
Phase I Desk Study Site Reconnaissance & Phase II Site Investigation Report

at Land South of Hanly
Lane, Cuckfield, Haywards
Heath, RH17 5HN

for Sigma Homes L

Report Reference LF3210/DSP:

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EXECUTIVE SUMMARY

The site comprises open fields with mature trees on the northern side and scrubland to the south. It is located to the south of Hanlye Lane, Cuckfield.

Proposals for the site comprise the construction of 55 No. one and a half storey residential dwellings over the northern half of the site, with the northern section providing public open space.

The site is previously undeveloped although a small structure and tank were shown on historical maps in the south western corner of the site from 1748 to present.

The site is mapped as being underlain by the Tunbridge Wells Sandstone in the north eastern corner, the Grinstead Clay over most of the site, and a outcrop of the Cuckfield Stone Bed within parts of the southern half of the site.

In the proposed developable area the investigation confirmed the ground conditions to comprise topsoil to depths of around 0.30 m, but locally 0.70 m over firm to stiff silty clay deposits. Reworked soils were found in three locations only to a maximum depth of 0.80 m. The silty clays generally extended to between 1.10 m and 1.80 m, but locally deeper and up to +3.0 m. Mudstones, siltstones and locally sandstones were noted below. Softer ground (up to 3.5 m deep) was identified within a surface depression close to the central eastern boundary.

In the proposed public open space area to the south, silty clays between 0.60 m to 1.60 m over sandstone (recovered as sand) and siltstone were noted.

An allowable bearing capacity of 100kPa is recommended for the silty and dense sands below about 1.3-1.5 m. However, the clays on site have been classified as MEDIUM VCP and foundations will need to be deepened in accordance with NHBC requirements where trees are present and to extend beneath shear faces in the clay. Deepening is terminated on the non-plastic soils at depth.

Further works would be required around the identified soft spot, to determine its full extent and any impacts on nearby foundations.

A preliminary assessment of the foundation type using our calculator indicates that assuming the foundations summarised above are utilised on site traditional footings would be the less carbon intensive option to depths <1.7 m. Where deepening is required below this depth, piled foundations would be the less carbon intensive option.

Suspended floor slabs are recommended.

Laboratory testing indicates that the soils would be classified as the BRE as sulphate design class DS-1 and the ACEC class is AC-1d.

Only one soakaway test was able to be undertaken close to the access due to soft ground conditions limiting access to the majority of the site. The results of the test (1.5×10^{-7} m/s) suggests that this part of the site is not suitable for conventional soakaways. Further testing could be undertaken at a later stage to confirm infiltration rates, but based on clay soils soakaways are unlikely to be a viable option for the site.

A preliminary design CBR value of 3% is recommended for the clay soils.

7KH VLWH VORSHV GRZQ WRZD B GWHGK HÜ VIRDOK ZKZLWK WQKH
UHGHHORSPHQW ZLOO RFFXUDSSURPLPSWRQRXÜENGSDHOHQ
southern part of the site. It is recommended that a topographical survey is undertaken together with qualitative assessment on slope stability once design proposals are known.

No significantly elevated heavy metal or PAH concentrations were recorded and no asbestos was identified. Pesticides and herbicides were also tested and were reported below analytical limits of detection.

It should be noted that some fly-tipped waste was present in the northern part of the site, and there may be localised contamination beneath these materials. It is recommended that once they are removed limited further testing is undertaken in the area. Likewise around the small historical tank and structure in the south western part of the site limited further testing is recommended to confirm that the soil is not contaminated.

As with any redevelopment site, there is always the risk of undetected contamination, and further investigations should be carried out prior to redevelopment.

Recommendations are given for the sustainable reuse on site. If it is not possible to reuse the soils on site or offsite the soils are expected to be classified as non-hazardous waste. Further testing would be recommended to confirm if the soils could be classified as inert waste.

Signed :	 Sophie Shafi-Cooke MSsi MSc FGS
Countersigned :	 Martin Weil BSc MA C.WEM
	 Richard Brinkworth BEng CEng MICE
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Revisor	Issue1

A INTRODUCTION

1 Authority

Leap Environmental Ltd (hereafter referred to as LEAP) has been appointed by Sigma Homes Ltd to undertake a Phase 1 Desk Study, and Phase II intrusive Site Investigation of a site referred to as Land south of Hanlye Lane, Cuckfield, Haywards Hed 1175 HN (Figure 1, Appendix B). The instruction was given in an email dated 10 January 2023 and signed by Adam Light of Sigma Homes Ltd.

2 Objective

LEAP understands that Sigma Homes proposes to develop the site with No 51 to 2.5 storey residential dwellings as per the attached layout in Drawing No. 7181SK02-B, (Figure 2) Appendix B. It is noted that only the northern part of the site is proposed to be developed, with southern section providing public open space.

The proposed development is currently at a preplanning phase and has been assessed in accordance with BS EN 1997 as being a Geotechnical Category 1 structure.

The objectives of this report are to:

- x Provide information on the geotechnical and environmental quality of the ground present on the site with respect to the proposed development;
- x Assess the potential health and other environmental risks posed by the site to the proposed development and to other specifically identified receptors;
- x Assess the potential for offsite contamination to adversely affect proposed development.

3 Previous Studies

LEAP has not been made aware of any previous reports pertaining to the site.

A previous investigation by LEAP was completed at a site located approximately 85m to the east of the site, referred to as Former Court Meadow School, reference LP2863 for Sigma Homes Ltd, dated 12 April 2022.

¹ BS EN 1997-1(2004)+A1:2013 Eurocode 7: Geotechnical Design – General Rules

4 Scope of Works

This report describes a two-stage process whereby the site is investigated and risks are assessed. The terms geotechnical and geoenvironmental are referred throughout the report.

Geoenvironmental refers principally to the chemical nature of the ground and the degree of soil, water and/or land gas contamination and the impact that contamination may have on current or future development and also on the wider environment.

Geotechnical refers to all other aspects of the ground conditions and the impact they may have on the physical construction of existing or future development, principally foundations, slope stability, drainage, pavement and road design and groundwater.

The investigation comprises two phases of work.

4.1 Phase 1 Scope

The first part of this report presents the results of a desk study and site reconnaissance. It provides a review of previous site investigation and remediation reports, where they have been made available by the Client or where LEAF has been able to locate that information from third party sources. The previous reports referred to are detailed above. The following publicly accessible sources of information have also been reviewed:

- x British Geological Survey (BGS) 1:50,000 Series Geological Sheet 302 Horsham' Solid and Drift ed. 1972
- x BGS Borehole log ref. TQ32NW15 located 174m to the northwest of site boundary.
- x Groundsure.io website accessed on 14/02/23.
- x Groundsure database report (reference: GS-9297177)
- x Unexploded WWII aerial delivered bomb (UXB) regional risk maps produced by Zetica.
- x Interrogation of the World Wide Web on 14/02/23 for general information pertaining to the site history.

² The report contains British Geological Survey material © UKRI 2019 and public sector information licensed under the Open Government Licence v3.0.

A site reconnaissance was carried out on 23 January 2023.

The desk study and site reconnaissance have been used to develop an initial conceptual site model, which forms the basis for the site investigation strategy. The initial site conceptual model is used to identify geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them. In terms of the geo-environmental assessment the conceptual site model is used to identify potential sources of contamination, potential receptors and pathways by which the two may be connected. These are known as possible contaminant linkages and it is these contaminant linkages that are key to contaminated land risk assessment.

The Phase I investigation is also referred to as a Preliminary Investigation.

4.2 Intrusive Investigation Scope

The Phase II work comprises intrusive investigation, on-site testing and laboratory analysis. The results of this and previous investigation reports are used to validate and/or update the initial site conceptual model. This phase of site investigation comprised the following proposed tasks:

- x 6 No. 5m deep windowless boreholes drilled with a tracked rig;
- x 10 No. 3m deep machine excavated trial pits;
- x 6 No. BRE365 soakage tests;
- x In-situ geotechnical testing including Standard Penetrometer Tests in the boreholes and field vane tests in the trial pits;
- x Geotechnical Laboratory Testing including Atterberg Limit Tests, and Shrinkage Tests, and PSD; and
- x Chemical Laboratory tests including up to 12 No. LEAP standard soil suite tests, 3 No. pesticide and herbicide screens.

The intrusive works were completed by contractors who have been authorised and are on LEAPs approved contractor list. The windowless sampling was carried out by Oakland SI, The machine excavated trial pits were carried out by BPH and supervised by LEAP.

Selected samples of soil were scheduled for laboratory testing for a range of potential contaminants including metals, non-metals, polyaromatic and petroleum hydrocarbons,

³ BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites – Code of Practice.

pesticides and asbestos. The laboratory testing has been carried out by The Environmental Laboratory Ltd at its laboratories in East Sussex.

Selected soil samples have been classified by laboratory analysis for geotechnical design purposes. The laboratory testing has been carried out by Geolabs Ltd's laboratories in Watford.

The final stage in the geo-environmental assessment comprises a quantitative risk assessment and revision of the preliminary Conceptual Site Model. Preliminary recommendations for remediation have been provided, based on various development assumptions. The risk assessment has been carried out in accordance with UK industry standards and in particular in accordance with LCRM and BS10175:2011+A2:2017.

The final stage of the geotechnical assessment is the provision of preliminary soil parameters for use in geotechnical design, and broad recommendations for appropriate foundation options. It is intended that the Geotechnical Information section of this report will fulfil the general requirements of the Ground Investigation Report as set out in Section 6 of BS EN 1997-2:2007.

5 Sustainability Considerations

5.1 Carbon Reduction

There is an urgent need to optimise redevelopment to significantly reduce the carbon footprint of the process without compromising the requirement for delivering a safe and suitable use of the site. With that in mind, Leap has worked in partnership with the University of Surrey to develop a series of carbon reduction design tools (CReDiT). These provide information on the embodied carbon cost of its report recommendations and encourage the conversation about carbon at an early stage in the design process.

Consideration has been taken throughout the report to align the recommendations with climate protection, circular economy and sustainable materials.

Leap recognises the unique position that it occupies at the beginning of development projects and the value of informing clients on the carbon cost of design recommendations. As such, headline information from the CReDiT tools will be provided in site investigation reports

⁴ Environment Agency. Land Contamination Risk Management (LCRM), <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

⁵ BS EN 1997 Eurocode 7- Geotechnical Design- Part 2: Ground Investigation and Testing (2007)

without additional cost to the client. This is being done in order to engage furthermore detailed consultation where the full range of Leap's sustainability policies can be deployed.

6 Limitations

This report has been prepared by Leap Environmental Ltd on the basis of information received from a variety of sources which Leap Environmental Ltd believes to be accurate. Nevertheless, Leap Environmental Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

Leap Environmental Ltd has used all reasonable skill, care and diligence in the design and execution of this report, taking into account the manpower and resources devoted to it in agreement with the Client. Although every reasonable effort has been made to obtain all relevant information, all potential contamination, environmental constraints or liabilities associated with the site may not necessarily have been revealed.

The conclusions reached in this report are necessarily restricted to those which can be determined from the information consulted and may be subject to amendment in the light of additional information becoming available. These conclusions may not be appropriate for alternative schemes.

This report is confidential to the Client, and Leap Environmental Ltd accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known, unless formally agreed by Leap Environmental Ltd beforehand. Any user relies upon the report at their own risk.

Full details of the limitations are provided in Appendix A.

B PHASE I – DESK STUDY

7 Environmental Setting

7.1 Site Location and Description

The site is located to the south of Hanlye Lane, Cuckfield, Haywards RH17 5HN as shown in Figure 1, Appendix B.

The approximate National Grid Reference of the site is 531096, 125614. The site is moderately rectangular in shape and covers an area of approximately 0.55 Ha.

7.1.1 General Description and Boundaries

The current site layout is shown in Figure 2, Appendix B. A walkover survey was carried out on 23/01/2023 and photographs are included within Appendix C. The Grounds Report is provided as Appendix D.

The site is situated to the northeast of Cuckfield town and comprises an open field with a paddock in the northeast corner. There is a footpath aligned west-east across the central part of the site with access via a metal gate located in the centre of the western boundary. At the time of the walkover survey and intrusive investigation (which preceded by a week of freezing conditions followed by a rapid thaw) the ground surface close to this access point was muddy and soft underfoot. At the time of the walkover, the land was used to keep a number of horses and in the far northeast corner a small fenced area and evidence of hay troughs were noted.

The southern part of site comprises scrubland (dense brambles and mature trees). A small rectangular brick feature containing logs was located along the south western boundary and in the south west corner of the site relict brick walls relating to a former structure were present. No visual or olfactory evidence of ground contamination was noted at either feature.

Mature trees line the site boundaries, with more trees through the centre of the site trending east to west and through the northwest quadrant trending north to south. An area used for fly tipping and anecdotally bonfires is located in the northeast quadrant of the site. Fly tipped materials noted included mattresses, laminate flooring, textiles, tips, concrete and plasterboard were observed in this area. Overhead communications cables noted aligned north to south along the eastern boundary and a number of manholes were noted in the western half of the site, associated with water supply pipes. A hole cover was also present centrally in the northern half of the site, but it was not possible to discern what service it was related to.

The northern boundary of the site lies at an estimated elevation between 120m and 125m Above Ordnance Datum (mAOD) whilst the southern boundary ranges between 104 and 110 mAOD.

mAOD. The slope falls approximately 10m from the northern boundary to the central part of the site. The slope falls approximately 10m from the northern boundary to the central part of the site, from the central part of the site to the southern boundary, around a 10m drop over 90m.

The site is bound by fields to the south and south east, a school and residential housing development to the west, residential housing and a former school to the north east and Hanlye Lane to the north. A small structure, possibly associated with a local scout group is present offsite to the north of the site entrance.

7.2 Geology

The geology of the site has been ascertained by reference to 1:50,000 British Geological Survey sheet EW_320 Horsham, solid and drift edition, the BGS website (www.bgs.ac.uk) and the Groundsure report. The site is mapped as being underlain by Upper Tunbridge Wells Sand in the north east corner, Upper Grinstead Clay across much of the northern part of the site and the Cuckfield Stone Bed across the centre and southern areas. The Grinstead Clay is also present to the south of the Cuckfield Stone Bed and the boundary between the two appears to visually follow the slopes and valleys noted during site walkover. A fault trending west to east is located 250m north of the site.

7.2.1 Upper Tunbridge Wells Sand

The Upper Tunbridge Wells Sand unit comprises a complex succession of thin bedded silty mudstones, siltstones, silty sandstones and fine grained sandstones which are laterally persistent over long distances. Sandstones, which form a prominent scarp and dip slope features, are typically fine-grained and quartzose, weathering to a yellowish grey or brown colour. In the Cuckfield area, silt is the dominant component. Here, grey and greenish grey silty mudstones and siltstones, red-mottled in part, dominate the lower part of the unit, whereas pale grey to yellowish grey sandstone mostly appear in the upper part.

7.2.2 Grinstead Clay

Grey to greenish grey mudstones, commonly very silty with sub horizontal thin beds of siltstone, nodular clay ironstone and shelly limestone. Rootlet horizons and planar beds common. Over part of its outcrop the member is divided by a bed of calcareous sandstone, the Cuckfield Stone Bed, into the informally named lower and upper Grinstead Clay. On places, the Cuckfield Stone Bed cuts out the lower Grinstead Clay entirely and rests on the Ardingly Sandstone Member.

The upper boundary is placed at the up-section conformable change from mudstones (Upper Grinstead Clay unit) up into the silt and sand rhythms of the upper part of the Tunbridge Wells Sand Formation. The top of the Grinstead Clay unit is commonly well stained, which helps to emphasise the contact.

7.2.3 Cuckfield Stone Bed

Sandstone, fine-grained, calcareous in part, pale yellow brown and flaggy (Tilgate Stone) with some parts showing trough cross-bedding ("festoon-bedding"), casts and flute casts. Thin mudstone containing carbonaceous plant debris partings. Rare pale and ferruginous shelly limestones developed in places towards base of unit.

7.2.4 BGS Boreholes

The online BGS Geoindex <http://www.bgs.ac.uk/geoindex/> has been reviewed for detailed local geological and hydrogeological information. 1 No. Boreholes have been identified within 250m of the site. The borehole was undertaken in January 1965.

Borehole ref TQ32NW15, located 174m NW of the site indicates ground conditions comprise Cuckfield Stone to 4.4m bgl over Lower Grinstead Clay to 9m bgl Lower Tunbridge Wells Sand to 36m bgl over Wadhurst Clay to 105m bgl over Ashdown Beds to end of excavation at 137m bgl. No groundwater was recorded within the borehole.

7.3 Hydrogeology

Table 1: Hydrogeology

Bedrock	Upper Tunbridge Well	Secondary - high vulnerability
	Cuckfield Stone Bed	Secondary - high vulnerability
	Grinstead Clay	Unproductive
Source Protection Zone	None on site	
License abstraction:	None on site	

The hydrogeology of the site has been ascertained from the Groundsure report. The source of the data is reported to be the Environment Agency groundwater vulnerability mapping.

The bedrock deposits soils which are mapped beneath the site as identified as Secondary A aquifers in the northwest and south of the site and an unproductive aquifer mapped in the centre of the site.

The site is not situated within a Groundwater Source Protection Zone (SPZ). The Groundsure report lists no active abstraction licences within 2000m of the subject site.

7.4 Hydrology

Horsgate Pond lies immediately north east of the site. The Groundsure report lists the nearest surface water feature as an inland river, located 211m to the east of the site. The site is within the catchment of the 'Scrase Bridge Stream' river.

The Groundsure report indicates that there are two discharge consents within 500m of the site, the nearest is 265m south of the site and is for the discharge of treated effluent into the land from the sewage discharges of Horsgate Farm

7.5 Flooding

According to the Environment Agency, the site is not located within a flood zone. The highest risk from surface water flooding on site resulting in ponding or flooding is for a 1 in 30 year rainfall event. This appears to relate to the ground depression located centrally along the eastern boundary.

The risk from groundwater flooding on site is reported as negligible.

7.6 Designated Environmentally Sensitive Sites

A review of designated environmentally sensitive sites presented within the Groundsure report has been carried out. The dataset makes reference to a number of environmentally sensitive sites including the following:

- x Sites of Special Scientific Interest (SSSI);
- x Records of National Nature Reserves (NNR);
- x Areas of Special Conservation (SAC);
- x Records of Special Protection Areas (SPA);
- x Records of Ramsar Sites;
- x Records of Local Nature Reserves;
- x Ancient Woodland Records.

According to the Groundsure report, 1 No. Designated Ancient Woodland is located on site, which relates to Horsgate which is located just on the south-east boundary of the site. A further 20 No. Designated Ancient Woodland sites are located within 100m of the site. The site is located within an Area of Outstanding Natural Beauty 'High Weald'.

The site is not located within a Nitrate Vulnerable Zone.

7.7 Ground Workings

According to the Groundsure report, 11 No. surface ground workings are present on site including unspecified pits, old sand pits, and ponds dating from 1879 to 1992. Most of these pits refer to small scale open sandstone pits along the southern boundary and north western corner. A pit dating from 1874 is also located on the central-east boundary. The excavation immediately north west of the site is the current pond. The workings shown along the southern boundary were sandstone pits and may relate to the topographical valleys noted during the site walkover.

7.8 Mining, Extraction and Natural Cavities

The Groundsure report indicates the site is not situated within an area affected by coal mining. Two records of iron ore mining is located within 500m of the site, the nearest of which is 400m southeast of the site boundaries.

No natural cavities have been noted within 500m of the site.

7.9 Chemical Storage

According to the Groundsure report, a historic tank is located along the western site boundary, which is mapped in 1874, 1911, 1938, 1955 and 1970. Given the age and location of this tank, which corresponds with the brick structure noted on the walkover survey, it was most likely a water storage tank. Although hydrocarbons were noted on the walkover it is not possible to rule out fuel storage.

8 Site History

8.1 Site History

The contaminative and development history of the site has been ascertained with reference to the Ordnance Survey historical maps, Groundsure report, the World web and Google Earth.

In summary, the site has been mapped as an undeveloped field since the earliest available historical maps (1874). A tank is mapped on the southwestern boundary from 1874 and a small building is mapped in the southwest corner of the site from 1896. A windpump in the northwest is mapped on site between 1910 and 1967.

The areas surrounding the site during 1874 were mapped as fields with buildings, residential houses a union workhouse to the west. Various clay and sand pits were mapped during the 19th and 20th centuries. Only one is shown on present day maps which relates to pond to the south of the site. A building associated with a miniature range is mapped immediately west of the site from the mid-20th Century. The surrounding area has undergone considerable residential development, particularly around the town of Cuckfield to the southwest of the site.

8.1.1 Historical Map Evidence

The historical Ordnance Survey maps provided spanned the period 1874 to present day (2023) at scales of 1:10,000, 1:2,500 and 1:1,250. The maps are included in Appendix D.

Table 2: Summary of Historical Map Evidence

Year	On site	Surrounding area
1874	The site is mapped as a field with trees in the south and centre of the site. Footpaths are present across the boundary. A farm comprising of 3 farm buildings and a lodge is situated to the east. Residential housing is located to the south of the site. A pit (presumably an old sand pit) is shown on the eastern part of the site in the location of the depression noted during the site walkover. A tank is mapped along the southwestern boundary.	The surrounding site is mainly fields used as farmland. A road aligns with the northern site boundary. A pond is located immediately northwest of the site. A union workhouse mapped 100m east of the site. Pug Mill is located 120m southwest of the site. Two clay pits are mapped 20m southwest of the site boundary. Gore wood is mapped 120m north of the site, with a brick field located east of it (120m NW of the site). A pond/pit is located 110m northwest of the site.
1897	The pit in the east of the site is no longer mapped. A small building is mapped in the south western corner of the site with a small enclosure (possibly an animal pen?)	Only one pit is mapped 20m southwest of the site. One pit is mapped 100m east of the site. Two pits are mapped 10m south east of the site boundary, one is labelled old sand pit. A small building is located in between these two pits. The town of Cuckfield has developed and is mapped 350m southwest of the site. The brick work 120m north of the site is no longer mapped
1910	A windpump is located in the north west of the site.	The union workhouse is mapped as a P.A. institute
1938	No significant change on site. Only 1:10,560 map available.	The road on the northern site boundary is labelled Hanlye Lane.
1955	The site is shown as being split into field boundaries approximately following the treelines currently present on site.	Only 1:2,500 map available. Buildings have been developed associated with the former P.A. institute for use as a hospital. A tennis court is located 100m north east of the site. A miniature rifle range is mapped immediately west of the site.
1962	No significant change on site. Only 1:10,560 map available.	The P.A. institute is renamed Cuckfield Hospital
1976	The tank is no longer mapped on site. The windpump is no longer mapped on site.	The south of 1:10,000 map is incomplete. The pits off the southwest of the site are not mapped. Meadow court school is mapped 90m northeast of the site. Both pits in the southwest and one pit in the south east are no longer mapped. The remaining pit in the southeast is now mapped as a pond.

		Residential hous, a reservoir and a council depot have been developed 50m north west of the site. The tennis court is no longer mapped, a school is now mapped.
1993	No significant change on site.	No significant change.
2001	Only 1:10,000 map availa. No significant change on site.	The hospital, depot and reservoir are no longer mapped, and have been developed into residential housing.
2010	Only 1:10,000 map availa. No significant change on site.	No significant change.
2023	Only 1:10,000 map availa. No significant change on site.	The pond southeast of the site is no longer mapped.

8.2 Unexploded Ordnance (UXO)

The risks from unexploded ordnance have been assessed in accordance with guidance. A non-UXO specialist preliminary screening assessment has been carried out. The risks have been assessed by considering firstly the likelihood of military activities on, or in the vicinity of the site as determined from the desk study and historical review. Secondly the risk of UXO has been assessed by reference to the unexploded WWII aerial delivery bomb (UXB) regional risk maps produced by Zetica.

The Zetica risk maps indicate a low risk. Hence the overall risk of UXO is rated as low.

8.3 Waste Planning and Landfill Records

8.3.1 Recorded Landfill Sites

The Environment Agency website and Groundsure report contain details of historic and active landfilling in the vicinity of the site.

There are no areas of historic or active landfill listed within 500m of the subject site. According to the Groundsure report, landfill records have been provided by Mid Sussex District Council.

8.3.2 Waste Management Facilities

According to the Groundsure report, there are no waste management facilities within 250m of the site.

8.3.3 Waste Transfer or Treatment Sites

According to the Groundsure report, there are no waste transfer or treatment sites within 250m of the site.

⁶ CIRIA C681 2009. Unexploded ordnance (UXO) - A guide for the construction industry

8.4 Other Regulatory Records

According to Groundsure report, there are 3No. pollution incidents to controlled waters within 250m of the site. The nearest is located 9m north of site and consisted of inert material and waste pollution and occurred in September 2003. The incident had a minor impact to land but no impacts to air or water.

8.5 Radon

According to the Groundsure report database search, the site is not within a radon affected area (less than 1% of homes are above the action level for radon). Therefore, no special protective measures are required in the construction of buildings on site, in respect of radon gas.

9 Previous Investigations

A neighbouring site, located approximately 85m to the east, has been the subject of an investigation undertaken by LEAP, the findings of which are summarised below.

9.1 LEAP Phase 1 Desk Study, Site Reconnaissance & Site Investigation Report at Former Meadow Court School, Hanlye Lane, Cuckfield, RH17 5HN

At the time of the investigation, the site was occupied by disused buildings of the former Meadow Court School, and included areas of hardstanding above the car park and former playgrounds. The desk study identified a number of potential resources of contamination associated with the site's former use, including asbestos within existing structures on site, made ground on site, potential coal tar and PAH compounds in the blacktop hardstanding, hydrocarbons associated with below ground and above ground storage tanks. Ground gases associated with a backfilled swimming pool were also identified as a potential risk.

The ground conditions encountered on that site comprised made ground to a maximum depth of 0.9m bgl over firm to very stiff sandy clayey silt and silty clay to the full depth of investigation. Very weak to weak silty sandstones were noted in the excavation in the north of the site. The shallow soils appeared desiccated in several locations. Groundwater seepages were encountered between 0.50m and 0.35m bgl. Groundwater monitoring recorded standing groundwater levels between 1.17m and 3.30m bgl.

An allowable bearing capacity of 125kPa was recommended for the silts and clays below about 1m bgl. The soils were classified as Medium Volume Change Potential (VCP) and thus it was recommended that foundations were deepened in accordance with BS Chapter 4. Preliminary assessment of the laboratory testing results indicated that the shallow soils are desiccated. A CBR value of 3% was recommended for the shallow soils beneath the site.

Elevated concentrations of lead, arsenic and benzo(a)pyrene were encountered during the investigation on site.

C PRELIMINARY RISK ASSESSMENT

10 Preliminary Geoenvironmental Conceptual Site Model

10.1 Approach

A risk-based approach is used in the UK to assess contaminated potentially contaminated land. For a potential risk to exist, there must be a contaminant linkage place, i.e., there must be a source of contamination, a potential receptor, and a pathway linking the two. The purpose of this preliminary conceptual site model (CSM) was to systematically identify all of the potential contaminant linkages using the information provided in Section B of this report. The preliminary CSM was then used to enable uncertainties and further assessment requirements to be identified to allow a suitable intrusive investigation to be scoped.

10.2 Potential Sources of Contamination

Based on a review of the available information discussed in Section B of this report and Annex 3 of R&D66, Table 3 provides a summary of the potential plausible current and historical on- and off-site sources with the anticipated nature and distribution of the sources:

Table 3: Potential Plausible Sources of Contamination

Potential Source	Potential Contaminants of Concern	Anticipated Distribution
On-Site		
Former use of the site as agricultural land	Pesticides, herbicides and heavy metals	Potentially site wide
Potential infilling of historical pit	Ground gases (carbon dioxide and methane)	Located near to the eastern boundary.
Historical tank	Petroleum hydrocarbons	Potential for localised leaks and spills of hydrocarbons if used for fuel storage.
Made ground associated with the building in the southwest of the site	Wide range of contaminants possible including asbestos, metals, polycyclic aromatic hydrocarbons (PAH), petroleum hydrocarbons, ground gases	Likely to be localised in the vicinity of the building.

⁷ NHBC and Environment Agency 'Guidance for the Safe Development of Housing on Land Affected by Contamination' R&D Publication 66: 2008.

Bonfires and fly tipper waste	Metals PAHs Asbestos	Localised to fly tipping and bonfires.
Off-Site		
Potential infill of clay and sand pits. of various	Ground gases (carbon dioxide and methane)	Localised to any areas of backfill

The whole site is mostly open fields and there is the possibility that it had been used for agricultural purposes and as such pesticides and herbicides may have been used. It is likely that if there were any such chemicals present, could be site wide.

The former pit shown historically on the site, but not shown after 1897 may have had some backfilling. However, a depression is still visually noticeable on site in this area and is also shown on readily available LIDAR data suggesting that backfilling may have occurred or was very limited.

A small tank was shown historically on the south western boundary of the site (1910-1970), close to small structures. The walkover identified a small brick rectangular structure filled with logs, broadly in the position of the mapped historical tank. No visual or olfactory signs of hydrocarbon were noted in the structure or surrounding soils.

Made ground associated with the relict structures in the southern corner of the site are likely to be highly localised. No visual or olfactory signs of hydrocarbon were noted during the walkover. The area has only been built on once and therefore risk from made ground here is considered to be negligible and this potential source of contamination has been discounted.

The fly tipped materials and potential burning of waste on the northern part of the site may have led to localised heavy metal, PAH, petroleum hydrocarbon and asbestos contamination.

Several off site clay and sandstone pits have been identified to the south east of the site. Inspection of LIDAR data for the area, suggests that these depressions are still present and mostly likely not backfilled. Additionally the distance between these and the proposed development, (which is restricted to the areas ~120m to the north) together with age of the pits indicates that they are unlikely to pose a significant risk to the proposed development.

10.3 Potential Receptors

In the context of the proposed future land use, the following potential receptors of ground contamination were identified:

Human Health

- x Future residents and site users
- x Construction workers

Controlled Waters

- x The Tunbridge Wells Sand and Cuckfield Stone are both Secondary A aquifers (SPZ)
- x Surface waters are not considered to be at risk from the site due to the topography.

Other

- x Material construction of buildings and infrastructure

10.4 Potential Contaminant Linkages

The potential plausible contaminant linkages are summarised in the appended in Appendix E and were assigned a qualitative risk classification in line with the guidance presented in Annex 4 of R&D66. The preliminary risk levels were determined following a review of the available desk-based information with the significance of the linkages being dependant both upon the likelihood of exposure occurring and the severity of that exposure.

10.4.1 Human Health

The proposed development comprises residential housing with private gardens and public open space, etc. Therefore, all the generic Contaminated Land Exposure Assessment (CLEA) exposure linkages between humans and potential contaminants in the ground are plausible i.e., direct ingestion of soil, ingestion of homegrown produce, inhalation of indoor and outdoor vapours and dusts. Groundworkers could be potentially exposed via all these pathways, except for those involving edible plants. However, due to the low likelihood for high concentrations of contaminants to be present on-site, the potential for unacceptable risks to human health via these pathways is considered to be low.

The assessment of future on-site users is considered to be representative of the surrounding off-site residents and off-site commercial workers.

⁸ Environment Agency 'Updated technical background to the CLEA model' Science Report: SC050021/SR3. January 2009.

10.4.2 Ground Gases

No onsite sources of ground gases have been identified by the study and the off-site pits are not considered a gas risk to the site.

10.4.3 Controlled Waters

The site is underlain by a Secondary A aquifers in the northern and south western areas, with most of the central area being mapped as underlain by C. The risk to these aquifers from any potential on site contamination is likely to be very low.

10.4.4 Below Ground Infrastructure

The site is unlikely to be significantly contaminated and so the potential for unacceptable impacts to below ground infrastructure, including concrete and pipework is considered to be very low.

11 Geotechnical Risk Assessment

11.1 Preliminary Ground Model

Based on the findings of the desk study, the preliminary ground model for the site is summarised in Table 4 below.

Table 4: Preliminary Ground Model

Ground Mode	Characteristic	Notes
Ground Condition:	Tunbridge Wells Sand	Interbedded fluvial deposits comprising sands, gravels, and clays
	Grinstead Clay	Typically plastic over consolidated clays
	Cuckfield Stone	Sand and siltstone
Groundwater	Shallow	Perched groundwater anticipated within granular horizons
Surface Water feature	Pond to the north west	
Topography	Down toward the south	Typical slopes over the northern part of the site. The site is generally sloping down towards the south.
Existing structures	Two small derelict features remain in the southwest of the site	Where derelict structures remain, no development proposed.

History	Open fields and possible paddocks/ agricultural use. One small (possible) clay pit located within the central eastern boundary and other offsite historical pits to the southwest and southeast.	Possible infilling of ground with unknown materials.
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11.2 Geotechnical Risk Register

In order to establish the minimum requirements for geotechnical investigations, designs and post construction monitoring, it is necessary to establish the complexity of the geotechnical design and the associated risks.

The preliminary geotechnical risk register for the proposed development is summarised in the table in Appendix E.

11.3 Summary of Preliminary Geotechnical Risk Register

The following geotechnical hazards have been identified as substantial risks:-

Table 5 Geotechnical Risk Register Summary

Geotechnical Hazard	Overall Risk
Groundwater Level	Significant
Frost Susceptible soils	
Aggressive Ground Conditions	
Slope stability	

A geotechnical investigation is required to quantify the risks.

On the basis of the initial review and preliminary risk assessment, the site is given a Geotechnical Classification of Geotechnical Category 1 in accordance with EN1997-1 §2.1(14)-(21).

12 Sustainability Considerations

The geological, geotechnical and hydrological conditions of the site along with the potential for contamination can significantly influence the suitability of sustainable options on site.

The mapped ground conditions indicate high/medium/low plasticity clay to be anticipated. A piled foundation be the less carbon intensive option.

The site slopes gently to the south across the proposed development with a more pronounced slopes across the proposed open space area. The effect of potential adverse effects of climate change on slope stability may present a risk to the proposed development with anticipated drier summers and more intense winter rainfall event.

The conceptual site model has indicated a number of potential historical sources of contamination on site and anticipated widespread contamination across the site as such it is anticipated that some remediation will be required. / The conceptual model has indicated a low risk of contamination on site as such it is anticipated subject to testing that the soils will be suitable for reuse on site and caution should be taken to limit disturbance of natural soils.

D PHASE II - INTRUSIVE INVESTIGATION

13 Investigation Rationale

The key objective of the intrusive investigation was to aid the design/construction of the proposed development plan (Figure 2 and to determine any constraints associated with ground contamination, foundation design and slope stability.

The main purpose of the site investigation was to collect preliminary geo-environmental and geotechnical information to support the development of the site.

To achieve the investigation rationale, the scope of works comprised a total of 16 investigation locations across the site:

- x 10 No. machine excavated trial pits to a maximum depth of around 3m. 6 No. soakage tests.
- x 6 No. windowless sampler boreholes to depths of up to 3.0m

The scope of the investigation was non-targeted for the majority of positions to give general coverage with four locations targeting potential sources of contamination. The positions were, in accordance with BS10175, located with consideration to the proposed development plans and the preliminary geo-environmental and geotechnical risk assessment that were developed in Section C.

The spacing of the investigation locations was consistent with the recommended density of 25 to 50m for an exploratory investigation.

Investigation locations were spread evenly across the site to provide non-targeted coverage

The site investigation locations are provided in Figure 3 Appendix B and Table 6 provides a summary of the rationale, proposed scope and what was achieved in the field:

Table 6 Rationale and Scope for Investigation Locations

Trial Hole/Test Location	Rationale	Proposed Depth (m bgl)	Achieved Depth (m bgl)	Additional Comments
TP1, TP3-TP7	Provide information on ground conditions and geotechnical parameters. Investigate potential soil contamination) non targeted.	3-4m	1.8m-3m	Terminated at Depths of between 1.8m and 3m due to slow progress in the mudstone.
WS1-WS5	Provide information on ground conditions.	3m-4m	2-4m	

Trial Hole/Test Location	Rationale	Proposed Depth (m bgl)	Achieved Depth (m bgl)	Additional Comments
	Install groundwater monitoring well. Investigate potential soil contamination.			
WS6	Targeted to provide information on ground conditions within depression	3-4m	4m	Water monitoring standpipe installed
TP2-4, 7 & 9	Locate to carry out BRE365 soakage testing (shallow and deep)	1-2m	1-2m	

Due to an overhead cable in the proximity to TP8 this was not extended. Ground conditions around TP2 were very soft at the time of the investigation, as it was not possible to excavate the location.

Access for plant onto and across the site was hampered by the presence of soft ground conditions near the only entrance on the western boundary. Despite the use of track mats, 4x4 water tanker and use of a JCB for towing, the water tanker for the BRE365 tests could not get safely on to site. Because of this the BRE 365 soakage tests were not undertaken, in any pit other than TP9 where 70m+ of hosing was used and water was pumped from the tanker near the entrance. Whilst testing was not able to be carried out in the remaining pits, they were constructed and backfilled with gravel ready for testing at a later date when safe access for plant is more viable.

14 Site Work

14.1 Date and Weather Conditions

The intrusive investigations were undertaken over two days, 24 and 25 January 2023. At the time of the investigations, the weather was cold and overcast. It should be noted that the works were undertaken immediately following a period of very cold frost conditions which had resulted in the surface soils around the entrance to the site freezing and then rapidly thawing becoming very soft and unstable.

14.2 Site Work Methods

14.2.1 Windowless Sampler

The Windowless sampling rig consists of a tracked barrow with a sampling unit mounted on the top. When in the required position, the mast was raised to the height allowing a mechanised

drop weight to fall repeatedly onto an anvil, and drive ~~into~~ sample tubes or probe rods into the ground to produce reasonably intact continuous ~~samples~~ which were then extracted using the integrated hydraulic ram.

To reduce any tendency of the tubes to stick in the ground, a ~~series~~ of smaller diameters may be used to obtain full depth. Excavated soils were placed ~~for~~ inspection and sampling.

On completion the trial hole was backfilled with excavated material, ~~placed~~ in reverse order, and the surface reinstated unless Groundwater monitoring standpipes ~~were~~ installed as specified on the logs specified.

14.2.2 Trial Pitting

Trial pits were dug by a tracked excavator. Trial pit dimensions ~~are~~ shown on the trial pit logs, included as Appendix F. Spoil was placed adjacent to trial pits ~~from~~ discussions with the client on site and the need to minimise ground disturbance for ~~the~~ owners and horses in the field, it was decided to level and smooth over the trial ~~pits~~ adjacent areas where the machine had tracked over.

14.2.3 Soil Logging and Sampling

Soil samples were recovered from the boreholes and trial ~~pits~~ field screening, logging and sampling.

Boreholes were logged in general accordance with the requirements ~~5930~~⁹ and BS EN ISO 14688¹⁰. Borehole logs are presented in Appendix F.

Visual and olfactory evidence of contamination was noted if encountered ~~these~~ observations were used to aid scheduling of samples for chemical laboratory ~~analyses~~, and are included on the borehole logs in Appendix F.

Samples were collected with a clean sampling trowel or by hand ~~using~~ (dedicated nitrile gloves for each sampling location). Samples were placed into laboratory ~~supplied~~ sampling containers, specific to the type of analyses required.

All sample containers were sealed and labelled with a unique location ~~city~~, depth and date of sampling.

14.2.4 Monitoring Well Installation

Six No. groundwater monitoring wells were installed during this ~~investigation~~ within the windowless sample boreholes. The monitoring wells were constructed ~~of~~ 50mm diameter

⁹ BS5930:2015+A1:2020 Code of Practice for Ground Investigation

¹⁰ BS EN ISO 14688 Parts 1-2 (2018) Geotechnical Investigation and Testing. Identification and classification of soil

HDPE pipe. The response zone was typically targeted to intercept the groundwater surface and was surrounded by washed filter gravel. The top of the plain was surrounded with bentonite to provide a seal. The monitoring wells were finished with wings and raised steel covers. Sampling and Field Tests

14.2.5 Soil Sampling

Geo-environmental soil samples were selected to ensure that nearest exposure of human health via direct contact was targeted, as well as to spatially and vertically delineate possible sources of contamination.

Geotechnical soil samples were targeted to characterise the geological sequence, and to obtain characteristic soils properties and specific geotechnical design parameters as per the proposed development.

14.2.6 Standard Penetration Tests

Standard penetration tests were undertaken in the window sample boreholes at centres. Uncorrected blow counts, 'N values', are recorded on the borehole logs in Appendix F.

14.2.7 Field Vane Test

In-situ field vane tests were undertaken in cohesive soils in the trial pits in accordance with BS EN ISO 22476-9 (Draft). The results are recorded on the trial pits logs in Appendix F.

14.2.8 BRE365 Soakage Tests

Due to access issues for the plant testing was only undertaken in one. The test was carried out in general accordance with BRE Digest 365. However, given the time restrictions, it was only possible to fill and test the pit location once.

14.3 Groundwater Monitoring

To assess the groundwater level beneath the site six standpipes were installed and monitored following installation and then a further three times at monthly intervals.

14.4 Laboratory Analysis

14.4.1 Geotechnical Laboratory Testing

Selected samples of the soils have been classified by laboratory analysis for geotechnical design purposes. The laboratory testing has been carried out by Geolab Ltd's laboratories in Watford, in accordance with BS1377 and BS EN ISO17892. The sampling technique, type,

¹¹ Building Research Establishment DG365 Digest Soakaway Design (2016)

¹² BS1377 Parts 1-9:1990 Methods of test for Soils for Civil Engineering Purposes

¹³ BS EN ISO 17892 Parts 1-12 Geotechnical Investigation and Laboratory testing of soil

storage and transport and the number of laboratory tests have been undertaken where possible in accordance with BS EN 1997-2:2007 and BS EN ISO 22475

The following laboratory tests have been undertaken:-

Table 7 Geotechnical Laboratory Testing

Test	Number of Tests
Moisture Content	9
Atterberg Limit Test	9
Particle Size Distribution Test	3
California Bearing Ratio	3
Sulphate Determination	5
pH	5

The geotechnical laboratory test results are provided in Appendix I.

14.4.2 Chemical Soil Analysis

Selected samples of soil subjected to laboratory testing.

The suite of soil contaminant analysis took into account the potential contaminants of concern identified in the CSM (heavy metals, PAHs, asbestos, herbicides and pesticides). Soil samples were also analysed for pH and total organic carbon (TOC) to support selection of assessment criteria in the subsequent quantitative risk assessment (QRA) for human health.

Sampling techniques and storage have been undertaken as per BS 10175:2011 Code of Practice for Investigation of Potentially Contaminated Sites. The laboratory testing was carried out by The Environmental Laboratory Ltd at its laboratories in East Sussex. Where available, the tests for soils procedures were UKAS and MCS accredited.

The following analyses were completed on selected soil samples based on observations and for general vertical and lateral coverage:

- x 9 No. metals (As, Cd, Cr, CrVI, Cu, Pb, Hg, Ni, Se, Zn)
- x 9 No. USEPA 16 PAHs
- x 9 No. Asbestos identification
- x 3 No. Organochlorine and organophosphorus pesticide suites.
- x 9 No. pH
- x 9 No. TOC

15 Ground Conditions

The ground conditions are described in detail in the logs attached in Appendix F.

For the purpose of the assessment the ground model is divided into two areas, the proposed development area in the north and the public open space land in the south. A summary of the soil conditions in the developable northern part of the site were as follows:

Table 8: Summary of soils encountered in the northern half of the site

Depth From (m)	Depth To (m)	Soil Type	Description
GL	0.2 / 0.7	TOPSOIL	Dark brown silty clay TOPSOIL
0.2- 0.7	0.80	MADE GROUND / Reworked soils	MADE GROUND/Reworked soils were only encountered in WS2 and WS3 where some fine brick gravel was recorded to between 0.70 to 0.8m bgl, and at WS6 which was located in a ground depression and where fine brick and glass fragments were also recorded to 0.8m below ground level.
0.2 / 1.2	0.7*-4.0*	CLAY	Firm to stiff sandy silty CLAY with some fine to coarse gravel of siltstone and sandstone were generally recorded across the majority of the site with the exception of WS6, where soft clays were encountered to 3.5 m
0.8/1.4	1.2/+2.0	SAND	Grey mottled orange gravelly clayey SAND (W: to brown mottled grey gravelly clayey SAND (WS6) and pale grey / orange fine SAND (TP1)
1.1-1.8	4+	MUDSTONE / SILTSTONE / SANDSTONE	Recovered as mottled greyish yellow to grey gravelly SAND and gravels of weak coarse SANDSTONE, dark grey silty gravel MUDSTONE, and pale grey orange fine gravel SAND with coarse gravel of weak SILTSTONE or very sandy gravelly grey SILT with weak thinly laminated SILTSTONE or pale yellow grey SILTSTONE, recovered as a gravel.

It is noted that WS4 located in the north eastern corner of the site is mapped as being underlain by the Upper Tunbridge Wells Sand. The borehole recorded clay to 1.10m over gravelly clayey sand with very weak sandstone gravel.

It is noted that shear faces were recorded within the clay TP5 and TP6 located on the eastern half of the site at depths of between 1.2m and 1.6m.

WS6 was located within a noticeable ground depression and reworked soils were noted to 0.80m below ground level. The clay encountered below the reworked soils were recorded as wet and soft to a depth of around 3.5m bgl which was underlain by very stiff grey sandy silty clay.

TP9 and WS1 are located on the Cuckfield Stone Beds in the south of the site, recorded sand and/clay to 1.9 and 1.6mbgl (112.3 and 112.4m mAOD) before the siltstone sandstones were encountered.

15.1.1 Groundwater

Groundwater strikes were recorded in the following trial holes:-

Table 9: Groundwater Strikes

Trial Hole	Date of water strike	Depth to Groundwater strike (mbGL)	Comments
WS1	24/01/2023	1.4	
WS6	24/01/23	0.8	At boundary between reworked ground and Sand

Groundwater monitoring results are summarised as follows:-

Table 10: Groundwater Monitoring Results

Monitoring well	Depth to groundwater (mbgl)			
	25/01/2023	27/01/2023	20/02/2023	09/03/2023
WS1	0.67	0.63	1.09	0.15
WS2	Dry	Dry	Dry	1.46
WS3	-	Dry	Dry	1.69
WS4	1.0	0.99	1.26	0.99
WS5	Dry	Dry	Dry	Dry
WS6	-	0.44	0.89	0.05

The water within the standpipes was located where sands and siltstone was identified in WS1 and WS4, no groundwater was recorded at positions where clay was present throughout the borehole. Water and organic/alluvial odours were noted in WS6, where made ground soils and the depression in the ground level was noted. It is likely that this was a historical clay extraction pit that provided a low point and subsequently filled with water.

The full monitoring results are provided in Appendix H.

15.1.2 Visual and Olfactory Evidence of Contamination

No visual or olfactory evidence of significant contamination was encountered during the intrusive investigation or groundwater monitoring visits other than the organic odours noted at WS6.

E GEOTECHNICAL INFORMATION

16 Strata Encountered

The soils encountered have been compiled for both northern and southern areas of the site and is summarised below. It is noted that the Tunbridge Wells Sand was encountered in the north east of the site.

16.1 Made Ground

The site is generally underlain by undisturbed soils with made ground or worked soils only recorded at WS2 to 0.70m and WS3 and WS6 to 0.8m. Whilst found to be extensive by the investigation, it may be prudent to expect localised areas of made ground.

Made ground or fill is by nature highly variable in both composition and bearing capacity, and can be subject to large differential settlements when loaded therefore generally unsuitable for use as a bearing stratum. In addition, made ground may be contaminated and/or putrescible material. It can therefore be potential source of contamination and landfill gas.

16.2 Clay

The topsoil / made ground was underlain by firm to stiff plastic clays to depths of between 0.7m and 4.0m. The results of the geotechnical laboratory testing are summarised in Table 11 below.

Table 11: Summary of Geotechnical Test Results for Clay

Test	Range
SPT 'N' value	3-74
Moisture Content (%)	17.2-31.9
Liquid Limit (%)	33-68
Plastic Limit (%)	14-24
Plasticity Index (%)	16-45
California Bearing Ratio (lab soaked (%))	2.2-3.6
Sulphate Content (g)	<0.01%
pH	7.3-8.4

Hand shear vane testing recorded undrained shear strength values of between 71-108 kPa and hand penetrometers reported 90-470 kPa indicative of firm to very stiff soils.

The results of Atterberg limit testing indicate that shallow soils comprise intermediate to high plasticity clays and silts. The plasticity testing results are plotted on an A line plot available in Figure 4 Appendix B.

16.3 Sands

Two standard penetration tests were undertaken within the sands in the northern part of the site. The results indicate dense to very dense soils.

Table 12: Summary of Geotechnical Test Results for sands

Test	Range
SPT 'Nvalue	46 & 76

A single particle size distribution test was undertaken on a sample collected from TP7 at 1.90 m bgl. TP7 is located at the mapped boundary between the Grinstead and the Tunbridge Wells Sand. The results of the geotechnical laboratory testing are summarised in Table 13, below.

Table 13: Summary of Particle Size Distribution tests Sand/Gravel at TP7

Strata	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobbles (%)
SAND	13.5	19.7	32.2	34.6	0

On the Cuckfield Stone Bed encountered on the southern part of the site SPT values of 59, 33 and 66+ were recorded at 1m, 1.5m and 2.5m.

16.4 Siltstone/Mudstone/Sandstone

The clays were underlain by interbedded mudstones/ siltstones and sandstone to the full depth of borehole. Laboratory testing of the siltstone / sandstone / mudstone was beyond the scope of works. However, based on the field tests the siltstone / mudstone / sandstone is classified as extremely weak to very weak.

F GEOTECHNICAL APPRAISAL

17 Geotechnical Design

The foregoing geotechnical appraisal does not constitute a Geotechnical Design Report in accordance with BSEN1997. The following recommendations are for preliminary design purposes only.

For the detailed design, the short-term and long-term designations must be considered. Where relevant, the following limit states should be considered:-

- x Loss of equilibrium of the structure or the ground, considered as a global body, in which the strengths of structural material and the ground are significant in providing resistance (EQU)
- x Internal failure or excessive deformation of the structure or structural elements in which the strength of structural materials is significant in providing resistance (STR)
- x Failure or excessive deformation of the ground, in which the strength of soil or rock is significant in providing resistance (GEO)
- x Loss of equilibrium of the structure or the ground due to uplift, water pressure or other vertical actions (UPL)
- x Hydraulic heave, internal erosion and piping in the ground caused by hydraulic gradients (HYD)

The following factors should also be considered.

- x Overall stability and ground movements
- x Nature and size of the proposed construction including the design life
- x Conditions with regards to the surroundings (e.g. neighbouring structures, utilities, vegetation, contamination etc.)
- x Ground and groundwater conditions
- x Influence of the environment.

18 Geotechnical Appraisal

18.1 Swelling and Shrinkage

Based on the highest recorded laboratory test results in BS68, an overall classification of NHBC HIGH Volume Change Potential (VCP) is recommended for the clay. However, some mitigation of this requirement may be possible following further testing on a plot by plot basis. Furthermore, deepening may be terminated where the dense sandstones are encountered at depth.

Foundations will require deepening in accordance with NHBC Chapter 4.2 ~~and~~ clay soils are encountered near trees. Foundation depths should be calculated ~~based on~~ the mature height of the tree, however, the existing height is relevant for trees ~~which~~ are to be removed.

The BGS GeoClimate study (UKCP18) ¹⁴ indicates the potential change in subsidence due to changes in climate. The results project a 6.5% of properties ~~will be~~ affected by swelling and shrinkage by 2030, rising to 11% by 2070 (compared to 3% in 2020).

18.2 Sulphates

5 No. samples were tested for sulphate content and pH. All recorded ~~the~~ water soluble sulphate contents to be <0.010 g/l

Based on the results detailed in Section E and the above ~~it has~~ been classified by the BRE as sulphate design class DS-1, and, assuming a mobile groundwater ~~table~~, the ACEC class is AC-1d.

18.3 Groundwater

The groundwater monitoring results/observations are given in ~~Section~~ 15.1.1. On the basis of these results, groundwater at about 1m below ground level ~~should~~ be anticipated within areas of sandy geology

Long term groundwater monitoring was beyond the scope of works ~~and~~ would be required to fully assess the groundwater regime.

Winter groundwater levels are anticipated to rise in some ~~areas~~ southern England. Storage on site will be reduced and may make conventional soakaways ~~inappropriate~~ for this development.

18.4 Soakage Potential

18.4.1 Test Results

1 No. soakage test was undertaken on site in accordance with BRE ¹⁵ Given the time restrictions, it was only possible to fill and test TP9 pit on ~~the~~ site. The pits have been prepared for soakaway testing and will be ready for testing at such time ~~that~~ ^{that} workers are able to access the site. The results are attached in Appendix G and are summarised ~~below~~

¹⁴ <https://www.bgs.ac.uk/news/maps-show-the-real-threat-of-climate-related-subsidence-to-british-homes-and-properties/>

¹⁵ Building Research Establishment DG365: 2016. Digest Soakaway Design

Table 14: Summary of soakage tests

Test Location	Soakage Rate (m/s)	Comments
TP9	1.5×10^{-07}	Test not BRE365 compliant. Water did not fall to 75% max water depth therefore calculations are based on the actual fall of the water. Only one test undertaken

The single test undertaken in TP9 was carried out within the Cuckfield Beds which are only located in the southern section of the site. The calculated soakage rate of 1.5×10^{-07} m/s suggests that this part of the site is not suitable for conventional soakaways.

Gravel filled soakage pits have been constructed ready for use across other parts of the site. However much of the site was underlain by clays, mudstone and siltstone and as such significant soakage rates might not be anticipated. Sandier horizons encountered locally and these may produce better rates, although high groundwater levels indicate that soaks are not viable.

Further testing will be undertaken when weather conditions allow safe access to the site. The findings of this testing will be reported on under a separate cover.

18.4.2 Sustainable Considerations for soakage design

Winter groundwater levels are anticipated to rise in some areas of southern England. Storage on site will be reduced and may make conventional soakaways inappropriate for this development.

Design of a SUDS scheme which can incorporate biodiversity net gain into the development and will support the NPPF requirement for multifunctionality managing water quality and design while improving diversity.

18.5 Bearing Capacity and Foundations

18.5.1 Shallow Foundations

Allowable Bearing Capacity or Pressure is a conservative estimate of the ultimate bearing resistance of the ground, selected on the basis of the soil description, and taking a presumed degree of settlement into account. It has traditionally been used to check simple foundation designs. The use of this method is acceptable under BS EN 1997-1¹⁶ as a

¹⁶ BS EN 1997-1(2004)+A1:2013 Eurocode 7: Geotechnical Design – General Rules

“prescriptive method”, with the allowable bearing pressures now termed “presumed bearing resistance”.

The presumed bearing resistance is highly dependent on proposed depth of foundation, width of foundation and the structure’s tolerance for settlement. The following section provides a preliminary presumed bearing resistance assuming a stated depth and width of foundation and assumes that settlements of up to 25mm can be tolerated by structure. Should alternative foundation depths and dimensions be required, or the proposed structure have different long term movement requirements then the following assessment should be repeated.

All loads should be transferred beneath any topsoil, made ground, soft, low strength, desiccated or disturbed soils and transferred onto the firm till, clays or dense to very dense sands and siltstone/mudstones which were generally encountered at depths of around 1.3-1.5m. On the basis of the findings of the intrusive investigation, a preliminary presumed bearing resistance of 100kPa may be assumed for a 600mm wide foundation on the firm clays and dense sands below about 1.30 m. However, foundations will require deepening in the clay soils near trees to NHBC MEDIUM VCP precautions. Several mature trees are present close to proposed residential properties where clays soils have been encountered. It should also be noted that shear faces were recorded within the clays at TP6, to depths of 1.5m and 1.6m, and it may be prudent to err on the side of caution and extend foundations to below this level.

Soft soils were encountered in the vicinity of WS6 to a depth of 3.5m below ground level and that houses are proposed nearby. Foundations in this part of the site need to be extended below any soft soils or the distance to the soft soils considered in their design.

Further information will likely be required for the detailed design stage, including the foundation design details and further investigation to meet the requirements of BS EN 1997 and BS 8004.

Where foundations are stepped or span different soil types, allowance should be made for nominal reinforcement.

18.5.2 Construction Supervision

Foundation excavations should be inspected by a suitably qualified engineer to ensure competent soils, in this case the firm till, clays or dense sands are encountered at formation level.

18.5.3 Sustainability Considerations for Foundations

LEAP’s foundation carbon calculator has been used to assess the relative embodied carbon output of the recommended foundation options. The tool considers the intrinsic carbon

¹⁷ BS 8004:2015+A1:2020 Code of Practice for foundations

dioxide generated from the materials which make up the foundations as well as emissions associated with onsite plant, earthworks and the disposal of the pile arisings.

Based on the limited information available to date on the proposed construction, the carbon calculator indicates that assuming the foundations summarised above are installed on site then traditional footings would be the less carbon intensive option.

The model also indicates that where traditional foundations are extended below 1.7 m bgl then piled foundations are the less carbon intensive foundation option.

Further more detailed calculations and wider sustainability assessments can be provided and you can register your interest in such an assessment [here](#) as part of the sustainability section of our website.

18.6 Floor Slabs

With reference to NHBC Standard 5.2, suspended floor slabs are recommended:-

- x Where the depth of fill exceeds 600mm
- x Where foundations are deepened below 1.5m in accordance with NHBC Standards Chapter 4.2
- x Where desiccated soils are encountered
- x Where vibratory ground improvement techniques have been used
- x On sloping sites
- x Where foundations have been piled.

Suspended floor slabs are therefore recommended on site.

18.7 Roads

18.7.1 Test Results

Three laboratory CBR tests were undertaken on samples of the shallow silty clays, and returned CBR values in the range 2.2%-3.6%. The results are detailed in Appendix I.

The shallow soils are assessed as frost susceptible, based on the results of the plasticity testing (see Section E).

18.7.2 Recommendations

A design CBR value of 3% is recommended for a silty clay subgrade.

Further confirmatory testing may be required if the proposed roads are to be adopted.

18.8 Excavations

Excavations in the silty clays should be stable in the short term. However, groundwater seepages should be anticipated along the more granular sand layers in the north eastern and southern most parts of the site and long term groundwater levels at or above 1m below ground level in these areas should be anticipated. Excavations should be unstable in the long term and should be backfilled as soon as possible. Allowance should be made for light pumping.

Appropriate Health and Safety precautions must be adhered to when entry into excavations is required. Even stiff clay soils at shallow depths can collapse, particularly following wet weather. Alternative foundation methods may need to be adopted where trench footings cannot be safely or satisfactorily constructed.

18.9 Filling

The preliminary recommendations contained within this report assume that ground levels are to remain at a similar level across the site for the proposed development, and that no significant changes in level are proposed. In the event that ground levels are to be raised, this may induce significant settlement, particularly across the area of clay on the eastern part of the site, which could adversely effect foundation design, drainage etc. Where significant changes in ground levels are proposed then further investigation will be required to assess the impact of such earthworks on the above recommendations.

18.10 Slope Stability

the northern part of the site where the proposed redevelopment will occur with a more surface clays in the north of the site indicating that historical slip has occurred and that soils will be at residual strength. It is recommended that a qualitative assessment for the site is made once final design proposals are known and a topographical survey undertaken to ensure that the proposed development does not constitute a slope stability issue, which at this stage would be considered to be low. General recommendations for development on slopes include the following:

- x Care must be taken to ensure that any cut and fill operations do not destabilise the slope. As a general principal, loading at the crest and cutting at the toe would have such an effect.
- x Retaining walls should be avoided if possible, kept to a maximum height of 600mm where necessary, and include adequate drainage. Retaining walls exceeding 600mm in height should be designed by a suitably qualified engineer..
- x Filling of subfloor voids should be avoided

- x Drainage of the site will be crucial.
- x All drains should be laid at twice the normal fall to accommodate any local ground movement.
- x Where houses include partial basements, allowance should be made in the design of the walls as retaining structures.
- x Vegetation will have stabilising effect and should be maintained for as long as possible.
- x Whilst soakaways are unlikely to be viable at the site, it is reiterated that the introduction of water into the slope must be avoided.
- x Excavations across the slope should be avoided if possible. Where necessary, they should be kept to short lengths, say 5m, and backfilled immediately.

Global stability checks will be required when developing on slopes and allowance should be made for slope stability analyses at the design stage.

Caution should be taken to ensure that your slope design factors include resilience. Climate change modelling indicates drier summers and more intense wetter periods in future.

18.11 Retaining Walls

Retaining walls should be avoided if possible. Care should be taken to ensure that if present they are founded on competent soils and do not upset the overall stability of the slope. Low retaining walls up to 600mm high may be used providing the overall slope is not exceeded. Retaining walls exceeding 600mm in height should be designed by a qualified engineer.

Care must be taken to ensure any loads are kept remote from retaining walls, or extend below the base of the retained soils.

Retained soils must be adequately drained to prevent the build up of excess water pressures. For some of the smaller retaining structures proposed, alternatives such as gabion walls, soil nailing or the use of ground improvement techniques may be considered as an alternative.

18.12 Settlement

Based on the presumed bearing resistance given in Section 18.1, settlements should be within typical tolerable limits for the low rise development proposed.

If soft clays are encountered at formation level or below, significant settlement should be anticipated and serviceable limit state analyses will be required. For Civil Category 2 and 3 structures, detailed settlement analyses are usually required.

At this stage it is assumed that ground levels will remain at their current level for the proposed development. If significant level raises are proposed, this may indicate significant settlement in the natural soils and detailed settlement analyses will be required.

Where foundations are stepped or span different soil types, differential settlement should be anticipated and allowance should be made for nominal reinforcement.

18.13 Heave and Uplift

In accordance with NHBC Standards Chapter 4.2, precautions against heave should be used where foundations are within the influence of trees and the resulting foundation depth is greater than 1.5m. Compressible material must be provided against the inside faces of all external wall foundations greater than 1.5m in depth. For pier and beam foundations, additional voids are required below ring beams.

Heave may also occur where shrinkable soils are unloaded, in say, at excavations. To avoid uplift pressures, voids or buffer zones should be left beneath slabs. As a preliminary guide, allowance should be made for a 300mm void for highly shrinkable clays, reducing for lower plasticity soils. This should be confirmed at the detailed design stage.

19 Geotechnical Recommendations

Further assessment including a geotechnical design report and a stability assessment will be required once the details of the proposed construction are known.

At this stage foundations will require deepening in the clay soils to NHBC HIGH VCP precautions and to bear below pre-existing shear faces in the clay.

Further intrusive works are needed around the soft spot in WS6 to assess its extent.

G GEO-ENVIRONMENTAL QUANTITATIVE RISK ASSESSMENT

20 Revised Conceptual Site Model

20.1 Introduction

The preliminary conceptual site model in Section C identified a number of plausible contaminant linkages. The revised CSM provides an updated understanding of the site based on the findings of the site investigation and analytical results. This was used to inform the quantitative risk assessment (QRA) undertaken in Sections 21 to 23 in the context of the proposed residential land use.

Following completion of the preliminary site investigation no revisions to the CSM are considered necessary before carrying out the generic quantitative risk assessment (GQRA).

20.2 Human Health

Given the nature of the contaminants encountered, plausible contaminant linkages for exposure to future residents and groundworkers at the site are considered as follows:

- x Ingestion of contaminated soils.
- x Inhalation of contaminated soil particles/dust and asbestos fibres.
- x Dermal contact with contaminated soils.
- x Ingestion of homegrown produce (future residents only).

As no evidence of VOCs was encountered, the inhalation of soil and groundwater-derived vapours was excluded as a plausible contaminant linkage. Groundwater was excluded in the preliminary risk assessment.

20.3 Controlled Waters

The site is mostly underlain by clay deposits with some sand and sandstones beneath the southern part of the site and the north easternmost corner. There is no evidence of a continuous shallow groundwater body being present beneath the site. There is no evidence of significant land contamination that would affect controlled waters.

21 Human Health Risk Assessment

21.1 Rationale and Approach

The generic quantitative risk assessment (GQRA) for human health was conducted in line with the CLEA methodology by comparing the soil analytical results to the ground investigation with Generic Assessment Criteria (GAC). The GACs were selected using the rationale and assumptions provided in Appendix L.

Sets of soil GACs are available for SOMs of 1%, 2.5% and 6%. For TOC in samples that were analysed ranged from 0.4% to 2.4%. Using the conversion $\text{TOC} \times 1.72$, this equates to a SOM range of 0.7% to 4%. 1% SOM was considered appropriate to maintain conservatism.

The risk assessment did not include statistical analysis. CL:AIRE provides guidance on the appropriate sample sizes for particular statistical distributions of data and non-targeted soil sampling approaches. The number of soil samples collected at site investigation indicates that statistics are not appropriate to use in this.

21.2 Evaluation of Potential Risks to Future Residents

The soils that were analysed comprised topsoil and underlying shallow soils. The laboratory analytical results were assessed to determine the potential risk to future site users under a generic residential land use scenario assuming that home grown produce is consumed. The quantitative risk assessment is provided in Appendix J and the analytical certificates are provided in Appendix K. A summary table is provided in Table 15.

Table 15: Summary of Soil Contamination Test Results

Determinand	Number of samples	Maximum Conc. (mg/kg unless otherwise stated)	Generic Assessment Criteria (mg/kg)	Number of Exceedances
Arsenic	9	9.7	37	0
Cadmium	9	<0.5	22	0
Chromium	9	20.6	910	0
Hexavalent Chromium	9	<0.8	21	0
Copper	9	34.4	2,400	0
Lead	9	84.2	200	0
Mercury ¹	9	<0.5	40	0
Nickel	9	12.5	130	0

¹⁸ CL:AIRE, 2020 'Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.' CL:AIRE, Buckinghamshire. ISBN 978-1-4056-5.

Determinand	Number of samples	Maximum Conc. (mg/kg unless otherwise stated)	Generic Assessment Criteria (mg/kg)	Number of Exceedances
Selenium	9	<1	250	0
Zinc	9	62.7	3,700	0
Asbestos	9	None detected	Presence	0
Benzo(a)pyrene ²	9	0.27	5.0	0
Naphthalene	9	0.06	2.3	0
Total PAHs	9	4.61	n.v	-

Notes to table

1. Assessment criterion based on inorganic mercury
 2. As a surrogate marker for genotoxic PAH
 3. As a marker compound for threshold PAH
- n.v. – no appropriate value

None of the recorded heavy metal or PAH concentrations were above the GAC for a residential development and no asbestos was identified at any point investigated. Selected soil samples were also screened for the presence of pesticides/herbicides and no sample reported pesticides / herbicides above the lower detection limit of the test.

It should be noted that some fly-tipping was present on the northern part of the site, and there may be localised contamination beneath these materials. It is recommended that once they are removed some testing is undertaken in this area. Likewise, a small historical tank and relict structure in the south-western corner may have also made ground and or localised contamination and as such when they are removed it would be prudent to inspect beneath their footprint would be prudent.

21.3 Evaluation of Potential Risks to Groundworkers

Whilst no significant contamination has been identified to date, there is a legal duty for employers to ensure that suitable health and safety controls should be in place to protect groundworkers and they should evaluate the potential for exposure during using data provided in this report which should be included in any future Health and Safety File for the site under The Construction (Design and Management) Regulations 2015.

22 Controlled Waters Risk Assessment

22.1 Testing

Significantly elevated concentration of contaminants that ~~are likely~~ pose a risk to controlled waters have not been identified. There is the possibility ~~that~~ yet unidentified contamination may be present. If this is the case then a revised controlled water risk assessment may be required.

23 Geo-Environmental Conclusions & Recommendations

The works to date have not identified any significant contamination with respect to identified human health receptors or controlled waters. No evidence of ~~significant~~ made ground soils have been recorded, however localised shallow pockets of reworked ~~soil~~ are present.

Whilst the assessment has not found any other significant contamination, there remains the possibility that as yet unidentified contamination may be present, particularly beneath the fly-tipping and former small structures. It is recommended that ~~further~~ testing in these areas once the materials and structures have been removed ~~is~~ undertaken.

23.1 Groundwater

Based on the investigation undertaken and the samples that were ~~tested~~ it is not anticipated that there are any contaminants on site that will pose a ~~risk to~~ groundwater.

24 Waste Reduction

24.1 Soil Retention

Soil contain approximately three times as much carbon as the ~~atmosphere~~. As such minimising its disturbance on site not only minimises the loss of ~~soil~~ carbon storage but retaining as much soil as possible allows for biodiversity net gain and ~~reduces~~ risk of surface flooding.

Where possible disturbance of soil functionality during earthworks ~~needs to be~~ minimised. Poorly managed soils that has been compacted in storage ~~have~~ a degraded physical structure and reduced capacity to maintain above and belowground biodiversity.

The proposed layout indicates public open space and where possible ~~the~~ ~~avoidance of~~ ~~contact~~ from soils in these areas should be avoided.

24.2 Soil Reuse

Prior to development, consideration should be given to any ~~in-situ~~ materials and their potential for re-use as part of, or during construction of, the ~~proposed~~ development.

24.3 Topsoil Re-use

Site-won topsoil is a resource and should, where possible, be protected as such to prevent damage to the soil structure. Where topsoil is to be stripped, stockpiled and re-used such activities should be undertaken during dry weather (generally June to September). Once stockpiled topsoil should be kept dry. Significant working of topsoil whilst wet can damage the soil structure, reducing the soils' ability to drain and resulting in anaerobic rather than aerobic soil conditions.

Anaerobic soil conditions can have a negative impact on plants and their roots, which will impact the ability of plants to take root once the soil has been placed for its proposed end use. Machinery tracking over recently placed topsoil should be avoided. Should prolonged poor storage result in degradation of the soil some treatment is likely to be required. This may include sand amelioration to improve the soil structure or the addition of composts to reduce nutrient deficiency.

Re-use of Made Ground and contaminated natural materials as well as importation of uncontaminated natural materials from a different site will require a Materials Management Plan (MMP) to be produced and a declaration made to CL:AIRE and WCoP. The declaration is required before any material movements are made and requires the RMS to have been approved through planning.

APPENDIX A – Limitations

Limitations

LIMITATIONS

This report is confidential to the Client, and Leap Environmental Ltd accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known, unless formally agreed by Leap Environmental Ltd beforehand. Any such third parties upon the report at their own risk. Unless explicitly agreed otherwise in writing, this report has been prepared under LEAP's standard terms and conditions, as included in the agreement for this works.

This report has been prepared by Leap Environmental Ltd on the basis of information received from a variety of sources which Leap Environmental Ltd believes to be accurate. Nevertheless, Leap Environmental Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

Leap Environmental Ltd has used all reasonable skill, care and diligence in the design and execution of this report, taking into account the manpower and resources devoted to it in agreement with the Client. Although every reasonable effort has been made to obtain all relevant information, all potential contamination, environmental constraints or liabilities associated with the site may not necessarily have been revealed. LEAP cannot be held responsible for any disclosures or changes in regulation that are required post production of this report, and will not automatically update the report.

The conclusions reached in this report are necessarily restricted to those which can be determined from the information consulted, and may be subject to amendment in the light of additional information becoming available. These conclusions may not be appropriate for alternative schemes.

The extent of the exploratory holes, laboratory testing and monitoring undertaken may have been restricted due to a number of factors including accessibility, presence of buried or overhead services, current development and site usage, timescale and clients specification. The exploratory holes only assess a small proportion of the site with respect to the site as a whole, and as such may only provide an overall assessment of ground conditions on site. The presence of hotspots of undisclosed contamination or exceptional and unforeseen ground conditions cannot be discounted.

Eurocode 7 gives guidance on the type of sampling, sample quality and spacing of intrusive investigations, and number of laboratory tests required. It is intended that the Geotechnical Information section of this report will fulfil the general requirements of the Ground Investigation Report as set out in section 6 of Eurocode 7¹⁹, although this is subject to the restrictions imposed on the investigation as listed above. For geotechnical design, Eurocode 7 requires the Geotechnical Design Report to address both geotechnical and

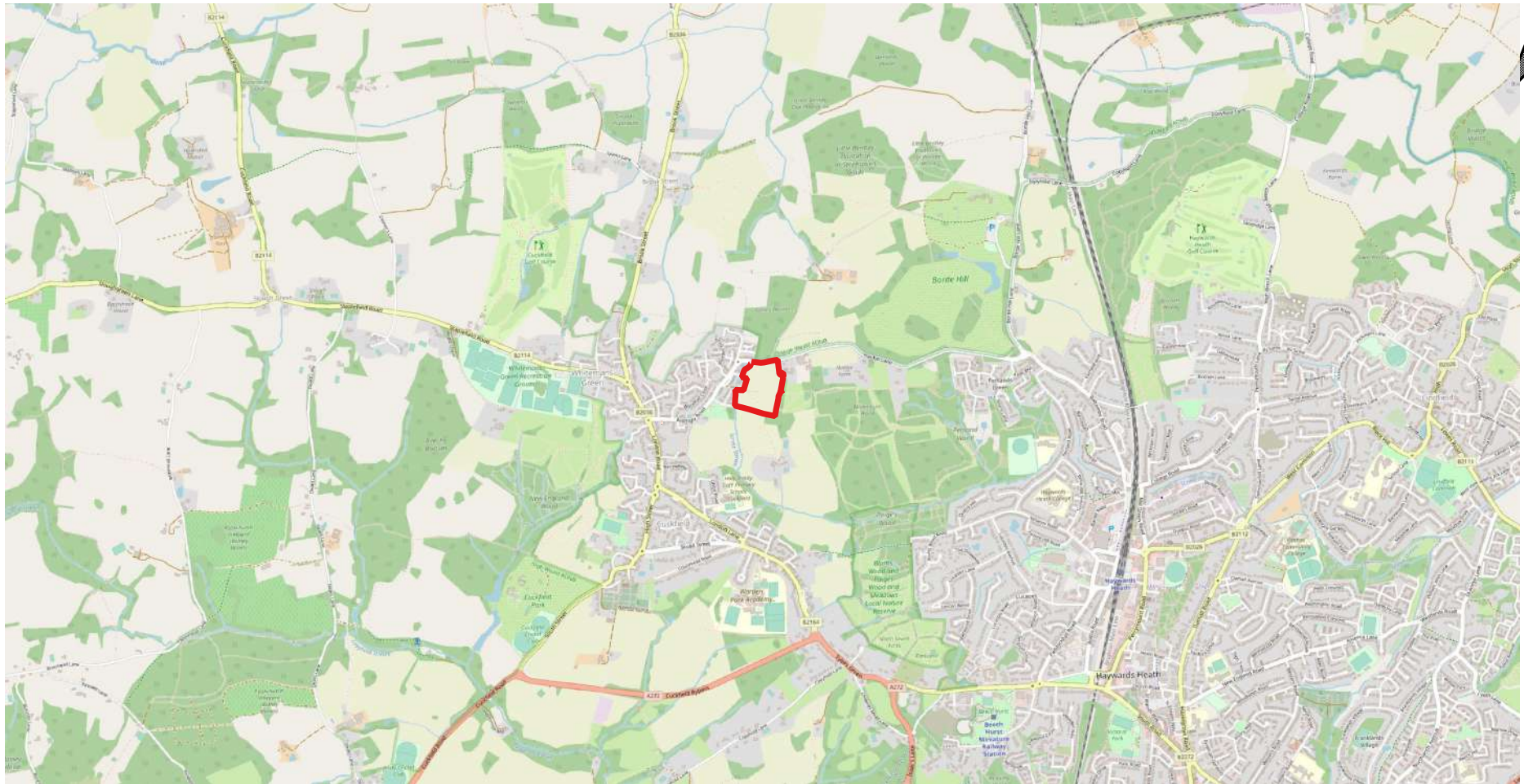
¹⁹ BS EN 1997 Eurocode 7- Geotechnical Design - Part 1: General Rules (2004) and Part 2: Ground Investigation and Testing (2007)

structural aspects of the geotechnical design for both the ~~land~~ and serviceability states. The Geotechnical Appraisal section of this report will not meet ~~the~~ requirements of a Geotechnical Design Report (GDR), and should therefore be used for preliminary guidance only.

The presence of asbestos may be noted during the site walkover survey, ~~investigations~~ and/or from the results of contamination ~~test~~ investigations. However, this report does not constitute an asbestos survey. On this basis, the presence of asbestos on site cannot be discounted and a full asbestos survey should be undertaken.

APPENDIX B – Figures and Drawings

Figure and Drawing



Basemap: © OpenStreetMap contributors

Client: Sigma Homes

Project: LP3210

Project ID: LP3210

Location: Land south of Hanlye Lane, Cuckfield

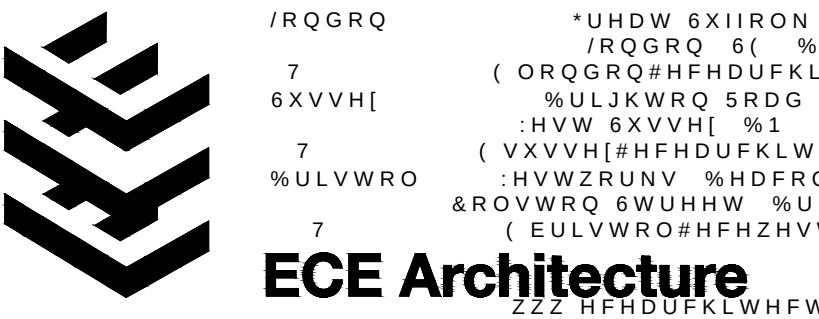
Date: March 2023

Figure No. 1

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      .VVXHG IRU DSSURYD      -5 1)
8SGDWHG ODIRXW DQG KRXLVLQJ PLJ
8SGDWHG KRXLVLQJ PLJ
8SGDWHG KRXLVLQJ PLJ      1) -5
      SHYLVHG SDUNLQJ DUUDQJHPHQW
      SHYLVHG VLWH ODIRXW FKQJHYW WLF SDU
      PHQGHG SDUNLQJ DUUDQJHPHQW
      SHYLVHG ODIRXW WR FOLHQW FPPHQW
      8SGDWHG ODIRXW WR PDWFK KRXLVLF WIS
      GUDLQJH LQIRUPDWLRQ
      SHYDWH      SHYLVLRQ 'HWDLQV      'U &K

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6LJPD +RPHV

RE 7LWOH
/DQG 6RXWK RI +DQO\H /D

UDZLQJ 7LWOH
3URSRVHG 6LWH /D\RXW

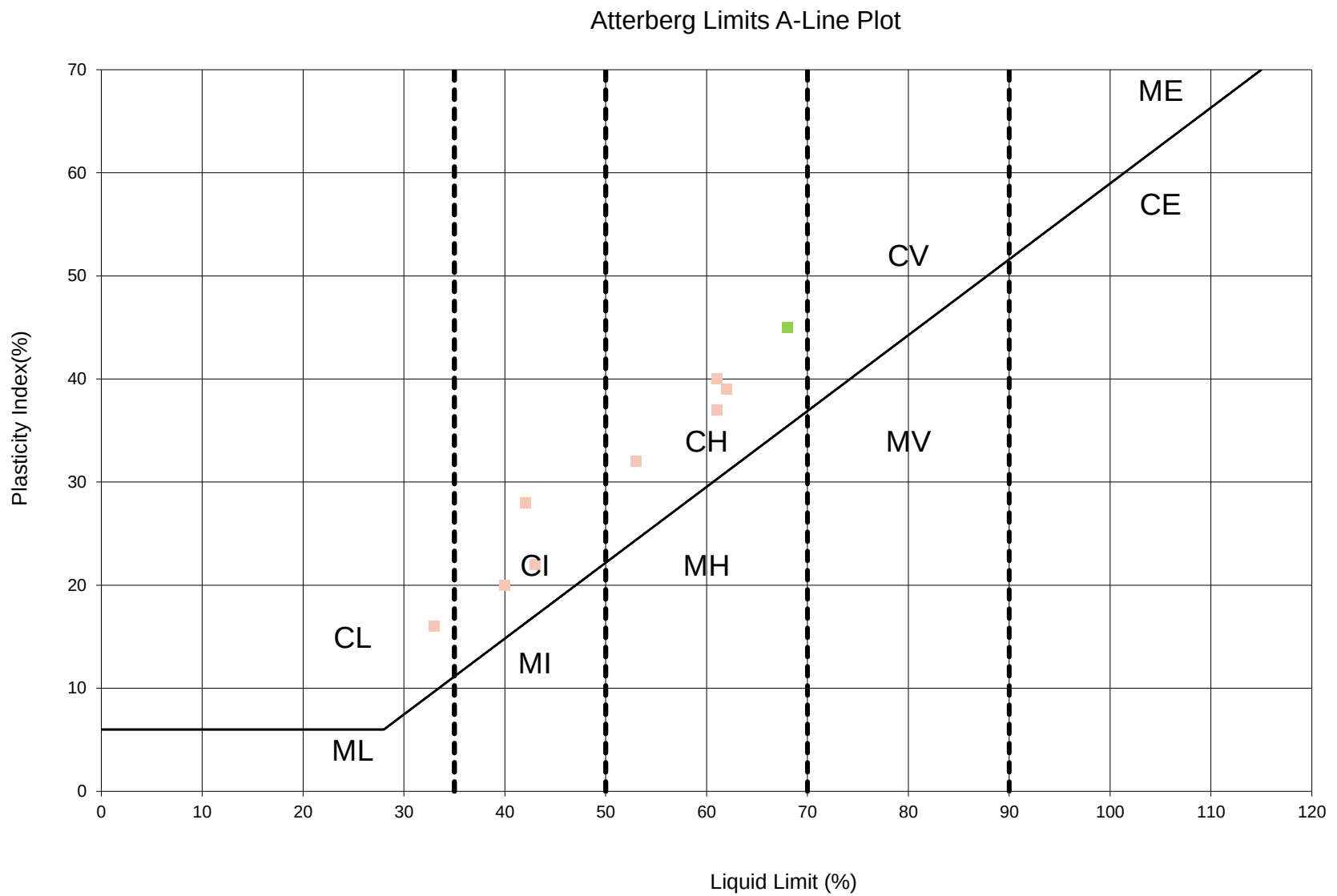


Basemap: ©
 Note 1: Exploratory holes have been positioned by handheld GPS survey / 3rd party surveyors and should therefore only be taken as approximate
 Note 2: Exploratory holes shown are not to scale
 Note 3: Elevations not shown

OpenStreet



	Client:	Sigma Homes	Title:	SI locations	Project ID:	LP3210
	Project:	Land south of Hanlye Lane, Cuckfield	Date:	10/03/2023	Figure No.	3



APPENDIX C – Photographic Record

Photographic Reco



Plate 1: Site facing north.



Plate 2: Site facing east.



Plate 3: Flytipping in the north of the site.



Plate 4: At the entrance of the site.



Plate 5: TP1 excavation.



Plate 6: TP3 excavation.



Plate 7: TP5 excavation.



Plate 8: TP5 arisings



Plate 9: TP6 excavation.



Plate 10: TP7 installation.



Plate 11: TP9 excavation.



Plate 12: TP9 arisings.

	
Plate 13: WS1 arisings (1-2m)	Plate 14: WS1 arisings

Plate 17: WS5 arisings.	Plate 18: WS6 arisings.

APPENDIX D – Groundsure Report

Groundsure Report

APPENDIX E – Preliminary Risk Assessment & Geotechnical Risk Register Tables

Preliminary Risk
Assessment &
Geotechnical Risk
Register Tables

Contaminant	Receptor	Pathway ¹	Likelihood of Exposure	Severity of Exposure	Risk Classification	Notes
All contaminants in soils (Herbicides/pesticides, PAHs, Heavy metals, Petroleum hydrocarbons)	Future Residents	Dermal contact, ingestion and inhalation of soil particles	Low likelihood	Medium	Moderate/low risk	Exposure to pesticides, herbicides, and heavy metals from fertilisers is considered possible as this is a diffuse source of contamination. Contaminants from made ground and fuel spills are expected to be localised.
		Consumption of contaminated home grown produce	Low likelihood	Medium	Moderate/low risk	
		Migration of ground gases through pore space / preferential pathways	Unlikely	Mild	Very low risk	No evidence of landfilling or deep made ground based on historical maps
	Construction workers	Dermal contact, ingestion and inhalation of soil particles	Unlikely	Mild	Very low risk	Construction workers are assumed to be provided with appropriate PPE. In addition, exposure to contaminants would be for a short time only.
	Secondary Aquifers and non aquifer on site	Vertical infiltration and leaching from impacted on-site soils	Unlikely	Mild	Very low risk	Most contamination is expected to be localised, or not at high enough concentrations to have a detrimental effect on the groundwater or surface water and most of the site is expected to be underlain by clay
	Surface water	Surface water run-off	Unlikely	Mild	Very low risk	Closest surface water features are up adjacent to the north west but topography flows down to the south.
Asbestos fibres in soils	Future Residents	Inhalation of asbestos fibres	Unlikely	Severe	Moderate/low risk	The northern part of the site has not been previously developed. Any asbestos present on site is expected to be very localised. However health effects are severe even with only minor exposure.
	Future commercial workers	Inhalation of asbestos fibres	Unlikely	Severe	Moderate/low risk	
	Construction workers	Inhalation of asbestos fibres	Unlikely	Severe	Moderate/low risk	

The classification is based upon the consideration of the magnitude of consequence and the likelihood of exposure as follows:

Likelihood		Consequence			
		Severe	Medium	Mild	Minor
	High likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very Low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Preliminary Geotechnical Risk Register

Geotechnical risk is the risk to building and construction work created by the site ground conditions. The Preliminary Geotechnical Risk Register has been developed to provide an assessment of the likely risks that may impact on the proposed development based on the results of the desk study, and should be used to specify the type and extent of the intrusive investigation and testing undertaken, and to identify potential mitigation measures to control the risk to an acceptable level.

The inclusion of a risk in the register does not indicate that the risk is present, rather the likelihood of mitigation measures being required due to that risk based on the available data. Equally, a risk classified as low indicates that mitigation measures are unlikely to be required for the hazard identified based on the available data.

The risk register should be developed and refined throughout the design process such that it will enable the management of geotechnical risk.

The Geotechnical Risk Register has been developed in accordance with the guidance presented in ICE/DETR Document "Managing Geotechnical Risk" (2002). The degree of risk (R) is determined by assessing the likelihood of a hazard (L) occurring and the effect of the hazard on the project (R=LxE). The effect may be measured in one or more aspects e.g. increased cost, delays in the programme and safety etc. The scale of the likelihood, effect and risk are determined as follows:-

Likelihood of Occurrence		
Scale	Likelihood	Chance
4	Probable	>1 in 2
3	Likely	1 in 10 to 1 in 2
2	Unlikely	1 in 100 to 1 in 10
1	Negligible	<1 in 100

X

Effect of Hazard		
Scale	Effect	Increase in cost or time
4	Very High	>10%
3	High	4-10%
2	Low	1-4%
1	Very Low	<1%

=

Degree of Risk		
Degree of Risk	Risk Level	Action required
1-4	Low	None
5-8	Significant	Consider cost effective solutions or improvements at no extra cost
9-12	Substantial	Work must not start until risk has been reduced. Additional resource required
13-16	Intolerable	Work must not start until risk has been reduced. If risk can not be reduced, project should not proceed.

Hazard	Effect	Likelihood of Occurrence	Effect of Hazard	Risk Classification	Notes
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Preliminary Geotechnical Risk Register

Geotechnical risk is the risk to building and construction work created by the site ground conditions. The Preliminary Geotechnical Risk Register has been compiled to provide an assessment of the likely risks that may impact on the proposed development based on the results of desk study, and should be used to specify the type and extent of the intrusive investigation and testing undertaken, and to identify potential mitigation measures to control the risk to an acceptable level.

The inclusion of a risk in the register does not indicate that the risk is present, rather the likelihood of it occurring and the measures being required due to that risk, based on the available data. Equally, a risk classified as low indicates that no measures are unlikely to be required for the hazard identified based on the available data.

The risk register should be developed and refined throughout the design process such that it will enable the management of geotechnical risk.

The Geotechnical Risk Register has been developed in accordance with the guidance presented in ICE/DETR Document "Managing Geotechnical Risk" (2002). The degree of risk (R) is determined by assessing the likelihood of a hazard (L) occurring and the effect of the hazard (E) on the project ($R=L \times E$). The effect may be measured in one or more aspects e.g. increased cost, delays in the program, health and safety etc. The scale of the likelihood and risk are determined as follows:-

Likelihood of Occurrence		
Scale	Likelihood	Chance
4	Probable	>1 in 2
3	Likely	1 in 10 to 1 in 2
2	Unlikely	1 in 100 to 1 in 10
1	Negligible	<1 in 100

X

Effect of Hazard		
Scale	Effect	Increase in cost or time
4	Very High	>10%
3	High	4-10%
2	Low	1-4%
1	Very Low	<1%

=

Degree of Risk		
Degree of Risk	Risk Level	Action required
1-4	Low	None
5-8	Significant	Consider cost effective solutions or improvements at no extra cost
9-12	Substantial	Work must not start until risk has been reduced. Additional resource required
13-16	Intolerable	Work must not start until risk has been reduced. If risk can not be reduced, project should not proceed.

Geotechnical Risk Register

Hazard	Effect	Likelihood of Occurrence	Effect of Hazard	Risk Classification	Notes
Made Ground	Deepened foundations	Unlikely	Low	Trivial	Site has not undergone extensive development, so any made ground present on site is expected to be localised around the small structure.
	Unstable excavations	Unlikely	Low	Trivial	
Compressible Ground	Bearing capacity failure	Unlikely	Low	Trivial	Solution features are not considered likely to be present.
	Excessive settlement	Unlikely	Low	Trivial	
High Groundwater Table	Unstable excavations/ running sands	Unlikely	Low	Trivial	Groundwater may be present within granular soils where present on site
	Dewatering	Likely	Low	Significant	
	Contamination	Likely	Low	Significant	
Deep Excavations	Deepened foundations	Negligible	High	Trivial	Absence of deep excavations on-site
Working in highway	Traffic Management	Negligible	Very low	Trivial	N/A
Shrinkable soils	Deepened foundations	Likely	Low	Significant	The Grinstead Clays may be susceptible to swelling and shrinkage. Large trees are located across and along the perimeter of the site and within site boundaries. Foundations may require deepening where clay soils are encountered near trees.
	Heave	Likely	Low	Significant	
Frost Susceptible soils	Road Design	Likely	Low	Significant	Clay deposits may be susceptible depending on silt content and high plasticity.
Aggressive ground conditions for Concrete	Concrete design	Likely	Low	Significant	Underlying geology may contain high concentrations of sulphates
Slope Stability/Retaining Structure	Local stability	Probable	Low	Significant	Site slopes down towards the south at approximately 3 degrees and 6 degree sand slope stability issues should not be discounted.
	Global stability	Unlikely	High	Significant	
Mining	Suitability for development	Likely	Low	Significant	Historical clay and sand pits are located around the site and an on site historical pit is noted
Ground dissolution/ Natural cavities	Remedial measures	Unlikely	Low	Trivial	Solution features are not expected.
Landfill	Land gas	Unlikely	Low	Trivial	
Contaminated land	Remedial measures	Likely	Low	Significant	Significant contamination is not expected across the site.
Archaeological remains	Remedial measures	Negligible	High	Trivial	N/A
UXO	UXO supervision	Unlikely	Low	Trivial	

APPENDIX F – Exploratory Logs

Exploratory Log:

	/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWLV 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLRQP HQWDO FRP	7ULDOSLW 1	
3URMHFW 1DPH	/DQG 6RXWK RI +DQOI\H /DQH &XFNLHOG /RFDWLRLQ	3URMHFW 1R /DQH &XFNLHOG /HYHO	6KHHW RI
		&R RUGV LOGHQLRQGV +HDWK 5+	'DWH
/DQG VRXWK RI +DQOI\H /DQH &XFNLHOGHQLRQGV +HDWK 5+		P	6FDOH
&OLHQW LJPD +RPHV		'HSWK	/RJHG 66&
DWHL 6WUL	6DPSOHV DQG ,Q 6LWX 'HSWK 7\SH 5HVXOWV P P	HJHQG	6WUDWXP 'HVFULSWLRQ
	(6 (6 , % % %		%URZQ VDQG\ 72362,/ ZLWK URRWOHWV 6WLII RUDQJH EURZQ DQG JUH\ PRWWOHHG V +DQG 3HQ 8&6 DW P N3D :LWK PXFK LURQVWRQH EHORZ P 0HGLXP GHQVH SDOH JUH\ DQG RUDQJH ILQ RFFDVLRQDO ILQH WR FRDUVH JUDYHO RI H VLOWVWRQH (QG RI SLW DW P
5HPDUNV7ULDO SLW UHPDLQH GUV DQG VWDEOH %DFNLOOHG ZLWK DUL			
6WDELORLW DEOH			

		/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWLV 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				7ULDO SLW 1 6KHHW RI		
3URMHEW 1DPH /DQG 6RXWK RI +DQO\H		3URMHEW 1R /DQH &XFNL /3		&R RUGV HOG /HYHO		'DWH		
/RFDWL +I		/DQG VRXWK RI +DQO\H /DQH &XFNL		HOG VDPGV +HDWK 5+ P		6FDOH		
&H LHQWLJPD +RPHV				'HSWK		/RJJHG 66&		
:DWH 6WUL	6DPSOHV DQG ,Q 6LWX		7HVWLQJ P P		HJHQQ		6WUDWXP 'HVFULSWLRQ	
	'HSWK 7\SH		5HVXOWV					
						%URZQ VDQG\ 72362,/ ZLWK PDQ\ URRW		
						6WLII RUDQJH EURZQ VLOW\ &/\$<		
						+DQG 3HQ 8&6 DW P N3D		
						(QG RI SLW DW P		
5HPDUNV7ULDO SLW UHPDLQHGU\ DQG VWDEOH %DFNLOOHG ZLWK JUD ,QVWDOOHG P RI VORWWHG SLSH ZLWK P DERYH JURXQG OHYH								
6WDELOLWVWDEOH								

				/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWLW 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				7ULDOSLW 1			
3URMHFW 1DPH /DQG 6RXWK RI +DQOI\H				3URMHFW 1R /DQH &XFNLHOG /3 /HYHO				6KHHW RI			
/RFDWLRO +1				/DQG VRXWK RI +DQOI\H /DQH &XFNLHOG +1				6FDOH			
H &QLHQW LJPD +RPHV				P 'HSWK				/RJJHG 66&			
6DP SOHV DQG ,Q 6LWX 'HSWK 7\SH 5HVXOWV				H P P /HJHQG				6WUDWXP 'HVFULSWLRQ			
(6				%URZQ VDQG\ 72362,/ ZLWK PDQ\ URRW				OHW			
%				6WLII RUDQJH EURZQ PRWWOHG VDQG\ VLOW JUDYHO RI LURQVWRQH				VLOW			
+93				+DQG 3HQ 8&6 DW P N3D							
%				%HFRPLQJ VLOW\ EHORZ P							
+93				*UH\ PRWWOHG RUDQJH YHU\ VDQG\ 6,7 ZLV JUDYHO RI H[WUHPHO\ ZHDN WKLQO\ ODPLQ							
%				(QG RI SLW DW P							
5HPDUNV7ULDO SLW UHPDLQH GUV DQG VWDEOH %DFNLOOHG ZLWK JUD ,QVWDOOHG P RI VORWWHG SLSH ZLWK P DERYH JURXQG OHYH								R P			
6WDELOLWV VWDEOH											

				/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWLV 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				7ULDO 3LW 73/RJ				7ULDOSLW 1			
3URMHFW 1DPH /DQG 6RXWK RI +DQO\H				3URMHFW 1R /DQH &XFNLH /3				&R RUGV HOG /HYHO				6KHHW RI 'DWH			
/RFDWLRLQ +1				/DQG VRXWK RI +DQO\H /DQH &XFNLH				HOGVLRQV P				6FDOH 'HSWK			
H &QLHQW LJPD +RPHV												/RJJHG 66&			
6DPSOHV DQG ,Q 6LWX 'HSWK 7\SH 5HVXOWV				H P P /HJHQG				6WUDWXP 'HVFULSWLRQ							
(6								%URZQ VDQG\ VLOW\ 72362,/ ZLWK URRWOHV							
%				+93				)LUP WR VWLII RUDQJH EURZQ JUH\ PRYWOH JUDYHO RI LURQVWRQH *UDYHO LV ILQH							
								)LUP EOXH JUH\ VLOW\ &/\$< ZLWK PXFK ILQH RI LURQVWRQH DQG RFFDVLRQDO VKHDU ID							
								([WUHPHO\ ZHDN SDOH \HOORZ JUH\ 6,7672 DV SDOH JUH\ ILQH WR FRDUVH JUDYHO							
								(QG RI SLW DW P							
5HPDUNV7ULDO SLW UHPDLQH GUV DQG VWDEOH %DFNLOOHG ZLWK DUL												1R I			
6WDELOLWV VWDEOH															

				/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWLW 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLRQP HQWDO FRP				7ULDOSL W 1											
3URMHFW 1DPH				/DQG 6RXWK RI +DQOIH				3URMHFW 1R /DQH &XFNLH /3				&R RUGV HOG /HYHO				6KHHW RI			
/RFDWLRI				/DQG VRXWK RI +DQOIH				/DQH &XFNLH				HOGV +HDWK 5+				6FDOH			
OLHQLJPD +RPHV												P				/RJHG 66&			
6DPSOHV DQG , Q 6LWX				7HVWLQJ HO				6WUDWXP 'HVFULSWLRQ											
'HSWK 7ISH 5HVXOWV				P P				/HJHQG											
												%URZQ VDQG\ VLOW\ 72362,/							
												6WLII RUDQJH EURZQ VLOW\ &/ \$< ZLWK RFFD							
				+93															
				+93								+DQG 3HQ 8&6 DW P N3D							
												6WLII JUHHQLVK JUH\ SXUSOH JUH\ PRWWC VLOW\ &/ \$< ZLWK VHYHUDO VKHDU IDFHV							
												:LWK PXFK ILQH WR FRDUVH JUDYHO RI VL							
				(6								3DOH JUH\ H[WUHPHO\ ZHDN WR ZHDN WKLO 6,/76721(ZLWK EDQGV RI LURQVRQH UHFR FRDUVH JUDYHO RI VLOWVWRQH DQG LURQV							
												:LWK LURQ VWRQH EDQGV EHORZ P							
												(QG RI SLW DW P							
5HPDUNV7ULDO SLW UHPDLQH GUA DQG VWDEOH %DFNILOOHG ZLWK DUL																1R I			
6WDELOLWV DEOH																			

		/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWLV 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				7ULDO SLW 1 7ULDO 3LW 73/RJ 6KHHW RI			
3URMHEW 1DPH		/DQG 6RXWK RI +DQO\H		3URMHEW 1R /DQH &XFNL /3		&R RUGV HOG /HYHO		'DWH	
/RFDWL		/DQG VRXWK RI +DQO\H		/DQH &XFNL		HOGV +DQGV +HDWK 5+		6FDOH	
+I						P		'HSWK	
H		LHQWLJPD +RPHV						/RJJHG 66&	
:DWH 6WUL		6DPSOHV DQG ,Q 6LWX		7HVWLQJ 'HSWKHJHO		HJHQG		6WUDWXP 'HVFULSWLRQ	
		'HSWK 7ISH 5HVXOWV		P P					
		(6						%URZQ VDQG\ 72362,/ ZLWK PDQ\ URRW	
								6WLII WR YHU\ VWLII OLJKW EURZQ RUDQJH &/ \$< ZLWK RFFDVLQRQDO JUDYHO RI ILQH LUR	
								+DQG 3HQ 8&6 DW P N3D	
								+DQG 3HQ 8&6 DW P N3D	
								/LJKW JUH\ PRWWOHG RUDQJH EURZQ YHU\ V ZLWK VRPH FRDUVH JUDYHO RI LURQVWRQH JUDYHO RI H[WUHPHO\ ZHDN WKLQO\ ODPLQ	
								%HFRPLQJ PRUH JUDYHOO\ DW P *UDYHO	
								/LJKW JUH\ ZLWK VRPH EURZQ PRWWOLQJ YH *5\$9(/ RI VLOW ZLWK RFFDVLQRQDO JUDYHO R LURQVWRQH	
								%DQGV RI LURQVWRQH DW P (QG RI SLW DW P	
5HPDUNV7ULDO SLW UHPDLQHG VWDEOH *URXQGZDWHU VHSDJH DW P 1R IX		JUDYHO WR P DQG WRSSHG ZLWK DULVLQJV WR JURXQG OHYHO ,QV						SURJU P R	
6WDELOLWVWDEOH									

		/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWLV 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				7ULDO 3LW 73/RJ		7ULDOSLW 1	
3URMHEW 1DPH		/DQG 6RXWK RI +DQOI\H		3URMHEW 1R /DQH &XFNIL /3		&R RUGV HOG /HYHO		6KHHW RI	
/RFDWLRI		/DQG VRXWK RI +DQOI\H		/DQH &XFNIL		HOGVVRGV +HDWK 5+ P		6FDOH	
/HQLHQWLJPD +RPHV						'HSWK		/RJJHG 66&	
6DPSOHV DQG ,Q 6LWX		'HSWK		/HJHQG		6WUDWXP 'HVFULSWLRQ			
'HSWK		7ISH		5HVXOWV					
		(6 (6 ,				%URZQ V DQG\ 72362,/)LUP SDOH EURZQ DQG RUDQJH PRWWOHG V ZLWK UDUH ILQH JUDYHO RI LURQVWRQH DQ WR FRDUVH ZHDN WKLQOI ODPLQDWHG FDOF VDQGVWRQH +DQG 3HQ 8&6 DW P N3D %DQGV RI LURQVWRQH EHZRZ P +DQG 3HQ 8&6 DW P N3D :HDN WR PHGLXP VWURQJ SDOH JUH\ DQG R 6,/76721(DQG 6\$1'6721(----- (QG RI SLW DW P			
5HPDUNV7ULDO SLW UHPDLQHGVWDEOH *URXQGZDWHU VHHSDJH DW P		DULVLQJV WR JURXQG OHYHO ,QVWDOOHG P RI VORWWHG SLSH						OOH P D	
6WDELOLWVWDEOH									

		/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWLV 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				7ULDO SLW 1 73/RJ 6KHHW RI	
3URMHEW 1DPH /DQG 6RXWK RI +DQO\H		3URMHEW 1R /DQH &XFNL /3		&R RUGV HOG /HYHO		'DWH	
/RFDWLRI		/DQG VRXWK RI +DQO\H /DQH &XFNL		HOGV +HDWK 5+		6FDOH	
/HJH		/HJH		P		'HSWK	
:DWH		6DPSOHV DQG ,Q 6LWX		7HVLQJH		6WUDWXP 'HVFULSWLRQ	
6WUL		'HSWK 7\SH 5HVXOWV		P P /HJH		6WUDWXP 'HVFULSWLRQ	
		(6				%URZQ VDDG\ 72362,/ ZLWK PDQ\ URRW	
		+93				9HU\ VWLII RUDQJH EURZQ VLOW\ &/\$< ZLWK RI LURQVWRQH	
						6WLII OLJKW JUH\ ZLWK VRPH OLJKW EURZQ &/\$< ZLWK RFFDVLRQDO EDQGV RI LURQVWR LURQVWRQH JUDYHO	
						+DQG 3HQ 8&6 DW P N3D	
						%HFRPLQJ GDUNHU LQ FRORXU IURP P	
						(QG RI SLW DW P	
5HPDUNV7ULDO SLW UHPDLQHGU\ DQG VWDEOH %DFNLOOHG ZLWK JUD		,QVWDOOHG P RI VORWWHG SLSH					
6WDELOLWVWDEOH							

				/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWL 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				%RUHKROH /RJ 6KHHW RI															
3URMHFW /DQG 6RXWK RI +DQO\H /DQH &XFNILHOG				3URMHFW 1R /3				&R RUGV				+ROH 7\SH :6											
/RFDWLRO /DQG VRXWK RI +DQO\H /DQH &XFNILHOG +D\ZDUGV +HDWK				5+ +1				6FDOH															
&OLHQW 6LJPD +RPHV								'DWHV								/RJJHG %\ .0							
:HO		:DW		HU 6DP		SOHV		DQG ,Q		6LWX		7HW		WLO		JHO		HJHQG		6WUDWXP		'HVFULSWLRO	
6WULN		HNV		HSWK		P\SH		5HVXOW		V		P		P									
						(6																	
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				/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWL V 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				%RUHKROH /RJ 6KHHW RI +ROH 7\SH :6 6FDOH /RJJHG %\							
3URMHFW 1DPR &XFNILHOG				3URMHFW 1R /3				&R RUGV							
/RFDWLRO 5+ +1				/DQG VRXWK RI +DQO\H /DQH &XFNILHOG +D\ZDUGV +HDWK /HYHO											
&OLHQW 6LJPD +RPHV				'DWHV				/RJJHG %\							
:HO				DW 6WUL				HU 6DPSOHV DQG ,Q 6LWX LHVW P				HJHQQG 6WUDWXP 'HVFULSWLRQ			
												*UDVV RYHU EURZQ VOLJKWO\ VDOG\ 72 URRWV			
												%URZQ JUDYHOO\ VOLJKWO\ VDOG\ 5(:2 &/\$< ZLWK ILQH EULFN IUDJPHQWV *UD PHGLXP VXEDQJXODU IOLQW			
												6WLII RUDQJH PRWWOHG JUH\ JUDYHOO			
												+DQG 3HQ 8&6 DW P N3D			
												/DPLQDWHG GDUN JUH\ 08'6721(UHFRY VLOW\ JUDYHO *UDYHO LV H[WUHPHO\			
												6WLII WR KDUG JUH\ DQG RUDQJH PRW VDQG\ &/\$< 6DQG LV ILQH *UDYHO LV ZHNN VDQGVWRQH			
												(QG RI ERUHKROH DW P			

		/HDS (QYLURQPHQW DO /WG 7KH \$WULXP &XUWL V 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQP HQWDO FRP		%RUHKROH /RJ		6KHHW RI	
3URMHFW 1DPPH &XFNILHOG		/DQG 6RXWK RI +DQO\H /DQH &XFNILHOG +D\ZDUGV +HDWK		3URMHFW 1R /3		&R RUGV	
/RFDWLRQ 5+ +1						6FDOH	
&OLHQW 6LJPD +RPHV				'DWHV		/RJJHG %\ .0	
:HO	DW	HU 6DP	SOHV	DQG ,Q 6LWX	7HWLQ	HO	HJHQG 6WUDWXP 'HVFULSWLRQ
6WULNLHV	HSWK	PSH	5HVXOWV	P	P		
			(6				*UDVV RYHU EURZQ VOLJKWO\ VDOG\ F
							72362,/ ZLWK URRWV
							%URZQ VOLJKWO\ VDOG\ JUDYHOQ 5(:2
							&/\$< ZLWK ILQH EULFN IUDJPHQWV DQG
							LV ILQH VDQGVWRQH
			1				6WLII RUDQJH PRWWOHG JUH\ JUDYHOQ
							ZLWK URRWV 6DQG LV ILQH *UDYHO L
							+DQG 3HQ 8&6 DW P N3D
							9HU\ VWLII WR KDUG JUH\ PRWWOHG UH
							VDQG\ VLOW\ &/\$< 6DQG LV ILQH
							+DQG 3HQ 8&6 DW P N3D
			1				+DQG 3HQ 8&6 PHDVXUHPHQW H[FHHG
							(QG RI ERUHKROH DW P
5HPDUNV							
%RUHKROH UHFDLQHG GUI\ DQG VWDEOH %RUHKROH UHIXVHG DW P EJ							
SODLQ SLSH ZLWK EHQRQLWH VXUURXQG RYHU P VORWWHG SLSH ZLWK HO VX							

				/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWL V 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				%RUHKROH 1R							
3URMHFW 1R &XFNILHOG				3URMHFW 1R /3				&R RUGV				6KHHW RI +ROH 7\SH :6			
/RFDWLRQ 5+ +1				/DQG VRXWK RI +DQO\H /DQH &XF 5+ +1				NILHOG +D\ZDUGV +HDWK /HYHO				6FDOH			
&OLHQW 6LJPD +RPHV								'DWHV				/RJJHG %\ .0			
:HO		DW 6WUL		HU 6DPSOHV DQG ,Q 6LWX NHW		PSH 5HVXOWV P		XZHW P		7HVW P		HJHQG		6WUDWXP 'HVFULSWLRQ	
W				(6		1								*UDVV RYHU EURZQ VOLJKWO\ VDQG\ F 5(:25.(' 72362,/ ZLWK URRWV DQG JDUH IUDJPHQWV	
														+DUG RUDQJH PRWVOHG JUH\ JUDYHOC ZLWK YHU\ VDQG\ SRFNHWV DQG ZLWK ILQH *UDYHO LV ILQH WR FRDUVH VDQ	
														+DQG 3HQ 8&6 DW P N3D	
														1R URRWV QRWHG EHORZ P EJO	
														'HQVH JUH\ PRWVOHG RUDQJH JUDYHO 6\$1'6721(6DQG LV ILQH WR PHGLXP * ILQH WR FRDUVH YHU\ ZHDN VDQGVWRQ	
				1										%HFRPHV YHU\ VLOW\ EHORZ P EJO	
														:HDN WR PRGHUDWHO\ ZHDN JUH\LVK \H RUDQJH VOLJKWO\ JUDYHOO\ ILQH 6\$1' ILQH VDQGVWRQH	
														(QG RI ERUHKROH DW P	
5HPDUNV %RUHKROH UHPDLQH G U\ DQG VWDEOH %RUHKROH UHIXVHG DW P EJO LWRUI SODLQ SLSH ZLWK EHQRQLWH VXUURXQG RYHU P VORWWHG SLSH ZLWK HO VX															

				/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWL V 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				%RUHKROH /RJ 6KHHW RI +ROH 7\SH :6 6FDOH /RJJHG %\ .0			
3URMHFW &XFNILHOG				/DQG 6RXWK RI +DQ /3				&R RUGV			
/RFDWLRF				/DQG VRXWK RI +DQO\H /DQH &XF 5+ +1				N\HOG +D\ZDUGV +HDWK /HYHO			
&OLHQW 6LJPD +RPHV				'DWHV							
:HOG				HU 6DP SOHV DQG ,Q 6LW 6WULNHY				HJHQQ 6WUDWXP 'HVFULSWLRF			
				(6							
				(6							
				1							

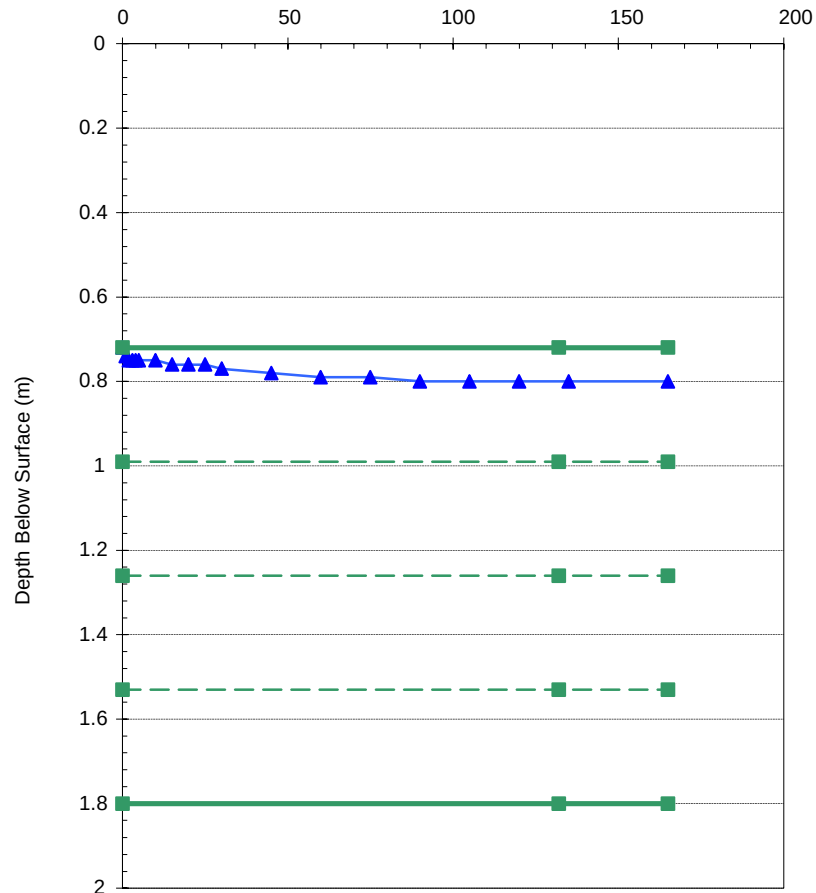
				/HDS (QYLURQPHQWDO /WG 7KH \$WULXP &XUWL V 5RDG 'RUNLQJ 6XUUH\ 5+ ;\$ 7HO ZZZ OHDSHQYLURQPHQWDO FRP				%RUHKROH /R J 6KHHW RI +ROH 7\SH :6 6FDOH /RJJHG %\ .0						
3URMHFW 1DQ &XFNILHOG				3URMHFW 1R /3				&R RUGV						
/RFDWLRQ 5+ +1				/DQG VRXWK RI +DQO\H /DQH &XF NILHOG +D\ZDUGV +HDWK /HYHO										
&OLHQW 6LJPD +RPHV				'DWHV										
:HO	DW 6WUL	HU 6DPSOHV DQG ,Q 6LW X\H SWK /HYH	ASH 5HVXOWV P	P	HJHQG	6WUDWXP 'HVFULSWLRQ								
W	▼		(6	1		*UDVV RYHU EURZQ VDQG\ FOD\H\ 7236 URRWV								
						%URZQ PRWWOHG JUH\ VOLJKWO\ JUDY VDQG\ 5(:25.(' &/\$< ZLWK URRWV DQG Z ILQH EULFN IUDJPHQWV DQG JODV IUD LV ILQH VDQGVWRQH								
						%URZQ PRWWOHG JUH\ JUDYHOO\ VOLJ 6\$1' ZLWK URRWV *UDYHO LV FRDUVH VDQGVWRQH								
						+DQG 3HQ 8&6 DW P N3D								
						9HU\ VRIW WR VRIW EHRPLQJ YHU\ VW VOLJKWO\ VDQG\ JUDYHOO\ VLOW\ &/\$< RGRXU								
			1			1R URRWV QRWHG EHORZ P EJO								
						+DQG 3HQ 8&6 DW P N3D								
			1			9HU\ VWLII JUH\LVK EOXH VDQG\ VLOWV +DQG 3HQ 8&6 DW P N3D								
						(QG RI ERUHKROH DW P								
5HPDUNV %RUHKROH UHPDLQH G\ DQG VWDEOH *URXQGZDWHU HQFRXQWHUH G LQVWDOOHG WR P EJO FRPSULVLQJ P SODLQ SLSH ZLWK EHQRQLWH								EJO XQG R						

APPENDIX G – Geotechnical Field Test Results

Geotechnical Field Test Results

BRE Digest 365 - Soakage Test

Filling to Max Water Depth (min)



initial)

Test Hole No: TP9
Test No: Test No 1

Pit Length (m)	1.8
Pit Width (m)	0.5
Depth to Pit Base (m)	1.8
Depth to Top of Permeable Soils (m)	
Depth to Groundwater Surface (m)	3
Depth to Top of Granular Fill (m)	0.3
Voids Assumed for Granular Fill (%)	35%

Depth of Water at Start of Test (m)	0.72
Max Water Dropdown during Test (m)	0.08
Total Soakage Test Time (min)	165
Mean Internal Discharge Area (m ²)	5.546
Discharge Rate (litre/min)	0.0525
Soakage Rate (litre/m ² /min)	0.009466282

BRE Soil Infiltration Rate (m/sec)	1.57771E-07
------------------------------------	-------------

Comments:

Water level did not fall to 75% max water depth, calculations were based on Result not compliant with BRE365 requirement since water did not fall to 25%

Client:

Site: Land to the south of Hanlye Land Cuckfield

Tested By:

Test Date:

APPENDIX H – Groundwater Monitoring Records

GroundwaterMonitoring Records

LP3210 Land South of Hanley Lane Cuckfield

Borehole Location	Date							
	25/01/2023		27/01/2023		20/01/2023		10/03/2023	
	BH	WL	BH	WL	BH	WL	BH	WL
TP3	0.68	0.67 (DRY)	0.68	0.68 (DRY)	0.68	DRY		
TP4	2.2	1.97	2.2	1.81	2.2	1.16		
TP7	2.05	1.37	2.05	0.97	2.05	1.04		
TP9	1.8		1.8	0.5	1.8	0.91		
TP10	1.85	1.85 (DRY)	1.85	1.85 (DRY)	1.85	DRY		
WS1	2.15	0.67	2.15	0.63	2.15	1.09	2.13	0
WS2	2.7	2.7 (DRY)	2.7	2.7 (DRY)	2.7	DRY	2.7	
WS3	2.6		2.6	2.6 (DRY)	2.6	DRY	2.6	
WS4	2.45	1	2.45	0.99	2.45	1.26	2.45	0
WS5	1.8	1.8 (Dry)	1.8	1.8 (DRY)	1.8	DRY	1.8	DRY
WS6	3.45		3.45	0.44	3.45	0.89	3.45	-0

APPENDIX I – Geotechnical Laboratory Test Results

Geotechnical Laborator Test Results
--

Leap Environmental Limited
Southern Coast Regional Office
Victoria Road
Burgess Hill
West Sussex
RH15 9LR

GEOLABS Limited
Bucknalls Lane
Garston
Watford
Hertfordshire
WD25 9XX
Tel: +44(0) 1923 892 190
Fax: +44(0) 1923 892 191
email: admin@geolabs.co.uk
web: www.geolabs.co.uk

06 March 2023

Report No : GEO/37433/01

Page 1 of 1

For the attention of Ms S Shafi-Cooke

		Date samples received	01/02/2023
		Date written instructions received	15/02/2023
Our ref	GEO / 37433	Date testing commenced	16/02/2023
Your Ref	LP3210	Date of sample disposal	03/04/2023

Project LAND OFF HANLYE LANE, CUCKFIELD

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	~	Geotechnical Test Summary
~	9	Water Content
~	9	Liquid & Plastic Limits
2	~	Geochemical Test Summary
~	5	BRE SD1 Suite B - Natural ground + pyrite
3	3	Particle Size Distribution
4	3	California Bearing Ratio

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of GEOLABS Limited

S Burke
Senior Technician

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC	LL	PL	PI	<425 µm	Bulk	Dry	Condition	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					%	%	%	%	%	Mg/m³	Mg/m³		kPa	kPa	kPa		g/L	mg/L	
TP1	1.00		B	Multicolour slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is fine to medium.	17.2	42	14	28	98										Chemical
TP1	1.50		B	Light brown clayey silty fine SAND.															Particle Size Distribution
TP3	0.50		D	Greyish brown and brownish grey mottled CLAY with rare fine gravel and rootlets.	24.4	62	23	39	99										Chemical
TP4	0.50		B	Brown mottled orangish brown silty CLAY with roots.															California Bearing Ratio
TP4	1.00		D	Orangish brown and brownish grey mottled CLAY with rare fine gravel and rootlets.	31.9	61	24	37	99										
TP5	0.40		B	Brown light brown and yellowish brown mottled silty CLAY with rare roots.															California Bearing Ratio
TP5	1.30		D	Grey and yellowish brown mottled CLAY with rare fine gravel.	26.7	61	21	40	99										
TP6	0.50		D	Grey and yellowish brown mottled CLAY with rare fine gravel and rootlets.	23.5	43	21	22	99										
TP6	0.60		B	Orangish brown mottled brown very slightly gravelly silty CLAY with rare roots.															California Bearing Ratio
TP6	1.40		D	Greyish brown, dark brown and yellowish brown mottled silty CLAY.	26.6	53	21	32	100										Chemical

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by	Project Number: GEO / 37433 Project Name: LAND OFF HANLYE LANE, CUCKFIELD LP3210	
S Burke - Senior Technician 06/03/2023		

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC	LL	PL	PI	<425 µm	Bulk	Dry	Condition	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					%	%	%	%	%	Mg/m³	Mg/m³		kPa	kPa	kPa		g/L	mg/L	
TP7	0.50		D	Yellowish brown, brown and light grey mottled slightly sandy silty CLAY with rare fine to medium gravel.	18.0	33	17	16	99										
TP7	1.90		D	Yellowish brown clayey silty SAND and GRAVEL.															Particle Size Distribution
TP9	0.50		D	Yellowish brown, brown and brownish grey mottled CLAY with rare fine gravel.	25.0	40	20	20	99										
TP10	1.00		D	Brown mottled grey CLAY.	31.6	68	23	45	100										
TP10	1.20		D	Brownish grey slightly sandy silty CLAY with rare fine to medium gravel.															Particle Size Distribution
WS4	0.70		D																Chemical
WS6	1.10		D																Chemical

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by	Project Number:	GEO / 37433	
	Project Name:		
S Burke - Senior Technician 06/03/2023	LAND OFF HANLYE LANE, CUCKFIELD LP3210		

SUMMARY OF CHEMICAL TESTS ON SOIL

Location	Depth m	Sample Ref	Sample Type	pH Value	Total Acid Soluble Sulphate as SO ₄ %	Water Soluble Sulphate as SO ₄ 2:1 Water:Soil Extract g/l	Total Sulphur %	Water Soluble Chloride g/l	Water Soluble Nitrate g/l	Magnesium g/l	Organic Content %	Mass Loss on Ignition %	Carbonate Content %
TP1	1.00		B	7.3	0.015	< 0.010	< 0.010	-	-	-	-	-	-
TP3	0.50		D	7.7	< 0.010	< 0.010	< 0.010	-	-	-	-	-	-
TP6	1.40		D	8.4	0.025	< 0.010	< 0.010	-	-	-	-	-	-
WS4	0.70		D	8.0	0.010	< 0.010	< 0.010	-	-	-	-	-	-
WS6	1.10		D	8.4	< 0.010	< 0.010	< 0.010	-	-	-	-	-	-

Tested by Chemtest Ltd : MCERTS / UKAS No 2183

Checked and Approved by:

S Burke - Senior Technician
08/03/2023

Project Number:

GEO / 37433

Project Name:

LAND OFF HANLYE LANE, CUCKFIELD
LP3210

PARTICLE SIZE DISTRIBUTION

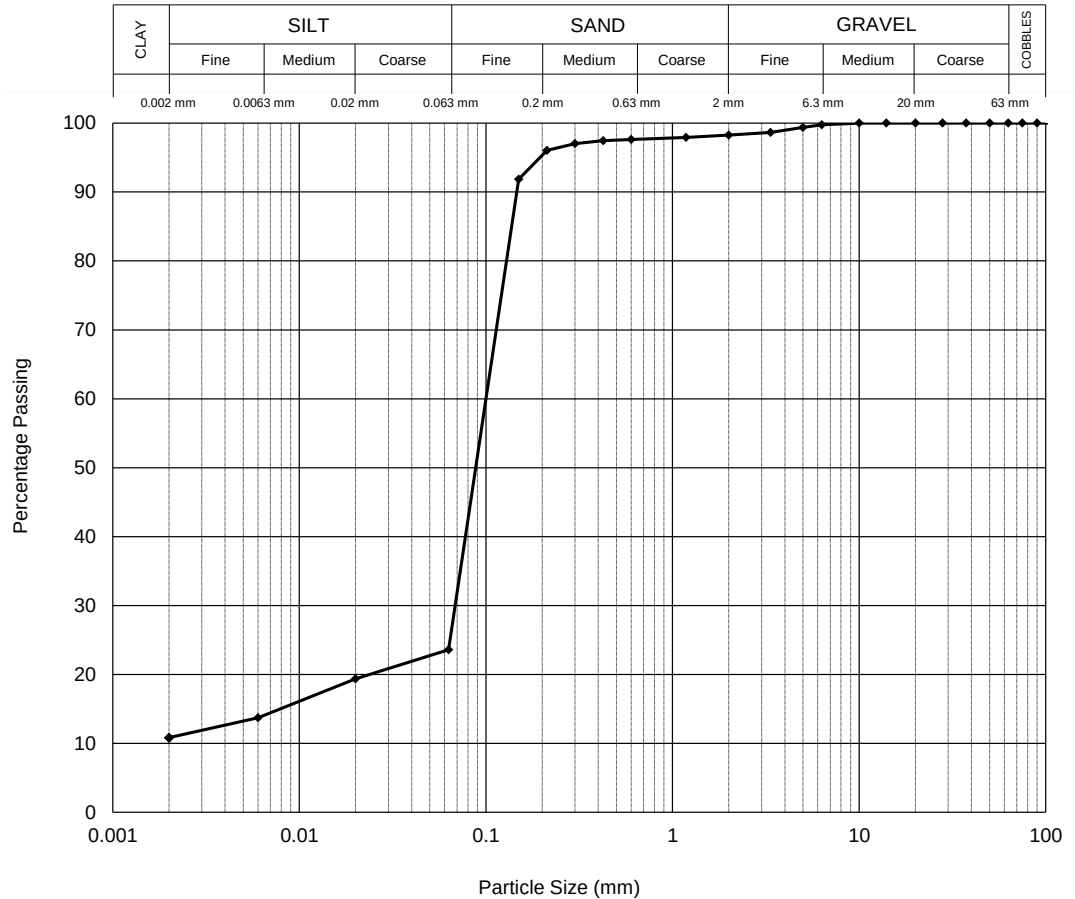
Location TP1
Depth (m) 1.50
Sample Type B

Description

Light brown clayey silty fine SAND.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	99
3.35 mm	99
2.00 mm	98
1.18 mm	98
600 µm	98
425 µm	97
300 µm	97
212 µm	96
150 µm	92
63 µm	24



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	19
6 µm	14
2 µm	11
Particle Density 2.70(A) Mg/m³	

Particle Proportions	
Cobbles	0.0
Gravel	1.7
Sand	74.7
Silt	12.8
Clay	10.8

Tested by AW
Checked and Approved by

S Burke - Senior Technician
06/03/2023

Project Number:

GEO / 37433

Project Name:

LAND OFF HANLYE LANE, CUCKFIELD
LP3210

PARTICLE SIZE DISTRIBUTION

Location TP7
Depth (m) 1.90
Sample Type D

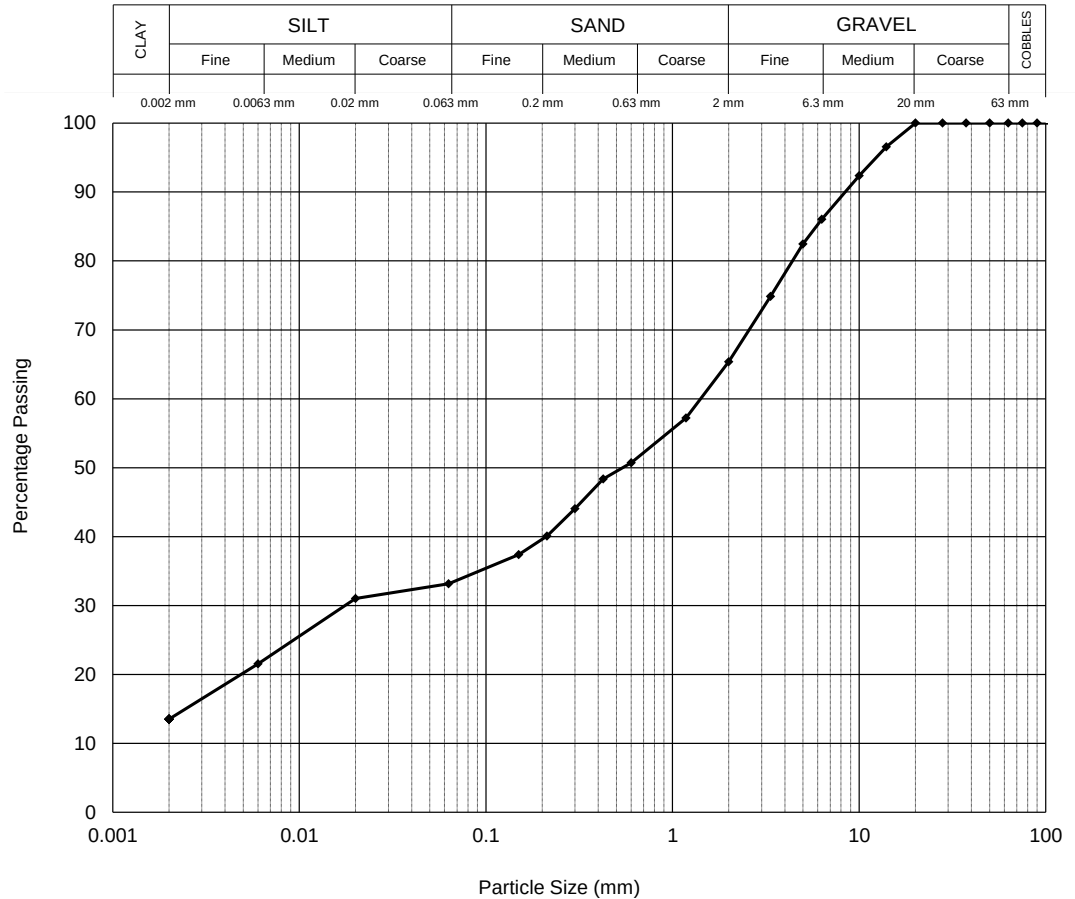
Description

Yellowish brown clayey silty SAND and GRAVEL.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	97
10.0 mm	92
6.30 mm	86
5.00 mm	82
3.35 mm	75
2.00 mm	65
1.18 mm	57
600 µm	51
425 µm	48
300 µm	44
212 µm	40
150 µm	37
63 µm	33



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	31
6 µm	22
2 µm	14

Particle Density 2.70(A) Mg/m³

Particle Proportions	
Cobbles	0.0
Gravel	34.6
Sand	32.2
Silt	19.7
Clay	13.5

Tested by AW
Checked and Approved by

S Burke - Senior Technician
06/03/2023

Project Number:

GEO / 37433

Project Name:

LAND OFF HANLYE LANE, CUCKFIELD
LP3210

PARTICLE SIZE DISTRIBUTION

Location
Depth (m)
Sample Type

TP10
1.20
D

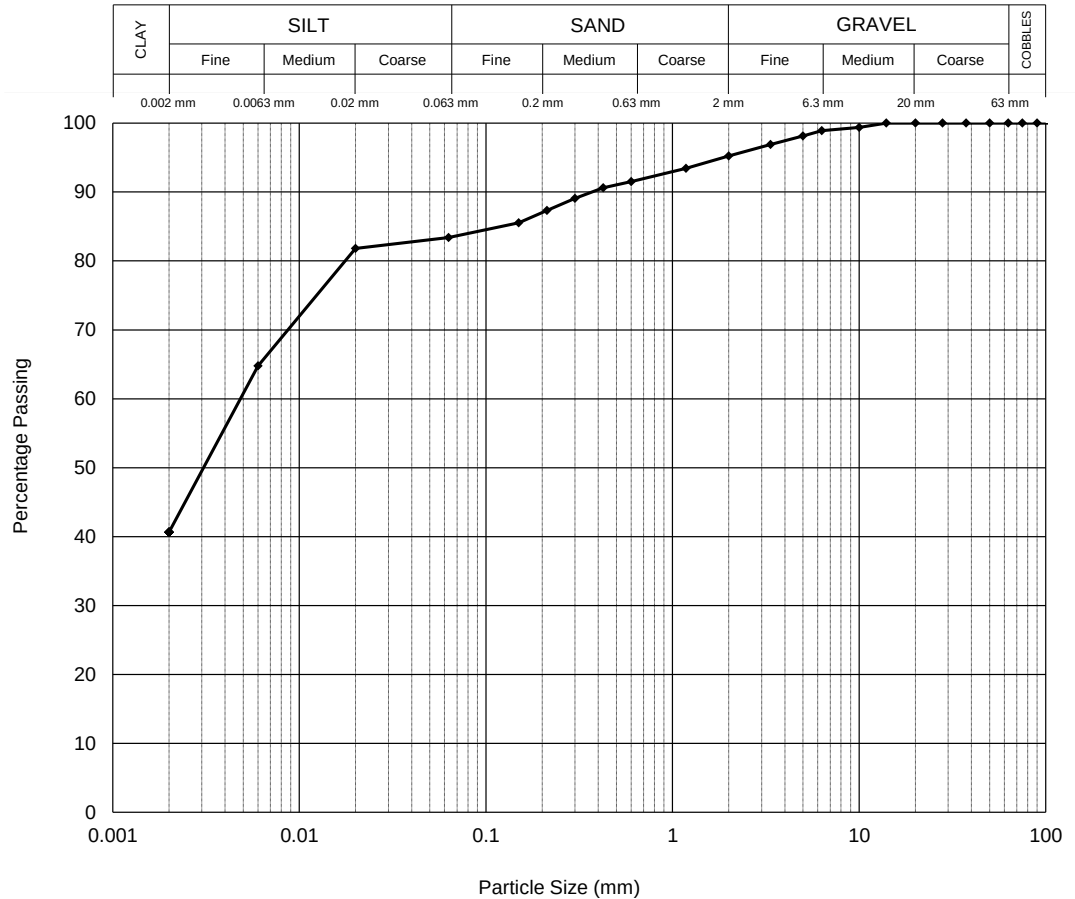
Description

Brownish grey slightly sandy silty CLAY with rare fine to medium gravel.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	99
6.30 mm	99
5.00 mm	98
3.35 mm	97
2.00 mm	95
1.18 mm	93
600 µm	92
425 µm	91
300 µm	89
212 µm	87
150 µm	86
63 µm	83



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	82
6 µm	65
2 µm	41

Particle Density 2.70(A) Mg/m³

Particle Proportions	
Cobbles	0.0
Gravel	4.8
Sand	11.8
Silt	42.7
Clay	40.7

Tested by AW
Checked and Approved by

S Burke - Senior Technician
06/03/2023

Project Number:

GEO / 37433

Project Name:

LAND OFF HANLYE LANE, CUCKFIELD
LP3210

BS1377 : Part 4 : Clause 7 : 1990
CALIFORNIA BEARING RATIO

Location TP4
Depth (m) 0.50
Sample Type B

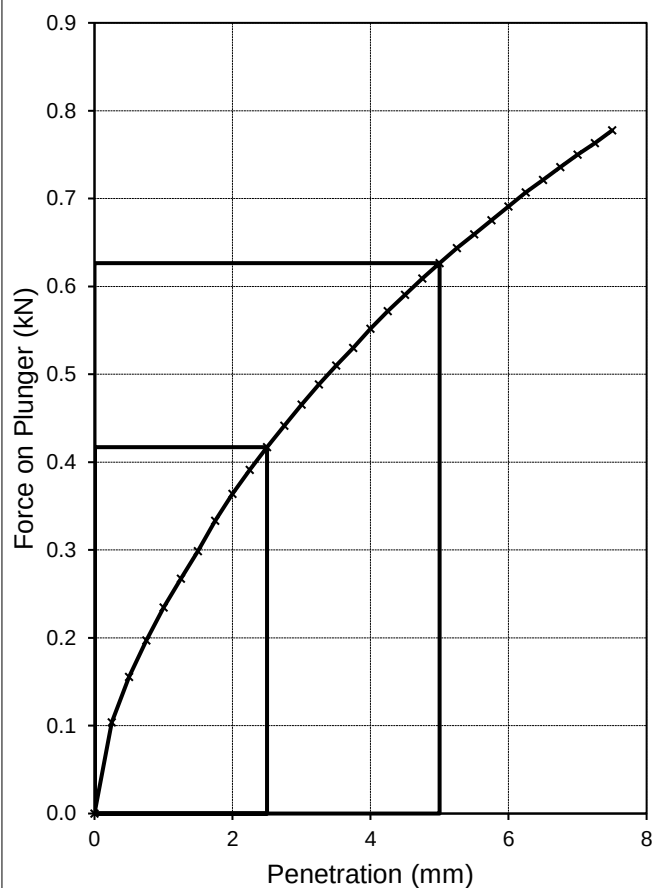
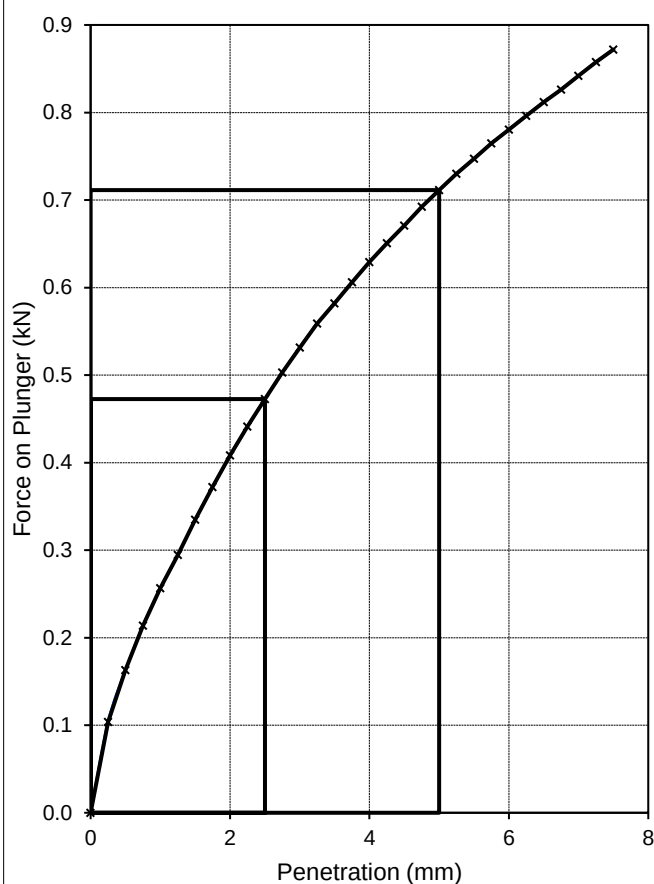
Description:

Brown mottled orangish brown silty CLAY with rare roots.

PREPARATION DETAILS

The specimen was soaked for 4 days, after which swelling equilibrium had been reached with 0.2 % vertical swell.
The specimen was prepared at the as received water content of 28%
The specimen was prepared by dynamic compaction using a 2.5 kg rammer
Soaked specimen bulk density 1.94 Mg/m³ (1.94 Mg/m³ before soaking)
Soaked specimen dry density 1.51 Mg/m³ (1.51 Mg/m³ before soaking)
0.0 % of the sample was retained on a 20mm sieve

Test Details	Top	Base
Surcharge	9.0 kg	9.0 kg
Seating load	10 N	10 N
Water content	29 %	28 %
CBR Value	3.2 %	3.6 %

Top of Specimen**Base of Specimen**

Tested by ME
Checked and Approved by

S Burke - Senior Technician
06/03/2023

Project Number:

GEO / 37433

Project Name:

LAND OFF HANLYE LANE, CUCKFIELD
LP3210

BS1377 : Part 4 : Clause 7 : 1990
CALIFORNIA BEARING RATIO

Location TP5
Depth (m) 0.40
Sample Type B

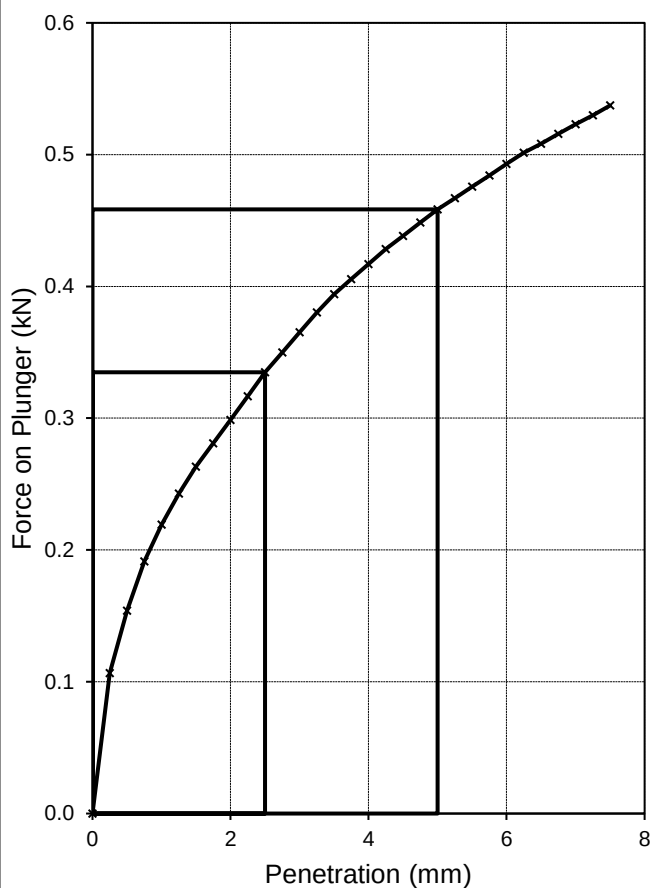
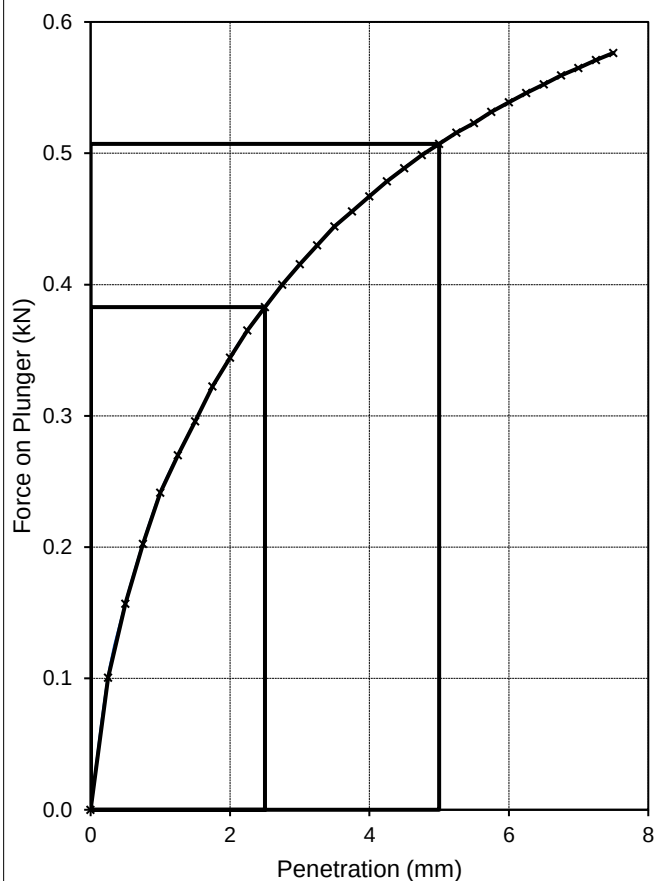
Description:

Brown light brown and yellowish brown mottled silty CLAY with rare roots.

PREPARATION DETAILS

The specimen was soaked for 4 days, after which swelling equilibrium had been reached with 0.3 % vertical swell.
The specimen was prepared at the as received water content of 29%
The specimen was prepared by dynamic compaction using a 2.5 kg rammer
Soaked specimen bulk density 1.92 Mg/m³ (1.92 Mg/m³ before soaking)
Soaked specimen dry density 1.48 Mg/m³ (1.48 Mg/m³ before soaking)
0.0 % of the sample was retained on a 20mm sieve

Test Details	Top	Base
Surcharge	9.0 kg	9.0 kg
Seating load	10 N	10 N
Water content	30 %	30 %
CBR Value	2.5 %	2.9 %

Top of Specimen**Base of Specimen**

Tested by ME
Checked and Approved by

S Burke - Senior Technician
06/03/2023

Project Number:

GEO / 37433

Project Name:

LAND OFF HANLYE LANE, CUCKFIELD
LP3210

BS1377 : Part 4 : Clause 7 : 1990
CALIFORNIA BEARING RATIO

Location	TP6
Depth (m)	0.60
Sample Type	B

Description:

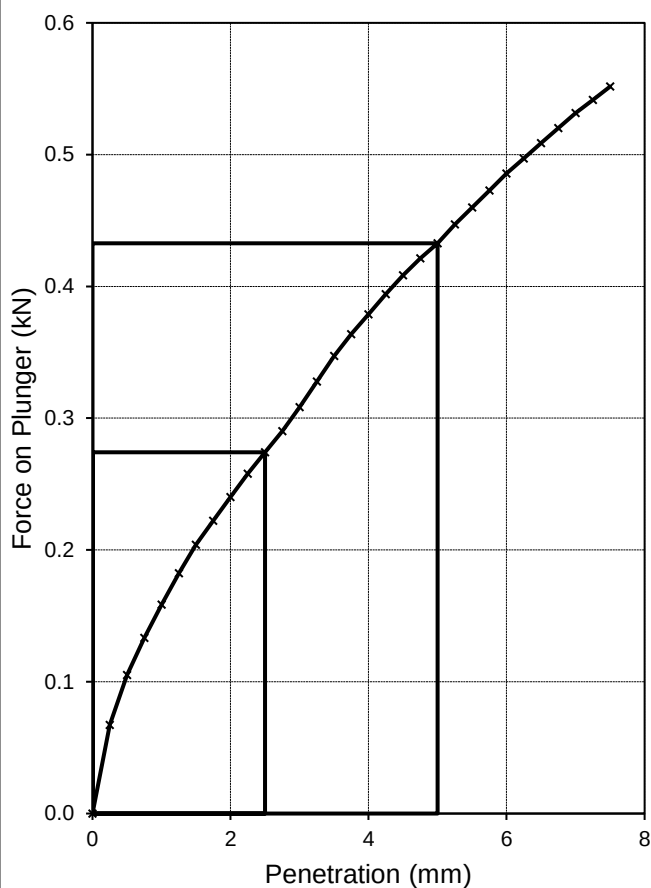
Orangish brown mottled brown very slightly gravelly silty CLAY
with rare roots.

PREPARATION DETAILS

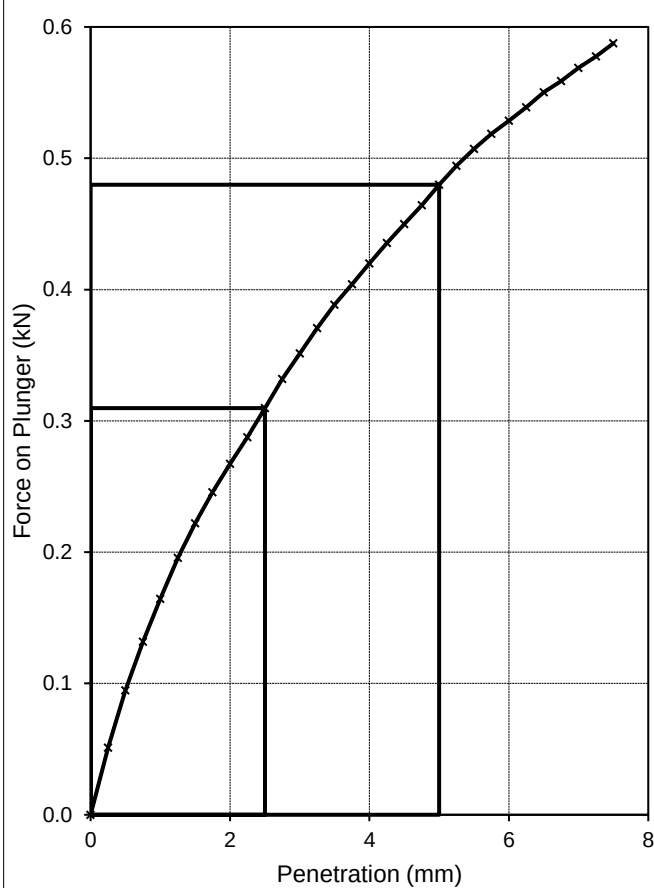
The specimen was soaked for 4 days, after which swelling equilibrium had been reached with 0.2 % vertical swell.
The specimen was prepared at the as received water content of 27%
The specimen was prepared by dynamic compaction using a 2.5 kg rammer
Soaked specimen bulk density 1.95 Mg/m³ (1.95 Mg/m³ before soaking)
Soaked specimen dry density 1.53 Mg/m³ (1.53 Mg/m³ before soaking)
0.3 % of the sample was retained on a 20mm sieve

Test Details	Top	Base
Surcharge	9.0 kg	9.0 kg
Seating load	10 N	10 N
Water content	28 %	27 %
CBR Value	2.2 %	2.4 %

Top of Specimen



Base of Specimen



Tested by ME
Checked and Approved by

S Burke - Senior Technician
06/03/2023

Project Number:

GEO / 37433

Project Name:

LAND OFF HANLYE LANE, CUCKFIELD
LP3210

APPENDIX K – Geoenvironmental Analytical Laboratory Certificates

Geoenvironmenta
Analytical Laboratory
Certificates

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone: (01424) 718618

cs@elab-uk.co.uk
info@elab-uk.co.uk

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 23-46242
Issue: 1
Date of Issue: 10/02/2023
Contact: Sophie Shafi-Cooke
Customer Details: Leap Environmental Ltd
Book House
Glebelands Centre
Dorking
Surrey RH4 3HW
Quotation No: Q22-03403
Order No: LPO7077
Customer Reference: LP2310
Date Received: 26/01/2023
Date Approved: 10/02/2023
Details: Hanlye Lane, Cuckfield
Approved by:

Tim Reeve, Quality Officer

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

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Sample Summary

Report No.: 23-46242, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
309619	TP1	24/01/2023	27/01/2023	Silty loam	
309620	TP3 0.20	24/01/2023	27/01/2023	Silty loam	
309621	TP4 0.20	24/01/2023	27/01/2023	Silty loam	
309622	TP5 0.20	25/01/2023	27/01/2023	Silty loam	
309623	TP6 0.20	25/01/2023	27/01/2023	Silty loam	
309624	TP7 0.20	25/01/2023	27/01/2023	Silty loam	
309625	TP9 0.20	24/01/2023	27/01/2023		
309626	TP10 0.20	24/01/2023	27/01/2023	Silty loam	
309627	WS2 0.50	24/01/2023	27/01/2023	Silty loam	
309628	WS6 0.40	24/01/2023	27/01/2023	Silty loam	
309629	WS1 0.50	24/01/2023	27/01/2023	Silty loam	
309630	WS1 0.20	24/01/2023	27/01/2023		
309631	WS3 0.20	24/01/2023	27/01/2023		
309632	WS4 0.10	24/01/2023	27/01/2023		
309633	WS5 0.20	24/01/2023	27/01/2023		
309634	WS5 0.50	24/01/2023	27/01/2023		
309635	? 0.50	Not Provided	27/01/2023		a
309636	TP 0.20	24/01/2023	27/01/2023		

Results Summary

Report No.: 23-46242, issue number 1

ELAB Reference				309619	309620	309621	309622	309623
Customer Reference								
Sample ID								
Sample Type				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location				TP1	TP3	TP4	TP5	TP6
Sample Depth (m)					0.20	0.20	0.20	0.20
Sampling Date				24/01/2023	24/01/2023	24/01/2023	25/01/2023	25/01/2023
Determinand	Codes	Units	LOD					
Soil sample preparation parameters								
Moisture Content	N	%	0.1	n/t	16.7	18.6	23.3	26.1
Material removed	N	%	0.1	n/t	< 0.1	7.5	6.0	9.1
Description of Inert material removed	N		0	n/t	None	Stones	Stones	Stones/Brick
Metals								
Arsenic	M	mg/kg	1	n/t	5.8	6.8	8.0	7.0
Cadmium	M	mg/kg	0.5	n/t	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	n/t	12.1	16.8	20.6	20.5
Copper	M	mg/kg	5	n/t	30.4	17.4	17.6	21.1
Lead	M	mg/kg	5	n/t	44.7	28.6	33.8	74.3
Mercury	M	mg/kg	0.5	n/t	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	n/t	7.4	10.4	12.3	10.5
Selenium	M	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	n/t	62.7	39.6	45.8	44.9
Inorganics								
Hexavalent Chromium	N	mg/kg	0.8	n/t	< 0.8	< 0.8	< 0.8	< 0.8
Miscellaneous								
pH	M	pH units	0.1	n/t	7.0	6.2	6.1	6.1
Total Organic Carbon	N	%	0.01	n/t	2.4	1.5	2.4	2.0
Polyaromatic hydrocarbons								
Naphthalene	MS	mg/kg	0.02	n/t	0.06	< 0.02	< 0.02	< 0.02
Acenaphthylene	MS	mg/kg	0.02	n/t	< 0.02	< 0.02	< 0.02	< 0.02
Acenaphthene	MS	mg/kg	0.02	n/t	< 0.02	< 0.02	< 0.02	< 0.02
Fluorene	US	mg/kg	0.02	n/t	< 0.02	< 0.02	< 0.02	< 0.02
Phenanthrene	MS	mg/kg	0.02	n/t	0.32	< 0.02	< 0.02	< 0.02
Anthracene	US	mg/kg	0.02	n/t	0.05	< 0.02	< 0.02	< 0.02
Fluoranthene	MS	mg/kg	0.02	n/t	1.04	0.16	< 0.02	0.08
Pyrene	MS	mg/kg	0.02	n/t	0.77	0.13	< 0.02	0.07
Benzo(a)anthracene	US	mg/kg	0.02	n/t	0.46	0.08	< 0.02	0.05
Chrysene	MS	mg/kg	0.02	n/t	0.46	0.10	< 0.03	< 0.03
Benzo(b)fluoranthene	MS	mg/kg	0.02	n/t	0.41	0.07	< 0.02	< 0.02
Benzo(k)fluoranthene	MS	mg/kg	0.03	n/t	0.27	0.04	< 0.03	< 0.03
Benzo(a)pyrene	US	mg/kg	0.02	n/t	0.27	0.09	< 0.02	< 0.02
Indeno(1,2,3-cd)pyrene	MS	mg/kg	0.02	n/t	0.22	0.06	< 0.02	< 0.02
Dibenzo(a,h)anthracene	MS	mg/kg	0.02	n/t	0.06	< 0.02	< 0.02	< 0.02
Benzo[g,h,i]perylene	MS	mg/kg	0.02	n/t	0.21	0.05	< 0.02	< 0.02
Total PAH(16)	NS	mg/kg	0.34	n/t	4.61	0.79	< 0.34	< 0.34

Results Summary

Report No.: 23-46242, issue number 1

ELAB Reference				309619	309620	309621	309622	309623
Customer Reference								
Sample ID								
Sample Type				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location				TP1	TP3	TP4	TP5	TP6
Sample Depth (m)					0.20	0.20	0.20	0.20
Sampling Date				24/01/2023	24/01/2023	24/01/2023	25/01/2023	25/01/2023
Determinand	Codes	Units	LOD					
OrganoChlorine Pesticides								
alpha-HCH	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
beta_HCH	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
gamma-HCH	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
delta-HCH	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Heptachlor	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Aldrin	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Heptachlor expoxide	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
trans-Chlordane	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
alpha cis-Chlordane	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
p,p-DDE	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Dieldrin	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Endrin	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
p,p-DDD	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Endosulfan II	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Endrin aldehyde	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
p,p-DDT	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Endosulphan sulphate	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Methoxychlor	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
Endrin ketone	N	ug/kg	10	< 10	< 10	n/t	n/t	n/t
OrganoPhosphorus Pesticides								
Acephate	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Aziniphos-methyl	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Chlorpyrifos	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Demeton-s-methyl	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Dichlorvos	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Dimethoate	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Ethion	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Malathion	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Mathidathion	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Methamidophos	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Omethoate	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Pirimifos-methyl	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Profenofos	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Pyrazophos	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Tokuthion	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t
Tolclofos-methyl	N	ug/kg	100	< 100	< 100	n/t	n/t	n/t

Results Summary

Report No.: 23-46242, issue number 1

ELAB Reference				309624	309626	309627	309628	309629
Customer Reference								
Sample ID								
Sample Type				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location				TP7	TP10	WS2	WS6	WS1
Sample Depth (m)				0.20	0.20	0.50	0.40	0.50
Sampling Date				25/01/2023	24/01/2023	24/01/2023	24/01/2023	24/01/2023
Determinand	Codes	Units	LOD					
Soil sample preparation parameters								
Moisture Content	N	%	0.1	17.2	19.6	20.9	16.1	14.7
Material removed	N	%	0.1	12.3	13.6	7.9	6.1	8.9
Description of Inert material removed	N		0	Stones	Stones	Stones	Stones	Stones
Metals								
Arsenic	M	mg/kg	1	8.0	7.5	7.0	9.7	2.5
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	12.8	16.8	18.8	16.7	7.3
Copper	M	mg/kg	5	34.4	18.0	19.5	16.9	7.1
Lead	M	mg/kg	5	43.2	84.2	29.2	26.4	6.4
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	8.7	11.7	12.5	10.4	< 5.0
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	50.8	42.8	38.8	43.2	14.5
Inorganics								
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Miscellaneous								
pH	M	pH units	0.1	6.6	6.8	6.6	7.1	6.7
Total Organic Carbon	N	%	0.01	2.4	1.3	1.4	0.45	0.51
Polyaromatic hydrocarbons								
Naphthalene	MS	mg/kg	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Acenaphthylene	MS	mg/kg	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Acenaphthene	MS	mg/kg	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Fluorene	US	mg/kg	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Phenanthrene	MS	mg/kg	0.02	0.04	< 0.02	< 0.02	< 0.02	< 0.02
Anthracene	US	mg/kg	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Fluoranthene	MS	mg/kg	0.02	0.13	0.07	< 0.02	< 0.02	< 0.02
Pyrene	MS	mg/kg	0.02	0.11	0.05	< 0.02	< 0.02	< 0.02
Benzo(a)anthracene	US	mg/kg	0.02	0.07	0.04	< 0.02	< 0.02	< 0.02
Chrysene	MS	mg/kg	0.02	0.06	0.04	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	MS	mg/kg	0.02	< 0.02	0.04	< 0.02	< 0.02	< 0.02
Benzo(k)fluoranthene	MS	mg/kg	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	US	mg/kg	0.02	< 0.02	0.04	< 0.02	< 0.02	< 0.02
Indeno(1,2,3-cd)pyrene	MS	mg/kg	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dibenzo(a,h)anthracene	MS	mg/kg	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo[g,h,i]perylene	MS	mg/kg	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total PAH(16)	NS	mg/kg	0.34	< 0.34	< 0.34	< 0.34	< 0.34	< 0.34

Results Summary

Report No.: 23-46242, issue number 1

ELAB Reference				309624	309626	309627	309628	309629
Customer Reference								
Sample ID								
Sample Type				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location				TP7	TP10	WS2	WS6	WS1
Sample Depth (m)				0.20	0.20	0.50	0.40	0.50
Sampling Date				25/01/2023	24/01/2023	24/01/2023	24/01/2023	24/01/2023
Determinand	Codes	Units	LOD					
OrganoChlorine Pesticides								
alpha-HCH	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
beta_HCH	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
gamma-HCH	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
delta-HCH	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Heptachlor	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Aldrin	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Heptachlor expoxide	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
trans-Chlordane	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
alpha cis-Chlordane	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
p,p-DDE	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Dieldrin	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Endrin	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
p,p-DDD	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Endosulfan II	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Endrin aldehyde	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
p,p-DDT	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Endosulphan sulphate	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Methoxychlor	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
Endrin ketone	N	ug/kg	10	< 10	n/t	n/t	n/t	n/t
OrganoPhosphorus Pesticides								
Acephate	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Aziniphos-methyl	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Chlorpyrifos	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Demeton-s-methyl	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Dichlorvos	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Dimethoate	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Ethion	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Malathion	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Mathidathion	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Methamidophos	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Omethoate	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Pirimifos-methyl	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Profenofos	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Pyrazophos	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Tokuthion	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t
Tolclofos-methyl	N	ug/kg	100	n/t	n/t	n/t	n/t	n/t

Results Summary

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ELAB Reference				309619	309620	309624
Customer Reference						
Sample ID						
Sample Type				SOIL	SOIL	SOIL
Sample Location				TP1	TP3	TP7
Sample Depth (m)					0.20	0.20
Sampling Date				24/01/2023	24/01/2023	25/01/2023
Determinand	Codes	Units	LOD			
SVOCTIC						
Triazine herbicides	N	mg/kg	0.01	<0.01	<0.01	<0.01
TIC						

Results Summary

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Asbestos Results

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

Elab No.	Depth (m)	Clients Reference	Description of Sample Matrix #	Asbestos Identification	Gravimetric Analysis Total (%)	Gravimetric Analysis by ACM Type (%)	Free Fibre Analysis (%)	Total Asbestos (%)
309620	0.20	TP3	Brown Soil, Stones, Organics	No asbestos detected	n/t	n/t	n/t	n/t
309621	0.20	TP4	Brown Soil, Stones, Clinker, Organics	No asbestos detected	n/t	n/t	n/t	n/t
309622	0.20	TP5	Brown Soil, Stones, Organics	No asbestos detected	n/t	n/t	n/t	n/t
309623	0.20	TP6	Brown Soil, Stones, Clinker, Organics	No asbestos detected	n/t	n/t	n/t	n/t
309624	0.20	TP7	Brown Soil, Stones, Clinker, Plastic, Organics	No asbestos detected	n/t	n/t	n/t	n/t
309626	0.20	TP10	Brown Soil, Stones, Clinker, Organics	No asbestos detected	n/t	n/t	n/t	n/t
309627	0.50	WS2	Brown Soil, Stones, Clinker	No asbestos detected	n/t	n/t	n/t	n/t
309628	0.40	WS6	Brown Soil, Stones, Clinker, Organics	No asbestos detected	n/t	n/t	n/t	n/t
309629	0.50	WS1	Brown Soil, Stones, Clinker, Organics	No asbestos detected	n/t	n/t	n/t	n/t

Method Summary

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Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Hexavalent chromium	N	As submitted sample	31/01/2023	110	Colorimetry
pH	M	Air dried sample	01/02/2023	113	Electromeric
Aqua regia extractable metals	M	Air dried sample	31/01/2023	118	ICPMS
SVOC in solids	N	As submitted sample	07/02/2023	167	GC-MS
Organochlorine Pesticides in solids	N	As submitted sample	07/02/2023	173	GC-MS
Organophosphorus Pesticides in solids	N	As submitted sample	07/02/2023	173	GC-MS
Total organic carbon/Total sulphur	N	Air dried sample	01/02/2023	210	IR
Asbestos identification	U	Air dried sample	02/02/2023	281	Microscopy

Tests marked N are not UKAS accredited

Report Information

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Key

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

LOD LOD refers to limit of detection, except in the case of pH soils and pH waters where it means limit of discrimination.
Soil sample results are expressed on an air dried basis (dried at < 30°C), and are uncorrected for inert material removed.
ELAB are unable to provide an interpretation or opinion on the content of this report.
The results relate only to the sample received.
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request
Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

Deviation Codes

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

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

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

TPH Classification - HWOL Acronym System

HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
2D	GC-GC - Double coil gas chromatography
#1	EH_Total but with humics mathematically subtracted
#2	EH_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry

APPENDIX L – Approach to the Selection of Generic Assessment Criteria

Approach to the
Selection of Generic
Assessment Criteria

LEAP APPROACH TO THE SELECTION OF GENERIC ASSESSMENT CRITERIA

Chronic Risks to Human Health

Defra and the EA have published a limited number of Soil Guideline Values (SGVs) which represent minimal chronic risk to human health. CL:AIRE has published a limited number of Category Four Screening Levels (C4SLs) which represent a low but still strongly precautionary level of chronic risk to human health. Both the SGVs and C4SLs have both been derived for a Soil Organic Matter (SOM) content of 6%, which is not always representative of the low SOM that are encountered within Made Ground brownfield sites.

Land Quality Management Ltd. (LQM) responded to the demand for a comprehensive set of screening values and for a wider range of SOM by producing Suitable for Use Levels (S4ULs) which are a hybrid of SGVs and C4SLs. The S4ULs have been endorsed by the Chartered Institute of Environmental Health (CIEH).

A smaller set of 35 GACs was published by CL:AIRE in association with AOSH and EIC in 2010. These were based on the exposure scenarios that were used to derive SGVs. These exposure scenarios have since been superseded, in part, by the publication of the C4SLs and the S4ULs. A second phase of C4SLs is currently under development.

LEAP uses C4SLs where they are available as generic assessment criteria to quantitatively assess the potential chronic risks to human health. Where C4SLs are not available, the S4ULs or CL:AIRE GACs are used. It is noted that S4ULs are not equivalent to C4SLs in all their exposure assumptions but are generally more conservative. To ensure the most possible consistency in LEAP's human health GQRAs, the physicochemical and toxicological input parameters that were used to derive the CL:AIRE GACs have been retained using the exposure parameters selected by LQM to derive the S4ULs.

For the organic compounds benzene and benzo(a)pyrene) for which C4SLs are available for a SOM of 6% only, LEAP has calculated equivalent C4SLs for 1% and 2.5% SOM. SOM does not affect the inorganic contaminants.

²⁰ Environment Agency Science Report SC050021 series.

²¹ CL:AIRE Final Project Report. 'SP1010 – Development of Category 4 Screening Levels for assessment of land affected by contamination'. CL:AIRE, December 2011.

²² 'The LQM/CIEH S4ULs for Human Health Risk Assessment', Nathaniel P et al, 2015. Copyright Land Quality Management Ltd, reproduced with permission: Publication Number S4UL3509.

In accordance with current Public Health England (PHE) guidance²³, LEAP carries out the assessment of PAHs using a surrogate marker approach, whereby assessment of risk from benzo(a)pyrene also captures potential risks from other carcinogenic PAHs that may be present. The alternative S4ULs for PAHs using the Toxic Equivalency Factor (TEF) approach are not used because this approach is likely to under predict the carcinogenicity of PAHs and is not advocated by PHE. The threshold PAHs have been assessed similarly, by using naphthalene as a marker compound due to its high volatility relative to other PAHs.

Total phenols are assessed by LEAP against the S4UL for phenol and total chromium is assessed against the S4UL for trivalent chromium.

LEAP does not consider the theoretical soil saturations in the evaluation of organic compounds and as such, some of the S4ULs for the less sensitive exposures are lower than their more sensitive equivalents.

Risks to human health from inhalation of vapours derived from groundwater are evaluated by LEAP using the SoBRA groundwater GAC_{gw vap}²⁴.

Acute Risks to Human Health

Cyanide has not been modelled using CLEA because it has high acute toxicity. LEAPs designed to evaluate chronic risks. Assuming an acute risk based on a single dose of 3 g of soil, an assessment criterion of 33 mg/kg for inorganic cyanide and 544 mg/kg for complex cyanide has been calculated by LEAP. At this stage, LEAP has chosen to adopt a conservative screening value of 20 mg/kg for total cyanide (essentially the sum of free and complex cyanides) to highlight any potential risks to human health.

Risks to Controlled Waters

RTM (2006)²⁵ requires receptor-specific Water Quality Standards (WQS) to be used to determine potentially unacceptable risks to water bodies in England and Wales. It requires appropriate criteria to be taken from a hierarchy of sources, where they are available as follows:

²³ HPA 'Contaminated Land Information Sheet. Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)'. Public Health England, 2017.

²⁴ Society of Brownfield Risk Assessment (SoBRA) 'Developed Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater' Version 1.0. February 2017.

²⁵ EA 'Remedial Targets Methodology: Hydrogeological Assessment for Land Contamination' 2006.

1. UK published values
2. EU published values
3. WHO published values

Drinking Water Resources

For groundwater and surface waters that are abstracted for potable supply, LEAP uses:

- x UK Drinking Water Quality Standards (DWS) from The Water Supply (Water Quality) Regulations 2016 (England).
- x The Water Supply (Water Quality) Regulations 2016 (Wales) as amended in 2016.
- x World Health Organisation Guidelines for Drinking Water Quality, Fourth Edition, Volume 1, (2011).

Where the groundwater is not abstracted for potable supply, this precautionary approach which protects the potential future exploitation of groundwater.

Surface Water (Ecological) Receptors

For surface waters as ecological receptors, LEAP uses the Environmental Quality Standards (EQS) from The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. There are no appropriate EU or WHO standards available.

Petroleum Hydrocarbons

There are no current UK standards available for petroleum hydrocarbons, neither for groundwater or surface water receptors, so an initial assessment criterion of 10µg/l, based on the former target concentration for dissolved or emulsified hydrocarbons, is used to represent a conservative preliminary screening value for total petroleum hydrocarbons.

Where considered appropriate, LEAP then follows the guidance of CL:AIRE 2017 the further assessment of the petroleum hydrocarbon fractions and derivatives. For a drinking water resource, the WHO guidelines are used. For surface water ecological receptors, proxy compounds are used to select appropriate EQS based on recommended indicator compounds, as follows:

- x Aromatic EC5-EC7 – benzene
- x Aromatic >EC7-EC8 – toluene

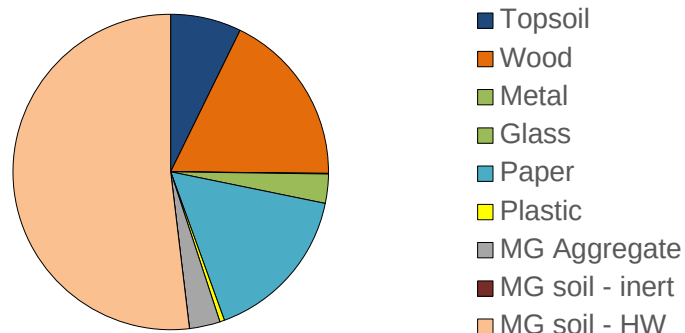
²⁶ CL:AIRE, 2017. 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies'. CL:AIRE, London. ISBN 978-1-905046-31-7.

- x Aromatic >EC8-EC10 – ethylbenzene
 - x Aromatic >EC10-EC12 – naphthalene
 - x Aromatic >EC12-EC16 – no proxy
 - x Aromatic >EC16-EC21 – anthracene
 - x Aromatic >EC21-EC35 – benzo(a)pyrene
-

APPENDIX M – Carbon Assessment of Remediation

Remediation Optio	1	2	3
Summar	1m cover on landfill area	Excavate 0.5m ar 1m cover in landfill area	Excavate 1m with 1m cover in landfill area

The base option is for all excavated material to be sent to landfill. Based upon this – the relative carbon footprint of this landfilled material is:



The relative carbon footprint of the remediation options 1-3a is shown below. Reusing material onsite or processing leads to considerable savings in the carbon footprint of the remediation options as shown in options 2b and 3b. Maximum savings are made by focusing on preventing material with a high carbon footprint being sent to landfill. Carbon savings are made if the material is processed leading to a net reduction in carbon emitted.

