

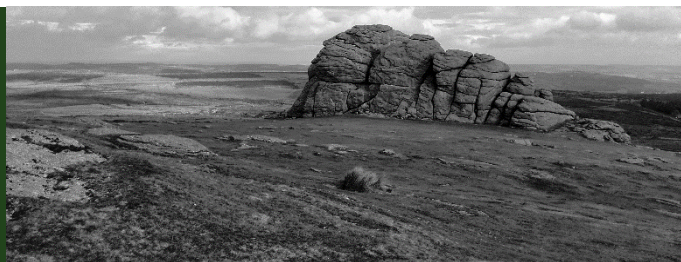
GROUND INVESTIGATION REPORT

**Proposed Residential Development
Fives Court, Mere, Wiltshire**

Prepared for: Wiltshire Council

Date: November 2022

Report No: PO-22-039/GIR



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Proposed Residential Development
Fives Court, Mere, Wiltshire

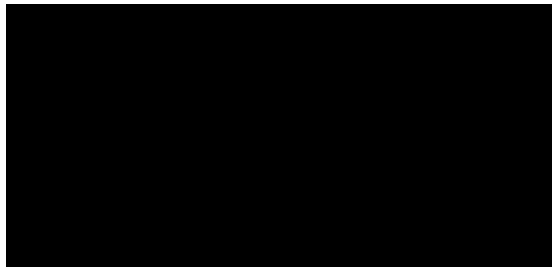
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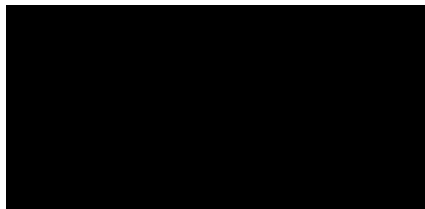
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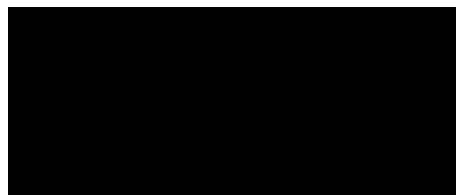
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EXECUTIVE SUMMARY

Proposals		Wiltshire Council is proposing the construction of a new residential development within land at Fives Court, Mere, Wiltshire. The proposed development will consist of a two-story building comprising of 1 and 2 bed flats with communal areas, for people aged 60 and above, and all associated infrastructure.				
Geology		The Geological Map of the area shows the site to be underlain by the West Melbury Marly Chalk Formation, which the BGS describes as buff, grey and off-white, soft, marly chalk and hard grey limestone arranged in couplets. No Superficial Deposits are shown to overlie the bedrock geology of the area.				
Field Investigation		The site works were undertaken during September 2022 and comprised 4No. machine excavated trial pits, 3No. in-situ soakaway tests, 4No. in-situ CBR tests and 3No. Inspection pits. The ground conditions can be summarised as below:				
		Made Ground		0.00	0.20 / 1.00	- Concrete and subbase (<i>internal cores only</i>) - Dark brown slightly gravelly slightly sandy silty CLAY - Grey slightly sandy clayey GRAVEL with low cobble content
		Residual Soils	Cohesive	0.20 / 1.00	0.90 / 1.50	- Firm dark grey / grey mottled yellow brown slightly sandy to sandy slightly gravelly to gravelly CLAY
			Granular	0.90 / 1.50	>2.10	- Medium dense light grey clayey GRAVEL with low to medium cobble content.
		During the Ground Investigation no perched/deep groundwater was encountered.				
Contamination Risk Assessment	Chemical Evaluation	The results of the chemical testing have revealed elevations of Lead and Dibenzo(a,h)anthracene above the relevant soil guidance values. Therefore, remediation will be required across the site to render the site fit for use.				
	Human Health	A cover system will likely be the most appropriate form of remediation, comprising capping of the site with the building footprint, areas of hard standing and 600mm of inert suitable materials within proposed soft-landscaped areas. Alternatively, the made ground material can be removed to an appropriate landfill facility.				
	Aquatic Environment	Risk Assessment has confirmed low risk to the aquatic environs based on the chemical evaluation and environmental setting.				
	Gas Migration	There is a low risk to the site end users from ground/landfill gas and a low risk from radon gas where no radon protection measures are likely to be required.				
Engineering Recommendations	Foundation and Floor Slab Solution	Traditional strip/trench fill foundations should be founded within the granular Residual Soils comprising medium dense light grey clayey GRAVEL, with an allowable bearing capacity of 100kN/m ² at depths of typically between 0.90m and 1.50m bgl. Based on plasticity testing, to avoid damage from frost heave and thermal shrinkage, the base of the foundations should lie at least 0.90m below final ground level. Due to the plastic nature of the underlying deposits, floor slabs should be designed as suspended.				
	Storm Drainage	3No. in-situ permeability/soakaway test were undertaken at TP01, TP02 and TP03 locations in accordance with the requirements of BRE 365. The tests did not sufficiently drain to 75% to give an infiltration rate. Therefore, it is unlikely soakaways will be viable at the site.				
	Highways	It is recommended a CBR value of 4% is adopted for the natural cohesive soils at the site. Any new roads constructed upon on the existing Made Ground at the site should use a conservative CBR value of 1%.				
	Buried Concrete	Using guidance within BRE SD1 (2005) it is recommended that any buried concrete within the site conforms to Design Class DS-1 and ACEC Class AC-1s.				
	Further Works	Due to access restrictions at the time of the ground investigation we were not able to access the southern parts of the site. As the geological map indicates that ground conditions may change close to the southern boundary it is recommendation that further investigation should be completed in this area in order to de-risk the site.				

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SECTION 1 Introduction and Proposed Development

Wiltshire Council is proposing the construction of a new residential development within land at Fives Court, Mere, Wiltshire. The proposed development will consist of a two-story building comprising of 1 and 2 bed flats with communal areas, for people aged 60 and above, and all associated infrastructure.

Terra Firma (South) have been commissioned as Geotechnical and Geo-Environmental Engineers to carry out a Ground Investigation of the site.

The main objectives of the geo-technical ground investigation were to:

- Determine the type, strength and bearing characteristics of the near surface soils and underlying bedrock geology.
- Provide recommendations for a suitable and economic foundation/floor slab solution for the development.
- Provide recommendations with regard to any other geo-technical aspects pertaining to the development.

The main objectives of the geo-environmental assessment programme were to:

- Identify the potential environmental liabilities at the site associated with any soil and groundwater contamination from past site uses.
- Provide a summary of the environmental conditions at the site, together with any necessary remediation works to render the site fit for its intended use.
- Provide recommendations with regard to any other geo-environmental aspects pertaining to the development.

The Ground Investigation has been undertaken in accordance with the following advisory guidance:

- Code of Practice for Site Investigations - (BS 5930): 2015 + A1:2020
- Investigation of Potentially Contaminated Sites - CoP (BS 10175): 2011 + A2:2017
- Methods of test for soils for civil engineering purposes - In-situ tests (BS 1377-9):1999

In order to achieve the above objectives, Terra Firma (South) carried out an assessment programme including a review of existing data, followed by a field investigation to determine the prevailing ground conditions and also to collect and analyse soil samples from selected locations around the site.

1.1 Limitations and Exceptions of Investigation

Wiltshire Council has requested that a Ground Investigation Report (GIR) be performed in order to establish the ground conditions at the site and collect representative samples for laboratory analysis.

The Ground Investigation was conducted and this report has been prepared for the sole internal reliance of Wiltshire Council and their design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (South). If an unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill.

The report represents the findings and opinions of experienced geo-environmental and geo-technical consultants. Terra Firma (South) does not provide legal advice and the advice of lawyers may also be required.

The subsurface geological profiles, any contamination and other plots are generalised by necessity and have been based on the information found at the locations of the exploratory holes and depths sampled and tested.

The ground investigation was limited by the following site constraints:

- The presence of underground services and utilities,
- The presence of existing buildings, structures and/or hard standing,
- The presence of access restrictions to the required locations,
- The presence of underground obstructions, structures and/or unexpected ground conditions, and
- The presence of time restraints outside of our reasonable control.

SECTION 2 Site Setting

2.1 Physical Setting

The proposed development is to be located within property boundaries of Fives Court, Mere, Wiltshire, BA12 6DH.

The site is centred approximately on National Grid Reference (NGR) ST 81304 32282. The site location is presented in **Drawing 2.1** below.



Drawing 2.1: Site Location Plan

The site is irregular in shape with a plan area of approximately 0.36 hectares and sits between approximately 105 and 106m above ordnance datum (aod).

The topography of the site is typically flat. The topography of the surrounding area typically slopes towards the South/ South-West.

To the north, north west, east and south, the site is typically bound by residential properties. The main road running through the town of Mere is situated to the north of site. Along this main road, a series of town amenities can be found such as a post office, fish and chip shop, pharmacy/ doctors' surgery, pub/hotels and a Co-op. Located to the West is St Michael's church with an associated graveyard. To the south of site an additional cemetery is also present. Extending further south a series of farm land/ open fields is present.

2.1.1 Current Use and Site Conditions

At the time of the investigation the site currently comprises of an empty care home building (ready for demolition), with a hardstanding car park area situated to the north and soft landscaped garden areas surrounding the building.

2.2 Phase 1 Risk Assessment

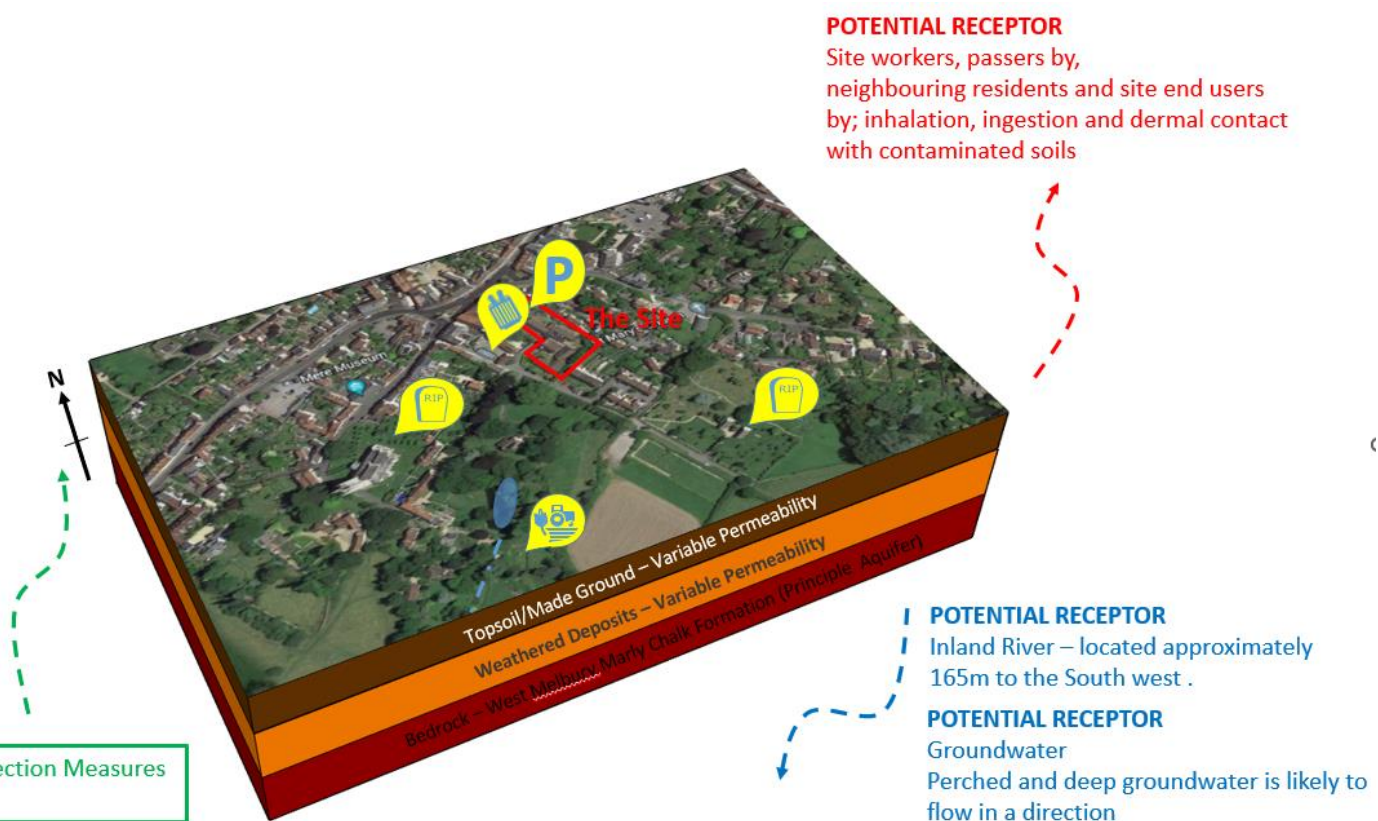
A Phase 1 Contaminated Land Risk Assessment was undertaken by Terra Firma (South) in October 2022 (Report number PO-22-039/P1) and should be read in conjunction with this report. A summary of the report is detailed below:

Geology		The Geological Map of the area shows the site to be underlain by the West Melbury Marly Chalk Formation, which the BGS describes as buff, grey and off-white, soft, marly chalk and hard grey limestone arranged in couplets. Immediately south of the site is the Kimmeridge Clay Formation which the BGS describes as mudstones and thin siltstone and cementstone beds; locally sands and silts. No Superficial Deposits are shown to overlie the bedrock geology of the site with Alluvium recorded 100 m to the southwest.
Mining		The risk from underground and/or surface mining activity is likely to be Low .
Preliminary Geotechnical Risk Assessment		The preliminary geotechnical risk assessment has revealed that a Low to Moderate risk is present from geotechnical aspects, with particular risk specifically associated with the potential from swelling, sulphates within the Kimmeridge Clay located 25 m south of the site and groundwater flooding.
Recommendations		In order to confirm the above preliminary geotechnical risk assessment, it is recommended that a Phase 2 Intrusive Site Investigation is undertaken in order to determine the ground conditions and confirm relevant geotechnical aspects.
Potential Sources of Contamination	On-site	Historically, the site has typically comprised of an open field. During 1901, the site was occupied by a rectangular building along the north west boundary of site. During the mid to late 1920s, this building was extended eastwards with an additional small shed/ outbuilding located within the south eastern corner of site. During the late 1970's/early 1980's, these buildings were demolished with the construction of the purpose-built care home which has remained unchanged to present day. Present day and historical uses of the site have a number of potential contamination sources including Potential Made Ground and Car Parking Areas.
	Off-site	Historically, from the earliest map edition (1886), the surrounding area (<250m) has typically comprised of the main town 'Mere' situated to the north of site with residential buildings and town amenities. To the west and south approx. 100m/150m is a cemetery and graveyard. The area south of site largely comprises of fields/ arable farmland. In the 1940s through to 1950s, some residential expansion of the town Mere has occurred with associated infrastructure such as an electrical substation situated northwest of site approximately 20m. Present day and historical uses of the surrounding area have a number of potential contamination sources. However, given their distance, they are not considered to be influencing the site and risk from off site contamination sources is considered to be low.
	Gas Migration	Due to the absence of any influencing active or historic landfills, underlying organic material (e.g. peat) limited thickness of Made Ground, the presence of ground gas is unlikely.
Preliminary Human Health & Environmental Risk Assessment		The preliminary human health and environmental risk assessment has revealed that due to the sites and surrounding areas current and past land uses that a Low to Moderate risk is present from contamination present beneath the site, with particular risk specifically associated with Potential Made Ground and the car parking areas on site.

	In addition, a Low risk is present from the migration of radon gas, a Low risk from the migration of landfill gas and a Low risk from the migration of ground gas.
Recommendations	Based on a Low to Moderate overall risk rating, in order to confirm the above preliminary human health and environmental risk assessment it is recommended that a Phase 2 Ground Investigation is undertaken comprising site specific soil chemical testing in order to determine the ground conditions, soil chemistry and any environmental liability associated with the site.

2.2.1 Preliminary Illustrative Site Conceptual Model

The following illustration represents a theorised model through the site. The drawing is generalised and not to scale.



Drawing 2.2: Preliminary Site Conceptual Model

SECTION 3 Field Investigation

3.1 General

The site works were scoped by Terra Firma (South) and comprised the following:

- 4No. machine excavated trial pits (TP01-TP04),
- 3No. in-situ soakaway tests (SA01-SA03),
- 4No. in-situ California Bearing Ratio (CBR) tests (CBR01-CBR04), and
- 3No. Inspection pits (IP01 – IP03).

The site works were carried out at the site on the 15th of September 2022.

The inspection pits were carried out on the site on the 8th November 2022.

Prior to the site works, the following Health and Safety measures were undertaken:

- Risk Assessment & Method Statement (RAMS) was issued and approved beforehand,
- Underground Utility Plans were obtained from the relevant Statutory Undertakers,
- Safety fencing was used to prevent unauthorised access into the site working area, and
- Before any excavation, all exploratory hole locations were scanned using a Cable Avoidance Tool (CAT).

The exploratory holes were set out at locations provided by Terra Firma (South), and adjusted where necessary to take account of the site constraints detailed in Section 1.1.

Approximate exploratory hole co-ordinates and levels were picked up post-investigation using a hand-held Global Positioning System (GPS) receiver and presented in the table below:

Table 3.1: Exploratory Hole Co-ordinates		
Exploratory Hole	Easting	Northing
TP01	381314	132302
TP02	381298	132318
TP03	381281	132275
TP04	381293	132308
Core 1	381300	132305
Core 2	381306	132297
Core 3	381305	132293
Core 4	381297	132280
Core 5	381290	132264
Core 6	381274	132269
Core 7	381287	132286
IP01	381266	132275
IP02	381288	132299
IP03	381313	132268

The site works were supervised by Terra Firma (South), who also logged the exploratory holes to the requirements of BS5930:2015 + A1:2020.

The exploratory hole logs and in-situ test results are presented in **Annex A** and **Annex B** respectively, and their locations shown on **Drawing 3.1** below.



Drawing 3.1: Exploratory Hole Location Plan

3.2 Exploratory Holes

3.2.1 Machine Excavated Trial Pits

The trial pits were excavated using a tracked 5 tonne excavator.

Following completion of soil logging, in-situ testing and sampling, the trial pits were backfilled using arisings and re-compacted as best as practicably possible using the excavator backhoe. If necessary, the trial pit was left slightly proud in order to allow for short-term settlement.

3.3 In-situ Testing

3.3.1 Permeability Testing

The in-situ permeability tests were undertaken within the excavated trial pits in order to provide a soil infiltration rate to be used in soakaway design. A 2000-gallon tractor-towed bowser was used to rapidly fill the pit with water.

During the site investigation, in-situ permeability tests were undertaken within TP01, TP02 and TP03 and where possible were carried out to the requirements of BRE Digest 365.

The appropriate calculation sheets are presented in **Annex B** and the results given in the table below.

Table 3.2: Infiltration Test Results				
Soak away Test	Depth (m)	Type	Soil Type	Infiltration Rate (m/s)
TP01	2.10	Storm Drainage	Residual Soils	*
TP02	1.80		Residual Soils	*
TP03	1.20		Residual Soils	*

Notes:

- * The test did not drain sufficiently (75% effective depth) to give an infiltration rate

3.3.2 California Bearing Ratio (CBR) Testing

The in-situ CBR tests (4No. tests) were carried out using a TRL Dynamic Cone Penetrometer (DCP) probe. The probes were typically sunk to a depth of <1.00m below ground level, targeting the proposed formation layer.

The in-situ CBR tests were carried out in accordance with 'Methods of test for soils for civil engineering purposes' – BS1377; Part 9 (1999).

The in-situ CBR test results are presented on the relevant trial pit logs or in **Annex B** and should be referred to for specific depth related values.

3.4 Sampling

3.4.1 Sampling Quality Assurance

Care was taken to ensure that sampling quality assurance occurred during site works. This included the following measures:

- The use of nitrile gloves at each sampling point.
- Stainless steel shovels were used to collect soil samples. The tool was cleaned with distilled water between each sample point.
- Soil samples were stored at a temperature below 4 degrees.
- Soil samples were stored within sample containers according to the chemical testing required.
- No head space was left in sample containers.

3.4.2 Soil Chemical Test Sampling Regime

During the intrusive investigation small disturbed soil samples were collected for chemical testing.

The sample locations and depths are illustrated in the table below:

Table 3.3: Chemical Test Sample Descriptions			
Sample No.		Sample Type	Description
TP01	0.40	MG	Dark brown slightly gravelly slightly sandy silty CLAY
TP02	0.30	MG	Grey slightly sandy clayey GRAVEL
TP03	0.40	MG	Cream and grey slightly gravelly CLAY
TP04	0.50	MG	Dark brown slightly gravelly slightly sandy silty CLAY

Core 1	0.25	MG	-
Core 2	0.25	MG	-
Core 3	0.26	MG	-
Core 4	0.28	MG	-
Core 5	0.25	MG	-
Core 6	0.23	MG	-
IP1	0.35	MG	-
IP2	0.35	MG	-
IP3	0.30	MG	-
IP3	0.50	MG	-

Notes

- Sample Type: MG (Made Ground)

3.4.3 Soil Property Test Sampling Regime

During the intrusive investigation bulk soil samples were collected for soil property testing.

The sample locations and depths are illustrated in the following table:

Table 3.4: Soil Property Test Sample Laboratory Descriptions			
Sample No.		Sample Type	Description
TP01	0.40-0.50	MG	Dark brown slightly sandy gravelly clayey SILT. Sand is fine. Gravel is fine to medium.
TP01	0.80	RS	Multi-coloured slightly sandy CLAY with rare fine gravel. Sand is fine.
TP01	1.40	RS	Light grey slightly sandy gravelly clayey SILT with abundant cobbles and rare roots.
TP02	1.10	RS	Grey mottled brown slightly gravelly slightly sandy CLAY. Gravel is mudstone.
TP02	1.60	RS	Light grey clayey GRAVEL with abundant cobbles.
TP03	0.40-0.60	RS	Light brown and dark brown mottled slightly gravelly silty CLAY. Gravel is mudstone.
TP03	0.80	RS	Light brown gravelly CLAY. Gravel is mudstone.
TP04	1.00	RS	Grey and brown mottled slightly gravelly slightly sandy CLAY with rare rootlets. Sand is fine. Gravel is fine to medium.

Notes

- Sample Type: MG (Made Ground), RS (Residual Soils)

SECTION 4 Ground Conditions

4.1 Summary

The ground conditions encountered by the exploratory holes were variable across the site and but can in general be summarised as shown in the following table:

Table 4.1: Summary of Ground Conditions						
Depth (mbgl)		Thickness (m)		Stratum		
From	To	Min	Max			
0.00	0.20 / 1.00	0.20	1.00	Concrete and subbase (<i>Internal cores only</i>) Dark brown slightly gravelly slightly sandy silty CLAY Grey slightly sandy clayey GRAVEL with low cobble content		Made Ground
0.20 / 1.00	0.90 / 1.50	0.50	0.70	Firm dark grey / grey mottled yellow brown slightly sandy to sandy slightly gravelly to gravelly CLAY		Cohesive
0.90 / 1.50	>2.10	Unproven		Medium dense light grey clayey GRAVEL with low to medium cobble content.		Granular
						Residual Soils

Within trial pits, the estimated strength of granular deposits was determined from visual assessment only (ease/difficulty of excavation and pit stability).

4.2 Stability

The sides of the excavations were typically found to be stable.

Due to the hole stability casing was not needed to advance the boreholes.

4.3 Strata Details

4.3.1 Made Ground

The Made Ground was encountered within all exploratory holes and typically comprises of grass over dark brown slightly gravelly slightly sandy silty CLAY. Gravel is subangular to subrounded fine to coarse of brick, pottery and limestone. Occasional roots are present in TP01 (max diameter 6cm). Made ground thicknesses are between 0.20mbgl and 1.00mbgl.

Within TP02, at depths of between 0.30 and 1.00mbgl, the made ground comprises of a grey slightly sandy clayey GRAVEL with low cobble content. Gravel is angular to subrounded fine to coarse of brick, limestone and concrete.

Within the existing onsite building, the floor slab was found to be between 200mm and 255mm thick overlying a subbase comprising of greyish brown slightly silty slightly sandy gravel. Gravel is subangular fine to coarse of limestone.

4.3.2 Residual Soils

The Residual Soils were encountered within all exploratory holes TP01-TP04. The Residual Soils typically comprised of two distinct units; a cohesive layer and a granular layer. The upper cohesive layer was comprised of a firm dark grey / grey mottled yellow brown slightly sandy to sandy slightly gravelly to gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and limestone.

From depths of 0.90mbgl to 1.50mbgl the lower granular Residual Soils layer was encountered and comprised a medium dense light grey clayey GRAVEL with low to medium cobble content. Gravel is subangular to subrounded fine to coarse of limestone.

The trial pits refused on a limestone band within TP01 – TP03 at depths of between 1.20mbgl and 2.10mbgl. The limestone band deepens to the east.

4.4 Water Strikes

No groundwater was encountered within any of the exploratory hole locations.

SECTION 5 Laboratory Chemical Testing

5.1 General

During the recent site works, 14No. soil samples were taken and dispatched to the laboratories of Chemtest for laboratory chemical testing.

The following chemical testing was undertaken:

Table 5.1: Summary of Chemical Testing Suites		
Inorganics	Metals	Arsenic (As), Cadmium (Cd), Chromium (Cr), Hexavalent Chromium (CrVI), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Selenium (Se), Zinc (Zn)
	General	Cyanide (CN ⁻), Sulphate (SO ⁴), Organic Matter (OM)
Organics		Phenol, Poly-Aromatic Hydrocarbons (PAH), Petroleum Hydrocarbons (PH): EPH

The results of the above chemical tests are presented in **Annex C** and evaluated below.

5.2 Risk Assessment

5.2.1 Introduction

The results obtained from the investigation, which are discussed in detail in Section 5.3, were used to conduct an environmental risk assessment for the site. The risk assessment aimed to:

- Identify sensitive receptors
- Determine pathways for contaminant migration to the receptors
- Estimate contaminant impact on receptors
- Establish whether remedial action is required
- Calculate remediation target levels if required

The future use of the site i.e. whether it is to be used for residential or commercial has an impact on any risk assessment. As the site is expected to comprise a two-storey building comprising of 1 and 2 bed flats, for people aged 60 and above with communal areas, soil guidance values (SGV) for a residential without plant uptake end-use has been adopted.

5.2.2 Methodology

Soils

Environmental risk assessment evaluates the risk to receptors via an analysis of the 'source-pathway-target' linkage. In order for a risk to be present, there must be a contaminant source capable of causing a health risk, a vulnerable receptor, and a pathway linking the two.

This sort of risk assessment is usually conducted using a tiered approach. Tier 1 consists of a comparison of the analytical results obtained from the site investigation with Soil Guideline Values (SGV's) specific to the type of development obtained from The Environment Agency Contaminated Land Exposure Assessment (CLEA) Guidelines.

The CLEA model, technical guidance and Soil Guideline Values are currently under review, as a direct result of the publication published by DEFRA (2006) 'Soil Guideline Values: The Way Forward'. The technical guidance CLR 9 and CLR 10 have been superseded by Science Reports (SR) 2 and SR3.

Whilst the toxicological and risk assessment framework is under review, the laboratory soil chemical test results have been evaluated by comparison with the following published Generic Assessment Criteria (GAC), with preference in most onerous order:

1. Category 4 Screening Levels (C4SLs) - Department for Environment, Food and Rural Affairs (DEFRA, 2014),
2. Suitable for Use Levels (S4ULs) - Land Quality Management & Chartered Institute of Environmental Health (LQM & CIEH, 2015),
3. Soil Guideline Values (SGVs) - EA / DEFRA, 2002-2009,
4. Generic Assessment Criteria (GAC) - Contaminated Land: Applications in Real Environments (CL:AIRE, 2010), and
5. Generic Assessment Criteria (GAC) derived by Terra Firma (South).

In the absence of a GAC, the laboratory Limit of Detection (LoD) has been used for comparison in order to establish the presence/absence of determinants and for initial screening purposes.

The above sources typically have derived GAC with reference to the EA's Contaminated Land Exposure Assessment (CLEA) model and using the CLEA software.

All receptor profiles, source inputs and toxicological parameters comply with both peer reviewed literature and CLR 7 to CLR 10. As with SGV's the SSV's and CIEH GAC are not yet updated to SR2 and SR3.

Should Tier 1 levels be exceeded, a choice is made either to remediate the site to conservative Tier 1 levels, or proceed to Tier 2.

Tier 2 makes use of site-specific data to evaluate acceptable concentrations of chemicals for the particular conditions present at the site.

At each tier, the amount and detail of investigation work increases as more site-specific data are needed to refine the characterisation of the site. Conversely, as site conditions are better understood, a more site-specific remediation strategy can be determined.

Controlled Waters

In the case of groundwater and/or leachate, the acceptable concentrations are sourced from the Environment Agency Chemical Standards Report for each individual substance. The report presents a variety of target concentrations specific to protection goals and environmental media in which the standard applies. The most applicable protection goal and environmental media for this project is the protection of aquatic life in a freshwater environment.

Where there is no standard for a freshwater environment, the target concentrations are derived from UK standards for drinking water (for human consumption). In the absence of any published guideline, a conservative threshold is suggested.

5.2.3 Assessment of Zones/Areas

Following initial findings from the Phase 1 Desk Study and subsequent Ground Investigation, a site can be zoned into separate areas, for the purposes of contamination assessment. This zoning can be based on the sites previous history and/or from the proposed end use of the site. These zones can then be subdivided into averaging areas which in turn can be assessed for differing soil types and potentially differing pathways. Each averaging area can then be considered independently of each other for human health exposure assessment.

Based upon a site end use of residential with plant uptake and the findings from the Phase 1 Desk Study and Ground Investigation it is proposed that the site be treated as a single zone site.

5.2.4 Sources

The sources of contamination considered in the risk assessment are taken to be concentrations of chemicals beneath the site.

5.2.5 Pathways

The various pathways considered in the risk assessment are summarised in the table below:

Table 5.2: Summary of Potential Contamination Pathways	
Potential Contamination Pathway	
Human Health	Ingestion of soil and soil dust
	Consumption of site grown produce
	Dermal contact (Inc. eye uptake) with soil, soil dust and water
	Inhalation of soil particles, dust, asbestos and vapours, both indoors and outdoors
	Inhalation of landfill / ground gas, accumulation and risk of explosion
	Contaminant permeation of drinking water pipes and ingestion of contaminated water supply
Aquatic Environment	Surface water runoff
	Migration of surface water into underlying soils and groundwater
	Leaching of contaminants via groundwater transport into the wider aquatic environment – surface waters and groundwater

5.2.6 Potential Receptors

A summary of the potential affected receptors at the site are summarised in the table below:

Table 5.3: Summary of Potentially Affected Receptors
Potentially Affected Receptors
Construction Workers
Neighbouring Site Users
Passers-by
Future Residents/ Visitors
Maintenance Contractors
Employees
Residents in the surrounding area
Persons who may come into contact with water in the vicinity of the site
Vegetation from phytotoxic contaminants
Building Materials from aggressive ground conditions
The underlying principal aquifer
Nearby surface waters and the aquatic life within

5.3 Evaluation of Analytical Results

5.3.1 Soils

A summary of the Inorganic (Metals) soil chemical test results are shown in the table below.

Table 5.4: Soil Chemical Test Results – Inorganics (Metals)

Substance	Land Use / Guideline Values (mg/kg)	Measured Levels of Substances (mg/kg)		Number of exceedances	95% UCL
	R wo HP	Min	Max		
Arsenic	40	3.3	32	0	-
Cadmium	150	0.16	3.8	0	-
Chromium	910	5.2	30	0	-
Chromium III	910	5.2	30	0	-
Chromium VI	21	<0.5	<0.5	0	-
Copper	7100	3.2	73	0	-
Lead	310	27	700	3	287.8
Mercury (Total)	56	<0.05	0.56	0	-
Nickel	180	2.7	27	0	-
Selenium	430	<0.25	1.3	0	-
Zinc	40000	48	340	0	-

Notes

- C4SL - Provisional Category 4 Screening Levels
- S4UL - Suitable for Use Levels
- R_{wo}HP (Residential without Home-grown Produce),
- A total of 14 representative soil samples were tested for these substances

A summary of the Inorganic (General) soil chemical test results are shown in the table below.

Table 5.5: Soil Chemical Test Results – Inorganics (General)

Substance	Land Use / Guideline Values (mg/kg)	Measured Levels of Substances (mg/kg)		Number of exceedances	95% UCL
	R wo HP	Min	Max		
pH (pH Units)	Considered in BRE SD1, BS3882, BS8601 and/or UKWIR	7.4	10.5	0	-
Cyanide (Total)	8	<0.5	<0.5	0	-
Organic Matter	Considered in Organic Contaminant Guideline Value Assessment, BS3882 and/or BS8601	0.4	21	0	-
Sulphate (Total) (%)	Considered in BRE SD1	0.053	0.15	0	-

Notes

- SGV - Soil Guideline Value
- BRE SD1: 2005 - Concrete in Aggressive Ground
- BS 3882: 2015 - Specification for Topsoil
- BS 8601: 2013 - Specification for Subsoil and requirements for use
- UKWIR – Guidance for the Selection of Water Supply Pipe to be used in Brownfield Sites: 2010
- R_{wo}HP (Residential without Home-grown Produce),
- A total of 14 representative soil samples were tested for these substances

A summary of the Organic (General) soil chemical test results are shown in the table below.

Table 5.6: Soil Chemical Test Results – Organics (General)

Substance	SOM	Land Use / Guideline Values (mg/kg)	Measured Levels of Substances (mg/kg)		Number of exceedances	95% UCL
		R wo HP	Min	Max		
Total Phenol	1	440	<0.1	<0.1	0	-
	2.5	690			0	
	6	1200			0	
Total PAH*		-	<2	41	-	-
Total EPH (C ₁₀ -C ₄₀)**	1	130+	<10	280	0	-
	2.5	330+			0	
	6	770+			0	

Notes

- S4UL - Suitable for Use Levels
- R_{wo}HP (Residential without Home-grown Produce),
- SOM - Soil Organic Matter
- * Total PAH - Poly-Aromatic Hydrocarbons, EPA 16 (See Speciated PAH Results Table)
- ** Total EPH – Extractable Petroleum Hydrocarbons, Ali/Aro
- + Based on worse-case Aliphatic C₁₀-C₁₂ fraction
- - No comparable Guideline Value
- A total of 14 representative soil samples were tested for these substances

In order to accurately assess the risk from Total PAH, speciation was undertaken, which splits the total PAH concentration into its sixteen components.

A summary of the Organic (Speciated PAH) soil chemical test results are shown in the table below.

Table 5.7: Soil Chemical Test Results – Organics (Speciated PAH)

Substance	SOM	Land Use / Guideline Values (mg/kg)	Measured Levels of Substances (mg/kg)		Number of exceedances	95% UCL
		R wo HP	Min	Max		
Naphthalene	1	2.3	0.1	1	0	-
	2.5	5.6			0	
	6	13			0	
Acenaphthylene	1	2900	0.1	2.3	0	-
	2.5	4600			0	
	6	6000			0	
Acenaphthene	1	3000	0.1	0.79	0	-
	2.5	4700			0	
	6	6000			0	
Fluorene	1	2800	0.1	0.75	0	-
	2.5	3800			0	
	6	4500			0	
Phenanthrene	1	1300	0.1	5.6	0	-
	2.5	1500			0	
	6	1500			0	
Anthracene	1	31000	0.1	1.4	0	-

	2.5	35000			0	
	6	37000			0	
Fluoranthene	1	1500	0.1	6	0	-
	2.5	1600			0	
	6	1600			0	
Pyrene	1	3700	0.1	5.9	0	-
	2.5	3800			0	
	6	3800			0	
Benzo(a)anthracene	1	11	0.1	2.8	0	-
	2.5	14			0	
	6	15			0	
Chrysene	1	30	0.1	3.7	0	-
	2.5	31			0	
	6	32			0	
Benzo(b)fluoranthene	1	3.9	0.1	3.6	0	-
	2.5	4			0	
	6	4			0	
Benzo(k)fluoranthene	1	110	0.1	1.6	0	-
	2.5	110			0	
	6	110			0	
Benzo(a)pyrene		5.3	0.1	3	0	-
Indeno(1,2,3-cd)pyrene	1	45	0.1	2.8	0	-
	2.5	46			0	
	6	46			0	
Dibenzo(a,h)anthracene	1	0.31	0.1	1.1	0	0.4
	2.5	0.32			0	
	6	0.32			4	
Benzo(g,h,i)perylene	1	360	0.1	1.8	0	-
	2.5	360			0	
	6	360			0	

Notes

- C4SL - Provisional Category 4 Screening Levels
- S4UL - Suitable for Use Levels
- R_{wo}HP (Residential without Home-grown Produce),
- SOM - Soil Organic Matter
- A total of 14 representative soil samples were tested for these substances

A summary of the Miscellaneous (Asbestos) soil chemical test results are shown in the table below.

Table 5.8: Soil Chemical Test Results – Miscellaneous (Asbestos)			
Sample No. & Depth (m)		ID Result	Comments
Core 1	0.25	No Asbestos Detected	-
Core 3	0.26	No Asbestos Detected	-
Core 4	0.28	No Asbestos Detected	-
IP03	0.30	No Asbestos Detected	-
IP03	0.50	No Asbestos Detected	-

5.4 Contaminants of Concern in Soils

5.4.1 Soils

Contaminants of concern are those where the measured concentrations and 95% Upper Confidence Limit exceeds the relevant Tier 1 CLEA Soil Guideline Value or CIEH Generic Assessment Criteria.

It can be seen from Tables 5.4 to 5.8 that the following contaminants were identified at concentrations above the SGV for their respective zone screening criteria.

Table 5.9: Contamination Exceedances					
Contaminant	Sample Details			Concentration detected (mg/kg)	Above 95% UCL
	Location	Depth (m)	Guideline Value		
Lead	TP01	0.40	310	700	✓
	Core 6	0.23		340	
	Core 1	0.25		320	
Dibenzo(a,h)anthracene	TP04	0.50	0.32	1.1	✓
	Core 3	0.25		0.64	
	IP01	0.35		0.47	
	IP03	0.50		0.40	

When calculated the 95% upper confidence level for Lead and Dibenzo(a,h)anthracene exceeded the soil guidance values, therefore identifying that the site should be considered as contaminated with appropriate mitigation measures adopted.

SECTION 6 Qualitative Risk Assessment/Mitigation Measures

The following is a representation of environmental processes on the site and its immediate vicinity. Its purpose is to identify potential contaminants, pathways and receptors with a view to identifying potential and significant pollution linkages.

6.1 Site Summary

Historically, the site has typically comprised of an open field. During 1901, the site was occupied by a rectangular building along the north west boundary of site. During the mid to late 1920s, this building was extended eastwards with an additional small shed/ outbuilding located within the south eastern corner of site. During the late 1970/early 1980s, these buildings were demolished with the construction of the purpose-built care home which has remained unchanged to this current present day.

Historically, from the earliest map edition (1886), the surrounding area (<250m) has typically comprised of the main town 'Mere' situated to the north of site with residential buildings and town amenities. To the west and south approx. 100m/150m is a cemetery and graveyard. The area south of site largely comprises of fields/ arable farmland. In the 1940s through to 1950s, some residential expansion of the town Mere has occurred with associated infrastructure such as an electrical substation situated northwest of site approximately 20m.

A summary of the ground conditions encountered during the Ground Investigation is given in the table below:

Table 6.1 Summary of Ground Conditions				
Stratum		Depth From (m)	Depth to (m)	Description
Made Ground		0.00	0.20 / 1.00	- Concrete and subbase (<i>internal cores only</i>) - Dark brown slightly gravelly slightly sandy silty CLAY - Grey slightly sandy clayey GRAVEL with low cobble content
Residual Soils	Cohesive	0.20 / 1.00	0.90 / 1.50	- Firm dark grey / grey mottled yellow brown slightly sandy to sandy slightly gravelly to gravelly CLAY
	Granular	0.90 / 1.50	>2.10	- Medium dense light grey clayey GRAVEL with low to medium cobble content.

The Aquifer Designation Map for the area shows the underlying Bedrock Geology beneath the site to comprise a Principal Aquifer. Principal Aquifers consist of layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Surface and perched groundwater flows from the site are likely to be in a South/ South – west direction following the natural topography of the wider area. These waters will probably be collected by the nearest water feature (inland river), located approximately 165 m to the SW of the site.

6.2 Potential Contaminants

6.2.1 Soils

When calculated the 95% upper confidence level for Lead and Dibenzo(a,h)anthracene exceeded the soil guidance values, therefore identifying that the site should be considered as contaminated with appropriate mitigation measures adopted.

6.3 Potential Receptors

The potential receptors at the site potentially affected during construction of the development are summarised in the table below:

Table 6.2: Summary of Potentially Affected Receptors (During Construction)
Potentially Affected Receptors
Construction Workers
Neighbouring Site Users, Passers-by and Residents in the surrounding area
The underlying principal aquifer
Nearby surface waters and the aquatic life within

The potential receptors at the site potentially affected following construction of the development are summarised in the table below:

Table 6.3: Summary of Potentially Affected Receptors (Following Construction)
Potentially Affected Receptors
Future Residents/ Visitors
Maintenance Contractors
Employees
Vegetation from phytotoxic contaminants
Building Materials from aggressive ground conditions
The underlying principal aquifer
Nearby surface waters and the aquatic life within

6.4 Potential Pathways

The site is planned to be occupied by a two-storey building comprising of 1 and 2 bed flats with communal areas for people aged 60 and above, and all associated infrastructure.

How the proposed development finish affects the various possible contamination pathways is considered below, and summarised in Table 6.1.

Potential risks are present during and following construction of the development to potential receptors from ingestion, inhalation, dermal contact, surface water run-off, leaching and groundwater transport. By adhering to the following protection measures any risks can be considered very low.

Ingestion of soil/soil dust, dermal contact and ingestion of site grown vegetables

Any combustible materials found during excavations should be removed and replaced with suitable materials. The combustible materials should be suitably disposed of.

If materials are imported, which are not a natural quarry product with British Standard Certification, or are not sourced from a builder's merchant, DIY store or retail outlet in bagged bulk form, analytical validation testing will be required, to ensure that imported materials is suitable and will not cause pollution to the site, and pose a risk to human health.

Any materials to be removed from site should be subject to the Waste Acceptance Procedure (WAP) in order to appropriately classify the waste for the correct type of landfill.

All service runs should be backfilled with inert materials to ensure that future maintenance workers / contractual workers do not come into contact with contaminated soils.

If during the development materials or abnormal ground conditions are encountered that are significantly different to those encountered in the investigation, the occurrence should be reported to the Engineer and appropriate action taken prior to continuing with the works.

The appointed contractor(s) should as a minimum;

1. Comply with all current Health and Safety regulations
2. Provide Method Statements and Risk Assessments in place to deal with measures set out in this section
3. Comply with Control of Substances Hazardous to Health (COSHH) Assessment
4. Maintain a good level of Personal Protection Equipment (PPE)
5. Maintain a good level of hygiene by site workers
6. Put in place dust suppression measures when necessary

The contractor(s) must also strictly adhere to the relevant Pollution Prevention Guidelines which aim to minimise detrimental harm to the environment and health.

Within the documentation prepared by the contractor(s), the following information should be provided, but not limited to:

1. Project Description
2. Key participants/contractor(s)
3. Technical procedures
4. Phasing of works and approximate timescales
5. Site plans to scale
6. Details of consents or license needed
7. Health and Safety, COSHH Assessment, Method Statements and Risk Assessments
8. Emergency contingencies

In addition, the following precautions should also be taken.

1. All potential chemicals and associated risks and emergency procedures for spills/leaks should be considered in a site risk assessment and the details provided to all site employees
2. Any potential pollutant materials or chemicals/detergents used on site should be adequately stored in suitable containers, with clear labelling.
3. Any oil or hazardous substance containers and associated pipe works should be enclosed within a bund.
4. Care taken during delivery of materials, with correct supervision and labelling detailing the substance and its quantities.
5. All delivery drivers should be informed of procedures and restrictions
6. Any materials on delivery should be covered to ensure no spillage from the vehicle.
7. Any detergents, paints, chemicals etc. should not be allowed to be discharged into surface drains or water courses
8. Washing out and cleaning of concrete/cement plant should be carried out in a contained area with adequate measures to collect all run-off water.
9. Security and prevention of vandalism, especially of oil drums/containers.

It is considered that the site will be sufficiently fenced off during development and that dust suppression measures will be made if required, meaning there will be no risk to neighbouring site occupants and passers-by.

The results of the chemical testing have revealed elevations of Lead and Dibenzo(a,h)anthracene above the relevant soil guidance values identified for the site. Therefore, remediation will be required across the site to render the site fit for use.

Given the nature of the development and levels of contaminants encountered a cover system will likely be the most appropriate form of remediation. The cover system should comprise capping of the site with the building footprint, areas of hard standing and 600mm of inert suitable materials within proposed soft-landscaped areas. Alternatively, the made ground material can be removed to an appropriate landfill facility.

It should be noted that the soils beneath areas of the existing development were not tested and it is possible that these may be impacted by contamination. However, the whole site is proposed to be capped (hardstanding areas, building footprint and 600mm clean imported material in soft land scaped areas) and as such any potential pollutants will not come into contact with future site users. Similarly, construction workers are unlikely to be impacted by any of these potential pollutants if the control measures detailed above are adopted. However, it would be prudent that a watching brief is maintained during construction works and if any significant evidence of contamination is encountered then guidance should be sought by a suitably qualified consultant to assess the risk.

Inhalation of soil dust /ground gas/radon

Protection of site workers from soil dust inhalation can be minimised by simple health and safety measures and dust suppression. Neighbouring site occupants and passers-by will similarly not be at risk with dust suppression.

It is considered that site workers, passers-by and neighbouring site occupants are not at risk from ground gas or vapours.

All risks to site users from dust inhalation will be eliminated by appropriate dust suppression measures.

Site end users, upon completion, will similarly not be at risk from soil dust/vapours once the above-mentioned remedial measures have been carried out.

There is also a low risk to the site end users from ground/landfill gas and a low risk from radon gas where no radon protection measures are likely to be required.

Surface water run-off/leaching into the groundwater/groundwater transport

1. Short-term

In respect of physical effects of the site works during the construction period, there is a very low risk to the environment/adjacent land and water bodies from digging foundations, moving contaminated soil, runoff from construction materials and/or exposed ground, wheel washings and oil or chemical spills.

All adverse effects should however be preventable by due diligence to good construction practice and housekeeping in preventing surface runoff and the spillage of materials. The basic measures that should be taken are as follows:

- Prepare a drainage plan
- Carry out any activities that could cause pollution in a designated, bunded area, away from rivers or boreholes
- Use settlement ponds to remove silty water;
- Store all oils and chemicals in a fully bunded area to prevent leaks or spills

It should be noted that the appointed contractor should provide Method Statements and Risk Assessments to deal with these matters.

2. Long-term

The chemical analysis of soil beneath the site constitutes a Level 2 assessment in terms of Remedial Targets Methodology, where the primary receptor/compliance point is the groundwater.

No leachate or groundwater chemical testing has been undertaken; however it is considered that the risk to the aquatic environment is low due to environmental setting as detailed below:

1. Contaminant concentrations within the site's near surface soils were low and leachates derived from these soils are likely to contain even lower contaminant concentrations. Therefore, if leachates did migrate to a controlled water the effect is likely to be negligible.
2. There are no groundwater abstraction licenses within the area.
3. Distance to the nearest surface water body (inland river 165m SW).
4. The effect of natural attenuation, dilution and absorption will reduce contaminant concentrations with groundwater.

It is therefore considered that there is likely to be a low risk to the aquatic environment and that the next level of assessment (Level 3) is not required, given the environmental setting detailed above.

Permeation of Water Pipes

If water pipes are to be laid beneath the site an assessment should be made, by the water provider, of soils along the route of the pipe with reference to the material selection criteria using the UKWIR methodology.

6.5 Human Health Risks

A Qualitative Risk Assessment on the potential human health effects is detailed in Table 6.4 below:

Table 6.4: Human Health Risk Assessment				
Source	Pathway	Target	Risk Assessment	Mitigation Measures
Made Ground	Dermal contact with soil/dust. Inhalation and ingestion of soil/soil dust	Construction workers	Low Risk with protection measures	COSHH assessment and good level of PPE/ hygiene by site workers/ staff; dust suppression measures if required and Watching Brief
Made Ground	Dermal contact with soil/dust. Inhalation and ingestion of soil/soil dust	Neighbouring site occupants, Passers-by	Low Risk during excavation phase of development and on completion	Site screening and dust suppression measures if required
Made Ground	Dermal contact with soil/dust. Inhalation and ingestion of soil/soil dust	Site end users	Low Risk with remediation	Capping of the site with the building footprint, areas of hardstanding and 600mm of clean inert material in soft landscaped areas is required

Landfill and Ground Gas	Inhalation	Site end users	Low Risk	No historic or active landfills within 250m of the site.
Radon Gas	Inhalation	Site end users	Low Risk	No Radon protective measures are required.
Made Ground	Permeation of water pipes	Site end users	Low Risk	All chemical lab results to be forwarded to the water provider to assess pipe specification. Made Ground within service trenches should be removed and replaced with clean fill.

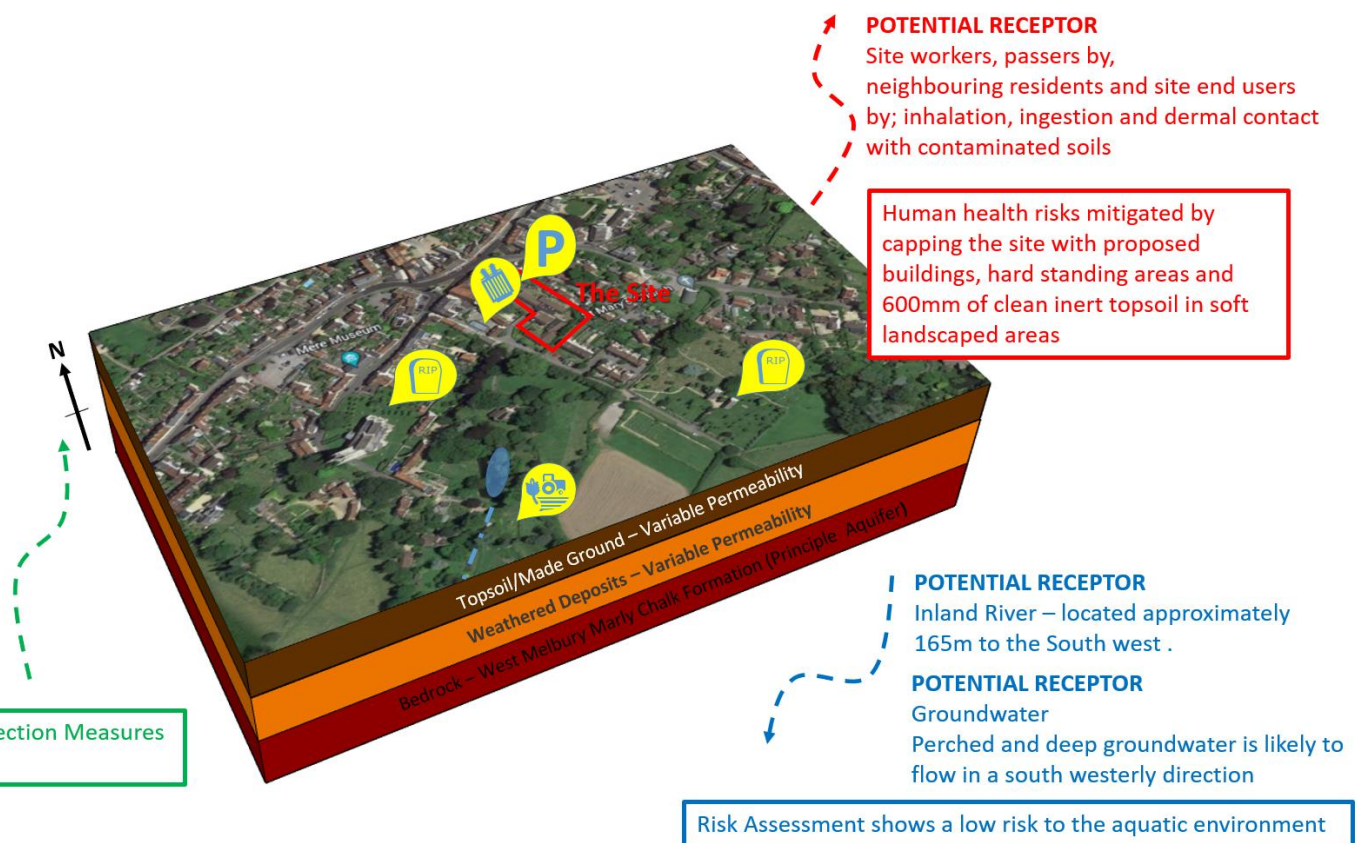
6.6 Risks to the Aquatic Environment

A Qualitative Risk Assessment on the potential effects to the aquatic environment is detailed in Table 6.5 below:

Table 6.5: Risks to the Aquatic Environment				
Source	Pathway	Target	Risk Assessment	Mitigation Measures
Made Ground	Surface water run-off	Surface Water	Low Risk due to the environmental setting and low concentrations identified.	Not Applicable
	Leaching into Groundwater	Groundwater	Reduced risk of contaminant migration and deep transmission is due to the installation of drainage systems and the effect of natural dilution and attenuation.	
Made Ground	Leaching into Groundwater	Groundwater	Low Risk during construction and excavation phase of development	Measures to avoid accidental spillage of materials during earthmoving activities, and to control surface run off

6.7 Site Conceptual Model

A schematic cross-section of the site is presented below. The cross section is based on the information available from the recent desk study and site investigation. The model is schematic and not to scale.



Drawing 6.1: Revised Site Conceptual Model

6.8 Limitations of the Site Conceptual Model

The areas of uncertainty within the conceptual site model are:

- Presence of and composition of the groundwater within the bedrock
- Direction of groundwater flow

SECTION 7 Geotechnical Laboratory Testing Results

7.1 General

A number of bulk samples were collected, and dispatched to the UKAS accredited laboratories of Geolabs for soil property testing, in accordance with the following:

1. Methods of test for soils for civil engineering purposes – Parts 1 to 8 (BS 1377): 1999.

The results of the below property tests are presented in **Annex D** and discussed below.

7.1.1 Classification Testing

In order to assess the classification characteristics underlying the site, bulk samples were collected, and dispatched to the laboratory for the following soil property tests:

- 8No. Moisture Content (MC)
- 6No. Plasticity Index (P.I)
- 2No. Particle Size Distribution (PSD)

In addition, in order to assess the aggressiveness of the underlying the site, bulk samples were collected and dispatched to the laboratory for the following soil chemical tests:

- 8No. BRE SD1 Suite B

A summary of the soil classification test results are shown in the table below.

Table 7.1: Summary of Soil Classification Test Results										
Test		Location	TP01	TP01	TP01	TP02	TP02	TP03	TP03	TP04
		Depth (m)	0.40-0.50	0.80	1.40	1.10	1.60	0.40 – 0.60	0.80	1.00
		Unit	MG	RS	RS	RS	RS	RS	RS	RS
Moisture Content		%	21.3	35.7	16.3	34.1	19.5	22.6	21.0	31.8
Plasticity	Liquid Limit	%	49	64	-	50	-	47	53	59
	Plastic Limit	%	32	31	-	27	-	22	26	23
	Plasticity Index	%	17	33	-	23	-	25	27	36
	% <425µm	%	59	98	-	67	-	82	56	93
	Modified PI	%	10.03	32.34	-	15.41	-	20.5	15.12	33.48
PSD	Cobbles	%	-	-	23.9	-	36.4	-	-	-
	Gravels	%	-	-	39.2	-	56.7	-	-	-
	Sands	%	-	-	6.0	-	1.5	-	-	-
	Silt & Clay	%	-	-	30.9	-	5.4	-	-	-
BRE	Total Sulphate	%	0.052	0.041	0.020	0.022	0.024	0.034	0.031	0.020
	2:1 Sulphate	g/l	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
	pH	-	8.5	8.7	9.1	8.6	9.1	8.5	9.3	8.8
	Total Sulphur	%	0.16	0.052	0.042	0.043	0.033	0.052	0.043	0.026

Notes

- Unit: MG (Made Ground), RS (Residual Soils).

SECTION 8 Preliminary Engineering Recommendations

Due to access restrictions at the time of the ground investigation we were not able to access the southern parts of the site. As the geological map indicates that ground conditions may change close to the southern boundary the below recommendations should be considered preliminary until further investigation has been completed in this area in order to de-risk the site.

These works can be undertaken now using a small drilling rig or post-demolition using an excavator on site.

8.1 Preparation of Site

Prior to the main site works, any buildings to be demolished should be subject to a full asbestos survey.

A structural survey should be undertaken of the adjacent buildings and structures (road and pavement structures) including pictorial records. This should be updated throughout the site development phases.

Any existing buildings, foundations, floor slabs, concrete/tarmac hard standings beneath the proposed buildings should be broken up and removed from site and disposed of at a suitable landfill facility.

Alternatively, the crushed site won materials may be re-used as structural fill, subject to laboratory chemical testing and compliance with site soil guidance values.

Significant allowances should be made for dealing with the historic foundations, floor slabs, basement structures and other buried obstructions.

The existing grass and scrub vegetation, including all roots and any trees to be removed (and not subject to preservation orders) should be grubbed up and removed from beneath the proposed buildings and roadways.

The reduced levels should be brought up to the required levels with well, compacted imported granular materials. Department of Transport (DoT) Type 2 sub-base or similar may be used and should be compacted in layers, in accordance with the Specification for Highway Works. Alternatively, appropriately selected inert imported fill could be used.

Allowances should be made for removing any 'soft spots/area' and their replacement with well compacted granular materials as previously described. The excavated materials will be unacceptable as structural fill and should be removed from site and taken to an appropriately licensed tip.

All materials to be removed from site should be subject to the appropriate Waste Acceptance Protocol (WAP) and taken to an appropriately licensed tip.

Contingencies should be made for the protection/diversion of any underground services present beneath the site, brought about as a result of the proposed works.

Contingencies should also be made for the protection and any necessary temporary/permanent support of nearby walls.

8.2 Foundation Solution

The ground conditions from the site investigation can be summarised as follows:

Table 8.1 Summary of Ground Conditions

Stratum		From (m)	To (m)	Description
Made Ground		0.00	0.20 / 1.00	- Concrete and subbase (<i>Internal cores only</i>) - Dark brown slightly gravelly slightly sandy silty CLAY - Grey slightly sandy clayey GRAVEL with rare cobbles
Residual Soils	Cohesive	0.20 / 1.00	0.90 / 1.50	- Firm dark grey / grey mottled yellow brown slightly sandy to sandy slightly gravelly to gravelly CLAY
	Granular	0.90 / 1.50	>2.10	- Medium dense light grey clayey GRAVEL with low to medium cobble content

During the Ground Investigation no perched or deep groundwater was encountered.

Based on the encountered ground conditions the following foundation solution is recommended.

Traditional Strip/Trench Fill

The Made Ground and upper/softer cohesive deposits are variable in respect to their thickness and geotechnical properties and if foundations were extended to these strata in their current state it would lead to unacceptable levels of differential settlement.

Therefore, in order to avoid unacceptable levels of differential settlement we recommend that mass concrete strip/trench foundations be extended into the underlying granular Residual Soils comprising medium dense light grey clayey GRAVEL with low to medium cobble content.

For the above foundation solution and in-situ materials it is recommended that a presumed bearing resistance of 100kN/m² is used for design purposes.

For the above given foundation solutions and bearing pressures, maximum total settlements of 25mm should result, with differential movements (δ/l) of the superstructure not exceeding 1:750 where δ is the differential settlement between two points of a foundation and l is the distance between these points.

All foundation formations should be inspected by a suitably qualified Engineer before being concreted.

8.2.1 Foundation Depth

The foundation depth will be determined by the worst case of the depth of foundation stratum, the plasticity of the soil, the effect of nearby trees. The table below summarises these depths:

Table 8.2 Foundation Depths

	Worse case	Founding Depth (m)
Foundation Stratum	Granular Residual Soils	0.90 – 1.50
Plasticity of Soil	Moderate	0.90
Tree Effect	TBC	TBC*
Minimum Founding Depth Required		0.90 – 1.50

Notes:

- * - Effect from surrounding trees on foundations can be re-assessed on receipt of arboricultural report.

Based on the above, foundations should be a minimum of 0.90m across the site, locally deepening to 1.50m to extend to the granular Residual Soils.

It is also recommended that the foundations achieve a minimum penetration of 200mm into the foundation bearing stratum.

Void former may be required along the inside faces of foundations and underground beams due to the plastic nature of the surface cohesive soils.

8.2.2 Floor Slabs

Based on Plasticity testing outlined in Section 7.1.1, the underlying shallow deposits exhibit a Modified Plasticity Index of >10%. Therefore, in accordance with NHBC guidelines, floor slabs should be designed as suspended.

Void former may be required beneath suspended concrete floors due to the plastic nature of the surface cohesive soils.

Allowances should be made for the removal of any 'soft spots' and their replacement with a suitable concrete mix or well-compacted granular material in layers to the specification for Highway Works.

8.3 Excavations and Formations

Most shallow excavations should be possible with normal soil excavating machinery, although significant allowances should be made for a hydraulic breaker when excavating out any historic foundations, concrete floor slabs and other buried obstructions.

No Ground water was encountered on site; therefore, it is unlikely that groundwater may be encountered during foundation excavations. Any inflows should be dealt with using conventional pumping techniques.

It should also be noted that during times of high rainfall a higher groundwater table may be encountered.

The sides of any excavations deeper than 1.00m, especially within the granular deposits, should be supported by planking and strutting or other proprietary means.

The sub-formations/formations will be susceptible to loosening, softening and deterioration by exposure to weather (rain, frost and drying conditions), the action of water (flood water or removal of groundwater) and site traffic.

Formations should never be left unprotected and continuously exposed to rain causing degradation, or left exposed/uncovered overnight, unless permitted by a qualified engineer.

Construction plant and other vehicular traffic should not be operated on unprotected formations. As a minimum the formation/excavation surfaces must be protected by a minimum thickness of 200mm of hard cover immediately after exposure.

Allowances should be made for trimming, re-trimming and re-compaction if necessary and for the removal of soft spots and their replacement with well compacted granular materials.

It is also recommended that if concerns still remain then a number of plate loading tests are carried out at formation level to confirm the suitability of the formations.

Allowances should be made for special precautions to prevent formation deterioration in addition to the above.

It is recommended that approval be gained from a qualified engineer of the formation condition before covering them with any subsequent construction.

8.4 New Access Road and Car Parking Areas

The in-situ CBR tests (4No) were carried out using a TRL DCP Probe within the area of the proposed roads and parking areas. The tests were typically undertaken at the base of the topsoil material.

A summary of the CBR test results is given below:

Table 8.3: Equilibrium CBR Test Results				
Location	Depth (mbgl)	TRL DCP Result (%)	Modified Plasticity Index	Equilibrium CBR value %*
TP01	0.80	8	32	4
TP02	0.70	38	15	5
TP03	0.54	5	15	5
TP04	0.79	11	33	6

Notes:

- * Taken from guidance issued by the Highways Interim Advice Note 73/06 (IAN) and PI Test results

Based on the data available it is recommended a CBR value of 4% is adopted for the natural cohesive soils at the site. Any new roads constructed upon on the existing Made Ground at the site should use a conservative CBR value of 1%.

Allowances should be made for the removal of any soft spots and their replacement with well-compacted imported granular materials as previously described.

8.5 Storm Drainage

3No. in-situ permeability/soakaway test were undertaken at TP01, TP02 and TP03 locations in accordance with the requirements of BRE 365.

The tests did not sufficiently drain to 75% to give an infiltration rate. Therefore, it is unlikely soakaways will be viable at the site.

8.6 Protection of Buried Concrete

The results of the BRE testing are given in Table 7.1 and the concrete design is class is summarised in the table below:

Table 8.4: Summary of Concrete Design Class					
	Stratum	Made Ground		Residual Soils	
	Unit	Min	Max	Min	Max
Total Sulphate	%	0.052	0.052	0.020	0.041
2:1 Sulphate	g/l	<0.010	<0.010	<0.010	<0.010
pH	-	8.5	8.5	8.5	9.3
Total Sulphur	%	0.16	0.16	0.026	0.052
Oxidisable Sulphates >0.3%?		N/A		No	
Design Sulphate Class		DS-1		DS-1	
ACEC Class		AC-1s		AC-1s	

No groundwater was encountered at the site and is therefore considered to be static.

Based on the above and using guidance within BRE Special Digest 1 (2005) it is recommended that any buried concrete within the site conforms to Design Class DS-1 and ACEC Class AC-1s.

SECTION 9 Recommended Further Works

Due to access restrictions at the time of the ground investigation we were not able to access the southern parts of the site. As the geological map indicates that ground conditions may change close to the southern boundary the below recommendations should be considered preliminary until further investigation has been completed in this area in order to de-risk the site.

These works can be undertaken now using a small drilling rig or post-demolition using an excavator on site.

Annex A: Exploratory Hole Logs

Remarks	Borehole Diameter	
	Base Depth	Diameter
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.		

 Consulting Geo-Technical & Geo-Environmental Engineers Site Investigation Contractors The Slate Barn, Lower Lowley, Dunsford, Exeter, EX6 7BP 01647 252414 www.terrafirmasouth.co.uk				Borehole No. C02 Sheet 1 of 1					
Project Name Fives Court, Mere			Project No. PO-22-039	Date 15/09/2022 to 15/09/2022		Hole Type WLS			
Client Wiltshire Council			Co-ords E: 381306.00 N: 132297.00 L:	Water Strike Details Depth StrikeTime ElapsedRose To			Logged By		
Contractor Portsmouth Diamond Drilling		Plant Used					Approved By		
						Scale 1:50			
Samples and Results			Depth, (Thickness)	Level	Stratum Description			Legend	Well
Results	Type	Depth							
			(0.23) 0.23 (0.02) 0.25		MADE GROUND: Concrete. Layer one 70mm. Layer two - 160mm. 0 MADE GROUND: subbase - greyish brown slightly sandy clayey GRAVEL. Gravel is subangular fine to coarse of limestone. 0 End of Borehole at 0.25m				
			1						
			2						
			3						
			4						
			5						
			6						
Remarks						Borehole Diameter			
						Base Depth		Diameter	
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.									

 Consulting Geo-Technical & Geo-Environmental Engineers Site Investigation Contractors					The Slate Barn, Lower Lowley, Dunsford, Exeter, EX6 7BP 01647 252414 www.terrafirmasouth.co.uk					Borehole No. C05 Sheet 1 of 1	
Project Name Fives Court, Mere				Project No. PO-22-039		Date 15/09/2022 to 15/09/2022			Hole Type WLS		
Client Wiltshire Council				Co-ords E: 381290.00 N: 132264.00 L:		Water Strike Details Depth StrikeTime ElapsedRose To			Logged By		
Contractor Portsmouth Diamond Drilling			Plant Used					Approved By			
								Scale 1:50			
Samples and Results			Depth, (Thickness)		Level		Stratum Description			LegendWell	
Results			Type		Depth						
			(0.24) 0.24 (0.02) 0.26				MADE GROUND: Concrete. Layer one 60mm unbound from layer below. Layer two - 180mm. MADE GROUND: subbase - greyish brown slightly sandy clayey GRAVEL. Gravel is subangular fine to coarse of limestone. End of Borehole at 0.26m				
			1								
			2								
			3								
			4								
			5								
			6								

Remarks		Borehole Diameter	
		Base Depth	Diameter

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

 Consulting Geo-Technical & Geo-Environmental Engineers Site Investigation Contractors				The Slate Barn, Lower Lowley, Dunsford, Exeter, EX6 7BP 01647 252414 www.terrafirmasouth.co.uk				Borehole No. C06 Sheet 1 of 1								
Project Name Fives Court, Mere				Project No. PO-22-039		Date 15/09/2022 to 15/09/2022		Hole Type WLS								
Client Wiltshire Council				Co-ords E: 381274.00 N: 132269.00 L:		Water Strike Details <table><tr><td>Depth Strike</td><td>Time Elapsed</td><td>Rose To</td></tr><tr><td></td><td></td><td></td></tr></table>			Depth Strike	Time Elapsed	Rose To				Logged By	
Depth Strike	Time Elapsed	Rose To														
Contractor Portsmouth Diamond Drilling			Plant Used					Approved By								
									Scale 1:50							
Samples and Results <table><tr><td>Results</td><td>Type</td><td>Depth</td></tr><tr><td></td><td></td><td></td></tr></table>			Results	Type	Depth				Depth, (Thickness)	Level	Stratum Description				Legend	Well
Results	Type	Depth														
			(0.23) 0.23 (0.02) 0.25		MADE GROUND: Concrete. Layer one 60mm unbound from layer below. Layer two - 180mm. MADE GROUND: subbase - greyish brown slightly sandy clayey GRAVEL. Gravel is subangular fine to coarse of limestone. End of Borehole at 0.25m											
			1													
			2													
			3													
			4													
			5													
			6													

Remarks	Borehole Diameter	
	Base Depth	Diameter

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

Project Name Fives Court, Mere		Project No. PO-22-039	Date 15/09/2022 to 15/09/2022		Hole Type TP
Client Wiltshire Council		Co-ords E: 381314.00 N: 132302.00 L:	Water Strike Details		Logged By AS
			Depth Strike	Remarks	
Contractor SW-Hire	Plant Used Tracked 5T excavator				Approved By PS
					Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Type	Depth				
	D B ES	0.30 0.40 - 0.50 0.40 - 0.50	(0.50) 0.50 (0.30)		MADE GROUND: Grass over dark brown slightly gravelly slightly sandy silty CLAY with occasional roots (max diameter 6cm). (Made Ground)	
	B	0.80	0.80 (0.20) 1.00	1	Dark grey slightly gravelly slightly sandy silty CLAY. Gravel is angular to subrounded fine to coarse of limestone/ mudstone.(Residual Soils)	
	B	1.40	(1.10) 2.10	2	Firm to stiff grey mottled orange brown slightly sandy CLAY with fine gravel sized organic inclusions. (Residual Soils)	
					Medium dense light grey clayey GRAVEL with low to medium cobble content. Gravel is subangular to subrounded fine to coarse of limestone. (Residual Soils)	
					End of Trial Pit at 2.10m	
				3		
				4		

Remarks

Trial pit refused on limestone at 2.10m

Pit Stability:	STABLE
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Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

2.00m

0.50m

Final Depth	2.10m
-------------	-------

Project Name Fives Court, Mere		Project No. PO-22-039	Date 15/09/2022 to 15/09/2022		Hole Type TP
Client Wiltshire Council		Co-ords E: 381298.00 N: 132318.00 L:	Water Strike Details		Logged By AS
			Depth Strike	Remarks	
Contractor SW-Hire	Plant Used Tracked 5T excavator				Approved By PS
				Scale 1:50	

[illegible]

Remarks

Trial pit refused on limestone at 1.80m

Pit Stability:	STABLE
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Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

2.00m

0.60m

Final Depth	1.80m
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Borehole No.

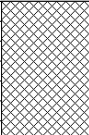
TP03

Sheet 1 of 1

Project Name Fives Court, Mere	Project No. PO-22-039	Date 15/09/2022 to 15/09/2022	Hole Type TP
Client Wiltshire Council	Co-ords E: 381281.00 N: 132275.00 L:	Water Strike Details Depth Strike Remarks	Logged By AS
Contractor SW-Hire	Plant Used Tracked 5T excavator		Approved By PS
			Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Type	Depth				
			(0.20) 0.20		MADE GROUND: Grass over dark brown slightly gravelly slightly sandy silty CLAY(Made Ground)	
	B ES	0.40 0.40 - 0.60	(0.70)		Firm grey and cream slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of limestone. (Residual Soils)	
	B	0.80	0.90 (0.30) 1.20	1	Medium dense light grey clayey GRAVEL with low to medium cobble content. Gravel is subangular to subrounded fine to coarse of limestone. (Residual Soils)	
					End of Trial Pit at 1.20m	
				2		
				3		
				4		

Remarks Trial pit refused on limestone at 1.20m	
Pit Stability: STABLE	
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.	

 Consulting Geo-Technical & Geo-Environmental Engineers Site Investigation Contractors				The Slate Barn, Lower Lowley, Dunsford, Exeter, EX6 7BP 01647 252414 www.terrafirmasouth.co.uk				Borehole No. TP04 Sheet 1 of 1	
Project Name Fives Court, Mere				Project No. PO-22-039		Date 15/09/2022 to 15/09/2022		Hole Type TP	
Client Wiltshire Council				Co-ords E: 381293.00 N: 132308.00 L:		Water Strike Details		Logged By AS	
Contractor SW-Hire				Plant Used Tracked 5T excavator		Depth Strike		Remarks	
								Approved By PS Scale 1:50	
Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend			
Results	Type	Depth							
	ES	0.50	(0.70)		MADE GROUND: Grass over dark brown slightly gravelly slightly sandy silty CLAY. Gravel is subangular to subrounded fine to coarse of brick, pottery and limestone. (Made Ground)				
	B	1.00	0.70 (0.30)	1	Firm light grey and light brown slightly sandy to sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of limestone. (Residual Soils)				
	End of Trial Pit at 1.00m								
Remarks									
Pit Stability: STABLE									
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.									

0.50m

1.00m

Final Depth 1.00m

Project Name Fives Court, Mere		Project No. PO-22-039	Date 15/09/2022 to 15/09/2022		Hole Type TP
Client Wiltshire Council		Co-ords E: 381314.00 N: 132302.00 L:	Water Strike Details		Logged By AS
			Depth Strike	Remarks	
Contractor SW-Hire	Plant Used Tracked 5T excavator				Approved By PS
					Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Type	Depth				
	D B ES	0.30 0.40 - 0.50 0.40 - 0.50	(0.50) 0.50 (0.30)		MADE GROUND: Grass over dark brown slightly gravelly slightly sandy silty CLAY with occasional roots (max diameter 6cm). (Made Ground)	
	B	0.80	0.80 (0.20) 1.00	1	Dark grey slightly gravelly slightly sandy silty CLAY. Gravel is angular to subrounded fine to coarse of limestone/ mudstone.(Residual Soils)	
	B	1.40	(1.10) 2.10	2	Firm to stiff grey mottled orange brown slightly sandy CLAY with fine gravel sized organic inclusions. (Residual Soils)	
					Medium dense light grey clayey GRAVEL with low to medium cobble content. Gravel is subangular to subrounded fine to coarse of limestone. (Residual Soils)	
					End of Trial Pit at 2.10m	
				3		
				4		

Remarks

Trial pit refused on limestone at 2.10m

Pit Stability:	STABLE
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Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

2.00m

0.50m

Final Depth	2.10m
-------------	-------

Project Name Fives Court, Mere		Project No. PO-22-039	Date 15/09/2022 to 15/09/2022		Hole Type TP
Client Wiltshire Council		Co-ords E: 381298.00 N: 132318.00 L:	Water Strike Details		Logged By AS
			Depth Strike	Remarks	
Contractor SW-Hire	Plant Used Tracked 5T excavator				
					Scale 1:50

[illegible]

Remarks

Trial pit refused on limestone at 1.80m

Pit Stability:	STABLE
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Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.

2.00m

0.60m

Final Depth	1.80m
-------------	-------



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Borehole No.

TP03

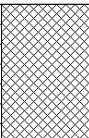
Sheet 1 of 1

Project Name Fives Court, Mere	Project No. PO-22-039	Date 15/09/2022 to 15/09/2022	Hole Type TP
Client Wiltshire Council	Co-ords E: 381281.00 N: 132275.00 L:	Water Strike Details Depth Strike Remarks	Logged By AS
Contractor SW-Hire	Plant Used Tracked 5T excavator		Approved By PS
			Scale 1:50

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Type	Depth				
			(0.20) 0.20		MADE GROUND: Grass over dark brown slightly gravelly slightly sandy silty CLAY(Made Ground)	
	B ES	0.40 0.40 - 0.60	(0.70)		Firm grey and cream slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of limestone. (Residual Soils)	
	B	0.80	0.90 (0.30) 1.20	1	Medium dense light grey clayey GRAVEL with low to medium cobble content. Gravel is subangular to subrounded fine to coarse of limestone. (Residual Soils)	
					End of Trial Pit at 1.20m	
				2		
				3		
				4		

Remarks Trial pit refused on limestone at 1.20m	0.50m 1.90m Final Depth 1.20m
Pit Stability: STABLE	
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.	

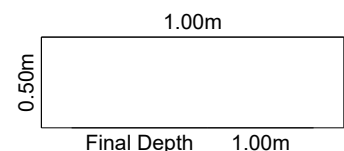
Project Name Fives Court, Mere		Project No. PO-22-039	Date 15/09/2022 to 15/09/2022		Hole Type TP
Client Wiltshire Council		Co-ords E: 381293.00 N: 132308.00 L:	Water Strike Details		Logged By AS
			Depth Strike	Remarks	
Contractor SW-Hire	Plant Used Tracked 5T excavator				Approved By PS
				Scale 1:50	

Samples and Results			Depth, (Thickness)	Level	Stratum Description	Legend
Results	Type	Depth				
	ES	0.50	(0.70)		MADE GROUND: Grass over dark brown slightly gravelly slightly sandy silty CLAY. Gravel is subangular to subrounded fine to coarse of brick, pottery and limestone. (Made Ground)	
	B	1.00	(0.30)		Firm light grey and light brown slightly sandy to sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of limestone. (Residual Soils)	
			1.00		End of Trial Pit at 1.00m	
			2			
			3			
			4			

Remarks

Pit Stability:	STABLE
-----------------------	--------

Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.



Annex B: In-situ Test Results

Site Name: Fives Court, Mere
Trial Pit No.: TP01

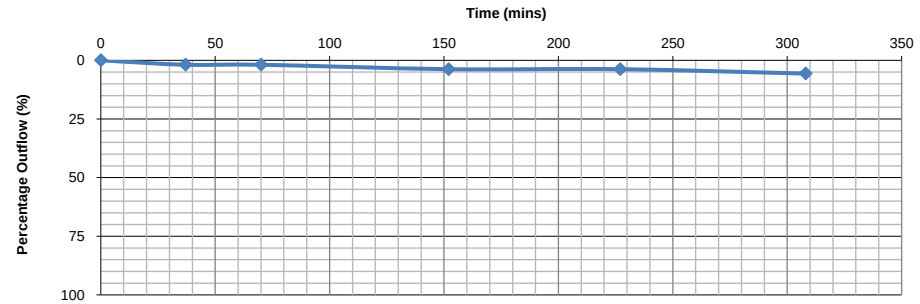
Job No.: PO-22-039
Engineer: AS

Date Undertaken: 15/09/2022

TEST NUMBER: T1
 VP25 (mBGL): 1.7025
 VP75 (mBGL): 1.9675
 VP25 (Mins): #DIV/0!
 VP27 (Mins): #DIV/0!

INFILTRATION RATE (m/s): #DIV/0!

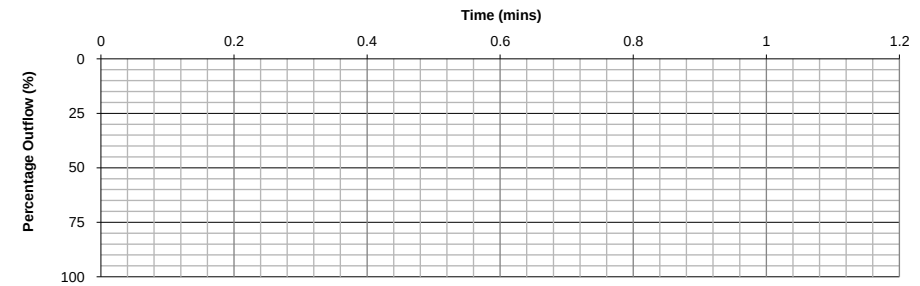
Drainage Field VP: #DIV/0!



TEST NUMBER: T2
 VP25: 0
 VP75: 0
 VP25 (Mins): #NUM!
 VP27 (Mins): #NUM!

INFILTRATION RATE (m/s): #NUM!

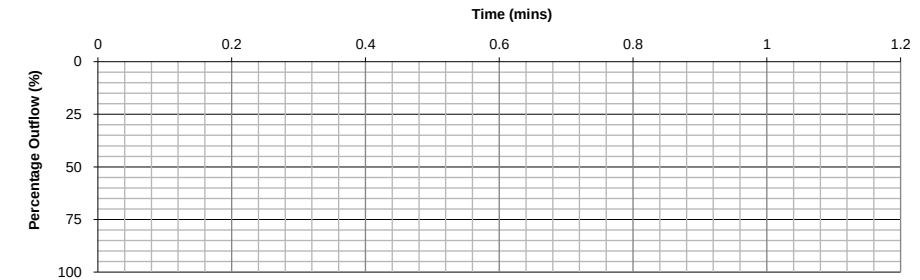
Drainage Field VP: #NUM!



TEST NUMBER: T3
 VP25: 0
 VP75: 0
 VP25 (Mins): #NUM!
 VP27 (Mins): #NUM!

INFILTRATION RATE (m/s): #NUM!

Drainage Field VP: #NUM!



REMARKS: Test carried out in accordance with BRE Digest 365 (2016)

Site Name: Fives Court, Mere
Trial Pit No.: TP02

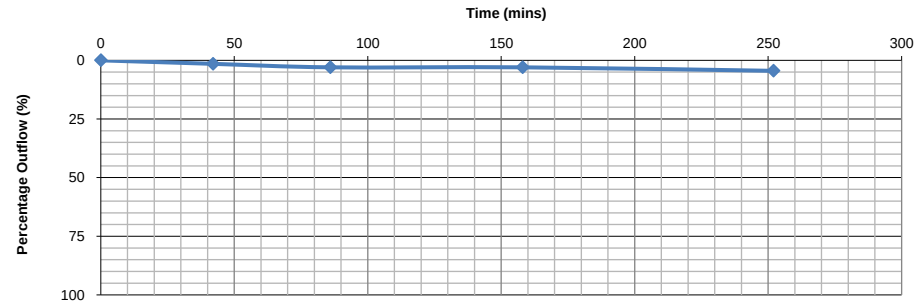
Job No.: PO-22-039
Engineer: AS

Date Undertaken: 15/09/2022

TEST NUMBER: T1
 VP25 (mBGL) : 1.2975
 VP75 (mBGL) 1.6325
 VP25 (Mins) #DIV/0!
 VP27 (Mins) #DIV/0!

INFILTRATION RATE (m/s): #DIV/0!

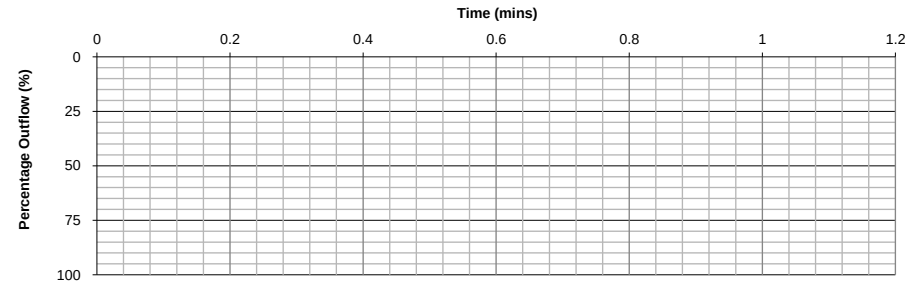
Drainage Field VP: #DIV/0!



TEST NUMBER: T2
 VP25: 0
 VP75: 0
 VP25 (Mins) #NUM!
 VP27 (Mins) #NUM!

INFILTRATION RATE (m/s): #NUM!

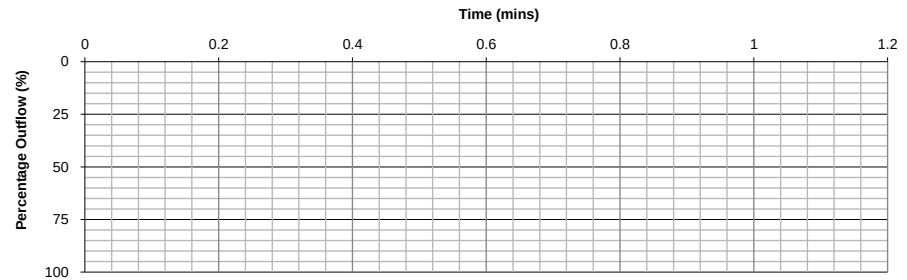
Drainage Field VP: #NUM!



TEST NUMBER: T3
 VP25: 0
 VP75: 0
 VP25 (Mins) #NUM!
 VP27 (Mins) #NUM!

INFILTRATION RATE (m/s): #NUM!

Drainage Field VP: #NUM!



REMARKS: Test carried out in accordance with BRE Digest 365 (2016)

Site Name: Fives court, Mere
Trial Pit No.: TP03

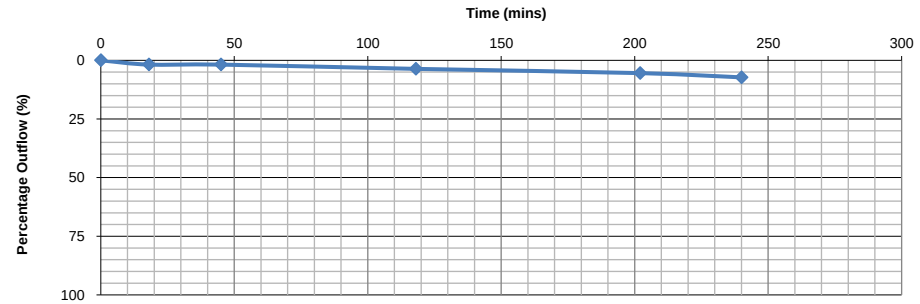
Job No.: PO-22-039
Engineer: AS

Date Undertaken: 15/09/2022

TEST NUMBER: T1
 VP25 (mBGL) : 0.9375
 VP75 (mBGL) 1.2125
 VP25 (Mins) #DIV/0!
 VP27 (Mins) #DIV/0!

INFILTRATION RATE (m/s): #DIV/0!

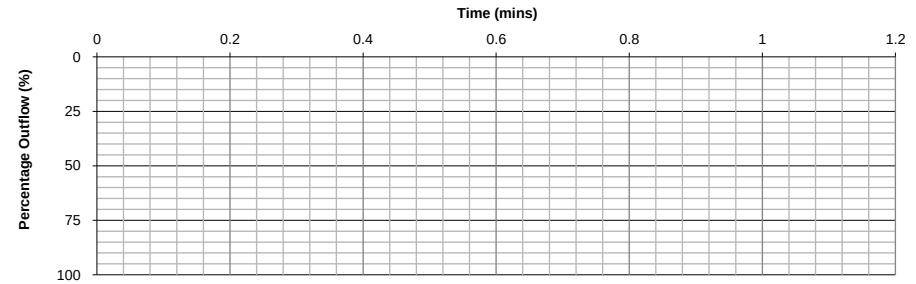
Drainage Field VP: #DIV/0!



TEST NUMBER: T2
 VP25: 0
 VP75: 0
 VP25 (Mins) #NUM!
 VP27 (Mins) #NUM!

INFILTRATION RATE (m/s): #NUM!

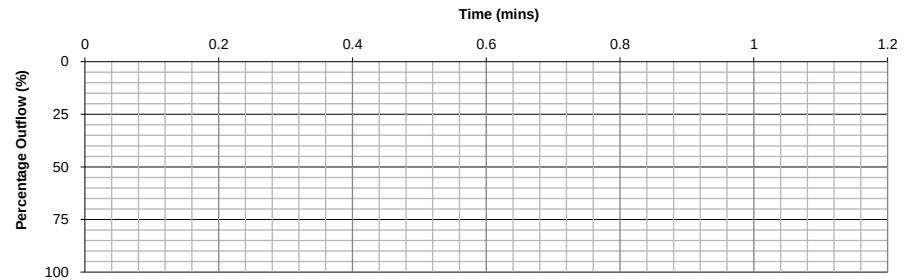
Drainage Field VP: #NUM!



TEST NUMBER: T3
 VP25: 0
 VP75: 0
 VP25 (Mins) #NUM!
 VP27 (Mins) #NUM!

INFILTRATION RATE (m/s): #NUM!

Drainage Field VP: #NUM!



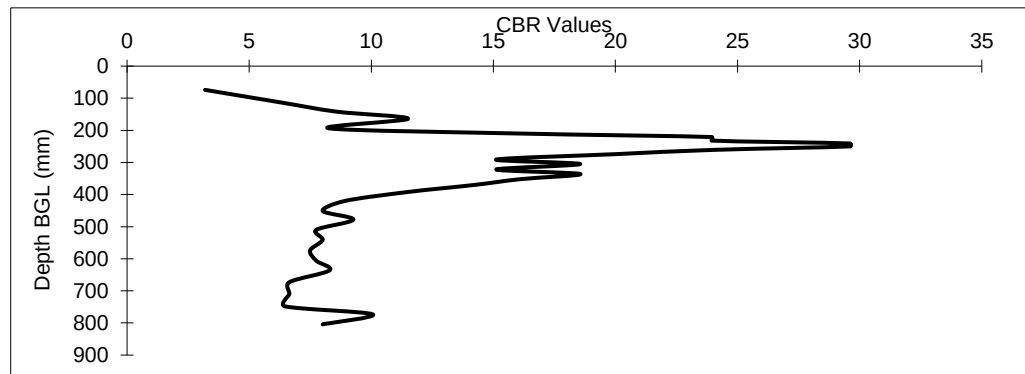
REMARKS: Test carried out in accordance with BRE Digest 365 (2016)

In-situ CBR by TRL DCP

TRRL Road Transport, Note 8

Project Name	Fives Court, Mere	Date	15/09/2022	Soil	
Project No.	PO-22-039	Location/ Test No.	CBR01	Description	

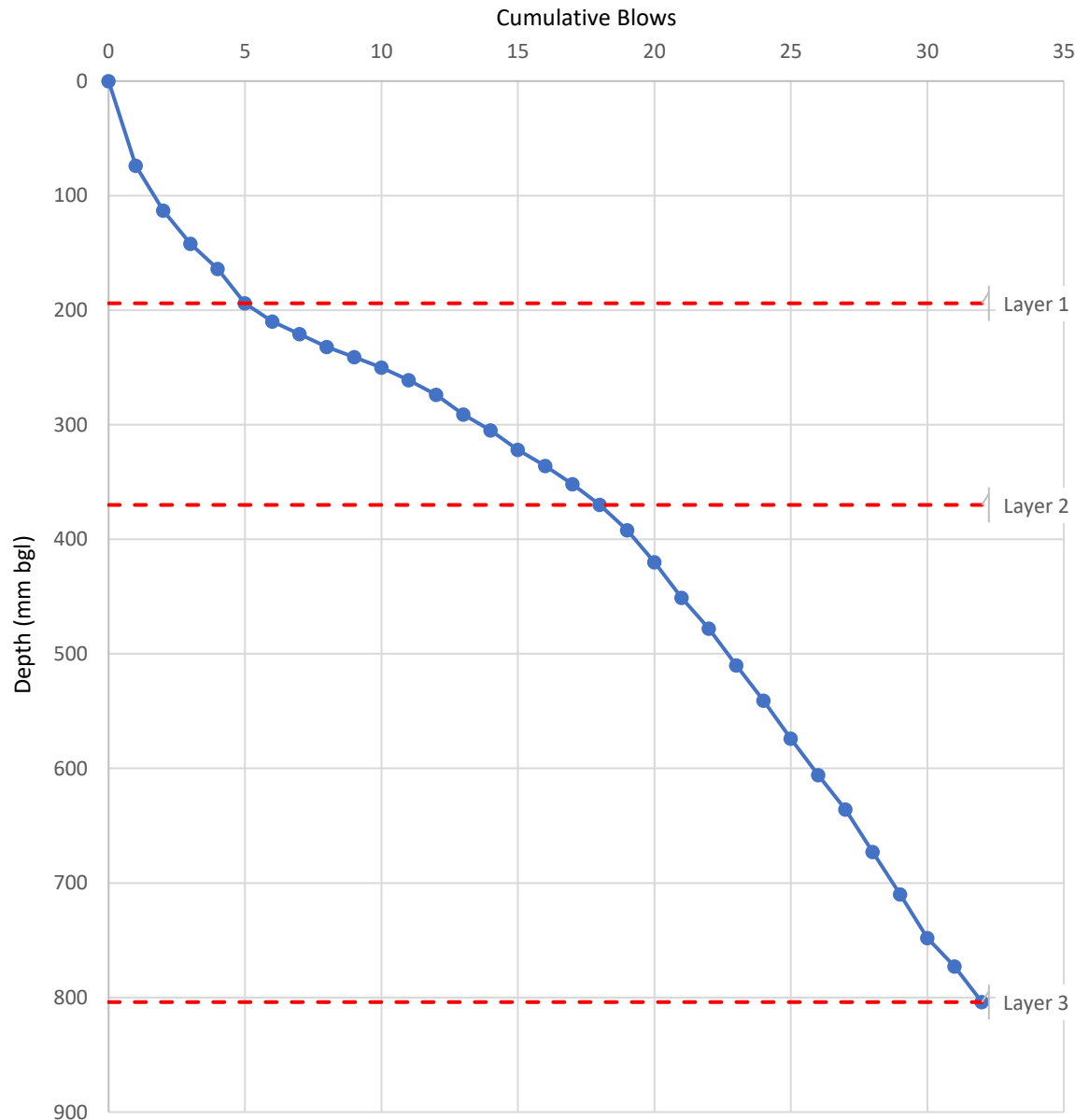
Depth of Test below ground level (mm): 0														
CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)	CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)	CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)
3.2	0		0	130	14.2	370	18.0	1	500					
6.3	74	74.0	1	204	11.5	392	22.0	1	522					
8.6	113	39.0	1	243	8.9	420	28.0	1	550					
11.5	142	29.0	1	272	8.0	451	31.0	1	581					
8.3	164	22.0	1	294	9.3	478	27.0	1	608					
16.1	194	30.0	1	324	7.7	510	32.0	1	640					
23.9	210	16.0	1	340	8.0	541	31.0	1	671					
23.9	221	11.0	1	351	7.5	574	33.0	1	704					
29.6	232	11.0	1	362	7.7	606	32.0	1	736					
29.6	241	9.0	1	371	8.3	636	30.0	1	766					
23.9	250	9.0	1	380	6.6	673	37.0	1	803					
20.1	261	11.0	1	391	6.6	710	37.0	1	840					
15.1	274	13.0	1	404	6.5	748	38.0	1	878					
18.6	291	17.0	1	421	10.1	773	25.0	1	903					
15.1	305	14.0	1	435	8.0	804	31.0	1	934					
18.6	322	17.0	1	452										
16.1	336	14.0	1	466										
	352	16.0	1	482										



In-situ CBR by TRL DCP

TRRL Road Transport, Note 8

Blows vs Depth



Layer Depth (mm bgl)	CBR Value
Layer 1 Base: 194	6.32
Layer 2 Base: 370	19.23
Layer 3 Base: 804	8.01

CBR value calculated from layers identified in cumulative blows per depth graph in accordance with CS229

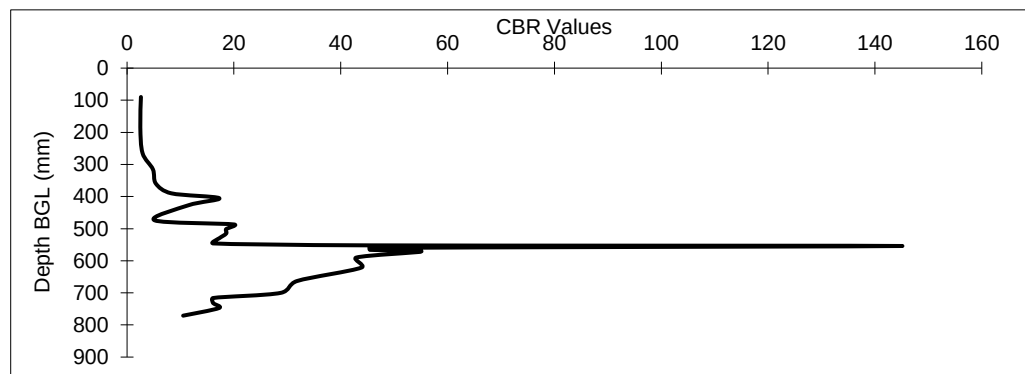


In-situ CBR by TRL DCP

TRRL Road Transport, Note 8

Project Name	Fives Court, Mere	Date	15/09/2022	Soil	
Project No.	PO-22-039	Location/ Test No.	CBR02	Description	

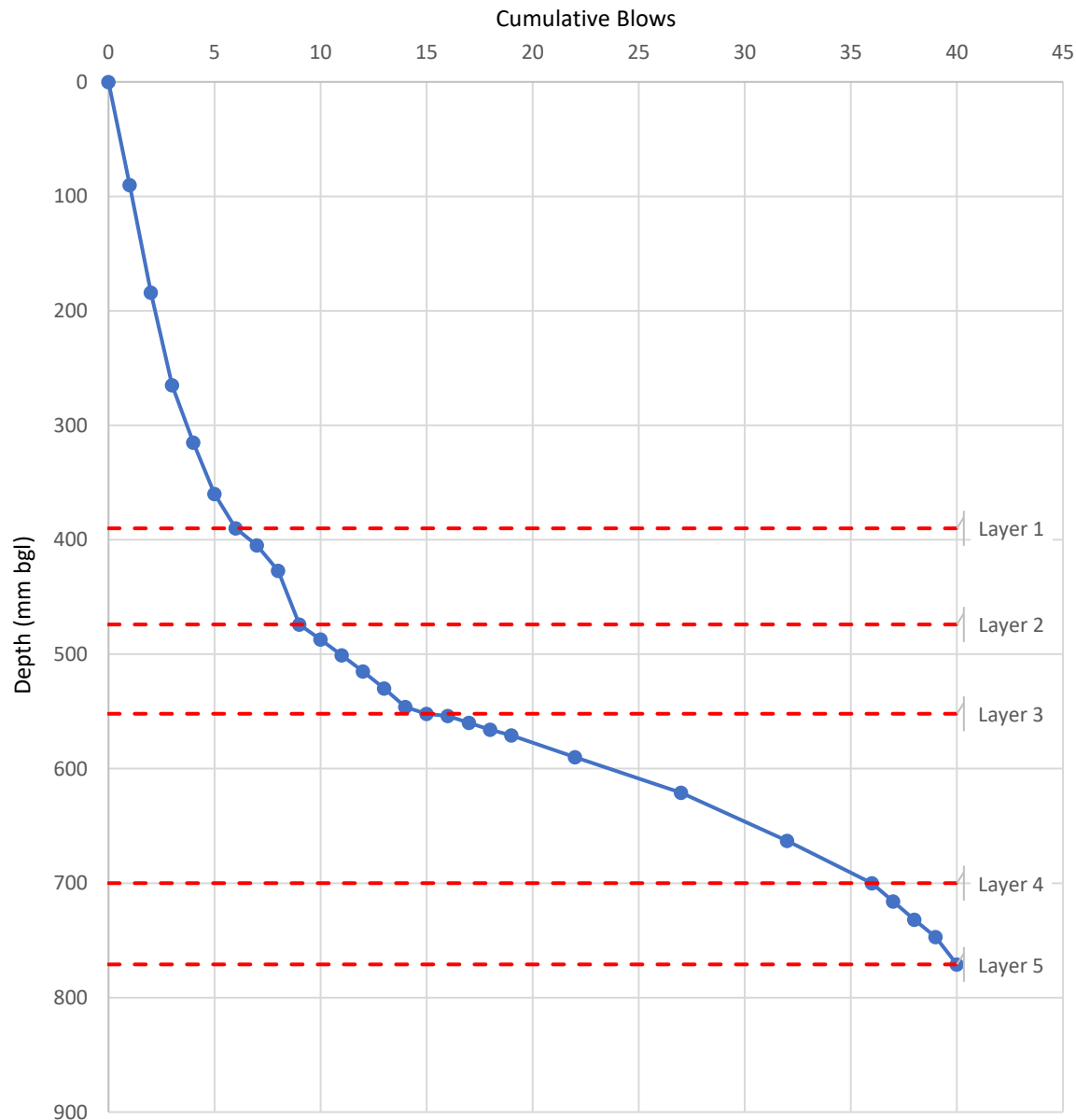
Depth of Test below ground level (mm): 0														
CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)	CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)	CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)
2.6	0		0	120	45.4	566	6.0	1	686					
2.5	90	90.0	1	210	55.1	571	5.0	1	691					
2.9	184	94.0	1	304	42.9	590	6.3	3	710					
4.8	265	81.0	1	385	43.9	621	6.2	5	741					
5.4	315	50.0	1	435	31.8	663	8.4	5	783					
8.3	360	45.0	1	480	28.8	700	9.3	4	820					
17.3	390	30.0	1	510	16.1	716	16.0	1	836					
11.5	405	15.0	1	525	16.1	732	16.0	1	852					
5.2	427	22.0	1	547	17.3	747	15.0	1	867					
20.1	474	47.0	1	594	10.5	771	24.0	1	891					
18.6	487	13.0	1	607										
18.6	501	14.0	1	621										
17.3	515	14.0	1	635										
16.1	530	15.0	1	650										
45.4	546	16.0	1	666										
145.1	552	6.0	1	672										
45.4	554	2.0	1	674										
	560	6.0	1	680										



In-situ CBR by TRL DCP

TRRL Road Transport, Note 8

Blows vs Depth



Layer Depth (mm bgl)	CBR Value
Layer 1 Base: 390	3.66
Layer 2 Base: 474	8.92
Layer 3 Base: 552	20.07
Layer 4 Base: 700	38.34
Layer 5 Base: 771	14.44

CBR value calculated from layers identified in cumulative blows per depth graph in accordance with CS229

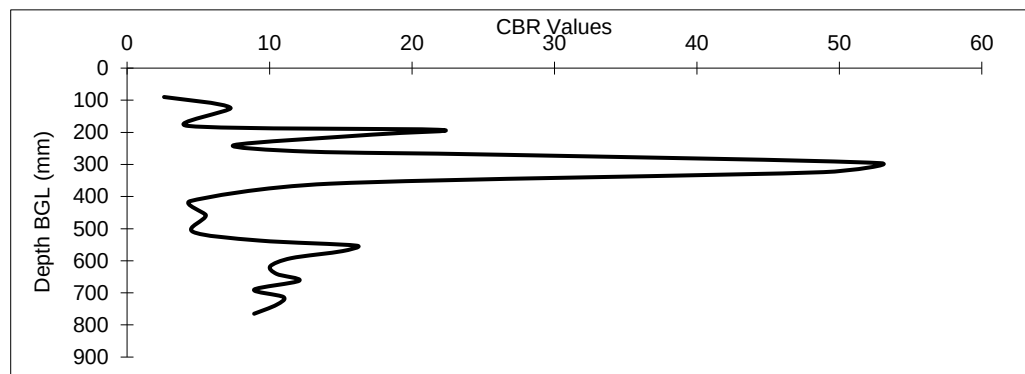


In-situ CBR by TRL DCP

TRRL Road Transport, Note 8

Project Name	Fives Court, Mere	Date	15/09/2022	Soil	
Project No.	PO-22-039	Location/ Test No.	CBR03	Description	

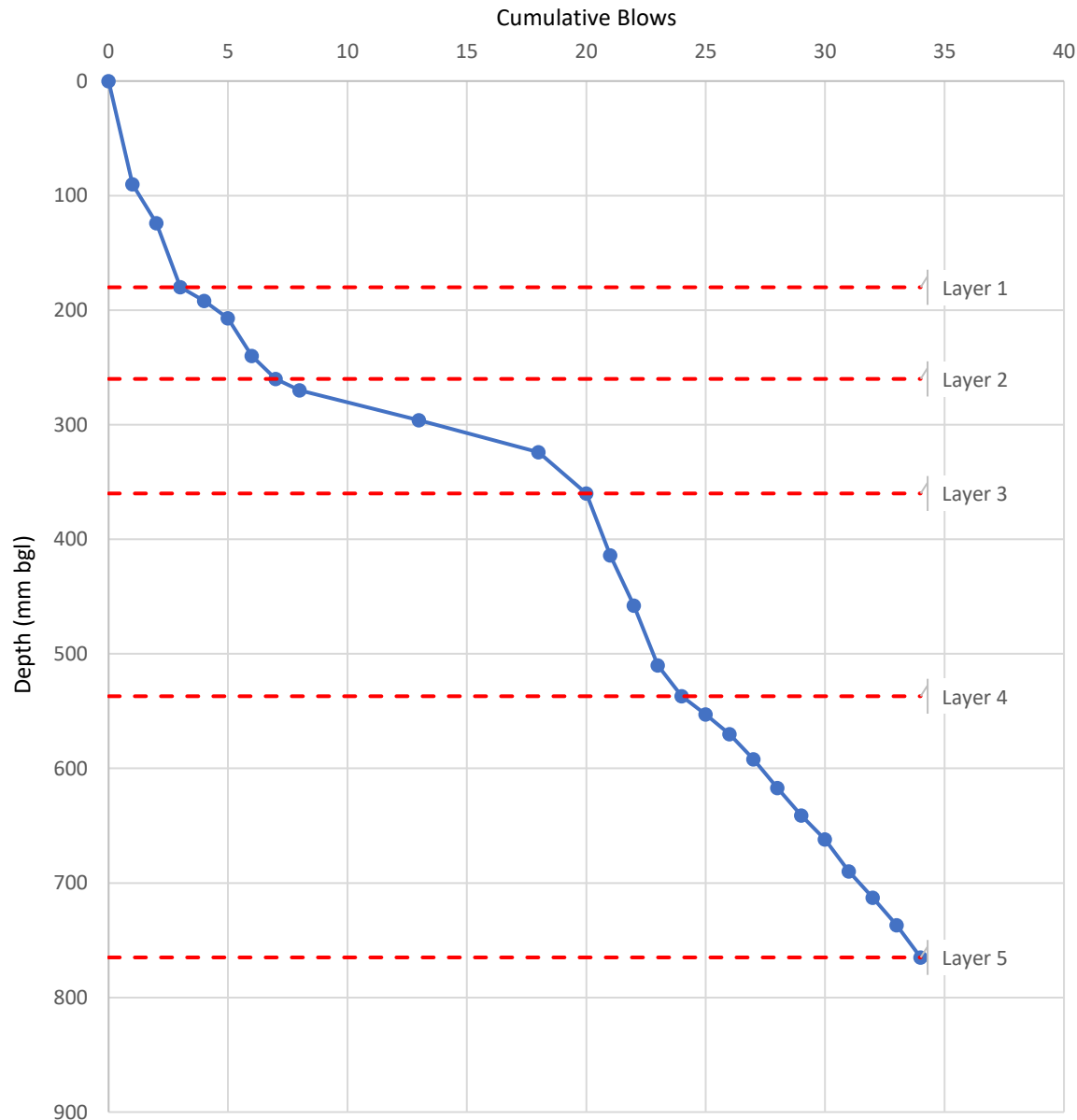
Depth of Test below ground level (mm): 0														
CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)	CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)	CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)
	0		0	150	11.5	592	22.0	1	742					
2.6	90	90.0	1	240	10.1	617	25.0	1	767					
7.3	124	34.0	1	274	10.5	641	24.0	1	791					
4.3	180	56.0	1	330	12.1	662	21.0	1	812					
21.8	192	12.0	1	342	8.9	690	28.0	1	840					
17.3	207	15.0	1	357	11.0	713	23.0	1	863					
7.5	240	33.0	1	390	10.5	737	24.0	1	887					
12.7	260	20.0	1	410	8.9	765	28.0	1	915					
26.5	270	10.0	1	420										
52.9	296	5.2	5	446										
48.9	324	5.6	5	474										
14.2	360	18.0	2	510										
4.5	414	54.0	1	564										
5.5	458	44.0	1	608										
4.6	510	52.0	1	660										
9.3	537	27.0	1	687										
16.1	553	16.0	1	703										
15.1	570	17.0	1	720										



In-situ CBR by TRL DCP

TRRL Road Transport, Note 8

Blows vs Depth



Layer Depth (mm bgl)	CBR Value
Layer 1 Base: 180	3.99
Layer 2 Base: 260	12.73
Layer 3 Base: 360	34.95
Layer 4 Base: 537	5.50
Layer 5 Base: 765	11.08

CBR value calculated from layers identified in cumulative blows per depth graph in accordance with CS229

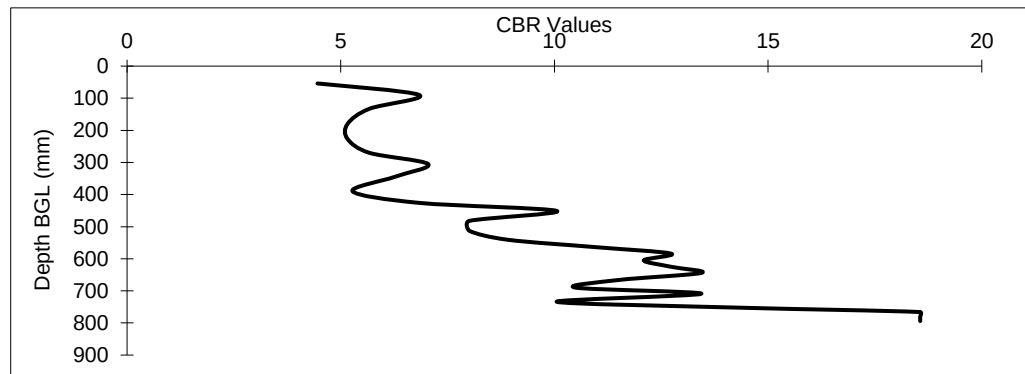


In-situ CBR by TRL DCP

TRRL Road Transport, Note 8

Project Name	Fives Court, Mere	Date	15/09/2022	Soil	
Project No.	PO-22-039	Location/ Test No.	CBR04	Description	

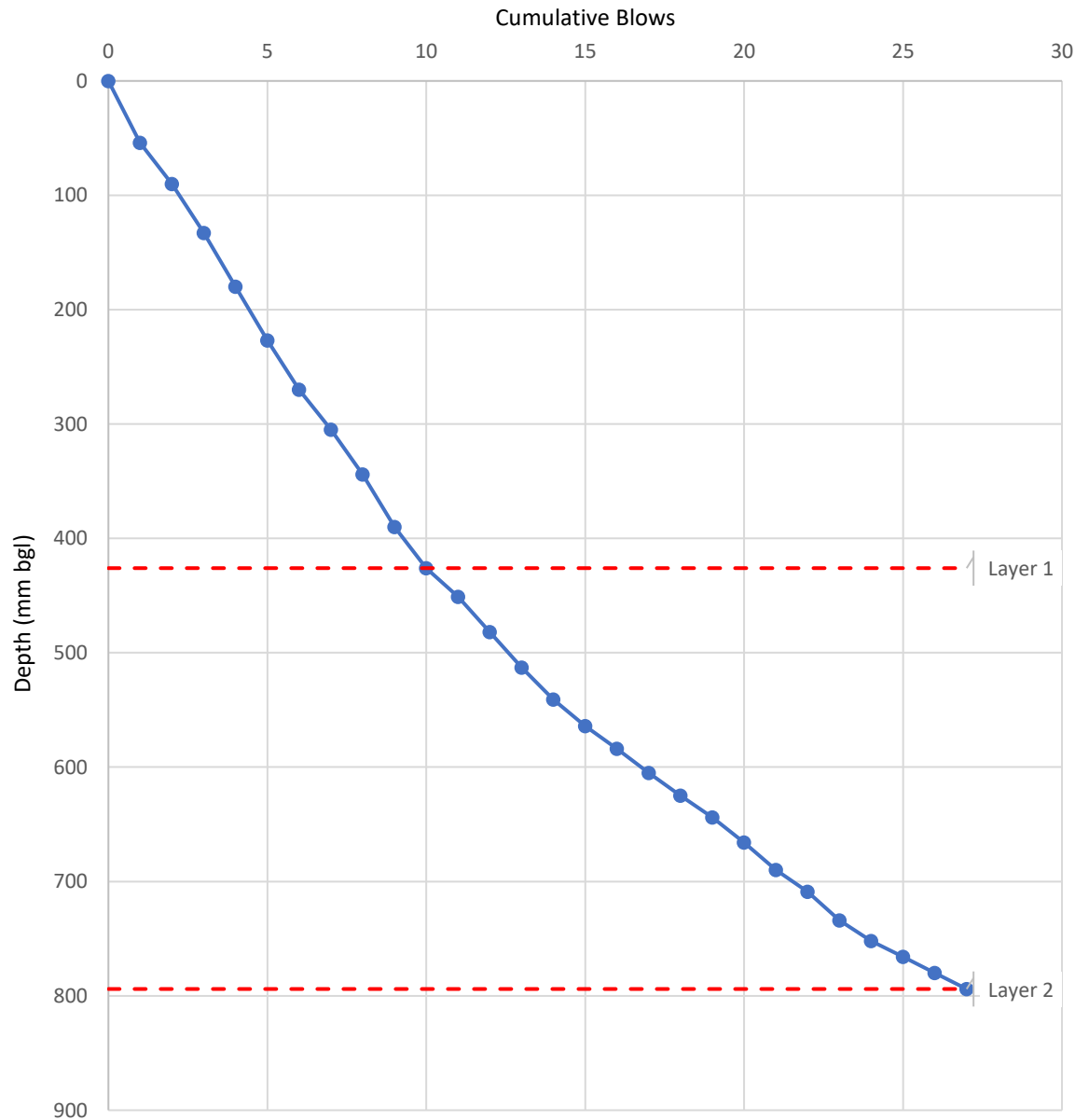
Depth of Test below ground level (mm): 0														
CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)	CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)	CBR Value %	Depth Below Ground Level (mm)	mm per blow	Blows	Reading on Scale (mm)
4.5	0		0	130	12.7	625	20.0	1	755					
6.8	54	54.0	1	184	13.4	644	19.0	1	774					
5.7	90	36.0	1	220	11.5	666	22.0	1	796					
5.2	133	43.0	1	263	10.5	690	24.0	1	820					
5.2	180	47.0	1	310	13.4	709	19.0	1	839					
5.7	227	47.0	1	357	10.1	734	25.0	1	864					
7.0	270	43.0	1	400	14.2	752	18.0	1	882					
6.3	305	35.0	1	435	18.6	766	14.0	1	896					
5.3	344	39.0	1	474	18.6	780	14.0	1	910					
6.8	390	46.0	1	520	18.6	794	14.0	1	924					
10.1	426	36.0	1	556										
8.0	451	25.0	1	581										
8.0	482	31.0	1	612										
8.9	513	31.0	1	643										
11.0	541	28.0	1	671										
12.7	564	23.0	1	694										
12.1	584	20.0	1	714										
	605	21.0	1	735										



In-situ CBR by TRL DCP

TRRL Road Transport, Note 8

Blows vs Depth



Layer Depth (mm bgl)		CBR Value
Layer 1 Base:		5.72
Layer 2 Base:		11.71

CBR value calculated from layers identified in cumulative blows per depth graph in accordance with CS229



Annex C: Chemical Test Results



2183

Amended Report

Report No.:	22-36235-2		
Initial Date of Issue:	30-Sep-2022	Date of Re-Issue:	07-Nov-2022
Client	Terra Firma		
Client Address:	t/a Terra Firma The Slate Barn Lower Lowley Dunsford Devon EX6 7BP		
Contact(s):	Info		
Project	PO-22-039 Fives Court, Mere		
Quotation No.:		Date Received:	22-Sep-2022
Order No.:	PO-22-039	Date Instructed:	22-Sep-2022
No. of Samples:	7		
Turnaround (Wkdays):	37	Results Due:	11-Nov-2022
Date Approved:	07-Nov-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: PO-22-039 Fives Court, Mere

Client: Terra Firma	Chemtest Job No.:				22-36235	22-36235	22-36235	22-36235	22-36235	22-36235	22-36235
Quotation No.:	Chemtest Sample ID.:				1511051	1511052	1511053	1511054	1511055	1511056	1511057
	Sample Location:				TP01	TP02	TP03	TP04	Core 2	Core 5	Core 6
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.40	0.30	0.40	0.50	0.25	0.25	0.23
	Bottom Depth (m):				0.50						
Determinand	Accred.	SOP	Units	LOD							
Moisture	N	2030	%	0.020	1.4	17	17	17	4.6	4.7	5.0
pH	U	2010		4.0	[A] 9.1	[A] 8.9	[A] 8.7	[A] 8.6	[A] 10.4	[A] 9.7	[A] 10.5
Cyanide (Total)	U	2300	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Sulphate (Total)	U	2430	%	0.010	[A] 0.11	[A] 0.14	[A] 0.082	[A] 0.10	[A] 0.090	[A] 0.053	[A] 0.087
Arsenic	U	2455	mg/kg	0.5	10	11	16	8.9	16	3.3	12
Cadmium	U	2455	mg/kg	0.10	0.66	0.72	3.8	0.54	1.9	0.57	1.8
Chromium	U	2455	mg/kg	0.5	15	20	30	19	6.6	5.2	8.8
Copper	U	2455	mg/kg	0.50	73	56	26	57	14	5.8	9.4
Mercury	U	2455	mg/kg	0.05	0.56	0.46	0.15	0.46	0.06	0.05	0.09
Nickel	U	2455	mg/kg	0.50	16	19	27	17	6.1	4.0	5.2
Lead	U	2455	mg/kg	0.50	700	230	62	190	170	39	340
Selenium	U	2455	mg/kg	0.25	0.63	0.63	1.3	1.1	< 0.25	0.46	< 0.25
Zinc	U	2455	mg/kg	0.50	340	250	83	190	140	62	99
Chromium (Trivalent)	N	2490	mg/kg	1.0	15	20	30	19	6.4	5.2	8.6
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	[A] 8.2	[A] 6.7	[A] 4.5	[A] 10	[A] 0.62	[A] < 0.40	[A] < 0.40
Total TPH >C6-C40	U	2670	mg/kg	10	[A] < 10	[A] 280	[A] < 10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
Naphthalene	U	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] 0.75	[A] < 0.10	[A] < 0.10	[A] < 0.10
Acenaphthylene	U	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] 2.3	[A] < 0.10	[A] < 0.10	[A] < 0.10
Acenaphthene	U	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] 0.47	[A] < 0.10	[A] < 0.10	[A] < 0.10
Fluorene	U	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] 0.30	[A] < 0.10	[A] < 0.10	[A] < 0.10
Phenanthrene	U	2700	mg/kg	0.10	[A] < 0.10	[A] 0.42	[A] < 0.10	[A] 0.75	[A] 1.2	[A] < 0.10	[A] < 0.10
Anthracene	U	2700	mg/kg	0.10	[A] < 0.10	[A] 0.14	[A] < 0.10	[A] 0.20	[A] 0.15	[A] < 0.10	[A] < 0.10
Fluoranthene	U	2700	mg/kg	0.10	[A] 1.1	[A] 1.6	[A] 0.32	[A] 2.5	[A] 2.4	[A] 0.23	[A] 0.90
Pyrene	U	2700	mg/kg	0.10	[A] 1.1	[A] 1.5	[A] 0.35	[A] 2.2	[A] 2.2	[A] 0.24	[A] 0.75
Benzo[a]anthracene	U	2700	mg/kg	0.10	[A] 0.51	[A] 1.3	[A] 0.30	[A] 2.1	[A] 1.6	[A] < 0.10	[A] 0.55
Chrysene	U	2700	mg/kg	0.10	[A] 0.91	[A] 1.0	[A] 0.20	[A] 1.6	[A] 1.7	[A] < 0.10	[A] 0.56
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	[A] < 0.10	[A] 1.9	[A] < 0.10	[A] 3.0	[A] 2.2	[A] < 0.10	[A] < 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	[A] < 0.10	[A] 0.60	[A] < 0.10	[A] 1.1	[A] 0.70	[A] < 0.10	[A] < 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	[A] < 0.10	[A] 1.3	[A] < 0.10	[A] 2.2	[A] 1.4	[A] < 0.10	[A] < 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] 1.8	[A] < 0.10	[A] < 0.10	[A] < 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] 1.1	[A] < 0.10	[A] < 0.10	[A] < 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] 1.2	[A] < 0.10	[A] < 0.10	[A] < 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	[A] 3.6	[A] 9.7	[A] < 2.0	[A] 24	[A] 14	[A] < 2.0	[A] 2.8
Total Phenols	U	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1511051			TP01		A	Amber Glass 250ml
1511051			TP01		A	Amber Glass 60ml
1511051			TP01		A	Plastic Tub 500g
1511052			TP02		A	Amber Glass 250ml
1511052			TP02		A	Amber Glass 60ml
1511052			TP02		A	Plastic Tub 500g
1511053			TP03		A	Amber Glass 250ml
1511053			TP03		A	Amber Glass 60ml
1511053			TP03		A	Plastic Tub 500g
1511054			TP04		A	Amber Glass 250ml
1511054			TP04		A	Amber Glass 60ml
1511054			TP04		A	Plastic Tub 500g
1511055			Core 2		A	Amber Glass 250ml
1511055			Core 2		A	Amber Glass 60ml
1511055			Core 2		A	Plastic Tub 500g
1511056			Core 5		A	Amber Glass 250ml
1511056			Core 5		A	Amber Glass 60ml
1511056			Core 5		A	Plastic Tub 500g
1511057			Core 6		A	Amber Glass 250ml
1511057			Core 6		A	Amber Glass 60ml
1511057			Core 6		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



2183

Final Report

Report No.:	22-42781-1		
Initial Date of Issue:	18-Nov-2022		
Client	Terra Firma		
Client Address:	t/a Terra Firma The Slate Barn Lower Lowley Dunsford Devon EX6 7BP		
Contact(s):	Dexter Williamson Info James Coley Kevin Scanlon Paul Standish Perry Smith		
Project	PO-22-039 Fivers Court, Mere		
Quotation No.:	Q18-13119	Date Received:	08-Nov-2022
Order No.:	PO-22-039	Date Instructed:	08-Nov-2022
No. of Samples:	3		
Turnaround (Wkdays):	10	Results Due:	21-Nov-2022
Date Approved:	18-Nov-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: PO-22-039 Fivers Court, Mere

Client: Terra Firma	Chemtest Job No.:				22-42781	22-42781	22-42781
Quotation No.: Q18-13119	Chemtest Sample ID.:				1540950	1540951	1540952
	Sample Location:				Core 1	Core 3	Core 4
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.25	0.26	0.28
	Asbestos Lab:				DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	9.5	3.3	4.7
pH	U	2010		4.0	[A] 9.3	[A] 9.5	[A] 10.1
Cyanide (Total)	U	2300	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Sulphate (Total)	U	2430	%	0.010	[A] 0.15	[A] 0.097	[A] 0.14
Arsenic	U	2455	mg/kg	0.5	32	11	3.8
Cadmium	U	2455	mg/kg	0.10	1.8	1.5	1.3
Chromium	U	2455	mg/kg	0.5	9.4	6.1	5.2
Copper	U	2455	mg/kg	0.50	29	5.6	3.2
Mercury	U	2455	mg/kg	0.05	0.10	0.06	< 0.05
Nickel	U	2455	mg/kg	0.50	14	3.7	2.7
Lead	U	2455	mg/kg	0.50	320	150	27
Selenium	U	2455	mg/kg	0.25	0.29	0.37	< 0.25
Zinc	U	2455	mg/kg	0.50	250	96	48
Chromium (Trivalent)	N	2490	mg/kg	1.0	9.4	6.1	5.2
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	[A] 13	[A] 21	[A] 12
Total TPH >C6-C40	U	2670	mg/kg	10	[AC] 210	[AC] < 10	[AC] < 10
Naphthalene	U	2700	mg/kg	0.10	[A] 1.0	[A] < 0.10	[A] < 0.10
Acenaphthylene	U	2700	mg/kg	0.10	[A] 0.26	[A] < 0.10	[A] < 0.10
Acenaphthene	U	2700	mg/kg	0.10	[A] 0.79	[A] < 0.10	[A] < 0.10
Fluorene	U	2700	mg/kg	0.10	[A] 0.75	[A] < 0.10	[A] < 0.10
Phenanthrene	U	2700	mg/kg	0.10	[A] 5.6	[A] 0.76	[A] < 0.10
Anthracene	U	2700	mg/kg	0.10	[A] 1.4	[A] 0.21	[A] < 0.10
Fluoranthene	U	2700	mg/kg	0.10	[A] 6.0	[A] 1.1	[A] 0.18
Pyrene	U	2700	mg/kg	0.10	[A] 5.9	[A] 0.99	[A] 0.34
Benzo[a]anthracene	U	2700	mg/kg	0.10	[A] 2.8	[A] 0.62	[A] 0.14
Chrysene	U	2700	mg/kg	0.10	[A] 3.7	[A] 0.87	[A] 0.39
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	[A] 3.6	[A] 1.0	[A] < 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	[A] 1.6	[A] 0.38	[A] < 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	[A] 3.0	[A] 0.64	[A] < 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	[A] 1.8	[A] < 0.10	[A] < 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	[A] 0.64	[A] < 0.10	[A] < 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	[A] 1.8	[A] < 0.10	[A] < 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	[A] 41	[A] 6.6	[A] < 2.0
Total Phenols	U	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1540950			Core 1		AC	Plastic Tub 500g
1540951			Core 3		AC	Plastic Tub 500g
1540952			Core 4		AC	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
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2183

Final Report

Report No.:	22-43465-1		
Initial Date of Issue:	24-Nov-2022		
Client	Terra Firma		
Client Address:	t/a Terra Firma The Slate Barn Lower Lowley Dunsford Devon EX6 7BP		
Contact(s):	Info		
Project	Fives Court Mere		
Quotation No.:	Q18-13119	Date Received:	11-Nov-2022
Order No.:	PO-22-039	Date Instructed:	11-Nov-2022
No. of Samples:	4		
Turnaround (Wkdays):	10	Results Due:	24-Nov-2022
Date Approved:	24-Nov-2022		
Approved By:			



Details: Stuart Henderson, Technical Manager

Results - Soil

Project: Fives Court Mere

Client: Terra Firma	Chemtest Job No.:				22-43465	22-43465	22-43465	22-43465
Quotation No.: Q18-13119	Chemtest Sample ID.:				1543925	1543926	1543927	1543928
	Sample Location:				IP1	IP2	IP3	IP3
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.35	0.35	0.30	0.50
	Asbestos Lab:						COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
ACM Type	U	2192		N/A			-	-
Asbestos Identification	U	2192		N/A			No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	26	25	23	25
pH	U	2010		4.0	[A] 7.4	[A] 7.6	[A] 7.7	[A] 7.6
Cyanide (Total)	U	2300	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Sulphate (Total)	U	2430	%	0.010	[A] 0.084	[A] 0.070	[A] 0.054	[A] 0.10
Arsenic	U	2455	mg/kg	0.5	8.6	9.9	7.6	11
Cadmium	U	2455	mg/kg	0.10	0.62	0.43	0.16	0.75
Chromium	U	2455	mg/kg	0.5	16	24	16	21
Copper	U	2455	mg/kg	0.50	43	44	19	66
Mercury	U	2455	mg/kg	0.05	0.35	0.27	0.09	0.37
Nickel	U	2455	mg/kg	0.50	14	21	15	20
Lead	U	2455	mg/kg	0.50	190	120	52	280
Selenium	U	2455	mg/kg	0.25	0.65	0.92	0.58	0.85
Zinc	U	2455	mg/kg	0.50	170	260	73	330
Chromium (Trivalent)	N	2490	mg/kg	1.0	16	24	16	21
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	[A] 10	[A] 4.5	[A] 4.7	[A] 9.8
Total TPH >C6-C40	U	2670	mg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
Naphthalene	U	2700	mg/kg	0.10	[A] 0.61	[A] 0.41	[A] < 0.10	[A] 0.83
Acenaphthylene	U	2700	mg/kg	0.10	[A] 0.50	[A] 0.24	[A] < 0.10	[A] 0.45
Acenaphthene	U	2700	mg/kg	0.10	[A] 0.29	[A] 0.17	[A] < 0.10	[A] 0.37
Fluorene	U	2700	mg/kg	0.10	[A] 0.21	[A] < 0.10	[A] < 0.10	[A] 0.38
Phenanthrene	U	2700	mg/kg	0.10	[A] 2.0	[A] 0.20	[A] < 0.10	[A] 0.51
Anthracene	U	2700	mg/kg	0.10	[A] 0.73	[A] < 0.10	[A] < 0.10	[A] 0.22
Fluoranthene	U	2700	mg/kg	0.10	[A] 3.1	[A] 0.39	[A] < 0.10	[A] 1.2
Pyrene	U	2700	mg/kg	0.10	[A] 3.9	[A] 0.58	[A] < 0.10	[A] 1.6
Benzo[a]anthracene	U	2700	mg/kg	0.10	[A] 1.5	[A] 0.17	[A] < 0.10	[A] 0.96
Chrysene	U	2700	mg/kg	0.10	[A] 2.0	[A] 0.27	[A] < 0.10	[A] 1.1
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	[A] 1.0	[A] < 0.10	[A] < 0.10	[A] 0.22
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	[A] 1.2	[A] < 0.10	[A] < 0.10	[A] 0.58
Benzo[a]pyrene	U	2700	mg/kg	0.10	[A] 2.2	[A] < 0.10	[A] < 0.10	[A] 1.2
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	[A] 2.8	[A] < 0.10	[A] < 0.10	[A] 0.78
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	[A] 0.47	[A] < 0.10	[A] < 0.10	[A] 0.40
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	[A] 0.98	[A] < 0.10	[A] < 0.10	[A] 0.45
Total Of 16 PAH's	U	2700	mg/kg	2.0	[A] 24	[A] 2.4	[A] < 2.0	[A] 11
Total Phenols	U	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10

Deviations

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Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1543925			IP1		A	Amber Glass 60ml
1543925			IP1		A	Plastic Tub 500g
1543926			IP2		A	Amber Glass 60ml
1543926			IP2		A	Plastic Tub 500g
1543927			IP3		A	Amber Glass 60ml
1543927			IP3		A	Plastic Tub 500g
1543928			IP3		A	Amber Glass 60ml
1543928			IP3		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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- D - Broken Container
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customerservices@chemtest.com

Annex D: Soil Property Test Results

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

Terra Firma (South)
The Slate Barn
Lower Lowley
Dunsford
Devon
EX6 7BP

24 October 2022

Report No : GEO/36529/01

Page 1 of 1

For the attention of Terra Firma (South) / Ms A Samuel

Our ref **GEO / 36529**

Date samples received 27/09/2022
Date written instructions received 27/09/2022
Date testing commenced 28/09/2022
Date of sample disposal 21/11/2022

Project **FIVES COURT, MERE**

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	~	Liquid & Plastic Limits Summary
~	8	Water Content
~	6	Liquid & Plastic Limits
2	2	Particle Size Distribution
3	~	Geochemical Test Summary
~	8	BRE SD1 Suite B - Natural ground + pyrite

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

eurolab



BGA

AGS



SUMMARY OF LIQUID AND PLASTIC LIMIT TESTS

Location	Depth m	Sample Ref	Sample Type	Description	Water Content BS EN ISO 17892-1 : 2014 %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Percentage Passing 425µm %	Atterberg Classification	Test Type	Sample Condition
TP01	0.40-0.50		B	Dark brown slightly sandy gravelly clayey SILT. Sand is fine. Gravel is fine to medium.	21.3	49	32	17	59	MI	2	3
TP01	0.80		B	Multi-coloured slightly sandy CLAY with rare fine gravel. Sand is fine.	35.7	64	31	33	98	CH	2	3
TP01	1.40		B	Light grey slightly sandy gravelly clayey SILT with abundant cobbles and rare roots.	16.3	~	~	~	~	~	~	~
TP02	1.10		B	Grey mottled brown slightly gravelly slightly sandy CLAY. Gravel is mudstone.	34.1	50	27	23	67	CI	2	3
TP02	1.60		B	Light grey clayey GRAVEL with abundant cobbles.	19.5	~	~	~	~	~	~	~
TP03	0.40		B	Light brown and dark brown mottled slightly gravelly silty CLAY. Gravel is mudstone.	22.6	47	22	25	82	CI	2	3
TP03	0.80		B	Light brown gravelly CLAY. Gravel is mudstone.	21.0	53	26	27	56	CH	2	3
TP04	1.00		B	Grey and brown mottled slightly gravelly slightly sandy CLAY with rare rootlets. Sand is fine. Gravel is fine to medium.	31.8	59	23	36	93	CH	2	3

Test Type:

- 1 - 1 point 80g / 30° fall cone method.
 2 - 4 point 80g / 30° fall cone method.
 3 - Non plastic determination.

Sample condition:

- 1 - As Received
 2 - Air Dried
 3 - Washed & Air Dried

Checked and Approved by:



S Burke - Senior Technician
24/10/2022

Project Number:

GEO / 36529

Project Name:

FIVES COURT, MERE

GEOLABS®



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 %
TP01	0.40-0.50		B	8.5	0.052	< 0.010	0.16	-	-	-	-	-	-
TP01	0.80		B	8.7	0.041	< 0.010	0.052	-	-	-	-	-	-
TP01	1.40		B	9.1	0.020	< 0.010	0.042	-	-	-	-	-	-
TP02	1.10		B	8.6	0.022	< 0.010	0.043	-	-	-	-	-	-
TP02	1.60		B	9.1	0.024	< 0.010	0.033	-	-	-	-	-	-
TP03	0.40		B	8.5	0.034	< 0.010	0.052	-	-	-	-	-	-
TP03	0.80		B	9.3	0.031	< 0.010	0.043	-	-	-	-	-	-
TP04	1.00		B	8.8	0.020	< 0.010	0.026	-	-	-	-	-	-

Tested by Chemtest Ltd : MCERTS / UKAS No 2183

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PARTICLE SIZE DISTRIBUTION

Location TP01
Depth (m) 1.40
Sample Type B

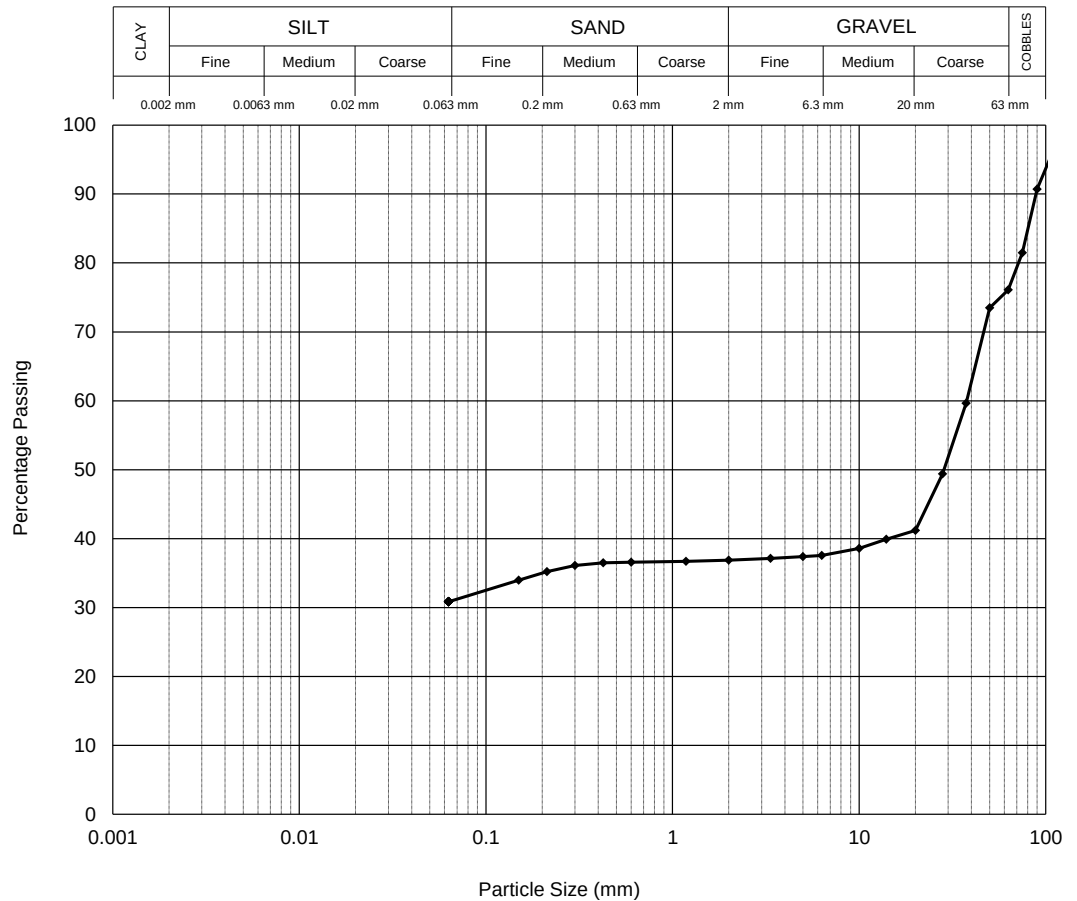
Description

Light grey slightly sandy gravelly clayey SILT with abundant cobbles and rare roots.

Remarks Insufficient sample supplied to comply with BS EN ISO 17892-4 : 2016 minimum mass requirements

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

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	91
75.0 mm	81
63.0 mm	76
50.0 mm	73
37.5 mm	60
28.0 mm	49
20.0 mm	41
14.0 mm	40
10.0 mm	39
6.30 mm	38
5.00 mm	37
3.35 mm	37
2.00 mm	37
1.18 mm	37
600 µm	37
425 µm	36
300 µm	36
212 µm	35
150 µm	34
63 µm	31



Particle Proportions	
Cobbles	23.9
Gravel	39.2
Sand	6.0
Silt & Clay	30.9

Tested by AW
Checked and Approved by



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PARTICLE SIZE DISTRIBUTION

Location TP02
Depth (m) 1.60
Sample Type B

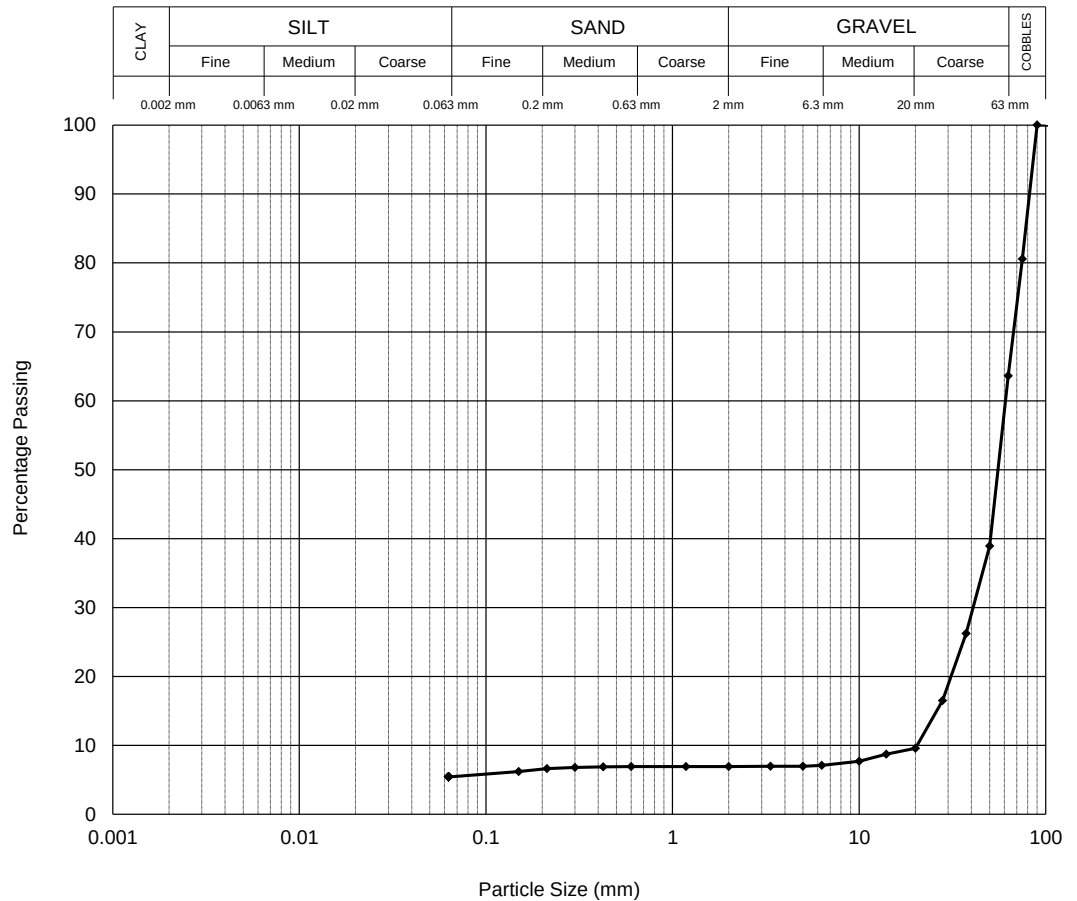
Description

Light grey clayey GRAVEL with abundant cobbles.

Remarks Insufficient sample supplied to comply with BS EN ISO 17892-4 : 2016 minimum mass requirements

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

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	81
63.0 mm	64
50.0 mm	39
37.5 mm	26
28.0 mm	16
20.0 mm	10
14.0 mm	9
10.0 mm	8
6.30 mm	7
5.00 mm	7
3.35 mm	7
2.00 mm	7
1.18 mm	7
600 µm	7
425 µm	7
300 µm	7
212 µm	7
150 µm	6
63 µm	5



Particle Proportions	
Cobbles	36.4
Gravel	56.7
Sand	1.5
Silt & Clay	5.4

Tested by AW
Checked and Approved by



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24/10/2022

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