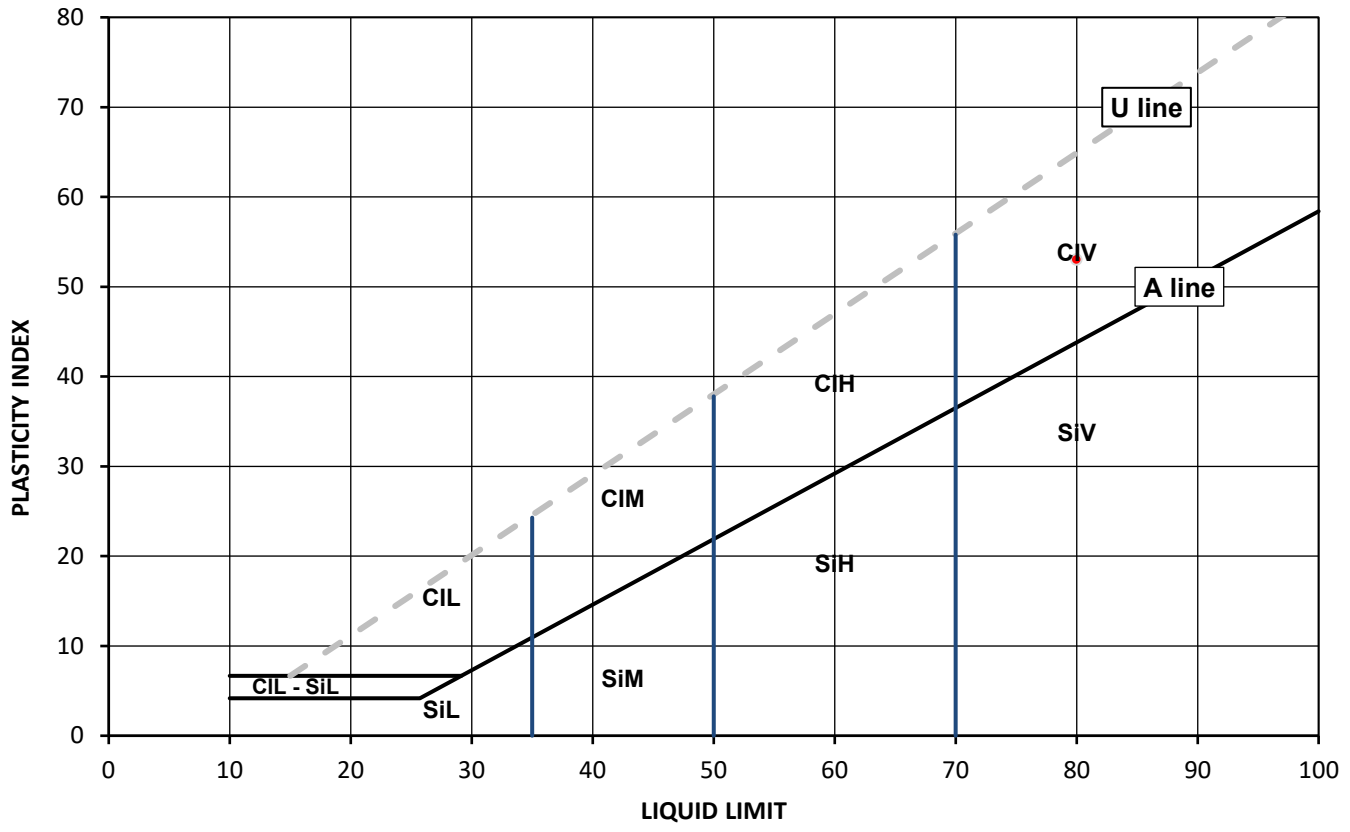
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240694	Depth Top [m]:	2.50
Hole No.:	WS12	Depth Base [m]:	2.60
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
33	80	27	53	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: Dudzinska Anna

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 12/05/2022

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	08/04/2022
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	26/04/2022
Site Address:	Ickenham	Sampled By:	Not Given

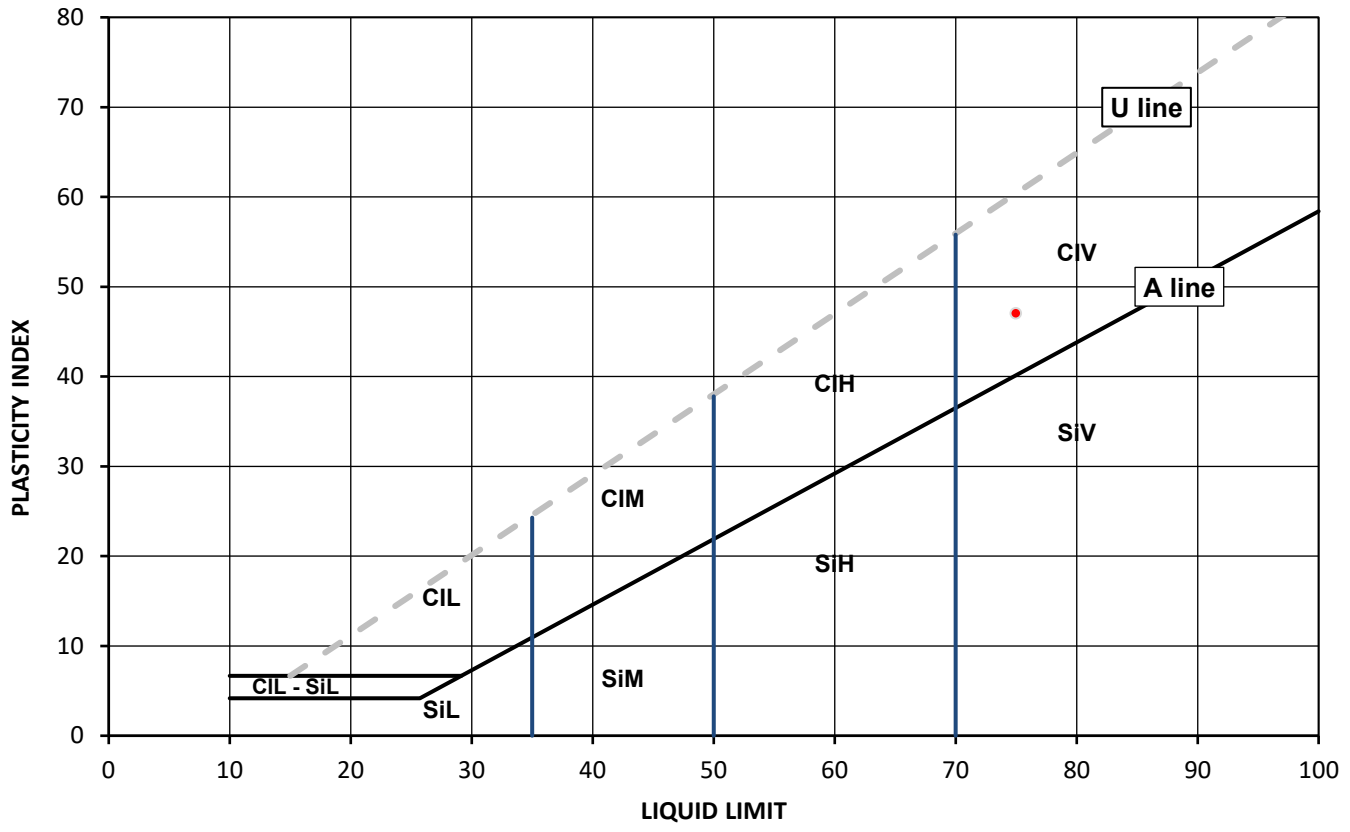
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2240695	Depth Top [m]:	1.80
Hole No.:	WS11	Depth Base [m]:	2.00
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
31	75	28	47	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: Dudzinska Anna

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 12/05/2022

GF 232.12

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	Not Given
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	06/05/2022
Site Address:	Ickenham	Sampled By:	Not Given

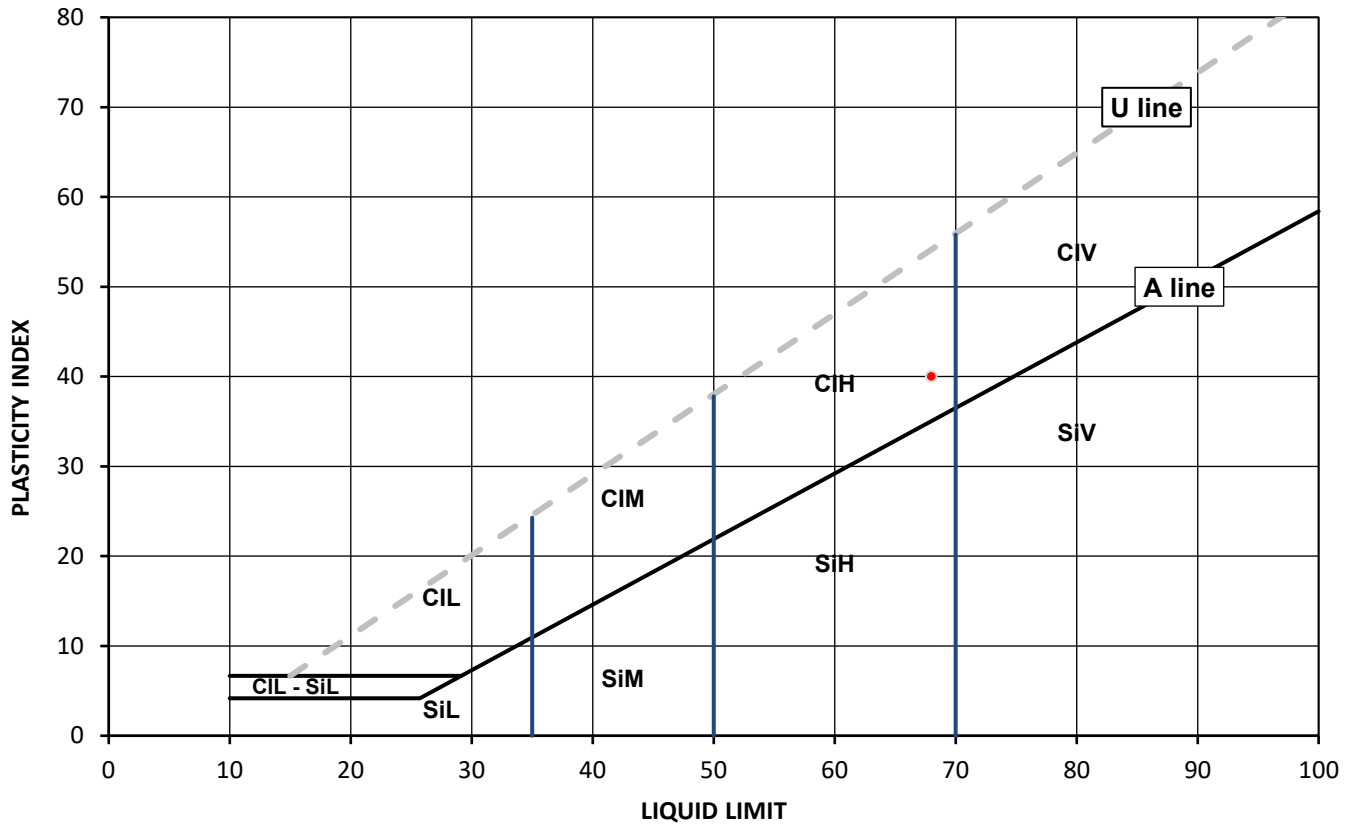
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2252230	Depth Top [m]:	3.00
Hole No.:	TP12	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown CLAY		

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
28	68	28	40	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: Dudzinska Anna

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 12/05/2022

GF 232.12

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

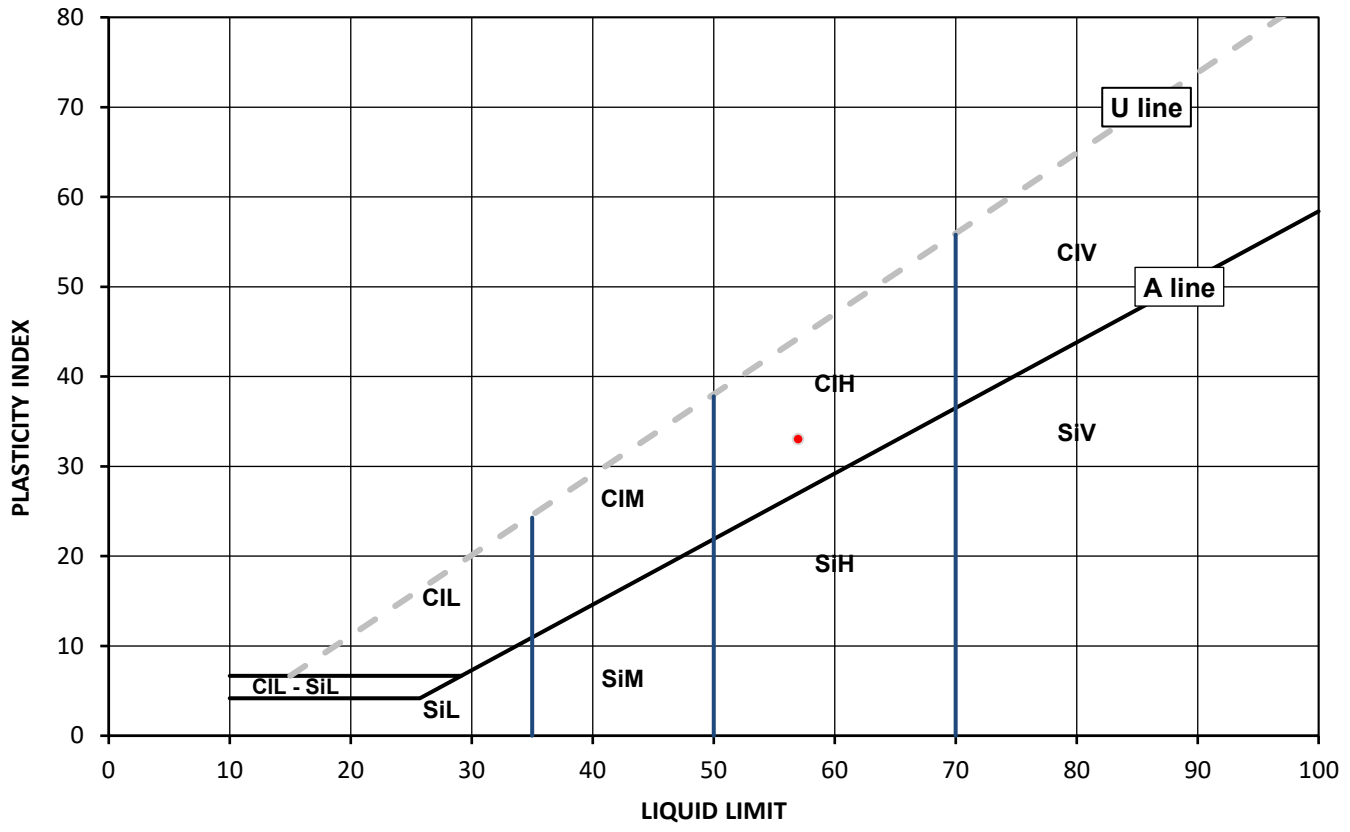
Client:	Johnson Poole & Bloomer	Client Reference:	WB307
Client Address:	Unit 8, Shaw House, Two Woods Lane, Brierley Hill, DY5 1TA	Job Number:	22-52085
		Date Sampled:	Not Given
		Date Received:	11/04/2022
Contact:	David Pacheco	Date Tested:	10/05/2022
Site Address:	Ickenham	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2252231	Depth Top [m]:	3.00
Hole No.:	TP04	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Yellowish brown slightly gravelly slightly sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
21	57	24	33	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
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Note: Water Content by BS 1377-2: 1990: Clause 3.2

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