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Proposed retirement living development

The Greenfinch

Didsbury

Ground Investigation Report

(August 2023)

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**Proposed retirement living development
The Greenfinch
Lapwing Lane
Didsbury
Manchester
M20 3ZA**

**GROUND INVESTIGATION REPORT
(August 2023)**

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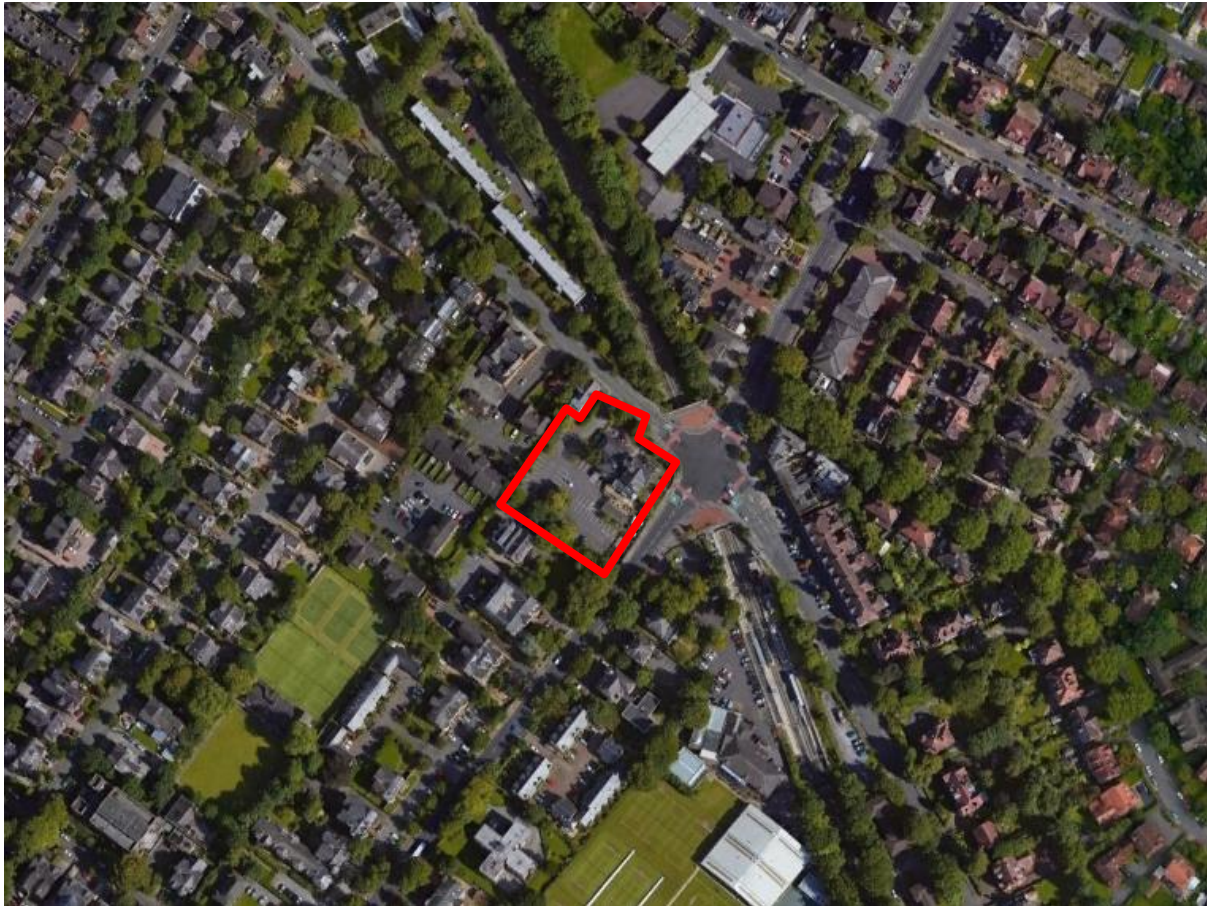
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Director



Aerial photograph of site



Approximate site boundary edged in **RED**.

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Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Executive summary	Rev A	First Issue
2	Introduction		
3	Desk study information and site observations		
4	Fieldwork		
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6	Ground conditions encountered		
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8	Chemical contamination		
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10	Effects of ground conditions on building materials		
11	Waste characterisation		
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List of drawings

Drawing	Principal coverage	Status	
		Revision	Comments
01	Site location plan	Rev A	
02	Exploratory hole plan (current layout)	Rev A	
03	Exploratory hole plan (proposed layout)	Rev A	

List of appendices

Appendix	Content	Status	
		Revision	Comments
A	Definitions of geotechnical terms used in this report		
B	Definitions of geo-environmental terms used in this report		
C	Insitu testing in trial pits	Results of infiltration testing	
D	Trial pit records	Machine and hand excavated	
E	Copies of laboratory test result certificates (Soil Engineering)	Soil classification testing	
F	Copies of laboratory test result certificates (Chemical)	Concentrations of chemical contaminants	
G	Analysis and summary of test data in relation to concentrations of chemical contaminants		
H	Conceptual models for chemical contamination		
I1	Waste characterisation	Hazardous waste classification spreadsheet	
I2		Waste acceptance criteria	
J	Copies of statutory undertakers' replies		
K	GeoSmart Information Phase 1 Contaminated Land Assessment (Report Ref: 74223R1; January 2021)		
L	Preliminary UXO risk review		

1 Executive summary

General

We recommend the following executive summary is not read in isolation to the main report which follows.

Site description, history and development proposals

The site is located within the predominantly residential/commercial area of West Didsbury approximately 6km south of Manchester City Centre. The site lies at the western corner of the Lapwing Lane and Palatine Road crossroads at postal address M20 3ZA.

The site was first developed in 1893 with a large building in the eastern corner matching the current site layout. Since 1893 several smaller buildings have been present in the north and west of the site which were subsequently demolished. The reported use of the site is a public house, residential and school. Offsite historic land uses include a town/corporation yard (adjacent to north west), railway line (adjacent to east), electrical substation (c.10m north) and a garage (c.135m north east).

We understand the site will be redeveloped for residential use comprising apartment blocks of twenty-four 1-bed and thirteen 2-bed retirement living units with shared landscaped space. The blocks are to be 2.5-3-stories in height.

Ground conditions encountered

Table summarising soil types				
Strata	Depth to top (m)	Depth to bottom (m)	Thickness (m)	Summary description
Made Ground	0.0	0.6 – >1.2	0.6 – >1.2	Light grey to brown gravels of limestone and brick
Glaciofluvial Sheet Deposits	0.6 – 0.9, locally >1.2	>3.2	>2.5	Light grey to brown gravelly slightly clayey sand.

Foundation solution

In our opinion the naturally deposited Glaciofluvial Sheet Deposits will adequately support the proposed buildings on concrete strip / trench fill type foundations. Further details are provided within Section 7 of the report.

Ground bearing floor slabs can be adopted at this site where Made Ground and Topsoil deposits are fully removed within the footprint of the building. In areas where ground floors are elevated requiring in excess of 600mm of fills, or where it is impracticable to remove Made Ground, then we recommend the use of a suspended ground floor with a sub floor void determined following NHBC Standards, Chapter 4.2.

Based on laboratory test results, a subgrade CBR value of 3% can be deduced at formation level. A concrete class of DS-1 and ACEC-1 can be adopted on site.

Initial infiltration testing was undertaken in 2021. Further on-site infiltration testing with observations made over an extended period of time was undertaken in October 2022, to allow production of more accurate infiltration rates.

In summary infiltration rates of $\sim 1.0 \times 10^{-5}$ m/s were recorded in TP101 and TP102 in the SW of the site. Slower infiltration rates of $< 1.0 \times 10^{-5}$ m/s were recorded elsewhere, with a site-wide average of 9.55×10^{-6} m/s.

Chemical and gaseous contamination

No access could be gained to the north and east of the site during the original 2021 investigation due to the presence of the public house. The western half of the pub was since demolished and further trial pits were undertaken in previously inaccessible areas to assess the wider extent of potential ground contamination.

Elevated PAH and TPH concentrations were identified on site during the 2021 and 2022 investigations. We are, therefore, of the opinion that the site represents a moderate risk of causing harm to the health of future end users based on current development proposals.

There is little soil onsite which could be utilised as a suitable growing medium for plants. The importation of soils for lawns and soft landscaping would be required. Such material will require verification prior to import, to ensure it is suitable for use with respect to concentrations of chemical contaminants.

No significant sources of gaseous contamination have been identified, therefore, do not consider there to be a gas risk on site.

Barrier pipes are likely to be a requirement on site due to the PAHs identified, however, we recommend Untied Utilities are consulted to determine their requirements.

Landfill classification

The site wide Made Ground (comprising sandy gravels of limestone and brick) are suitable for disposal at a **non-hazardous** landfill but cannot be classified as inert owing to the presence of elevated mineral oil within the soils.

2 Introduction

2.1	Objectives
2.2	Status of this report
2.3	Client instructions and confidentiality
2.4	Site location and scheme proposals
2.5	Report format and investigation standards
2.6	Report distribution
2.7	Soiltechnics liability

2.1 Objectives

- 2.1.1 This report describes a ground investigation carried out for a proposed retirement living development at the Greenfinch, Lapwing Lane, Didsbury, Manchester, M20 3ZA.
- 2.1.2 The objective of the ground investigation was to establish ground conditions at the site, sufficient to identify possible foundation solutions for the development and provide parameters necessary for the design and construction of foundations.
- 2.1.3 The investigation included an evaluation of potential chemical and gaseous contamination of the site leading to the production of a risk assessment in relation to contamination.
- 2.1.4 The investigation has also been produced to support a planning application for the site by satisfying National Planning Policy Framework (2021).
- 2.1.5 Our brief also included investigations and testing to allow classification of soils at the site to be disposed of to landfill.

2.2 Status of this report

- 2.2.1 This report is final based on our current instructions.

2.3 Client instructions and confidentiality

- 2.3.1 The original investigation was carried out in April 2021 and reported in June 2021, while additional fieldwork was carried out in October 2022 and reported in November 2022. Reliance of this report has been transferred to our new client in August 2023, Churchill Retirement Living Ltd.
- 2.3.2 This report has been prepared for the sole benefit of our above-named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

- 2.3.3 The investigations generally followed our original investigation proposals. The investigation process was also determined to maintain as far as possible the original investigation budget costs.

2.4 Site location and scheme proposals

- 2.4.1 The National Grid reference for the site is 384320, 392080. A plan showing the location of the site is presented on Drawing 01.
- 2.4.2 We understand the site will be redeveloped for residential use comprising apartment blocks of twenty-four 1-bed and thirteen 2-bed retirement living units with shared landscaped space. The apartment blocks are to be 2.5-3-stories in height.
- 2.4.3 We have received layout drawings of the existing site layout presented on Drawing 02.
- 2.4.4 We have received layout drawings of the proposed scheme with the layout presented on Drawing 03.
- 2.4.5 It should be noted that the red line boundary includes the existing public house building in the northeast of the site. It is understood that this is to be developed by others and therefore is not considered further in this assessment.

2.5 Report format and investigation standards

- 2.5.1 Sections 2 to 6 of this report describe the factual aspects of the investigation with Section 7 presenting an engineering assessment of the investigatory data. Section 8 provides a risk assessment of chemical contamination based on readily available historic records, inspection of the soils and laboratory testing. Section 9 provides a similar risk assessment in relation to gaseous contamination with Section 10, a risk assessment relating to construction materials likely to be in contact with the ground. Section 11 provides a classification of waste soils for off-site disposal under the waste acceptance criteria.

2.5.2 Geotechnical aspects

- 2.5.2.1 Geotechnical investigations were carried out generally, and where practical following the recommendations of BS EN 1997:2 2007 '*Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing*'. From a geotechnical viewpoint this is deemed to be a Ground Investigation Report (GIR) as set out in BS EN 1997:2. This report does not constitute a Geotechnical Design Report as defined in section 2.8 of BS EN 1997-1:2004+A1:2013 '*Eurocode 7 – Geotechnical Design – Part 1: General Rules*' and in particular will exclude assessment of lifetime actions to buildings from geotechnical influences.

2.5.3 Geo-environmental aspects

- 2.5.3.1 The investigation process also followed the principles of BS 10175:2011+A2:2017 '*Investigation of potentially Contaminated Sites – Code of Practice*'. A desk study report for this project was produced by GeoSmart Information Ltd in January 2021 (report ref: 74223R1) which is presented in Appendix K. We have used relevant information contained within the Phase 1 desk study to assist with our Phase 2 interpretive assessments.
- 2.5.3.2 The extent and result of the preliminary investigation (desk study) is reported in Section 3. Fieldwork combined the exploratory investigation and main investigation stages into one phase with the extent of these works described in Sections 4 and 6 of this report. Any supplementary investigations deemed necessary are identified in Section 13. Based on the results of the investigation, Section 8 will identify if any remediation is necessary with respect to chemical contamination, and a basic strategy for implementation presented in Section 12 where necessary. Similarly, Section 9 will identify if any remediation is necessary with respect to gaseous (landfill gas) contamination, and again a basic strategy for implementation presented in Section 12 where necessary.
- 2.5.3.3 This investigation has been carried out and reported based on our understanding of best practice. Improved practices, technology, new information and changes in legislation may necessitate an alteration to the report in whole or part after publication. Hence, should the development commence after expiry of one year from the publication date of this report then we would recommend the report be referred back to Soiltechnics for reassessment. Equally, if the nature of the development changes, Soiltechnics should be advised and a reassessment carried out if considered appropriate.

2.6 Report distribution

- 2.6.1 This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, subject to Soiltechnics liabilities defined below, although this list may not be exhaustive:

Table summarising parties likely to require information contained in this report	
Party	Reason
Client	For information / reference and cost planning
Developer / Contractor / project manager	To ensure procedures are implemented, programmed and costed
Planning department	Potentially to discharge planning conditions
Environment Agency	If ground controlled waters are affected and obtain approvals to any remediation strategies
Independent inspectors such as NHBC / Building Control	To ensure procedures are implemented and compliance with building regulations
Project design team	To progress the design
Principal Designer (PD)	To advise in construction risk identification and management under the Construction (design and management) regulations
Waste recycling operators (if appropriate)	For recycling or reducing hazardous properties (if and where appropriate)
Table 2.6	

2.7 Soiltechnics liability

- 2.7.1 Soiltechnics disclaims any responsibility to our Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence in accordance with the terms of our contract, taking account of the manpower, resources, investigations and testing devoted to it by agreement with our Client. This report is confidential to our Client and Soiltechnics accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

3 Desk study information and site observations

3.1	General
3.2	Site description, history and development proposals
3.3	History of the site
3.4	Ground conditions
3.5	Preliminary chemical and gaseous contamination risk assessment
3.6	Unexploded Ordnance (UXO) Risk

3.1 General

- 3.1.1 We recommend the following summary is not read in isolation to the Phase 1 Contaminated Land Assessment completed by GeoSmart Information Ltd (Report ref: 74223R1). A copy of the report is presented in Appendix K for completeness.

3.2 Description of the site

- 3.2.1 The site is located within the predominantly residential/commercial area of West Didsbury approximately 6km south of Manchester City Centre. The site lies at the western corner of the Lapwing Lane and Palatine Road crossroads at postal address M20 3ZA.
- 3.2.2 At the time of 2021 investigation the site comprised an abandoned three storey public house (formerly the Greenfinch) - partially demolished, across its eastern extent. To the west and south of the site there is a hardstanding car park, whilst access to the site is achieved from the north. A courtyard/beer garden with soft landscaping is present to the south and east of the public house.
- 3.2.2 By the time of the 2022 investigation the western half of the former public house had been demolished to ground level.
- 3.2.3 Ground levels across the site gently fall to the south/southwest, with slight mounding evident along the southern and partly western boundaries. Topographical levels in the general area fall gently southwest towards the site's nearest watercourse, the River Mersey, some 950m from site.
- 3.2.4 Numerous trees up to 15-20m in height are present across the southern, eastern and western boundaries of the site, with individual localised trees present towards the centre of the site.
- 3.2.5 Photographic records of the site are presented below.



Photograph 01: West of site looking towards public house in east of site. April 2021



Photograph 02: Southwest corner of site looking east. April 2021



Photograph 03: Looking north, showing partially demolished former The Greenfinch building. October 2022



Photograph 04: Looking east, showing existing car parking area and stockpile on site. October 2022

3.3 History of the site

- 3.4.2 The site was first developed in 1893 with a large building in the eastern corner matching the current site layout. Since 1893 several smaller buildings have been present in the north and west of the site, which were subsequently demolished. The reported use of the site is a public house, residential and school. Off site historic land uses include a town/corporation yard (adjacent to north west), railway line (adjacent to east), electrical substation (c.10m north) and a garage (c.135m north east).

3.4 Ground conditions

- 3.4.1 Based on published records, the likely sequence of soils underlying the site is as follows:

Summary of Geology and likely aquifer containing strata					
Strata	Bedrock or superficial	Approximate thickness	Typical soil type	Likely permeability	Aquifer designation
Glaciofluvial Sheet Deposits	Superficial	<4m	Sands, gravels and clays	Permeable in fractures	Secondary 'A' aquifer
Devensian Till	Superficial	<11m	Clays with sands and gravels	Effectively impermeable	Secondary 'undifferentiated' aquifer
Wilmslow Sandstone Formation	Bedrock	Up to 920m	Sandstone	Permeable in fractures	Principal aquifer
Table 3.4.1					

3.5 Preliminary chemical and gaseous contamination risk assessments

- 3.5.1 GeoSmart Information concludes that there is a moderate/low risk of chemical contamination on site.
- 3.5.2 **Onsite sources of chemical contamination**
- 3.5.2.1 Given the localised multiple phases of construction and demolition onsite over time, and the presence of the town/corporation yard adjacent to the north west of the site between 1893 and 1993, there is considered a potential for contamination to be present on site in the form of potential inorganic, low volatility organic contaminants and asbestos containing materials (ACM) within the subsurface soils.
- 3.5.2.2 Possible receptors of the site include human health and controlled water (groundwater only, contained within Secondary 'A' superficial aquifer and Principal bedrock aquifer).
- 3.5.2.3 Although not strictly mentioned within the GeoSmart information risk assessment report, we also consider vegetation a receptor for the current and proposed site, as we understand proposed residential developments will include soft landscaping.

3.5.3 Offsite sources of chemical contamination

- 3.5.3.1 The main offsite source of contamination was advised as the historic town yard/corporation yard adjacent to the north west of the site. Potential contamination could include inorganic, low volatility organic contaminants and asbestos containing materials (ACM) within the subsurface soils.

3.5.4 Gaseous contamination

- 3.5.4.1 The GeoSmart Information risk assessment report also indicates there to be no discernible risk associated to gaseous contamination on site, as the site is not located within close proximity to any historic or registered landfill sites. In addition, the site is not located within an area of identified coal mining, as such there is no mine gas issues recorded on site.
- 3.5.4.2 The site is also recorded in an area where no radon protective measures are necessary in the construction of new dwellings or extensions.

3.6 Unexploded Ordnance (UXO) Risk

- 3.6.1 Prior to our fieldwork activities we obtained a desk study risk review report from MACC International. The risk review concluded that there was not a credible risk of encountering UXO during the ground investigation. It should be noted that this preliminary risk review does not constitute a detailed risk assessment for the purposes of the construction phase. A copy of the review report is presented in Appendix L.

4 Fieldwork

4.1	General
4.2	Site restrictions
4.3	Exploratory trial pits
4.4	Sampling strategies

4.1 General

- 4.1.1 The original fieldwork was carried out on 16th April 2021 has comprised five trial pits to a maximum depth of 3.2m below ground level (bgl). Additional fieldwork carried out on 6th and 7th October 2022 comprised a further six trial pits (one hand dug) to a maximum depth of 2.0m below ground level.
- 4.1.2 A plan of the site showing observed/existing site features and position of exploratory points is presented on Drawing 02.
- 4.1.3 The extent of fieldwork activities and position of exploratory points were determined by Soiltechnics.
- 4.1.4 Exploratory points were positioned to avoid known locations of underground services, to avoid possible location of proposed foundations but were also positioned to provide a reasonable coverage of the site. Prior to commencement of exploratory excavations an electronic cable locating tool was used to scan the area of the excavation. If we received a response to this equipment then the excavation would be relocated.
- 4.1.5 All soils exposed in excavations were described in accordance with BS EN ISO 14688 '*Identification and Classification of soil*' and BS EN ISO 14689 '*Identification and classification of rock*'.

4.2 Site restrictions

- 4.2.1 There were no significant onsite restrictions at the time of investigation with the exception of the presence of the remaining parts of the former public house buildings in both 2021 and 2022.

4.3 Exploratory trial pits

- 4.3.1 Trial pits TP01 to TP05 (2021) and TP101 to TP105 (2022) were excavated to a maximum depth of 3.2m using a rubber tyred excavator, while TP106 was excavated using hand held digging equipment to a depth of 0.7m. Surface asphalt was initially broken out using hydraulic breaking equipment fixed to the excavator. The excavations were backfilled with excavated material compacted using the back of the excavator bucket. Whilst we attempted to reinstate the excavation to its original condition some short-term settlement of the backfilling materials may occur. Asphalt surfacing was not replaced.

- 4.3.2 Sampling and logging was carried out as trial pit excavations proceeded but were not entered at depths exceeding 1.2m, or where trial pit sides were deemed unstable. The density of granular soils encountered in excavations was gauged by the ease of excavation.
- 4.3.3 Soil samples for subsequent laboratory determination of concentration of chemical contaminants were taken from the sides of trial pits using clean stainless-steel equipment and stored in new plastic containers, which were labelled and sealed. The stainless-steel sampling equipment was cleaned with deionised water between sampling points. Samples from below access depth into trial pits were taken as a sub sample from soil contained in the excavator bucket, discarding any soil, which may have been in contact with the bucket. If as a consequence of visual or olfactory evidence, a sample was suspected to be contaminated by organic material, the sample was stored in an amber glass jar with a PTFE sealing washer.
- 4.3.4 Soil samples for subsequent laboratory 'classification' testing were taken from the side of trial pits or from bulk samples taken from the excavator bucket. The sample was immediately placed in a plastic bag and subsequently sealed and labelled. Samples for determination of water content were placed in sealable tubs and appropriately labelled. Soil samples were obtained to meet Category A and quality class 3 to 5 as described in BS EN 1997-2:2007 (table 3.1) sufficient for laboratory testing being considered. Sample sizes were also appropriate for the laboratory test being considered (refer BS EN 1997-2:2007 annex L).
- 4.3.5 Copies of trial pit borehole logs are presented within Appendix D.
- 4.3.6 Infiltration testing carried out in trial pits**
- 4.3.6.1 Soil infiltration tests were carried out in trial pits TP02 and TP04 at depths between 1.12m and 1.82m in 2021 during our original 2021 investigations, and between TP101 to TP104 at depths between 0.90m and 2.0m during our 2022 investigation. Infiltration tests were carried out following the procedures described in the Building Research Establishment (BRE) DG 365 (2016) "*Soakaway Design*". Records of test results and calculations to determine a soil infiltration rate are presented in Appendix C.
- 4.3.6.2 During 2021 investigations the rate at which water placed in each trial pit dissipated was slow and a maximum of three test cycles could not be carried out in TP02 during one day of fieldwork (the BRE document recommends three full test cycles).
- 4.3.6.3 In 2022, three test cycles could were carried out in TP102 and TP103 during two days of fieldwork. Two test cycles were carried out in TP101 and TP104 during two days of fieldwork, with one cycle completed in TP04 in one day of fieldwork. Test results have been used to produce a soil infiltration rate for each test cycle, using the method described in the BRE publication.

4.4 Sampling strategies

4.4.1 Geotechnical

4.4.1.1 In general we adopted a judgemental sampling strategy in relation to geotechnical aspects of the investigation. The location and frequency of sampling was carried out in consideration of the following:

- i) Topography
- ii) Geology (including Made Ground)
- iii) Nature of development proposals

4.4.2 Environmental

4.4.2.1 Details of sampling with respect to contamination issues are described in Section 8.

4.4.3 Sample retention

4.4.3.1 Samples are stored for a period of one month following issue of this report, unless otherwise requested.

5 Laboratory testing

5.1	Classification testing
5.2	Chemical testing

5.1 Classification

5.1.1 Laboratory testing was carried out on samples retrieved from site. The method of testing is recorded on the laboratory test certificate. The following table summarises the classification testing scheduled;

Table summarising classification testing			
Exploratory point	Depth (m)	Soil type	Testing scheduled (determination of)
TP01	0.3	Made Ground	Concrete classification - BRE SD1 Suite C (brownfield – pyrite absent)
	1.0	Glaciofluvial Sheet Deposits	Particle size distribution
	2.5		
TP02	0.4	Made Ground	Concrete classification - BRE SD1 Suite C (brownfield – pyrite absent)
	0.8	Glaciofluvial Sheet Deposits	CBR (remoulded)
	1.2		Concrete classification - BRE SD1 Suite C (brownfield – pyrite absent)
TP04	0.8	Glaciofluvial Sheet Deposits	CBR (remoulded)
	1.3		Particle size distribution
TP05	1.8	Glaciofluvial Sheet Deposits	Particle size distribution
Table 5.1.1			

5.1.2 Laboratory test certificates are presented in Appendix E.

5.2 Chemical testing

5.2.1 Chemical testing was carried out based on ground conditions and with reference to the contamination Initial Conceptual Model as presented in Section 8. The test methods are recorded on the chemical test certificates. The following table summarises the chemical testing scheduled;

Table summarising chemical testing			
Exploratory point	Depth (m)	Medium/soil type	Testing scheduled (Refer to Appendix B for details).
TP01	0.6	Made Ground	Suite 1 / Suite 7 / Asbestos ID
TP02	0.2	Made Ground	Suite 1 / Asbestos ID
TP04	0.2	Made Ground	Suite 1 / Asbestos ID
	0.5		
TP05	0.3	Made Ground	Suite 1 / Suite 7 / Asbestos ID
	0.5		Suite 2
TP105	0.3	Made Ground	ST Basic classification suite
	0.7		
TP106	0.4		
WAC01	0.0	Made Ground	Waste Acceptance Criteria
Table 5.2.1			

5.2.2 Laboratory test certificates for chemical testing are presented in Appendix F.

6 Ground conditions encountered

6.1	Soils/rocks
6.2	Geotechnical parameters
6.3	Groundwater
6.4	Evidence of contamination
6.5	Obstructions and instability
6.6	Existing foundation arrangements

6.1 Soils / Rocks

6.1.1 Each exploratory excavation encountered a similar profile of soils considered to be Made Ground overlying Glaciofluvial Sheet Deposits.

6.1.2 Made Ground

6.1.2.1 Made Ground was encountered below a 0.11m to 0.12m thick layer of asphalt and typically comprised of light grey to brown subbase of very sandy gravels of brick and limestone, with occasional cobbles of half brick. Made Ground was recorded to a depth of 0.6m to 0.9m beneath the site, with the exception of TP105, where Made Ground was encountered at depth over 1.2m depth (full thickness not proven).

6.1.3 Glaciofluvial Sheet Deposits

6.1.3.1 Glaciofluvial deposits were recorded beyond the maximum depth of excavation (>3.2m) and typically comprised of light grey to brown gravelly slightly clayey sand, with gravels of sandstone. Based on the ease of the excavation, and collapse at depth, we anticipate the Glaciofluvial Sheet Deposits are in a 'loose' state of compaction beneath the site.

6.1.4 Summary

6.1.4.1 The following table summarises the geology encountered;

Table summarising soil types				
Strata	Depth to top (m)	Depth to bottom (m)	Thickness (m)	Summary description
Made Ground	0.0	0.6-0.9 but locally >1.2	0.6->1.2	Light grey to brown gravels of limestone and brick
Glaciofluvial Sheet Deposits	0.6 – >1.2	>3.2	>2.5	Light grey to brown gravelly slightly clayey sand.
Table 6.1				

6.1.4.2 With the exception of Made Ground, the investigation generally confirmed published geological records.

6.2 Geotechnical parameters

6.2.1 The following table summarises test data in the Glaciofluvial Sheet Deposits.

Table summarising soil testing and derived geotechnical parameters					
Geotechnical parameter	Method	Value range	Characteristic value	Derivation	Notes
Weight density above water table, γ_b (kN/m ³)	Soil descriptions	15-17	17	BS 8004 figure 1	
Weight density below water table, γ_b (kN/m ³)	Soil descriptions	18-20	20	BS 8004 figure 2	
N value	Fieldwork observations	5-9	5	Assuming deposits exhibit a 'loose' state of compaction	1
Critical state angle of shearing resistance, ϕ_{cv} (°)	Fieldwork observations & laboratory testing		32	BS8004:2015 Equation 4	2
CBR value	Laboratory derived	1.8-7.5	3	Laboratory remoulded	2

Table 6.2

1. Trial pit logs presented in Appendix D.
2. Test data present in Appendix E.

6.3 Groundwater

6.3.1 Groundwater inflows were only observed within TP01 at a depth of 3.1m. The groundwater filled the trial pit to 3.07m in 10 minutes.

6.4 Evidence of contamination

6.4.1 During excavation of our exploratory points, no visual or olfactory evidence of contamination was noted.

6.5 Obstructions and instability

6.5.1 A brick wall was observed in the first attempt of excavating TP101. Subsequently the trial pit was extended further south to avoid the obstruction.

6.5.2 Instability of trial pit sides was observed within the Glaciofluvial Sheet Deposits typically below depths of 2.0m, widening trial pit sides by up to 1.0m in some instances. Further details are provided within the trial pit logs presented in Appendix D.

7 Geotechnical Appraisal

7.1	General description of the development
7.2	Building regulations and this report section
7.3	The geological model
7.4	Building foundation solution
7.5	Determination of bearing resistance
7.6	Ground floor construction
7.7	Trench excavations
7.8	Infiltration potential
7.9	Pavement foundations
7.10	Reuse of excavated soils from the site

7.1 General description of the development

7.1.1 The following assessments are made on the investigatory data presented in the preceding sections of this report and are made with reference to specific nature of the development. Should scheme proposals change then it may be necessary to review the investigation and report.

7.1.2 We understand the site will be redeveloped for residential use comprising apartment blocks of twenty-four 1-bed and thirteen 2-bed retirement living units with shared landscaped space. The apartment blocks are to be 2.5-3-stories in height.

7.2 Building regulations and this report section

7.2.1 Building Regulations

7.2.1.1 Current Approved Document A of the building Regulations references Eurocodes and their UK National Annexes as practical guidance in meeting part A requirements. Approved document A advises there may be alternative ways of achieving compliance with requirements where it can be demonstrated that the use of withdrawn standards no longer maintained by the British Standards Institution continues to meet Part A requirements.

7.2.2 This report section

7.2.2.1 This chapter of the report provides both a foundation strategy for the proposed development and geotechnical design parameters to comply with Eurocode 7 (BSEN1997-1:2004 '*Geotechnical Design – part 1 General Rules*' and the corresponding UK National Annex).

7.2.3 Geotechnical terms

7.2.3.1 Definitions of geotechnical terms used in the following paragraphs are provided in Appendix A.

7.2.4 This report

- 7.2.4.1 This report is a ground investigation report (GIR) and does not constitute a Geotechnical Design Report as defined in section 2.8 of BS EN 1997-1:2004 '*Eurocode 7 – Geotechnical Design – Part 1: General Rules*' and in particular will exclude assessment of lifetime actions to buildings from geotechnical influences.

7.3 The geological model

7.3.1 Strata

- 7.3.1.1 Eleven trial pits formed at the site to a maximum depth of 3.2m each encountered a reasonably consistent profile of soils which are summarised in the following table:

Summary of ground conditions encountered at the site					
Strata	Summary soil type	Depth to base of strata		Groundwater	
		Range	Model	Range	Model
Made Ground	Light grey to brown gravels of limestone and brick	>1.2m	0.9m	None	
Glaciofluvial Sheet Deposits	Light grey to brown gravelly slightly clayey sand.	>3.2m	>3.2m	3.1m	3.0m
Table 7.3					

7.3.2 Groundwater

- 7.3.2.1 Groundwater inflows were only observed within TP01 at a depth of 3.1m. The groundwater filled the trial pit to 3.07m in 10 minutes.

7.4 Building foundation solution

- 7.4.1 In our opinion the naturally deposited Glaciofluvial Sheet Deposits will adequately support the proposed buildings on concrete strip / trench fill type foundations. The near surface Glaciofluvial Sheet Deposits are likely to be non-shrinkable and thus their volume will not be influenced by the water demands of the variety of trees at the site. Based on the above, in combination with ground conditions encountered on site, we recommend foundations extend a minimum of 0.75m below existing or proposed ground levels whichever provides the deeper foundation with all foundations penetrating the natural deposits by at least 0.3m subject to an overall foundation depth of 0.75m.

7.5 Determination of bearing resistance

7.5.1 Geotechnical category

- 7.5.1.1 In our opinion the project will comprise conventional types of structure and foundations with no exceptional risk, or difficult ground or loading conditions thus meeting the requirements of geotechnical category 2.

7.5.2 Assumptions

7.5.2.1 Eurocode 7 list assumptions made in the provision of the standard (in Section 1.3). Comments against some assumptions are provided below.

Assumption	Comment
Data for the design are collected, recorded and interpreted by appropriately qualified personnel	This report follows an in-house procedure of review and checking, ultimately approved by a Director of the company who by virtue of experience in geotechnical engineering and qualification is deemed appropriately qualified
Adequate continuity and communication exist between the personnel involved in data collection, design and construction	This can be challenging in situations in which structural and geotechnical design is carried out by different individuals and indeed different organisations. Invariably the ground investigation is carried out at an early stage of a development and prior to actions on buildings being established let alone their magnitude. It is important that we the geotechnical consultant form part of the design team with continuous review of geotechnical design data in the context of the structural design process.

Table 7.5.2

7.5.3 Ultimate limit state assessment

7.5.3.1 Based on the results of the investigations, we are of the opinion soils providing support to spread foundations are granular (coarse grained soils) and thus bearing resistance will be determined using drained conditions. The table below presents characteristic values (derived in Section 6) and design values (applying partial factors where appropriate as tabulated below) used in our calculations to derive bearing resistances for ultimate limit states.

7.5.3.2 We have also assessed that groundwater will not rise sufficient to extend within potential rupture surfaces of soils supporting foundations.

Table of geotechnical parameters for ULS – coarse grained (drained) soils			
Stata	Characteristic Value	Design Value (approach 1) C1 = Combination 1 C2 = Combination 2	Derivation / comment
Characteristic constant volume (known as critical state) effective angle of shearing resistance, (ϕ')			
Glaciofluvial	32°	32° (C1)	Design value in C2 derived using partial factor applied to $\tan \phi'$
Sheet		26.5° (C2)	
Deposits		$[\tan^{-1}(\tan \phi')/1.25]$	
Characteristic weight density γ_b , γ' (kN/m ³)			
Glaciofluvial	15 to 17	17 (γ_k)	Above water table from BS8004:2015 Figure 1
Sheet			
Deposits	18 to 20	20 (γ_k)	Below water table from BS8004:2015 Figure 2
Bearing coefficients (N_q , N_γ)			
Glaciofluvial		23 (C1) (N_q)	From BS8004:2015 Cl 5.4.1.2.2 Partial factors applied for combination 2
Sheet		13 (C2) (N_q)	
Deposits		28 (C1) (N_γ)	
		12 (C2) (N_γ)	
Table 7.5.3.2a			

Table 7.5.3.2a

Table of Partial Factors for limit states – coarse grained (drained) soils		
Ultimate limit state derived using Design Approach 1		
Parameter applied to	Combination 1	Combination 2
Material factors (M)		
Characteristic constant volume (known as critical state) effective angle of shearing resistance	1	1.25
Density of soils	1	1
Resistance factors (R)		
Bearing resistance	1	1
Table 7.5.3.2b		

7.5.3.3 The following table provides derived ultimate limit state bearing resistances.

Table of bearing resistance (strip /trench fill foundations)		
Ultimate limit state derived using Design approach 1		
Foundation width (m)	Combination 1 kN/m²	Combination 2 kN/m²
0.6	R _{d1} = 465	R _{d2} = 230
0.75	R _{d1} = 510	R _{d2} = 250
0.9	R _{d1} = 550	R _{d2} = 265
Table 7.5.3.3		

7.5.3.4 It is vitally important to note that partial factors given in table A3 of the code must be applied to actions (V_{uls}) imposed on the ground at foundation formation level (including self-weight of the foundation) to satisfy the requirement of:

$$V_{uls} \leq R_d$$

7.5.4 Serviceability limit state (SLS) assessment

7.5.4.1 It is a requirement to check the serviceability limit state by estimating permanent deformation of the ground (settlement) providing resistance to the applied actions. In order to determine settlement, we have used the following geotechnical parameters which are deemed characteristic of the soils supporting the foundation. These are as follows:

Table of geotechnical parameters to estimate settlement			
Symbol	Parameter	Range of values	Derivation
N_{ave}	Average Standard Penetration Test N Value in soils below foundation	5	Deposits assumed to comprise a loose state of compaction as determined by the ease of excavation.
Table 7.5.4.1			

7.5.4.2 There are many methods of calculating settlement induced in coarse grained soils from applied foundation stresses. As a practice we have adopted the methods described by Burland et al, in a published paper entitled '*Estimating the settlement of foundations on sands and gravels*'. Burland has used observations of settlement in buildings constructed on coarse grained soils and back analysed to provide a method of settlement prediction. This method is also presented in BSEN1997-2:2007 (annex F3).

7.5.4.3 The following table presents bearing resistances and associated estimates of settlement. It should be noted that the adopted methodology incorporates a creep factor which we have applied assuming a 50-year lifespan.

Table of bearing resistance (strip /trench fill foundations)		
Design approach 1		
Foundation width (m)	Bearing resistance (kN/m ²)	Estimated settlement (mm)
0.6	R _{sls} = 100	25
0.75	R _{sls} = 90	25
0.9	R _{sls} = 80	25
Table 7.5.4.3		

7.5.4.4 Differential settlement is totally dependent upon the variation of loads (actions) imposed on the ground and consistency of the foundation supporting ground. Assuming foundation loads are reasonably uniform, we consider differential settlement is unlikely to exceed say 15mm. It is likely settlement will be substantially achieved within say 5 years of construction. If stresses applied at foundation formation levels vary significantly then this will increase levels of differential settlement produced by variation in ground conditions alone

7.5.4.5 Thus actions (V_{sls}) imposed on the ground at foundation formation level (including self-weight of the foundation) taking into account a consideration of live (variable) loads the following must be satisfied;

$$V_{sls} \leq R_{sls}$$

7.5.4.6 The Glaciofluvial Sheet Deposits encountered in exploratory excavations are consistent and will provide uniform support to foundations. In the unlikely event foundation excavations encounter a very loose area, we recommend foundation excavations continue to locate denser soils or reinforcement introduced into foundation concrete to span the very loose area.

7.6 Ground floor construction

7.6.1 Ground bearing floor slabs can be adopted at this site where Made Ground and Topsoil deposits are fully removed within the footprint of the building. We recommend a blanket of good quality compacted granular material be placed prior to construction of the floor slabs.

- 7.6.2 In areas where ground floors are elevated requiring in excess of 600mm of fills, or where it is impracticable to remove Made Ground, then we recommend the use of a suspended ground floor with a sub floor void determined following NHBC Standards, Chapter 4.2.

7.7 Trench excavations

- 7.7.1 Excavations extending to depths greater than 2.0m are at an increasing risk of experiencing collapse. Moreover, any excavations in excess of 3.0m are also at an increasing risk of encountering water inflows which will further promote progressive instability in trench sides requiring continuous trench sheet shoring to maintain an open excavation. We anticipate water will be controlled with nominal pumping techniques. We anticipate that foundation excavation not exceeding depths of 1.5m should remain stable in the short term.
- 7.7.2 We recommend any trench excavation requiring human entry is shored as necessary to conform with current best practice, and accepted by the Health and safety Executive (HSE) and in particular, following guidance provided in the HSE publication 'Health and safety in construction (HSG 150)' (www.hse.gov.uk).

7.8 Infiltration potential

- 7.8.1 The permeability of the Glaciofluvial Sheet Deposits was measured in six trial pits following the procedures described in Building Research Establishment (BRE) Digest 365 (2007) "Soakaway Design". Records of testing and calculations are presented in Appendix C.
- 7.8.2 The summary of infiltration rates by location are presented in table below:

Table of infiltration rates					
Location	Test number	Test Length (mins)	Infiltration rate (m/s)	Average Infiltration Rate (m/s)	Median Infiltration Rate (m/s)
TP02 (2021)	1	138	1.68×10^{-5}	-	-
TP04 (2021)	1	258	8.11×10^{-6}	-	-
TP101 (2022)	1	338	8.64×10^{-6}	1.34×10^{-5}	-
	2	365	1.83×10^{-5}		
TP102 (2022)	1	212	1.29×10^{-5}	1.09×10^{-5}	1.29×10^{-5}
	2	108	6.44×10^{-6}		
	3	360	1.34×10^{-5}		
TP103 (2022)	1	350	6.75×10^{-6}	6.57×10^{-6}	-
	2	160	6.40×10^{-6}		
	3	77	-		
TP104 (2022)	1	125	7.39×10^{-6}	7.34×10^{-6}	-
	2	110	7.30×10^{-6}		
Average				9.55×10^{-6}	
Table 7.8.2					

- 7.8.3 If infiltration systems are adopted at the site as a means of disposing of stormwater, it would appear sensible to locate any drainage in the western part of the site (TP02, TP101 or TP102) where an infiltration rate of 1×10^{-5} m/s could be justified based on the calculated average. However, there is some notable variation in results across the site. We cannot guarantee, therefore, the long term performance of soakaway systems, and alternative means of disposal of roof water should be considered. In our opinion, the use of permeable paving to drain hardstanding/roads is likely to be effective at the site.
- 7.8.4 If infiltration systems are adopted as a means of stormwater disposal (including permeable pavement construction), we recommend approval for the use of soakaways is sought from the Environment Agency. It should be noted that the Groundwater Regulations 1998 require that list 1 substances (e.g. Hydrocarbons) are to be prevented from entering groundwater receptors and list 2 substances (e.g. metals) are also restricted. Typically, the Environment Agency will require details of the proposed soakaway systems, showing pollution prevention measures. They will also require geological and geo-hydrological information, (contained in this report) as well as the risks of chemical contaminants in the ground affecting water resources. It is also typical requirement that there is an 'unsaturated zone' between the base of the soakaway system and the groundwater table (saturated zone) providing attenuation capacity.

7.9 Pavement foundations

7.9.1 Location of the pavement formation

- 7.9.1.1 We anticipate that the proposed access road and associated hardstanding areas will be located at or about existing ground levels with formation located on Made Ground and Glaciofluvial Sheet Deposits.

7.9.2 Determination of subgrade CBR from laboratory testing

- 7.9.2.1 We have determined CBR values in the laboratory within two samples of the Glaciofluvial Sheets Deposits at a depth of 0.8m within TP02 and TP04. Laboratory test data is presented within Appendix E.
- 7.9.2.2 Based on the laboratory test results a subgrade CBR of 3.0% at a depth of 0.8m can be deduced.

7.9.3 Treatment of formation

- 7.9.3.1 Once formation levels have been established it is recommended that the formation be trimmed and rolled following current requirements of the Highways Agency Specification for Highways Works (clause 616) (refer <https://www.standardsforhighways.co.uk/ha/standards/>). Such a process will identify any loose areas, which we recommend be either excavated out and backfilled with a suitable well compacted material similar to those exposed in the sides of the resulting excavation, or large cobbles of a good quality stone rolled into the formation to stabilise the 'loose' area.

7.10 Reuse of excavated soils from the site

- 7.10.1 Generally soils excavated from the site could be reused as bulk filling, if reused at their natural moisture content. We recommend soils be classified and compacted in accordance with the current Highways Agency 'Specification for Highway Works' (600 series) – table 6/1 (refer <https://www.standardsforhighways.co.uk/ha/standards/>).

8 Chemical contamination

8.1	Contaminated land, regulations and liabilities
8.2	Objectives and procedures
8.3	Initial conceptual model
8.4	Fieldwork observations
8.5	Laboratory testing
8.6	Updated conceptual model
8.7	Risk assessment summary and recommendations
8.8	Statement with respect to National Planning Policy Framework

8.1 Contaminated land, regulation and liabilities

- 8.1.1 Full reference should be made to the Phase 1 Contaminated Land Assessment completed by GeoSmart Information Ltd (Report ref: 74223R1) dated January 2021, for full details of their source, pathway, receptor assessment.

8.2 Objectives and procedures

- 8.2.1 This report section discusses investigations carried out with respect to chemical contamination issues relating to the site. As stated in Section 2, the investigation process followed the principles of BS 10175:2011+A2:2017 '*Investigation of potentially contaminated sites – Code of Practice*' with the investigation combining the exploratory and detailed investigations (refer BS 10175 for an explanation).
- 8.2.2 This section of the report refines the outline conceptual site model (CSM) produced within the Phase 1 Contaminated Land Assessment Report by GeoSmart assessing the potential pollutant linkages identified based upon observations and investigatory data obtained from the intrusive investigation works.
- 8.2.3 Pollutant linkages are potential hazards to health or the environment, where a source-pathway-receptor link can be identified. Reference should be made to the Phase 1 Contaminated Land Assessment Report for the definition of terms and process used and for the findings of the initial CSM and identification of potential pollutant linkages.

8.3 Initial conceptual model

- 8.3.1 Based on a preliminary assessment of potential contaminative sources, identified receptors and viable pathways, an initial CSM was produced within the Phase 1 Contaminated Land Assessment Report by GeoSmart Information (Report ref: 74223R1).
- 8.3.2 Based on the initial CSM there were potential contaminant linkages which exceeded the low risk category and are therefore to be considered further in the following sections in order to refine the risk assessment.

- 8.3.3 A brief outline of the potential contaminant linkages are summarised below and are detailed in the initial CSM, which is replicated in Appendix H for reference.
- Contaminants within any Made Ground anticipated site wide associated to historic developments on site.
 - Contaminants associated to the former town yard/corporation yard located adjacent to the north west of the site.
- 8.3.4 All of the above contaminants are considered to impact current/proposed site users, construction operatives and controlled waters (limited only to groundwater receptors).
- 8.3.5 Vegetation has not been considered a receptor as part of this assessment. It is noted that some existing vegetation which borders the site will remain following development. This has been observed in a healthy condition (no sign of stress or poor growth) and it is considered unlikely that near surface soils are determinately impacting the growth of such. Our investigations have not encountered a discernible Topsoil layer across the site, with Made Ground present everywhere investigated to date.
- 8.3.6 The requirement to provide a remedial capping to all proposed landscaped areas is disused in further detail in the following sections and in Section 12. Providing a clean cover system is installed in all landscaped areas to mitigate against the human health risks already identified, this will also serve to sever the pathway of potential exposure to planting, and therefore the risk can be discounted from further consideration.

8.4 Fieldwork observations

- 8.4.1 None of the exploratory excavations exposed soils or groundwater displaying visual or olfactory evidence of gross contamination.
- 8.4.2 Anthropogenic material within the Made Ground included brick only. The thickness of the Made Ground was consistent across the site (0.6m to 0.9m) with the exception of TP105 in the footprint of the former western half of the pub, where the base of the Made Ground was not encountered within 1.2m bgl.
- 8.4.3 Based on the above, no additional potential pollutant linkages have been identified for consideration.

8.5 Laboratory testing

8.5.1 Testing regime

- 8.5.1.1 Based on the GeoSmart Information source assessment (and initial conceptual model) there is evidence to suggest a source of contamination within the Made Ground on site. However, as we did not clearly observe any evidence of gross contamination whilst undertaking fieldwork activities, we have undertaken a general suite of

chemical contamination laboratory testing site wide in order to provide sufficient coverage and allow an updated risk assessment to be made.

8.5.1.2 The following table summarises the chemical testing scheduled as well as a rationale for the testing;

Table summarising scheduled testing					
Exploratory point	Depth (m)	Strata/medium	Targeted sampling?	Scheduled testing	Rationale
TP01	0.6	Made Ground	N	Suite 1 / Suite 7 / Asbestos ID	Site wide coverage
TP02	0.2			Suite 1 / Asbestos ID	
TP04	0.2			Suite 1 / Asbestos ID	
	0.5				
TP05	0.3			Suite 1 / Suite 7 / Asbestos ID	
	0.5			Suite 2 (I)	
TP105	0.3	Basic classification suite			
	0.7				
TP106	0.4				

Table 8.5.1.2

(I) – leachable concentrations. Refer to Appendix B for testing suite descriptions.

8.5.1.3 The results of laboratory determination of concentration of chemical contaminants are presented in Appendix F.

8.5.2 Criteria for assessment of test data – Human receptors

8.5.2.1 Assessment of laboratory test data has been carried out with reference to current nationally recognised documents listed in the final page of Appendix B. Due to changes in guidance on contaminated land, items 6-8 and item 10 in the document listing above have been withdrawn. In the absence of alternative guidance however we have used these documents. Where new guidance is available, this has been followed in preference to superseded guidance.

8.5.2.2 The Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) have derived Suitable for Use Levels (S4ULs) which are presented in *'The LQM/CIEH S4ULs for Human Health Risk Assessment'* (2015). S4ULs have been used as a screening tool to assess the risks posed to the health of humans from exposure to soil contamination in relation to appropriate land uses. Where published S4ULs are not available, we have adopted C4SLs (Category 4 Screening Levels) produced by DEFRA or SGVs (Soil Guideline Values) as appropriate. In the absence of any of these criteria we have adopted Soil Screening Values (SSV) derived by Soiltechnics and by Atkins (SSV^{ATK}). The CLEA model used to derive SSVs has been used with toxicology data presented by the EA, LQM/CIEH and Atkins (in that order of preference). SSVs produced by Atkins are presented on their ATRISK^{SOIL} website.

8.5.2.3 S4ULs, C4SLs, SGVs, SSVs and SSV^{ATK}s represent 'intervention values'; indications to an assessor that soil concentrations above these levels might present an unacceptable risk to the health of site users. These guideline values have been produced using conceptual exposure models, which use assumptions and are applied to differing end uses of land. If the values are exceeded, it does not necessarily imply there is an actual

risk to health and site-specific circumstances should be taken into account. Conversely, where a critical pathway or chemical form of the contaminant has not been evaluated, a risk may be present even if the adopted guideline value has not been exceeded.

8.5.2.4 For evaluation of test data in relation to polycyclic aromatic hydrocarbon (PAH), phenols and total petroleum hydrocarbon (TPH) contamination, we have compared measured concentrations with corresponding S4ULs. The S4UL fractions are dependent on the Soil Organic Matter (SOM) content of the soils. We have adopted the relevant guideline values based on SOM testing.

8.5.2.5 We have followed procedures outlined by the CIEH to compare measured concentrations of metals and PAH contaminants against guideline values. TPH contamination results are compared directly with the relevant guideline values. The guidance presents an approach to data analysis and includes the examination of data for potential outliers, assessment of the normality of the test data and the calculation of a 95% Upper Confidence Limit (UCL). The UCL provides an estimate of the population mean, based on test data, with a 95% confidence that the actual mean does not exceed this value. The UCL is compared to the guideline value for the site.

8.5.2.6 As the site is currently unoccupied, we have not considered current site users. We have adopted a residential land use without home grown produce for proposed end users of the site.

8.5.3 Criteria for assessment of test data – Construction operatives

8.5.3.1 In the absence of guidelines we have adopted commercial guideline values for assessment of construction operatives.

8.5.4 Criteria for assessment of test data – Controlled waters

8.5.4.1 For interpretation of test data in relation to water receptors we have directly compared measured values with relevant screening values. Details of the source data and adopted threshold values are outlined on the summary tables in Appendix G.

8.5.4.2 Based on the GeoSmart receptor assessment, and in consideration of the pathways and migration potential for contaminants on site, the critical receptors for the site are the underlying Secondary A and Principal Aquifers contained within the superficial and bedrock deposits, respectively. As no notable surface water features are recorded within 250m of the site, surface waters are not considered a receptor to the site. Furthermore, as the site is not recorded within an area at extreme risk of flooding, then saturation of flood waters is also not considered to be a receptor.

8.5.4.3 On the above assessment we have adopted drinking waters as the critical receptor, and this has been utilised within our assessment model in Appendix G.

8.5.5 Evaluation of test data – Human receptors

8.5.5.1 Tables summarising and analysing test data are presented in Appendix G. The following table summarises the outcome of the analyses.

Table summarising assessment of test data for human receptors					
Analysis tables	Receptor group	Critical receptor	CLEA model	Inorganic contaminants	Organic contaminants
1, 3 and 5	Proposed site users	Child	Residential without plant uptake	Arsenic in 1 sample	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene TPH EC8-10 & EC10-12
2, 4 & 6	Construction operatives	Adult	Industrial / commercial	No exceedances	No exceedances

Table 8.5.5.1

8.5.5.2 As TP106 is not recorded within the development boundary, results from this exploratory position are excluded from the assessment.

8.5.5.3 With reference to Table 1 in Appendix G (inorganic contaminants), analysis of chemical test data with respect to critical (child) receptors for proposed site users, indicates all measured concentrations of selected contaminants and 95 percentile upper confidence limits (UCL) are below relevant adopted guideline values with the exception of arsenic. The elevated concentration was measured in a sample of limestone gravel (Made Ground) in TP04 at a depth 0.2m. It is likely that the exceedance is related to some ferruginous material within the limestone, which arsenic is commonly associated, and natural in origin. The toxicity of such naturally occurring contamination at the concentrations measured onsite are highly unlikely to present a significant risk of harm to human health.

8.5.5.3 The UCL of mercury was noted to be 1.5mg/kg compared to the guideline value of 1.2mg/kg for elemental mercury. Low level analysis undertaken on the 3No. samples from 2022 recorded mercury concentrations of 0.06-0.18mg/kg. The laboratory limit of detection of mercury for the 2021 samples was <1.0mg/kg, therefore, we have adopted a conservative concentration of 1.0mg/kg for such samples. The screening value for elemental mercury has been conservatively used however there is no evidence of previous site usage of elemental mercury therefore the inorganic mercury guideline value (40mg/kg) is more applicable to this site. As a result, the mercury UCL exceedance risk is considered very low and is not considered further.

8.5.5.4 With reference to Table 2 in Appendix G (organic contaminants), analysis of chemical test data with respect to critical (child) receptors for proposed site users, indicates all measured concentrations of selected contaminants and 95 percentile upper confidence limits (UCL) are below relevant adopted guideline values with the exception of Benzo(a)pyrene, Benzo(b)fluoranthene and Dibenzo(a,h)anthracene.

8.5.5.5 Elevated PAH concentrations have all been recorded within Made Ground of three samples across the site (TP01 and 2No. in TP105) in the south-western corner of the site, and under the footprint of the former pub building respectively.

- 8.5.5.6 The UCL for Benzo(a)pyrene was calculated as 7.8mg/kg compared to a SGV of 3.2mg/kg. The mean value of 2.6mg/kg does not exceed the SGV. Test results ranged from 4.3mg/kg to 7.4mg/kg across all three exceeding samples.
- 8.5.5.7 The UCL for Benzo(b)fluoranthene was calculated as 8.7mg/kg compared to a SGV of 4.0mg/kg. The mean value of 3.8mg/kg does not exceed the SGV. Test results ranged from 4.53mg/kg to 8.4mg/kg across all three exceeding samples.
- 8.5.5.8 The UCL for Dibenzo(a,h)anthracene was calculated as 1.1mg/kg compared to a SGV of 0.32mg/kg. The mean value of 0.4mg/kg also exceeds the SGV. Test results ranged from 0.51mg/kg to 1.1mg/kg across all three exceeding samples.
- 8.5.5.9 In addition, measured concentrations of TPH fractions EC8-10 (aliphatic) and EC8-10 in a sample of Made Ground from TP105 at 0.7m depth exceed the relevant guidelines.
- 8.5.5.10 With reference to Table 7, asbestos was not detected in any of the samples submitted for screening.
- 8.5.5.11 Based on the above evaluation, we are of the opinion that the near surface soils are likely to exhibit contamination from a perspective of human receptors.
- 8.5.5.12 As outlined in paragraphs 8.3.6 above, there is little soil which could be utilised as a suitable growing medium for plants. The importation of soils for lawns and soft landscaping would be required and would serve to mitigate any residual risk from elevated concentrations of arsenic, PAHs and TPHs (see below for further details).
- 8.5.6 Evaluation of test data – Controlled waters**
- 8.5.6.1 *Inorganic contaminants***
- 8.5.6.1.1 With reference to Table 7 in Appendix G, none of the measured concentrations of inorganic contaminants exceed the relevant guidelines for drinking water receptors.
- 8.5.6.2 *Organic contaminants (polycyclic aromatic hydrocarbons)***
- 8.5.6.2.1 For the analysis of PAH contamination, the sum of the following contaminants has been compared to a UKDWS.
- Benzo(b)fluoranthene
 - Benzo(k)fluoranthene
 - Benzo(ghi)perylene
 - Indeno(1,2,3-cd)pyrene
- 8.5.6.2.2 The summed concentration of the PAH 'suite' do not exceed the UKDWS. In addition the leachable concentration of benzo(a)pyrene and naphthalene, do not exceed their respective guideline values.

8.5.6.3 Summary

- 8.5.6.3.1 Based on the above evaluation, we are of the opinion that the near surface soils are unlikely to exhibit significant contamination with respect to controlled water resources.

8.6 Updated conceptual model

- 8.6.1 Having now completed analysis of laboratory testing, we can now update our conceptual model which is presented in Appendix H.

- 8.6.2 Based on the updated conceptual model risks to human health (future site users) are moderate and on this basis remedial action is considered necessary to render the site fit for purpose.

8.7 Risk assessment summary and recommendations

- 8.7.1 Based on our assessments described above, we can provide the following summary and recommendations for each identified receptor.

8.7.2 End users

- 8.7.2.1 As a source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a medium risk of causing harm to the health of future end users of the developed site, based on current development proposals.

8.7.3 Construction operatives and other site investigators

- 8.7.3.1 The risk of damage to health of construction operatives and other site investigators is, in our opinion, low. As a precautionary approach, however, we recommend adequate hygiene precautions are adopted on site. Such precautions would be:-

- Wearing protective clothing particularly gloves to minimise ingestion from soil contaminated hands.
- Avoiding dust by dampening the soils during the works.
- Wearing masks if processing produce dust.

- 8.7.3.2 Guidance on safe working practices can be obtained from the following documents

- The Health and Safety Executive Publication *“Protection of Workers and the General Public during the Development of Contaminated Land”* (HMSO) and
- *“A Guide to Safer Working on Contaminated Sites”* (CIRIA Report 132).

- 8.7.3.3 In addition, reference should be made to the Health and Safety Executive. In all cases work shall be undertaken following the requirements of the Health and Safety at Work Act 1974 and regulations made under the Act including the COSHH regulations.

8.7.4 Controlled waters

8.7.4.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a low risk of causing harm to water receptors.

8.8 Statement with respect to National Planning Policy Framework

8.8.1 Based on investigations completed to date with respect to chemical contamination, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended (without the need for any remedial action) thus meeting the requirements of the National Planning Policy Framework section 178, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture*'.

8.9 Remedial action

8.9.1 Based on the above we recommend the following action is taken:-

- a) Provision of a capping in soft landscaping areas. Details of this remediation (in the form of a statement / specification) is provided in section 12.
- b) Adoption of adequate hygiene precautions for construction operatives.

9 Gaseous contamination

9.1	Initial Conceptual Site Model
9.2	Conclusion
9.3	Statement with respect to National Planning Policy Framework

9.1 Initial Conceptual Site Model

- 9.1.1 As discussed within the GeoSmart Information Phase 1 Contaminated Land Assessment (Report ref: 74223R1), presented in Appendix K, no significant sources of landfill type gases were identified which would otherwise require further investigation and/or assessment.

9.2 Conclusion

- 9.2.1 As there is no evidence to demonstrate that there is a potential source rendering the site at a significant risk of being affected by ground gases (carbon dioxide / methane) sufficient to cause significant harm to human end users of the site, construction operatives or indeed buildings, it was not considered necessary to install ground gas wells and conduct a monitoring regime to further assess the risk.
- 9.2.2 Observations from the fieldworks did not identify any potential sources of ground gas which could alter this assessment.

9.3 Statement with respect to National Planning Policy Framework

- 9.3.1 Based on investigations completed to date with respect to gaseous contamination, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended (without the need for any remedial action) thus meeting the requirements of the National Planning Policy Framework section 121, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture*'.

10 Effects of ground conditions on building materials

10.1	General
10.2	Concrete – sulphate attack
10.3	Concrete – chloride attack
10.4	Concrete – acid attack
10.5	Concrete – magnesium attack
10.6	Concrete – ammonium attack
10.7	Plastic pipes

10.1 General

10.1.1 Building materials are often subjected to aggressive environments which cause them to undergo chemical or physical changes. These changes may result in loss of strength or other properties that may put at risk their structure integrity or ability to perform to design requirements. Aggressive conditions include:-

- Severe climates
- Coastal conditions
- Polluted atmospheres
- Aggressive ground conditions

10.1.2 This report section only considers aggressive ground conditions in relation to buried concrete and water pipes. Ground conditions may affect other materials but have not been considered here.

10.2 Concrete - Sulphate attack

10.2.1 Hazard

10.2.1.1 Sulphate attack on concrete is characterised by expansion, leading to loss of strength, cracking, spalling and eventual disintegration. There are three principal forms of sulphate attack, as follows:-

- Formation of gypsum through reaction of calcium hydroxide and sulphate ions.
- Ettringite formation through reaction of tricalcium alluminate and sulphate ions.
- Thaumasite formation as a result of reactions between calcium silicate hydrates, carbonate ions (from aggregates) and sulphate ions.

10.2.2 Assessment

10.2.2.1 The hazard of sulphide attack is addressed by reference to procedures described in Building Research Establishment (BRE) Special Digest 1: 2005 '*Concrete in Aggressive Ground*' to establish a design sulphate class (DS) and the '*aggressive Chemical Environment for Concrete*' (ACEC). These procedures have been followed during our investigation and are described in the following paragraphs.

10.2.3 Desk Study Information

- 10.2.3.1 The first step in the procedure is to consider specific elements of the desk study. These are tabulated below.

Summary of desk study information			
Element	Interrogation	Outcome	SD1: 2005 reference
Geology	Likelihood of soils containing pyrites	Unlikely	Box C6
Past industrial uses	Brownfield site?	Yes	C2.1.2

Table 10.1

- 10.2.3.2 A brownfield site is defined in SD1: 2005 as a site, or part of a site which has been subject to industrial development, storage of chemicals (including for agricultural use) or deposition of waste, and which may contain aggressive chemicals in residual surface materials, or in ground penetrated by leachates. Where the history of the site is not known, it should be treated as brownfield until there is evidence to classify it as natural.

- 10.2.3.3 Based on the above it is necessary to follow the procedures described in figure C6 (*'locations on brownfield sites except where soils may contain pyrite'*).

10.2.4 Laboratory testing

- 10.2.4.1 The following table summarises ground conditions and laboratory testing.

Item	Soil type	Outcome
Soil		
Number of samples	Made Ground	2
	Glaciofluvial Sheet Deposits	2
Characteristic w/s sulphate	Made Ground	21mg/l
	Glaciofluvial Sheet Deposits	17mg/l
Characteristic pH	Made Ground	8.5
	Glaciofluvial Sheet Deposits	7.5

Table 10.2

10.2.5 Disturbed ground

- 10.2.5.1 As potentially pyritic ground has not been identified at the site, disturbed ground is not considered in the following assessment.

10.2.6 Assessment of design sulphate class (DC) and aggressive chemical environment for concrete (ACEC)

10.2.6.1 Based on the design sulphate class, characteristic value of pH and assessment of groundwater mobility, and with reference to table C2 of SDI: 2005, the ACEC class for each soil type is presented in Table 10.2.6 below.

Summary of concrete classification				
Soil type	Disturbed ground?	Consider TPS?	DS class	ACEC class
Made Ground	y	n	DS-1	AC-1
Glaciofluvial Sheet Deposits	n	n	DS-1	AC-1
Table reference 10.3				

10.3 Concrete - Chloride attack

10.3.1 Hazards

10.3.1.1 There are a number of ways in which chlorides can react with hydrated cement compounds in concrete. These are as follows:-

- Chlorides react with calcium hydroxide in the cement binder to form soluble calcium chloride. This reaction increases the permeability of the concrete reducing its durability.
- Calcium and magnesium chlorides can react with calcium aluminate hydrates to form chloroaluminates which result in low to medium expansion of the concrete.
- If concrete is subject to wetting and drying cycles caused by groundwater fluctuations, salt crystallisation can form in concrete pores. If pressure produced by crystal growth is greater than the tensile strength of the concrete, the concrete will crack and eventually disintegrate.

10.3.2 Risk assessment

10.3.2.1 Chlorides of sodium, potassium, and calcium are generally regarded as being non-aggressive towards mass concrete; indeed, brine containers used in salt mines have been known to be serviceable after 20 years service. Depending upon the type of concrete, and the cement used up to 0.4% chloride is allowed in BS8110: Part 1.

10.3.2.2 In view of the past use of the site we consider the likelihood of elevated concentrations of chlorides in the ground is not likely to occur and on this basis have not specifically measured concentrations of chlorides and, in our opinion, the risk of buried concrete being affected by chlorides is considered low.

10.4 Concrete - Acid attack

10.4.1 Hazards

10.4.1.1 Concrete being an alkaline material is vulnerable to attack by acids. Prolonged exposure of concrete structures to acidic solutions can result in complete disintegration.

10.4.2 Risk assessment

10.4.2.1 The rate of acid attack on concrete depends upon the following:-

- The type of acid
- The acid concentration (pH)
- The composition of the concrete (cement/aggregate)
- The soil permeability
- Groundwater movement

British Standard BS8110: Part 1 classifies extreme environment as one where concrete is exposed to flowing groundwater that has a pH<4.5. The standard also warns that Portland Cement is not suitable for acidic conditions with a pH of 5.5 or lower.

10.4.2.2 The pH of the soil was measured exceeding 5.5 and on this basis the risk of concrete being affected by acidic conditions is considered low.

10.5 Concrete - Magnesium attack

10.5.1 Hazards

10.5.1.1 Magnesium salts (excepting magnesium hydrogen carbonate) are destructive to concrete. Corrosion of concrete occurs from cation exchange reactions where calcium in the cement paste hydrates and is replaced with magnesium. The cement loses binding power and eventually the concrete disintegrates.

10.5.2 Risk assessment

10.5.2.1 In practice 'high' concentrations of magnesium will be found in the UK only in ground having industrial residues. Following BRE Special Digest 1:2005, measurement of the concentration of magnesium is recommended if sulphate concentrations in water extract or groundwater exceed 3000mg/l. Once measured the concentration of magnesium is considered further in BRE Special Digest in establishing the concrete mix to resist chemical attack.

10.5.2.4 We have measured the concentration of magnesium in both the Made Ground and Glaciofluvial Sheet Deposits soil samples at the site which produced results in the range of 2.5mg/l to 5.3mg/l. These results fall below the range of the lowest exposure class; thus, we do not consider there to be a risk on site with respects to magnesium attack.

10.6 Concrete - Ammonium attack

10.6.1 Hazards

10.6.1.1 Ammonium salts, like magnesium salts act as weak acids and attack hardened concrete paste resulting in softening and gradual decrease in strength of the concrete.

10.6.2 Risk assessment

10.6.2.1 UK guidance is not available on the concentration of ammonium which may affect concrete. BS EN 206-1: 2000 '*Concrete - Part 1: Specification, performance, production and conformity*' does, however, provide exposure classes for concrete in contact with water with varying concentrations of ammonia for the design/specification for concrete mixes.

10.6.2.2 As only limited groundwater was encountered by the investigation, we have not been able to obtain a representative water sample for measurement of concentration of ammonia. In addition, the site has no history which provides evidence of the uses of ammonia on site, and in overall conclusion the risk of concrete being affected by ammonia is considered low.

10.7 Plastic Pipes

10.7.1 Hazards

10.7.1.1 Plastic pipes are predominantly manufactured from PVC and PE but other materials can be used. In general, they perform well but it is known that chemical attack and permeation of contaminants through the pipes can result from use in contaminated land. A published review on plastic pipes reports the following:-

- Polyethylene (PE) - good resistance to solvents, acids and alkalis
- Poly vinyl chloride (PVC) - most common form of pipe. Good general resistance to chemical attack but can be attacked by solvents such as ketones, chlorinated hydrocarbons and aromatic polypropylene (PP) - chemically resistant to acids, alkalis and organic solvents but not recommended for use with storing oxidising acids, chlorinated hydrocarbons and aromatics.
- Poly vinylidene fluoride (PVDF) - inert to most solvents, acids and alkalis as well as chlorine, bromide and other halogens
- Polytetrafluoroethylene (PTFE) - one of the most inert thermoplastics available. PTFE has good chemical resistance to solvents, acids and alkalis

A survey carried out by the Water Research Centre (WRC) on reported incidents of permeation (more than 25), only two involved PVC with these incidents relating to spillages of fuel.

10.7.2 Assessment

- 10.7.2.1 A survey carried out by the Water Research Centre (WRC) on reported incidents of permeation (more than 25), only two involved PVC with these incidents relating to spillages of fuel.
- 10.7.2.2 The UK Water Industry research (UKWIR) have published a document entitled '*Guidance for the selection of Water supply pipes to be used in Brownfield sites*'. The publication defines brownfield sites as
- 'Land or premises that have been used or developed. They may also be vacant, or derelict. However, they are not necessarily contaminated'*
- 10.7.2.3 The subject site has previously been developed and on this basis could potentially be considered brownfield in accordance with the UKWIR document. Following the preliminary risk assessment procedures described in the UKWIR document however, (paragraph 2.4.2) there is no evidence to indicate that chemicals have ever been used or stored on site.
- 10.7.2.4 Whilst we have not carried out a full investigation set out in guidance in the UKWIR document, the subject site does exhibit a degree of localised hydrocarbon (PAH) contamination. The UKWIR document advises a trigger concentration of 0.125mg/kg for their 'extended VOC (Volatile Organic Carbons) suite' which includes the PAH suite which we have results for. The measured concentration of individual contaminants forming part of the PAH suite exceeds the trigger value of 0.125mg/kg. At this stage, in our opinion it is considered possible that barrier pipes will have to be installed at this site, however, we recommend United Utilities is consulted on this to gain their opinion and requirements.

11 Waste characterisation

11.1	General
11.2	Waste populations and sampling
11.3	Waste characterisation summary
11.4	Reuse of soils - Materials Management Plans

11.1 General

- 11.1.1 We have undertaken sampling to characterise the insitu soils encountered on site for the potential disposal to landfill. Our assessment includes a hazardous waste classification, in accordance with WM3 (v1.1), and a Waste Acceptance Criteria (WAC) assessment, in accordance with the current requirements published by the government.

11.2 Waste populations and sampling

- 11.2.1 Based on the site observations and laboratory results, the Made Ground is relatively consistent across the site and for preliminary assessment purposes can be classified as a single site-wide population comprising sandy gravels of limestone and brick. This waste population can easily be visually distinguished on site.
- 11.2.2 No visible fragments of suspected ACMs were identified during the fieldworks. As with all brownfield sites, there remains a potential for asbestos materials to be encountered. In such an event these should be safely segregated for disposal as hazardous waste.
- 11.2.3 The asbestos screening results also indicated asbestos fibres were absent in all samples tested.
- 11.2.4 For the WAC assessment, a single composite sample of the Made Ground waste population was analysed. The composite WAC sample was combined with materials from all holes completed in 2021 and can be identified as WAC01.

11.3 Waste characterisation summary

- 11.3.1 Observations from the fieldwork and laboratory analysis indicate that the underlying natural soils are not impacted by contamination, and therefore are considered suitable for disposal as non-hazardous waste in an inert landfill site without the requirement for further testing, under the List of Wastes (LoW) code 17-05-04 (formerly known as EWC).
- 11.3.2 The hazardous waste classification assessment has been undertaken using a worst-case scenario, by adopting the maximum recorded concentration of each compound from the composite sample. The waste classification assessment sheet is enclosed within Appendices I1 and I2, and a summary of the findings is presented in the table below.

Waste characterisation summary			
Stratum	Hazardous classification	Landfill classification	Comments
Made Ground	Non-hazardous	Non-hazardous	Cannot be classified as inert owing to elevated concentrations of mineral oil within the waste population.
Table 11.3			

11.3.3 We understand that some landfill sites have licences which have restrictions on concentrations of chemical contaminants and thus we recommend this report is provided to the selected landfill facility to confirm (or otherwise) it can accept the waste. Please be aware that landfill sites are obligated to undertake in house quality assurance tests and thus may require further WAC testing for any soils encountered as part of this investigation. There is no obligation on any landfill operator to accept waste if they choose not to and waste operators may require additional testing of untested waste soils prior to acceptance at landfill in accordance with the landfill regulations.

11.3.4 It should also be noted that there remains the potential for unexpected or previously unencountered contamination to be encountered. For instance, in the vicinity of historical oil tanks and transfer pipes, oil interceptors, or underneath the footprint of existing structures on site. Any such materials intended for waste disposal should be segregated and tested to determine the appropriate classification and disposal route.

11.4 Reuse of Soils - Materials Management Plans

11.4.1 In terms of contaminated land risk assessment, there is no requirement for any of the identified waste populations to be removed from site. Where Made Ground soils are to be moved and reused onsite, a Materials Management Plan (MMP) or Waste Exemption is recommended.

11.4.2 The process of an MMP determines where soils are and are not considered to be a waste. By following *'The Definition of Waste: Development Industry Code of Practice'* published by CL:AIRE (2011), soils that are suitable for reuse without the need for remediation (either chemical or geotechnical) and have a certainty of use, are not considered to be waste and therefore do not fall under waste regulations.

11.4.3 In addition, this guidance presents opportunities to transfer suitable natural materials between sites, without the need for Waste Exemptions or Environmental Permits, and can facilitate moving hazardous wastes to a Soil Treatment Facility, thereby increasing the sustainability of the development and reducing landfill disposal costs.

11.4.4 MMPs offer numerous benefits, including maximising the use of soils onsite, minimising soils going to landfill and reducing costs and time involved in liaising with waste regulators. We can provide further advice on waste management, as required.

12 Remediation strategy and specification

12.1	Introduction
12.2	Summary of results of investigation leading to recommendations for remediation
12.3	Remediation Strategy
12.4	Specification for imported capping materials
12.5	Verification report

12.1 Introduction

- 12.1.1 This remediation statement has been produced with a view to isolating and clarifying remedial measures outlined in our main ground investigation report for the site. The objective of remediation works described in this report is to render the site *'fit for purpose'* in relation to the proposed development.
- 12.1.2 We understand the development will comprise the construction of residential dwellings with garden/landscaped and parking areas. Gardens/landscaping will be accessible to children resident in the completed development. A plan showing the proposed development layout is presented on Drawing 03.
- 12.1.3 This remediation statement only considers the process of remedial action in terms of addressing contamination recognised to date. If during development, contamination not previously identified, is found to be present at the site, then an addendum method statement will be required, and the appropriate measures taken on site.
- 12.1.4 All sampling and laboratory analysis associated with the recommended remediation will be undertaken following nationally recognised guidelines and standards that are appropriate at the point of investigation. Laboratory analysis must be commissioned with testing houses that are suitably experienced and are MCERTS accredited with a quality assurance system.
- 12.1.5 This statement has been prepared to assist in the process of the proposed development, and it normally will require distribution to the following parties prior to implementation, although this list may not be exhaustive:

Table summarising parties likely to require information contained in this section of the report

Party	Reason
Client	For information / reference and cost planning
Developer / Contractor / project manager	To ensure procedures are implemented, programmed and costed
Planning department	Potentially to discharge planning conditions
Independent inspectors such as NHBC / Building control	To ensure procedures are implemented and compliance with building regulations
Project design team	To allow for remedial measures in the design

Project landscape consultant	To ensure compatibility of cover system proposed in this document with landscape requirements
Supplier of remediation materials	To ensure compliance with specification.

12.2 Summary of results of investigations leading to recommendations for remediation

12.2.1 Investigations and assessment of chemical contamination is described primarily in Section 8. A summary of chemical contamination at the site is detailed below.

12.2.2 Evaluation of contamination - human receptors

12.2.2.1 Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene and TPH fractions EC8-10 were measured at concentrations above soil guideline values within the Made Ground. These contaminants are considered to pose a risk of causing harm to end-users at the site (particularly the critical human receptor) and thus remediation is considered appropriate.

12.2.3 Evaluation of contamination - water receptors

12.2.3.1 Based on the results of investigatory data, we are of the opinion that there is not a significant possibility of significant harm being caused to water resources from ground conditions explored at the site.

12.3 Remediation strategy

12.3.1 The provision of buildings and hardstanding areas across the site will sever the pathway to end-users by preventing human access to contaminated soils.

12.3.2 In proposed landscaped areas, an imported capping layer (cover system) of chemically 'clean' soils will be introduced to sever the pathway between contaminants and end-users, thus minimising the risk of human contact with soils containing contaminants which have the potential to cause harm to human health. Given the shared usage of the landscaped areas, produce will not be grown on site and therefore a minimum cover of 450mm with geotextile would be required in soft landscaped areas. In our opinion this may be reduced to 300mm given proposed end usage in accordance with BS3882:2015 '*Specification for topsoil*' where planting is not proposed.

12.3.3 Whilst the capping solution is widely accepted regulating Local Authorities (Environmental Health Departments) have differing views as to the minimum thickness required which range from 300mm to 450mm. The Building Research Establishment publication '*cover systems for land regeneration - thickness cover for systems for contaminated land*' indicates that 450mm of capping would be required at the site, though in our opinion this could be reduced to 300mm in non-productive garden and landscaped areas, however this needs to be verified with the Local Authority.

12.3.4 Following installation of the cover system described above, the capping thickness will require independent measurement to validate the correct thicknesses have been provided in landscaped areas.

12.3.5 In areas where vegetation is proposed, the thickness of any imported soils should be deepened to 600mm, and 900mm in areas of proposed trees as required to facilitate healthy vegetative growth.

12.4 Specification for imported capping materials

12.4.1 General

12.4.1.1 All imported capping materials (cover systems) shall be sampled and tested to demonstrate they are '*fit for purpose*' before being brought onto site.

12.4.2 Capping materials

12.4.2.1 Capping materials shall comprise Topsoil to a minimum thickness of 150mm, over subsoil, alternatively the capping can comprise Topsoil. A geotextile membrane should be used at the base of the system to ensure soil mixing is limited.

12.4.2.2 Topsoil shall comprise a material which will allow plants to grow healthily. Topsoil shall be general purpose grade in accordance with BS3882:2015 '*Specification for topsoil*' unless otherwise specified by the consultant landscape architect for the project. Testing shall be carried out to demonstrate compliance for general purpose topsoil (or other topsoil specified by others) with test criteria provided in table 2 of BS3882 with at least one sample tested per source. Topsoil shall be stored, handled and place following the recommendations of BS3882.

12.4.2.3 Subsoils shall be granular (sands / gravels) or clays / silts of natural origin, which shall be classified, placed and compacted in accordance with the current Specification for Highway works, Volume 1, 600 series, available on www.standardsforhighways.co.uk.

12.4.3 Rate of testing / sampling

12.4.3.1 If different sources are to be utilised for Topsoil/capping, each source shall be investigated.

12.4.3.2 Capping materials shall be from a source where at least 3 representative soil samples have been taken, subject to a minimum rate of at least 1 sample per 250m³.

12.4.4 Testing Regime - Human receptors

12.4.4.1 The testing regime really is dependant upon the history of the site where the capping materials are sourced. Past historical uses (from a potential chemical contamination viewpoint) of the source site will dictate the required testing regime potentially requiring additional testing to target / investigate concentrations of contaminants used at the source site where they are harmful to human health. At this stage we

cannot specify the scope and indeed the need for such site specific testing as the source of the imported fills is not known.

- 12.4.4.2 As a minimum testing shall be scheduled to measure the concentrations of commonly occurring inorganic and organic contaminants (listed in Table 12.4.7 below where guideline values are available).

12.4.5 Water receptors

- 12.4.5.1 The materials forming the cover system, may exhibit a degree of permeability, and thus the potential for any chemical contaminants contained in the soils to leach and thus migrate towards groundwater resources, although the risk of this occurring is dependant upon the location of the water table and indeed the permeability of the soils above the water table. Conversely, leachable contaminants could migrate laterally from cover system towards surface water resources. In order to minimise this risk, the soils forming the cover system shall be tested to determine leachable concentrations of potential contaminants. As with testing regimes associated with human health, the testing regime really is dependant upon the history of the site where the capping materials are sourced. At this stage we cannot specify the scope and indeed the need for such site specific testing as the source of the imported fills is not known.

- 12.4.5.2 As a minimum testing shall be scheduled to measure the leachable concentrations of commonly occurring inorganic and organic contaminants where they are considered a risk to harming water receptors (listed in Table 12.4.7 below where leachate guideline values are available).

12.4.6 Maximum concentrations (Human receptors)

- 12.4.6.1 The Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) have derived Suitable for Use Levels (S4ULs) which are presented in '*The LQM/CIEH S4ULs for Human Health Risk Assessment*' (2015). S4ULs have been used as a screening tool to assess the risks posed to the health of humans from exposure to soil contamination in relation to appropriate land uses. Where published S4ULs are not available, we have adopted C4SLs (Category 4 Screening Levels) produced by DEFRA or SGVs (Soil Guideline Values) as appropriate. In the absence of any of these criteria we have adopted Soil Screening Values (SSV) derived by Soiltechnics and by Atkins (SSV^{ATK}). The CLEA model used to derive SSVs has been used with toxicology data presented by the EA, LQM/CIEH and Atkins (in that order of preference). SSVs produced by Atkins are presented on their ATRISK^{SOIL} website.

- 12.4.6.2 S4ULs, C4SLs, SGVs, SSVs and SSV^{ATK}s represent 'intervention values'; indications to an assessor that soil concentrations above these levels might present an unacceptable risk to the health of site users. These guideline values have been produced using conceptual exposure models, which use assumptions and are applied to differing end uses of land. If the values are exceeded, it does not necessarily imply there is an actual risk to health and site-specific circumstances should be taken into account. Conversely, where a critical pathway or chemical form of the contaminant has not

been evaluated, a risk may be present even if the adopted guideline value has not been exceeded.

12.4.6.3 For evaluation of test data in relation to polycyclic aromatic hydrocarbon (PAH) and phenol contamination, we have compared measured concentrations with corresponding S4ULs. The S4UL fractions are dependent on the Soil Organic Matter (SOM) content of the soils. We have adopted the lowest S4UL (1% SOM) as an initial screening value.

12.4.7 Maximum concentrations (water receptors)

12.4.7.1 For interpretation of test data in relation to water receptors measured concentrations of leachable contaminants shall be directly compared with Drinking Water Standards (as outlined in Section 8.5.4.2), and where these values are not available, Environmental Quality Standards (EQS) as published by the Environment Agency shall be adopted.

12.4.8 Maximum concentrations (summary)

12.4.8.1 The following table summarises the maximum concentrations of chemical contaminants which shall not be exceeded in imported capping materials.

Table summarising maximum concentration of contaminants in soils used for capping			
Contaminant	Maximum allowable concentration and test criteria (Human Receptors) (Total concentration)		Maximum concentration (µg/l) (leachate concentration)
	C4SL (mg/kg)	S4UL/ATK (mg/kg)	
Inorganic contaminants			
Arsenic	-	37	10
Barium	-	-	700
Boron	-	290	1000
Beryllium	-	1.7	-
Cadmium (pH to 7.4)	-	11	5
Copper	-	2400	2000
Chromium	-	910	50
Cyanide (total)	-	34	50
Lead	210	-	10
Mercury	-	1.2	1
Nickel	-	180	20
Nitrate	-	-	50000
Selenium	-	250	10
Sulfate	-	-	250000
Sulfide	-	-	0.25
Vanadium	-	410	20
Zinc	-	3700	3000
Organic contaminants			
Acenaphthene	-	210	
Acenaphthylene	-	170	
Anthracene	-	2400	
Benzo(a)anthracene	-	7.2	
Benzo(a)pyrene	-	2.2	0.01
Benzo(b)fluoranthene	-	2.6	
Benzo(g,h,i)perylene	-	320	
Benzo(k)fluoranthene	-	77	
Chrysene	-	15	

Dibenzo(a,h)anthracene	-	0.24	
Fluoranthene	-	280	
Fluorene	-	170	
Indeno(1,2,3-cd)pyrene	-	27	
Naphthalene	-	2.3	
Phenanthrene	-	95	
Phenols	-	280	
Pyrene	-	620	
PAHs (sum of 4)			0.1
Table 13.4.7			

12.4.9 Information required

12.4.9.1 It is critically important that the imported capping material will minimise the risks of causing harm to human end users of the site. It is necessary to demonstrate the imported capping materials are 'fit for purpose', and relevant and current test result certificates are an important part of the necessary compliance documentation. Compliance documentation will be provided to other interested parties such as:-

- Local authority planning department to discharge planning permissions
- Checking bodies such as NHBC and Building Control (For compliance with building regulations)
- Potential purchasers of the buildings (and their legal advisors)
- Environment Agency (controlling body for ground / surface water resources)

Based on the above it is important to provide compliance documentation prior to importation to site, thus avoiding abortive works and delays to the construction programme with its potential financial penalties.

12.4.9.1 Compliance documentation shall include the following

- Copies of test result certificates signed by a MCERTS accredited laboratory which is signed and dated.
- Source and supplier of the capping material.
- Delivery notes confirming the material originates from the stated source (will form part of the subsequent validation reporting)

12.5 Verification report

12.5.1 The thickness of the completed cover system will require verification by an independent consultant. We can carry out such investigations on further instructions.

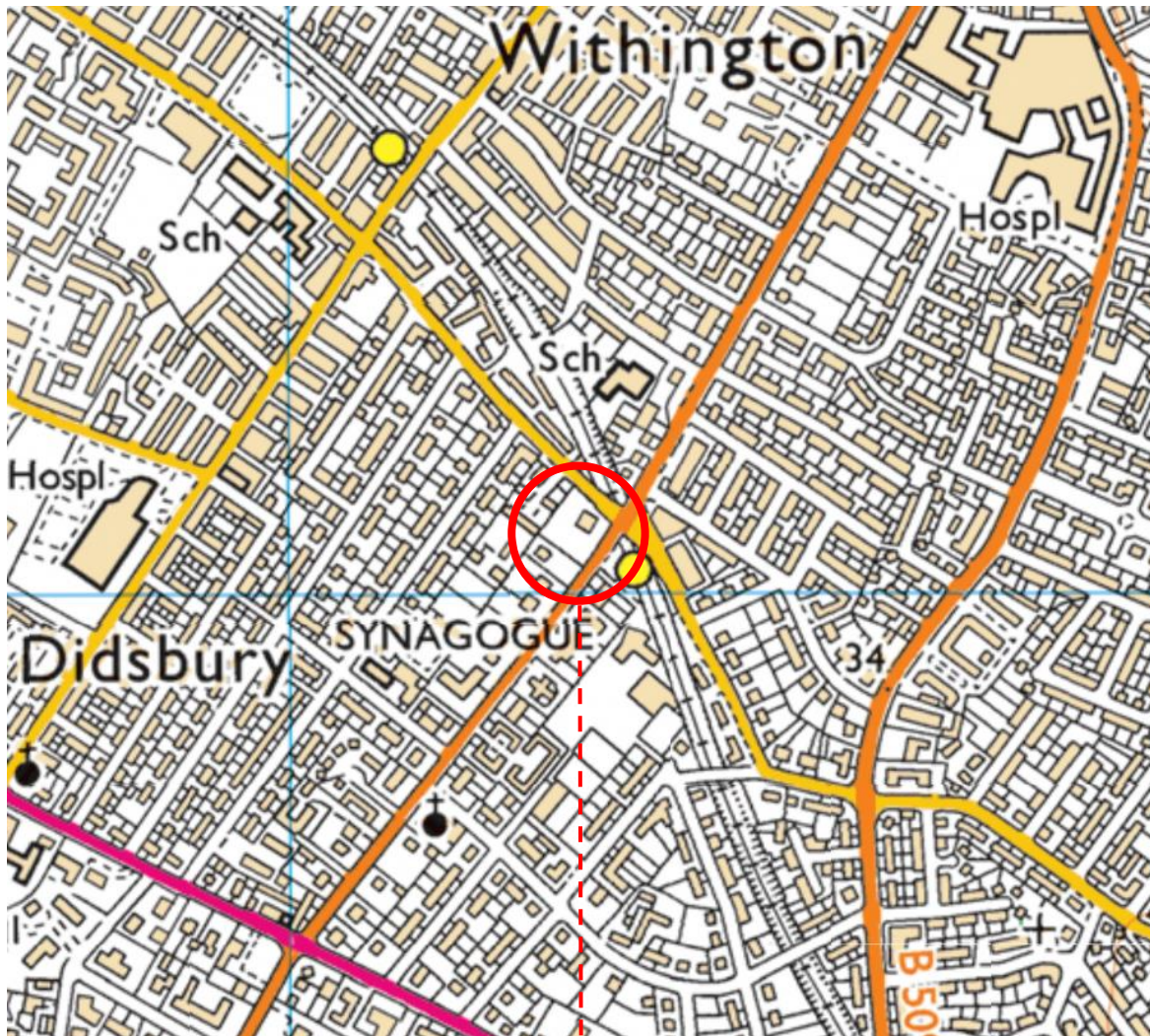
12.5.2 Following completion of remedial works detailed above, a closure report which provides details of all work undertaken as part of the remediation process will have to be prepared. The closure report will include details of imported materials to form the cover system, its thickness and thus verification of its fitness for purpose.

13 Further investigations

13.1	Further investigations
------	------------------------

13.1 We do not consider further investigations are required at this stage.

13.2 Following laboratory testing of any soils which require importation, and installation of the cover system, the capping thickness will require independent measurement to validate the correct thicknesses have been provided in landscaped areas.



Site location

Title

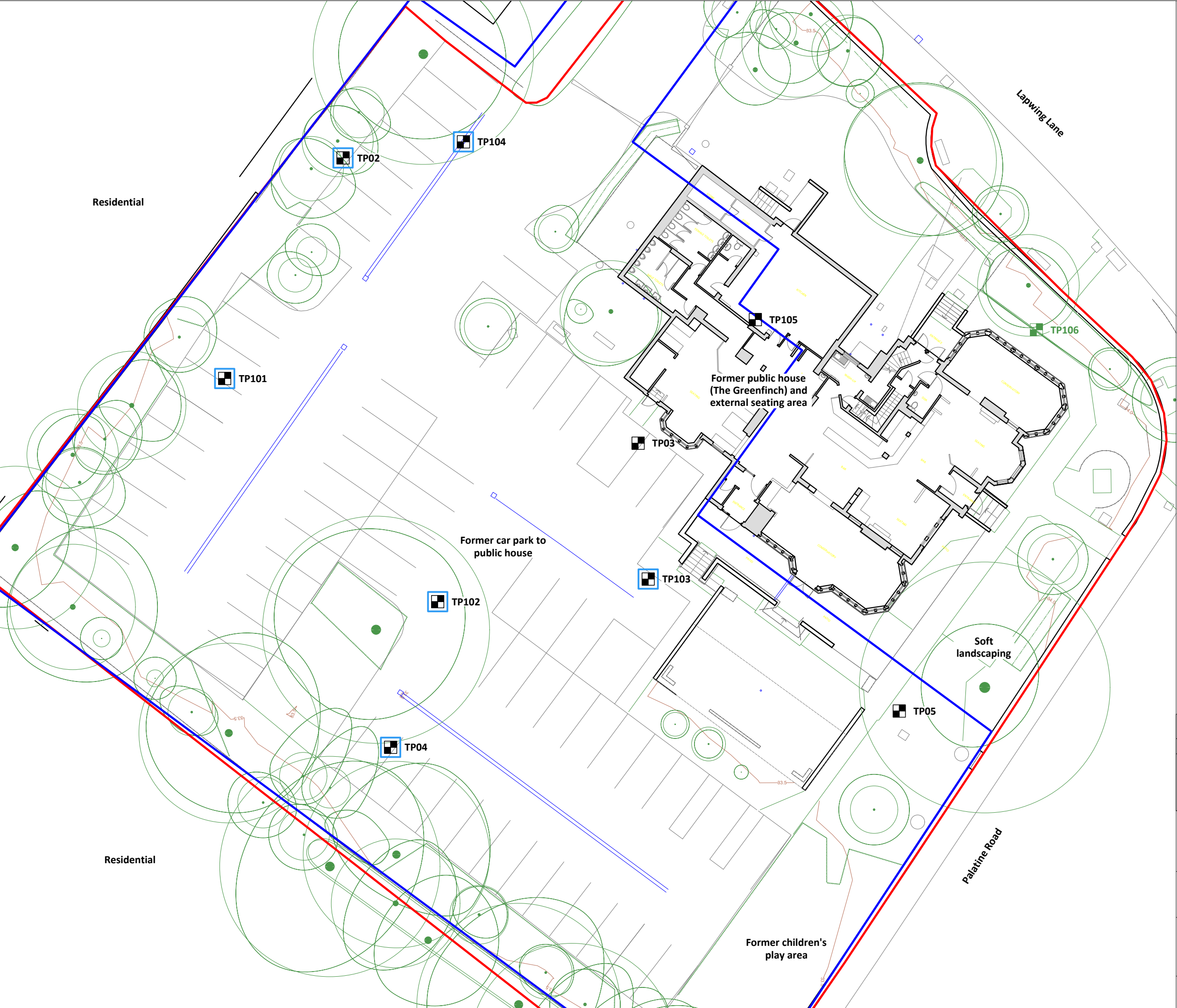
Site location plan

Scale

Not to scale

Drawing number

01



Key

- TP Hand excavated trial pit
- TP Machine excavated trial pit
- Infiltration testing performed
- Search area boundary
- Boundary under consideration

Notes

- 1. Base drawing provided by Client
- 2. Exploratory locations are approximate

B	Second issue - additional trial pit and soakaway tests	KD	TO	SCD	18.10.2022
A	First issue	KD	SCD	SCD	02.06.2021
REV	DESCRIPTION	PRODUCED BY	CHECKED BY	REVIEWED BY	DATE

soiltechnics
environmental • geotechnical • building fabric

PROJECT
Greenfinch, Didsbury

TITLE
Exploratory hole plan (current layout)

PROJECT NO. STV6154	SCALE AT A3 1:250	DRAWING NO. 02
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Key

TP

Hand excavated trial pit

TP

Machine excavated trial pit

Infiltration testing performed

Search area boundary

Boundary under consideration

- Notes
1. Base drawing provided by Client

2. Exploratory locations are approximate

A	First issue	KD	SCD	SCD	03.08.2023
REV	DESCRIPTION	PRODUCED BY	CHECKED BY	REVIEWED BY	DATE

soiltechnics

environmental • geotechnical • building fabric

PROJECT

Greenfinch, Didsbury

TITLE

Exploratory hole plan (proposed layout)

PROJECT NO.	SCALE AT A3	DRAWING NO.
STV6154	1:250	03

Definition of geotechnical terms used in this report - foundations

Strip foundations.

A foundation providing a continuous longitudinal ground bearing.

Trench fill concrete foundation.

A trench filled with mass concrete providing continuous longitudinal ground bearing.

Pad foundation.

An isolated foundation to spread a concentrated load.

Raft foundation.

A foundation continuous in two directions, usually covering an area equal to or greater than the base area of the structure.

Substructure.

That part of any structure (including building, road, runway or earthwork) which is below natural or artificial ground level. In a bridge this includes piers and abutments (and wing walls), whether below ground level or not, which support the superstructure.

Piled foundations and end bearing piles. A pile driven or formed in the ground for transmitting the weight of a structure to the soil by the resistance developed at the pile point or base and the friction along its surface. If the pile supports the load mainly by the resistance developed at its point or base, it is referred to as an end-bearing pile; if mainly by friction along its surface, as a friction pile.

Bored cast in place pile.

A pile formed with or without a casing by excavating or boring a hole in the ground and subsequently filling it with plain or reinforced concrete.

Driven pile.

A pile driven into the ground by the blows of a hammer or a vibrator.

Precast pile.

A reinforced or pre-stressed concrete pile cast before driving.

Driven cast in place pile.

A pile installed by driving a permanent or temporary casing, and filling the hole so formed with plain or reinforced concrete.

Displacement piles.

Piled formed by displacement of the soil or ground through which they are driven.

Skin friction.

The frictional resistance of the surrounding soil on the surface of cofferdam or caisson walls, and pile shafts.

Downdrag or negative skin friction. A downwards frictional force applied to the shaft of a pile caused by the consolidation of compressible strata, e.g. under recently placed fill. Downdrag has the effect of adding load to the pile and reducing the factor of safety.

Definition of geotechnical terms used in this report – bearing values

To Eurocode 7

Formal definitions of Eurocode terms are provided in BS EN 1990:2002 '*Eurocode – Basis of Structural Design*'. The following are considered informal definitions relating to the context of the geotechnical design report.

Bearing resistance

Calculated ability of a foundation to resist applied actions considered for ultimate and serviceability limit states.

Ultimate limit state (ULS) considerations

Partial factors applied to soil parameters, and actions (applied loads) in bearing resistance calculations to avoid risk of failure of the foundation in bearing.

Serviceability limit state (SLS) considerations

Calculations to determine bearing resistance of a foundation which will generate acceptable levels of settlement under applied actions

Characteristic geotechnical parameters

These are based on results and derived values from laboratory field tests, complemented by well-established experience.

Pre-Eurocode 7 methods.

Ultimate bearing capacity.

The value of the gross loading intensity for a particular foundation at which the resistance of the soil to displacement of the foundation is fully mobilised.

Presumed bearing value.

The net loading intensity considered appropriate to the particular type of ground for preliminary design purposes. The particular value is based on calculation from shear strength tests or other field tests incorporating a factor of safety against shear failure.

Allowable bearing pressure.

The maximum allowable net loading intensity at the base of the foundation, taking into account the ultimate bearing capacity, the amount and kind of settlement expected and our estimate of ability of the structure to accommodate this settlement.

Factor of safety.

The ratio of the ultimate bearing capacity to the intensity of the applied bearing pressure or the ratio of the ultimate load to the applied load.

Definition of geotechnical terms used in this report – road pavements

The following definitions are based on Transport and Road Research Laboratory (TRRL) Report LR1132.

Equilibrium CBR values.

A prediction of the CBR value, which will be attained at formation level under the completed pavement.

Thin pavement.

A thin pavement (which includes both bound and unbound pavement construction materials) is 300mm thick (very lightly trafficked road) and a thick pavement is 1200mm thick (typical of motorway construction).

Definition of geo-environmental terms used in this report

Conceptual model

Textual and/or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information obtained from the investigatory process.

Contamination

Presence of a substance which is in, on or under land, and which has the potential to cause harm or to cause pollution of controlled water.

Controlled water

Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three mile limit of territorial waters.

Harm

Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of humans, including property.

Pathway

Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.

Receptor

Persons, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by the contaminant(s).

Risk

Probability of the occurrence of, and magnitude of the consequences of, an unwanted adverse effect on a receptor.

Risk assessment

Process of establishing, to the extent possible, the existence, nature and significance of risk.

Definition of environmental risk/hazard terms used in this report

Based on CIRIA report C552 '*Contaminated land risk assessment – A guide to good practice*'.

Potential hazard severity definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species

Probability of risk definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

Level of risk for potential hazard definition

Probability of risk	Potential severity			
	Severe	Medium	Mild	Minor
High likelihood	Very high	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low likelihood	Moderate	Low/Moderate	Low	Very low
Unlikely	Low/Moderate	Low	Very low	Very low

See below for definitions of 'very high' to 'very low'

Definition of environmental risk/hazard terms used in this report

Based on CIRIA report C552 '*Contaminated land risk assessment – A guide to good practice*'.

Risk classifications and likely action required:

Very high risk

High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

High risk

Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk

It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk

It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk

It is a low possibility that harm could arise to a designated receptor. On the event of such harm being realised it is not likely to be severe.

List of documents used in assessment of chemical contamination

No.	Title	Publication reference / publisher
1	Human health toxicological assessment of contaminants in soil	EA Science Report – SC050021/SR2
2	Updated technical background to the CLEA model	EA Science Report – SC050021/SR3
3	CLEA Software (Version 1.03 beta) Handbook	EA Science Report - SC050021/SR4
4	Guidance on comparing Soil Contamination Data with a Critical Concentration	CIEH
5	The LQM/CIEH S4ULs for Human Health Risk Assessment (2015)	LQM/CIEH
6	Assessment of Risks to Human Health from Land Contamination: An overview of the development of soil guideline values and related research	R&D Publication, Contaminated Land Report CLR 7
7	Contaminants of Soil: Collation of Toxicological Data and Intake Values for Humans	R&D Publication, Contaminated Land Report CLR 9
8	The Contaminated Land Exposure Assessment Model (CLEA): Technical Basis and Algorithms	R&D Publication, Contaminated Land Report CLR 10
9	Model Procedures for the Management of Land Contamination	R&D Publication, Contaminated Land Report CLR 11
10	Contaminants in Soil: Collection of Toxicological Data and Intake Values for Human Values	R&D Publications, Tox. 6
11	Soil Guideline Values for Contamination (2002)	R&D Publications, SGV 10
12	Soil Guideline Values (2009)	EA Science Reports – SC050021
13	Atkins ATRISK ^{SOIL} (2011)	http://www.atrisksoil.co.uk
14	Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (September 2014)	CL:AIRE

CIEH	Chartered institute of Environmental Health
LQM	Land Quality Management
EA	Environment Agency
CL:AIRE	Contaminated Land: Applications in Real Environments

Testing suite summary

Table summarising testing suites		
Suite	Parameters	Medium
Suite 1	Arsenic, beryllium, boron, cadmium, chromium (total and VI), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex), organic matter content, PAH (16 speciated), pH, phenol (total), TOC	Soil
Suite 2	Arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, PAH (16 speciated), pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Leachate
Suite 3	Arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, PAH (16 speciated), pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Water
Suite 4	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, MTBE, PAH (16 speciated), organic matter	Soil
Suite 5	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, MTBE, PAH (16 speciated)	Leachate
Suite 6	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, MTBE, PAH (16 speciated)	Water
Suite 7	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, TOC, organic matter	Soil
Suite 8	Sulphur (total), sulphate (water and acid soluble), pH	Soil
Suite 9	Sulphate, ammoniacal nitrogen, dissolved magnesium, pH	Water
Suite 10	VOC, SVOC, TOC, organic matter	Soil
Suite 11	VOC, SVOC	Leachate
Suite 12	VOC, SVOC	Water
Suite 13	Organotins dibutyltin/ tributyl-tin/tetrabutyltin/triphenyl-tin, tetraethyl-lead/tetramethyl-lead	Soil
Suite 14	Organotin	Leachate
Suite 15	Organotin	Water
Suite 16	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, VOC, SVOC	Soil, water, leachate
Suite 17	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, SVOC, VOC, arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Soil, water, leachate
Concrete BRE suite	pH, sulphate (water and acid soluble), magnesium (water soluble), ammonia (water soluble), chloride, nitrate	Soil
MBAT suite	Dissolved Organic Carbon (DOC), pH, calcium, Hardness Total (as CaCO ₃)	Water
Basic classification suite	Arsenic, beryllium, boron, cadmium, chromium (total and VI), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex), organic matter content, Loss On Ignition (LOI), PAH (16 speciated), pH, phenol (total), EPH banded, asbestos screening	Soil

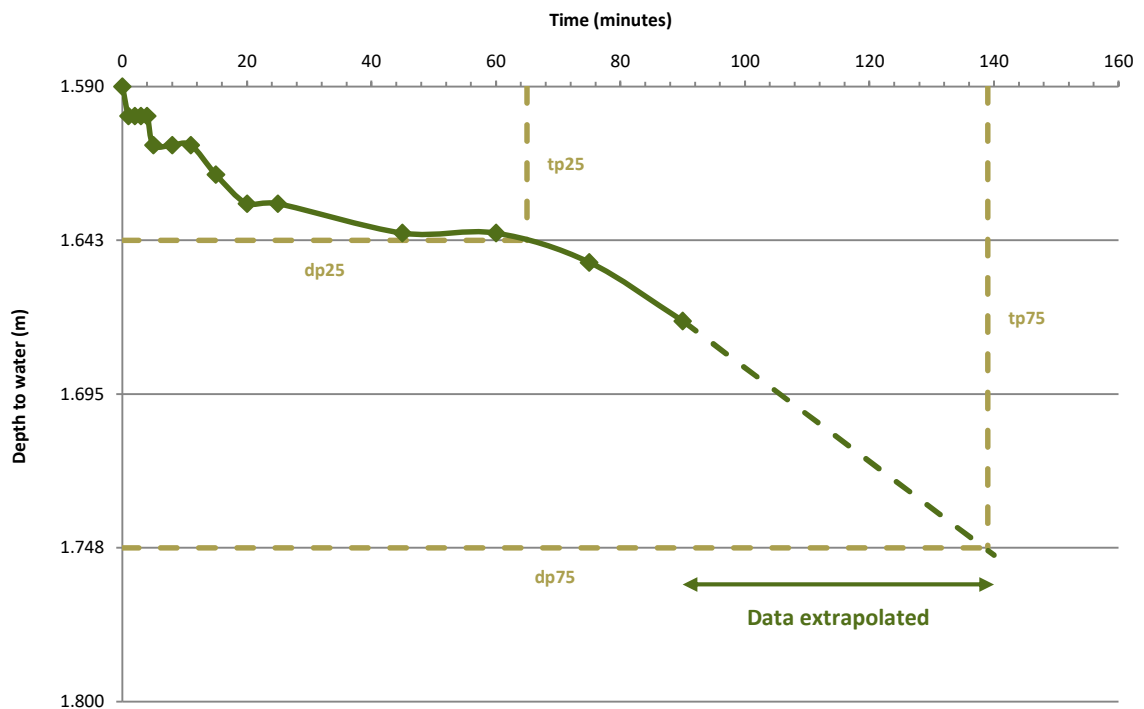
Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP02	1	16/04/2021	0.70m x 2.00m

Depth at start of test (m)	Groundwater observations (at time of excavation)
1.8	No groundwater encountered.

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}	Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	0.147m ³ m ³
a_{p50}	Internal surface area up to 50% effective depth and including the base	1.967m ² m ²
t_{p75-25}	Time for the water level to fall from 75% to 25% effective depth	4440 s

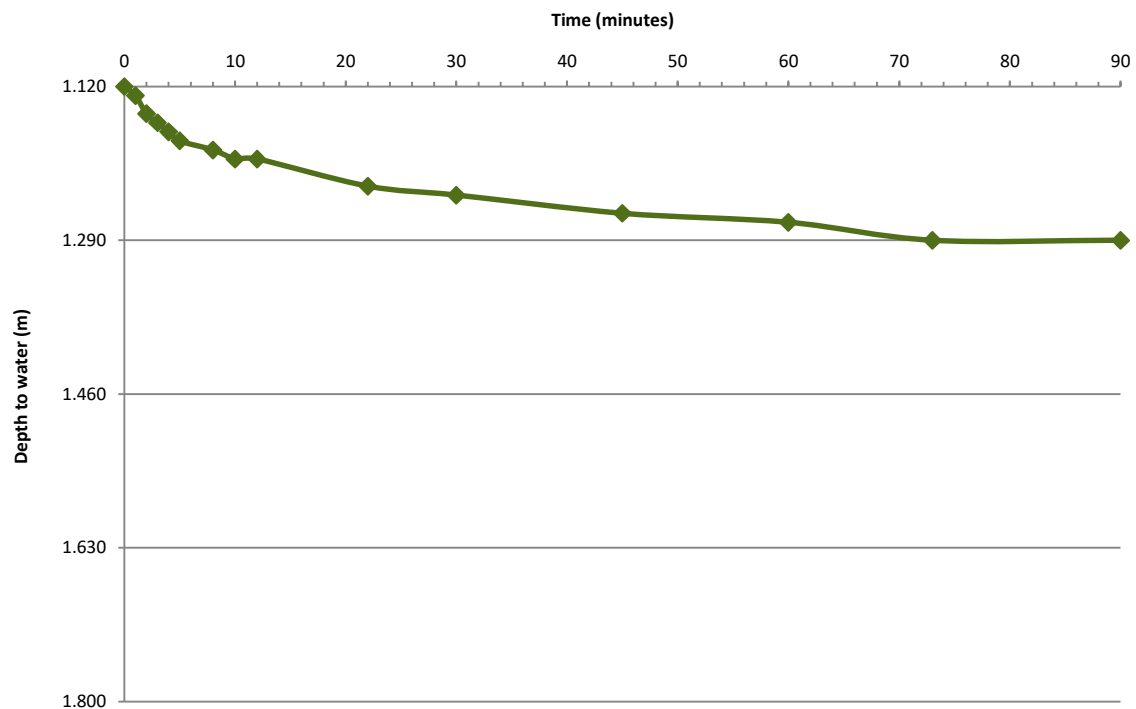


f	Soil infiltration rate	1.68E-05 m/s
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Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP02	2	16/04/2021	0.70m x 2.00m
Depth at start of test (m)		Groundwater observations (at time of excavation)	
1.8		No groundwater encountered.	

Insufficient infiltration over 90 minutes of monitoring therefore unable to calculate soil infiltration rate.

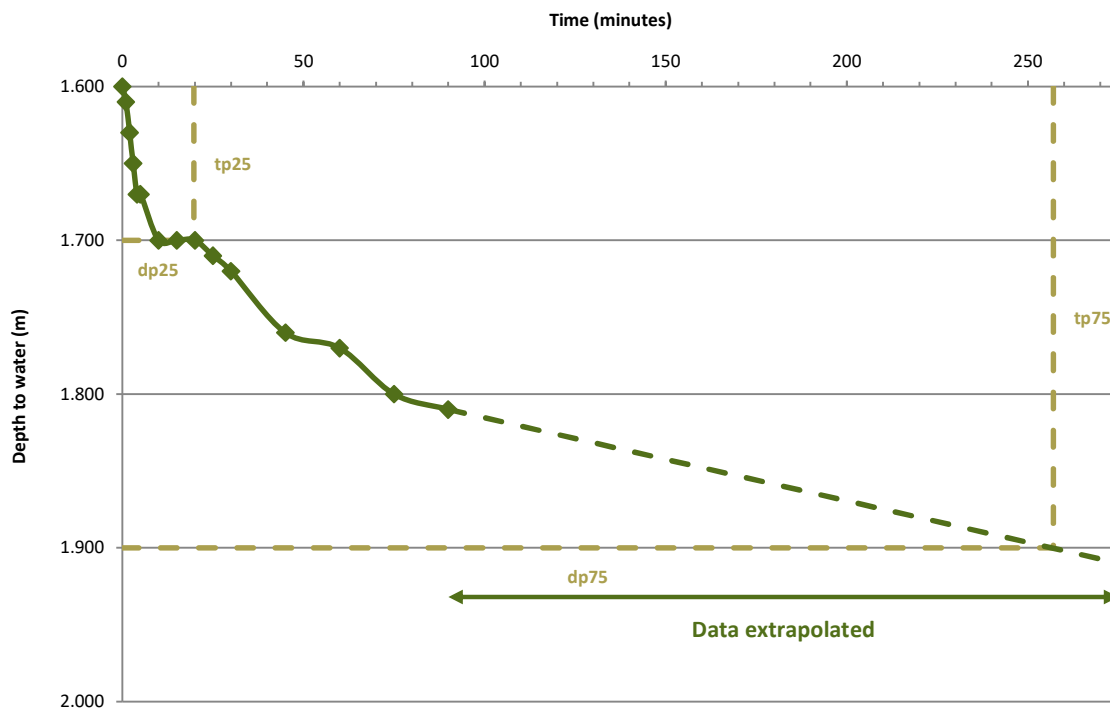


Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP04	1	16/04/2021	0.70m x 2.50m
Depth at start of test (m)			
2	Groundwater observations (at time of excavation)		
	No groundwater encountered.		

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}	Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	0.35m ³ m ³
a_{p50}	Internal surface area up to 50% effective depth and including the base	3.03m ² m ²
t_{p75-25}	Time for the water level to fall from 75% to 25% effective depth	14235 s

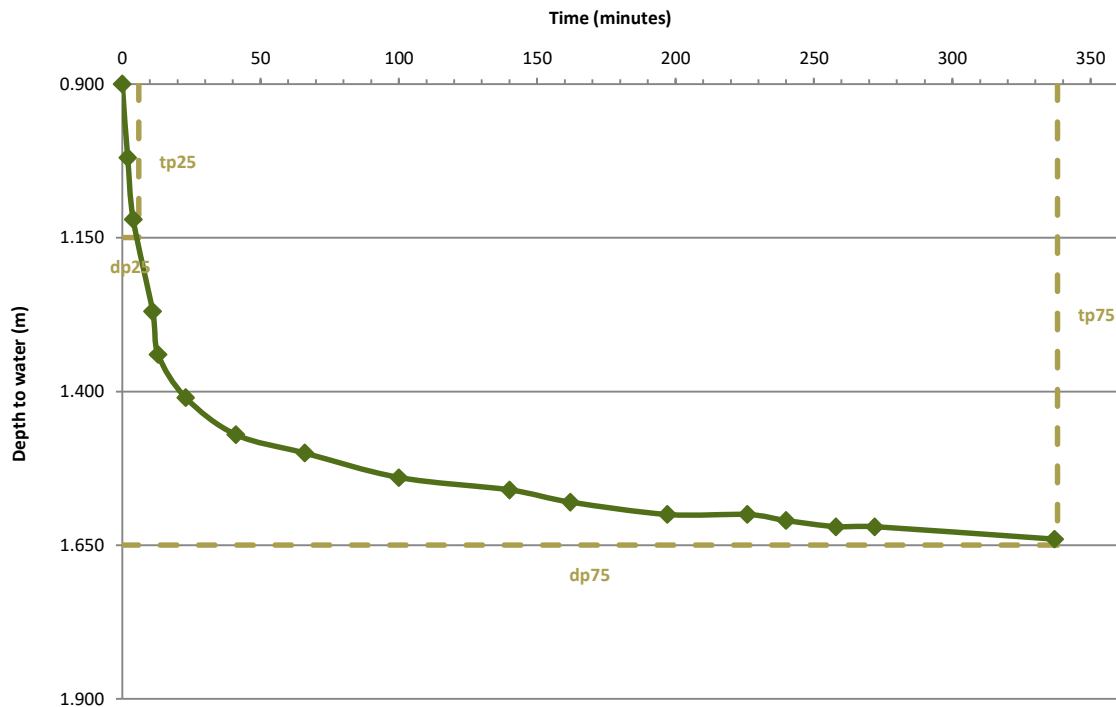


f	Soil infiltration rate	8.11E-06 m/s
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Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP101	1	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.9	No groundwater encountered. Pit silted to 1.9m depth



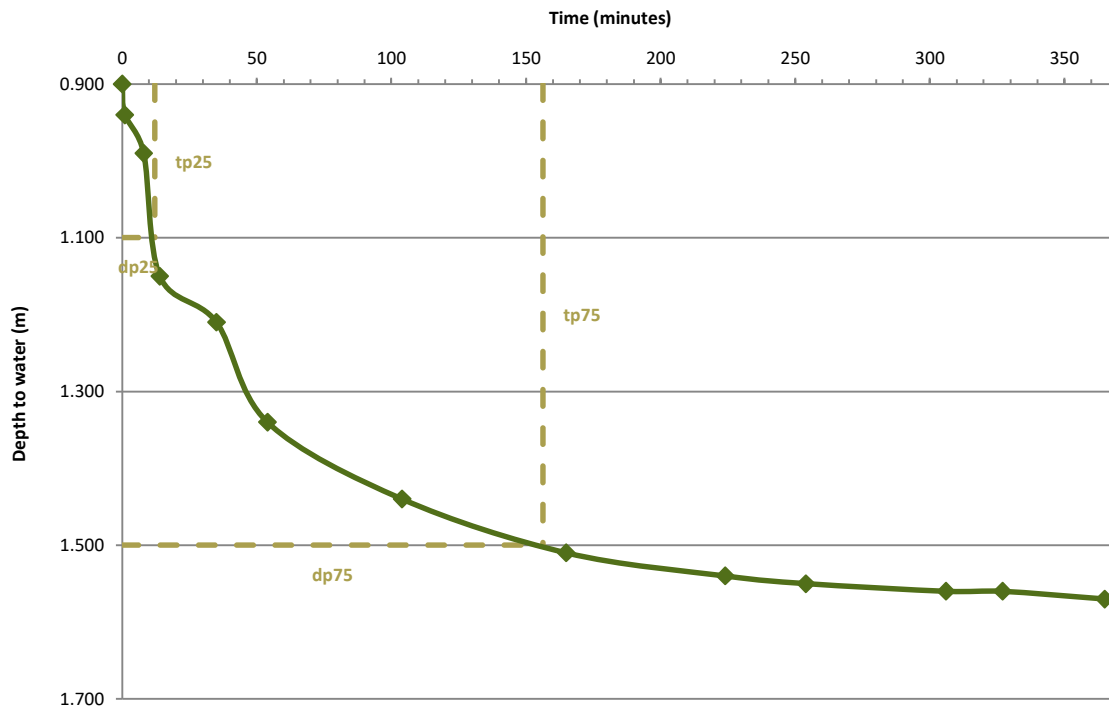
$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}		
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	0.735	m ³
a_{p50}		
Internal surface area up to 50% effective depth and including the base	4	m ²
$t_{p75} - t_{p25}$		
Time for the water level to fall from 75% to 25% effective depth	19920	s
f		
Soil infiltration rate	8.64E-06	m/s

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP101	2	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.9	No groundwater encountered. Pit silted/collapsed to 1.7m prior to 2nd cycle commencing



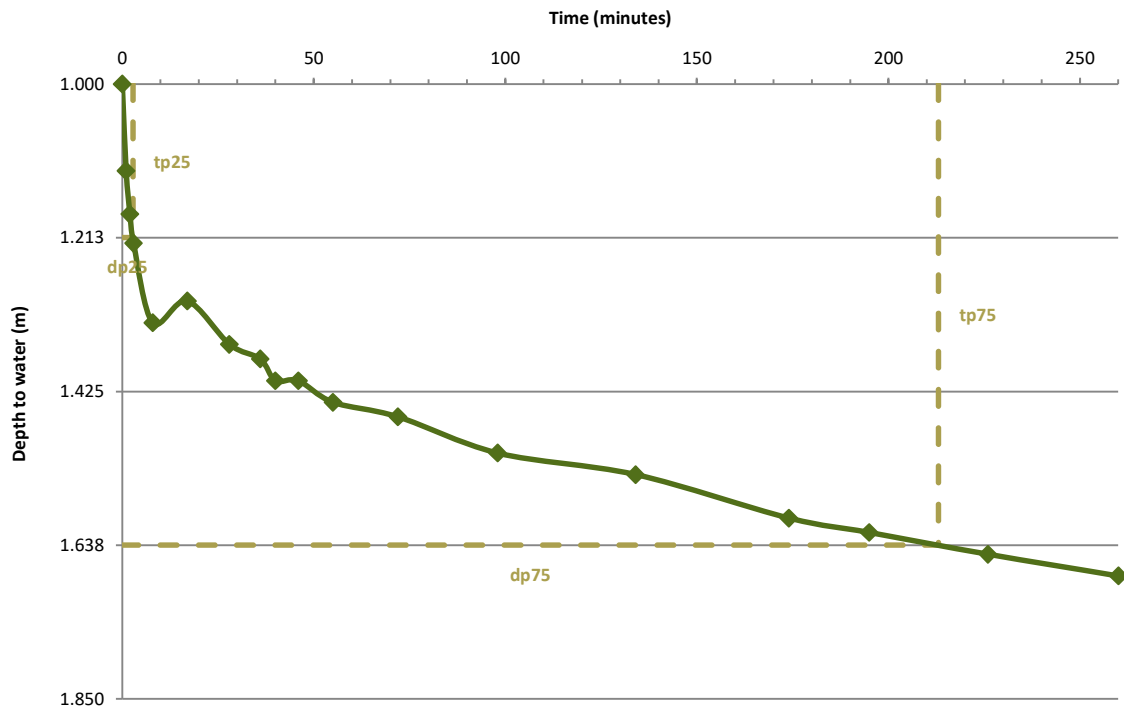
$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}		
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	0.588	m ³
a_{p50}		
Internal surface area up to 50% effective depth and including the base	4	m ²
t_{p75-25}		
Time for the water level to fall from 75% to 25% effective depth	8650	s
f		
Soil infiltration rate	1.83E-05	m/s

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP102	1	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
1	No groundwater encountered. Pit collapsed slightly at start of test to 1.85m depth



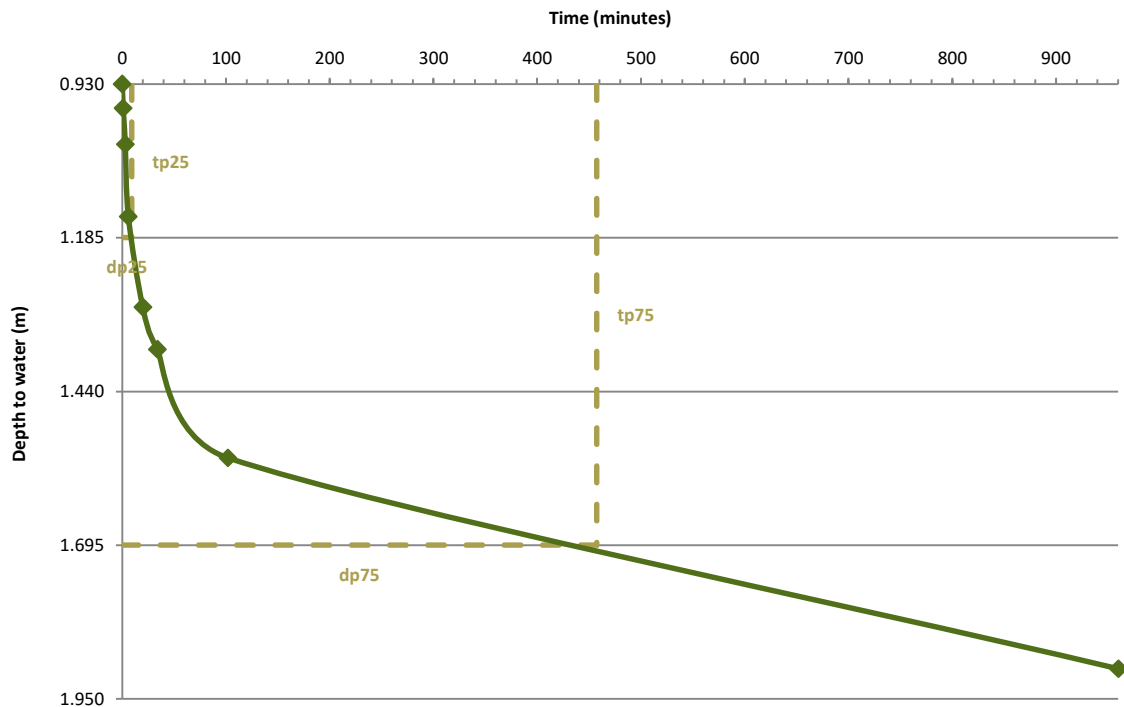
$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}	0.62475	m ³
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth		
a_{p50}	4	m ²
Internal surface area up to 50% effective depth and including the base		
t_{p75-25}	12616	s
Time for the water level to fall from 75% to 25% effective depth		
f	1.29E-05	m/s
Soil infiltration rate		

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP102	2	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.93	No groundwater encountered. Pit re-excavated to 1.95m depth for 2nd cycle



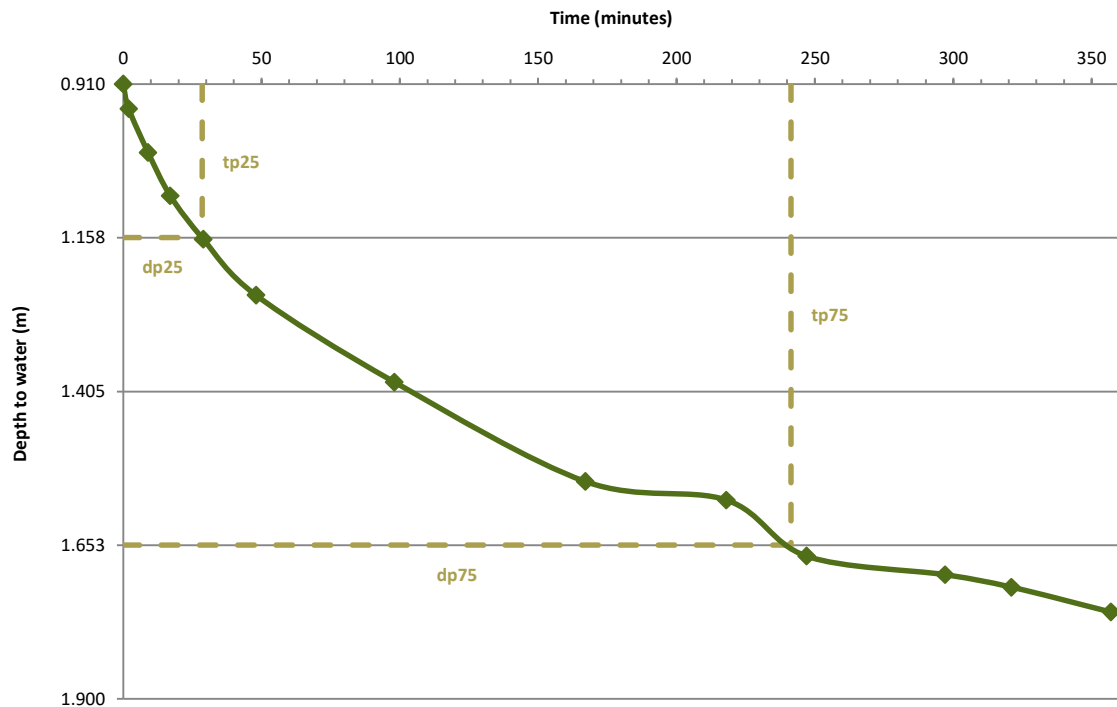
$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}	0.7497	m ³
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth		
a_{p50}	4	m ²
Internal surface area up to 50% effective depth and including the base		
$t_{p75} - t_{p25}$	26891	s
Time for the water level to fall from 75% to 25% effective depth		
f	6.44E-06	m/s
Soil infiltration rate		

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP102	3	07/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.91	No groundwater encountered. Pit silted to 1.9m at start of 3rd cycle on day 2



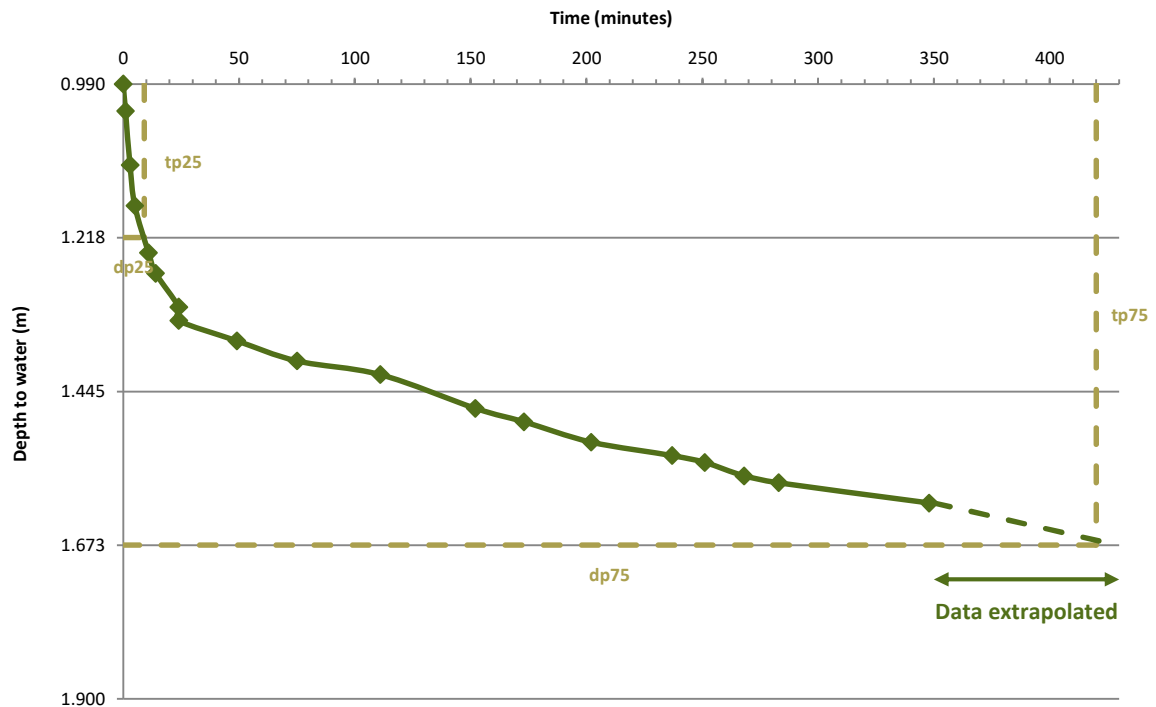
$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}		
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	0.72765	m ³
a_{p50}		
Internal surface area up to 50% effective depth and including the base	4	m ²
$t_{p75} - t_{p25}$		
Time for the water level to fall from 75% to 25% effective depth	12767	s
f		
Soil infiltration rate	1.34E-05	m/s

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP103	1	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.99	No groundwater encountered. Pit partially collapsed to 1.9m during test



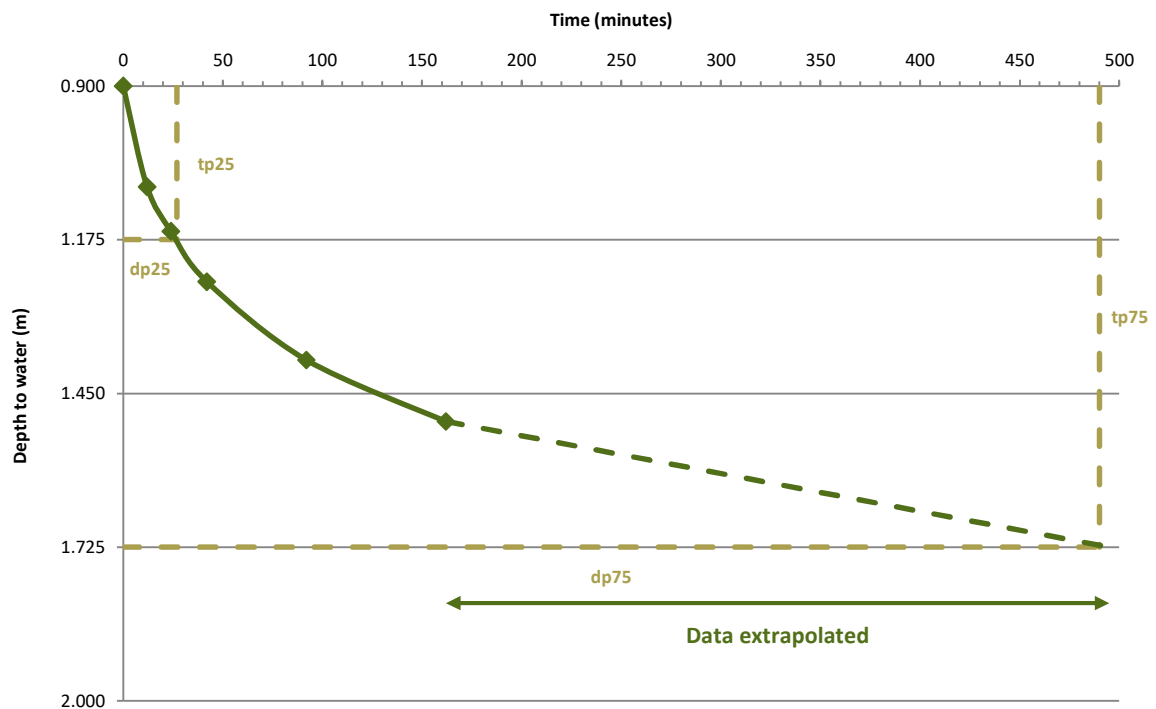
$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}	0.66885	m ³
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth		
a_{p50}	4	m ²
Internal surface area up to 50% effective depth and including the base		
$t_{p75} - t_{p25}$	24656	s
Time for the water level to fall from 75% to 25% effective depth		
f	6.75E-06	m/s
Soil infiltration rate		

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP103	2	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.9	No groundwater encountered. After 200mins the pit sides collapsed, significantly affecting the test. Data extrapolated from last measurement prior to collapse



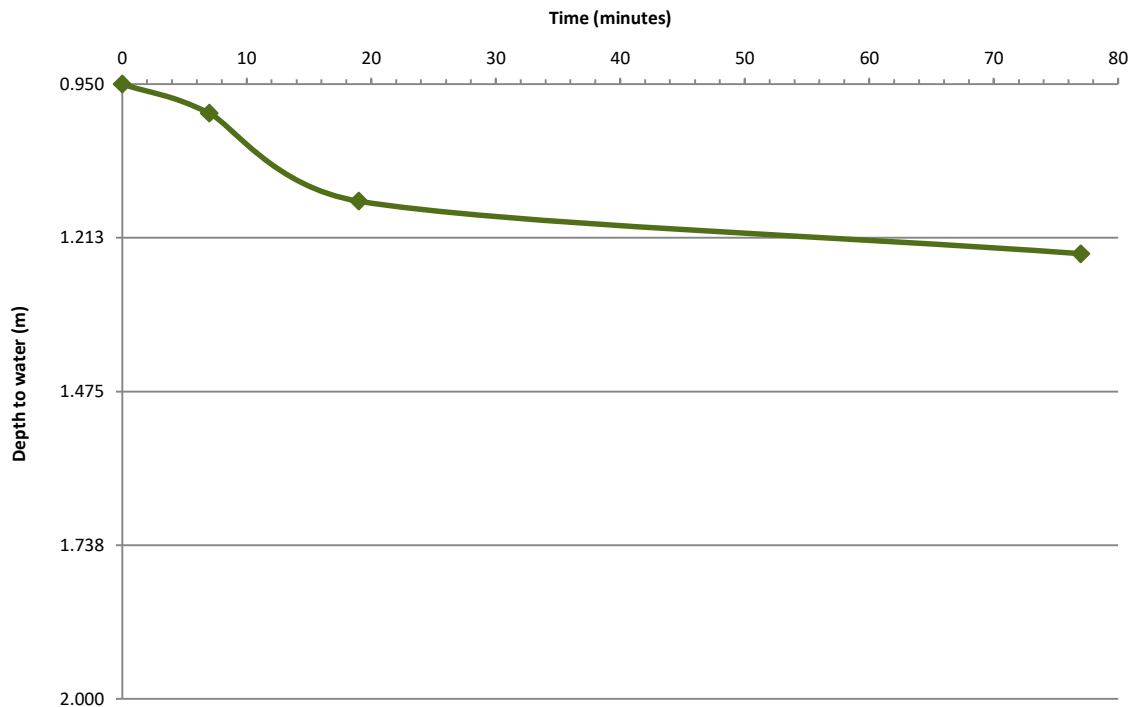
$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}	0.8085	m ³
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth		
a_{p50}	5	m ²
Internal surface area up to 50% effective depth and including the base		
$t_{p75} - t_{p25}$	27780	s
Time for the water level to fall from 75% to 25% effective depth		
f	6.40E-06	m/s
Soil infiltration rate		

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP103	3	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.95	No groundwater encountered.

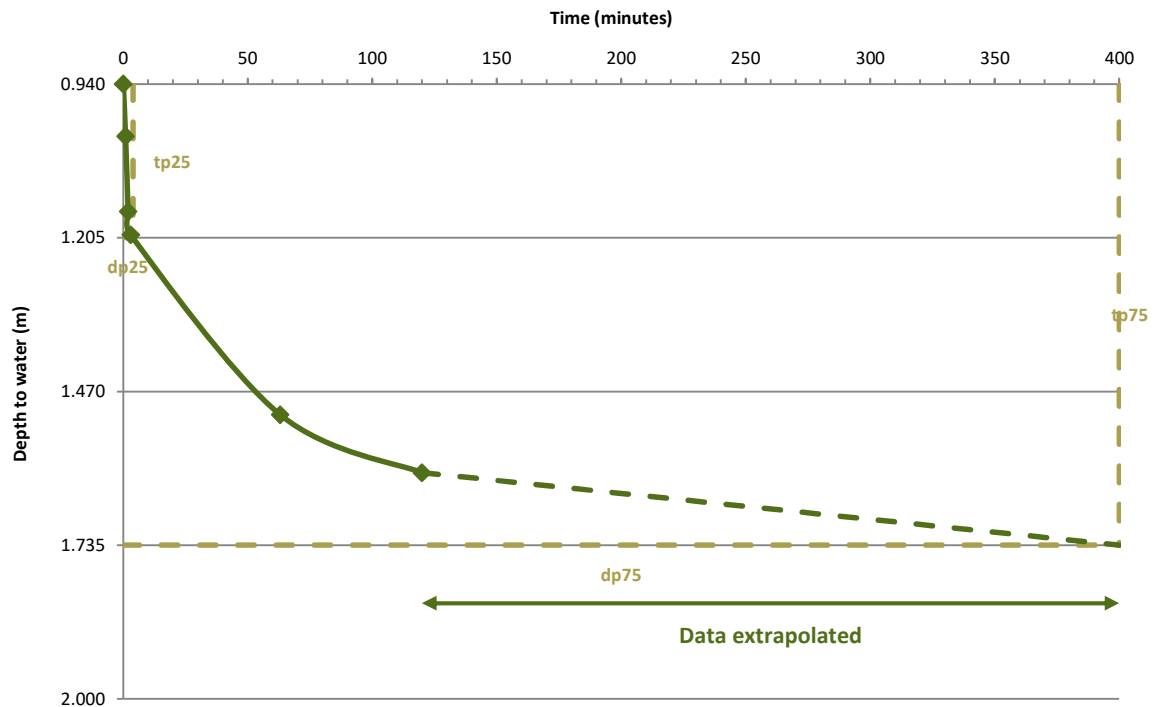


Insufficient infiltration over 77 minutes of monitoring therefore unable to calculate soil infiltration rate.

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP104	1	07/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.91	No groundwater encountered. Significant period of inclement weather after 120mins. Test terminated and data extrapolated from last measurement prior to event



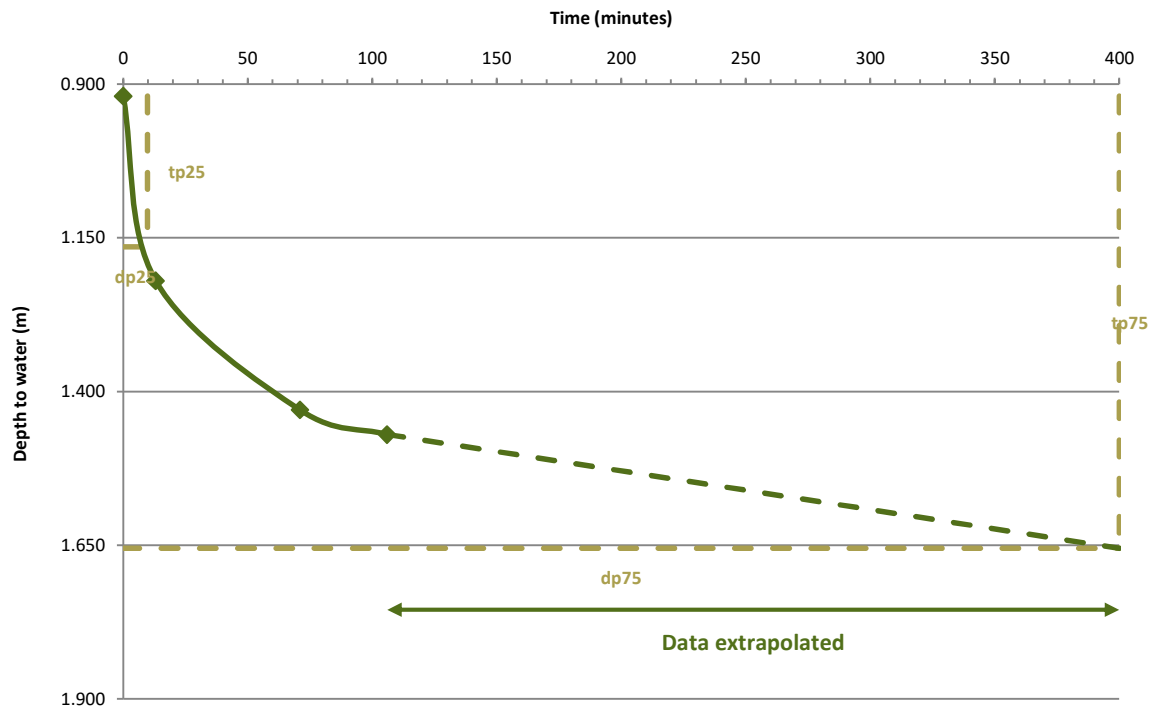
$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}		
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	0.7791	m ³
a_{p50}		
Internal surface area up to 50% effective depth and including the base	4	m ²
t_{p75-25}		
Time for the water level to fall from 75% to 25% effective depth	23762	s
f		
Soil infiltration rate	7.39E-06	m/s

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP104	2	07/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.92	No groundwater encountered.



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}		
Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	0.7203	m ³
a_{p50}		
Internal surface area up to 50% effective depth and including the base	4	m ²
t_{p75-25}		
Time for the water level to fall from 75% to 25% effective depth	23412	s
f		
Soil infiltration rate	7.30E-06	m/s

Key to legends

Composite materials, soils and lithology					
	Topsoil		Made Ground		Boulders
	Clay		Coal		Cobbles
	Gravel		Limestone		Mudstone
	Sand		Sandstone		Silt
					Siltstone
					Peat
					Concrete
					Chalk

Note: Composite soil types are signified by combined symbols.

Key to 'test results' and 'sampling' columns

Test result		Sampling	
Depth	Records depth that the test was carried out (i.e.: at 2.10m or between 2.10m and 2.55m)	From (m) To (m)	Records depth of sampling
	PP – Pocket penetrometer result reported as an equivalent undrained shear strength (kN/m ²) by applying a factor of 50.		D Disturbed sample
			B Bulk disturbed sample
			ES Environmental sample
Result	SV – Hand held shear vane result reported as an undrained shear strength (kN/m ²). Where multiple readings are taken at the same level the average value is shown on the log. * Signifies that instrument limit reached.	Type	W Water sample
			U Undisturbed thick-walled sample 100mm diameter sampler
			UT Undisturbed thin walled sample 100mm diameter sampler
			UTF Failed undisturbed sample

Water observations

Described at foot of log and shown in the 'water strike' column.

▼ Water level observed after specified delay in drilling

∇ Water strike

Density

Density recorded in brackets determined by qualitative field assessment or inferred from density testing and soil descriptions from across the site (i.e.: [Medium dense]).

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT. (MADE GROUND)	0.12								
[Medium dense] light grey to brown slightly sandy GRAVEL of medium to coarse angular to subrounded limestone. (MADE GROUND)							0.30		ES
							0.60		ES
[Loose] light grey to brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.70						1.00		B
...at 1m depth, clay pipe.									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT. (MADE GROUND)	0.11						0.20		ES
[Medium dense] light grey slightly sandy GRAVEL of fine to coarse angular limestone. (MADE GROUND)							0.40		ES
[Loose] light grey to brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.60						0.80		B
...at 1m depth, clay pipe.							1.20		B
							1.60		B
TRIAL PIT TERMINATED AT 1.80m	1.80								

Notes Trial pit sides remained upright and stable upon completion. Trail pit terminated to perform Infiltration testing.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.00m	Date(s) 16/04/2021
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP02

[illegible]

Notes Collapse of trial pit sides between 1.8-2.5m depth on completion, widening trial pit by 1.1m each side. Trail pit terminated due to extensive collapsing.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.30m	Date(s) 16/04/2021
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	
	Co-ordinates -	Checked by SCD	TP03

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT. (MADE GROUND)	0.12						0.20		ES
[Medium dense] dark brown to light grey slightly sandy GRAVEL of medium to coarse angular to subrounded limestone. (MADE GROUND)	0.60						0.50		ES
[Loose] light grey to brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)							0.80		B
							1.30		B
							1.80		B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Collapse of trial pit sides at 2m depth after filling with water widening trial pit by 0.5m on the east side and 0.4m on the west side. Infiltration testing performed.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.50m	Date(s) 16/04/2021
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP04

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT. (MADE GROUND)	0.12						0.20		ES
[Medium dense] brown very sandy GRAVEL of fine to coarse angular brick and limestone with occasional half brick. (MADE GROUND)	0.30						0.30		ES
	0.50						0.50		D
[Loose] light brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.60						1.00		B
	1.80								B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Collapse of trial pit sides at 2m depth widening trial pit by 1m on the east side and 0.6m on the west side filling pit to 1.2m depth. Trial pit terminated due to extensive collapsing.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.20m	Date(s) 16/04/2021
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP05

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASPHALT. (ASPHALT) Light grey to brown sandy medium to coarse angular to subrounded GRAVEL of limestone and brick. (MADE GROUND)	0.12								
Light grey to brown gravelly SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.80						1.00	2.00	B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Trial pit sides remained upright and stable upon completion.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.10m	Date(s) 06/10/2022
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP101

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASPHALT. (ASPHALT) Light grey to brown sandy medium to coarse angular to subrounded GRAVEL of limestone and brick. (MADE GROUND)	0.12								
Light grey to brown gravelly SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.70						1.00	2.00	B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Trial pit sides remained upright and stable upon completion.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.10m	Date(s) 06/10/2022
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP102

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASPHALT. (ASPHALT) Light grey to brown sandy medium to coarse angular to subrounded GRAVEL of limestone and brick with cobbles of brick. (MADE GROUND)	0.12								
Light grey to brown gravelly SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.90						1.00	2.00	B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Trial pit sides remained upright and stable upon completion.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.10m	Date(s) 06/10/2022
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP103

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASPHALT. (ASPHALT)	0.12								
Light grey to brown sandy medium to coarse angular to subrounded GRAVEL of limestone and brick. (MADE GROUND)									
Light grey to brown gravelly SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.60						1.00	2.00	B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Trial pit sides remained upright and stable upon completion.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.10m	Date(s) 07/10/2022
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP104

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Dark brown to brown very gravelly SAND. Gravel is fine to coarse angular brick, concrete, timber, glass and metal. (MADE GROUND)	1.20						0.30		ES
							ES		
							ES		
TRIAL PIT TERMINATED AT 1.20m									

Notes Trial pit sides remained upright and stable upon completion.	Title Trial pit record	Dimensions (w x l) 0.70m x 2.10m	Date(s) 07/10/2022
	Method Machine excavator	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP105

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass over dark brown slightly clayey SAND with rootlets. (MADE GROUND - TOPSOIL)	0.30						0.40		ES
Dark brown to brown very gravelly SAND. Gravel is fine to coarse angular brick, concrete, timber, glass and timber. (MADE GROUND)	0.70								
TRIAL PIT TERMINATED AT 0.70m									

Notes Trial pit sides remained upright and stable upon completion.	Title Trial pit record	Dimensions (w x l) 0.40m x 0.40m	Date(s) 07/10/2022
	Method Hand excavated	Logged by TO	Sheet number Sheet 1 of 1
Groundwater observations No groundwater encountered.	Level (m OD) -	Compiled by KD	Revision
	Co-ordinates -	Checked by SCD	TP106



TEST CERTIFICATE

Particle Size Distribution

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



Tested in Accordance with: BS 1377-2: 1990

Client: Soiltechnics Limited
Client Address: Cedar Barn, White Lodge,
Walgrave, Northampton,
NN6 9PY
Contact: Alexa Band
Site Address: Greenfinch, Didsbury

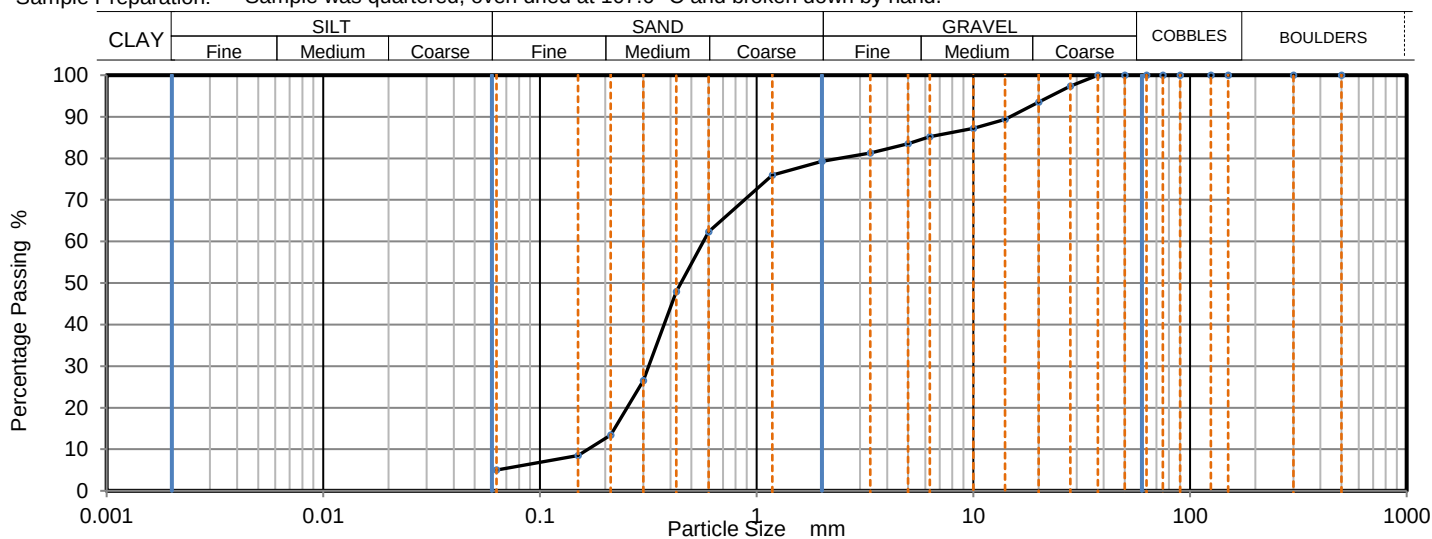
Client Reference: STT5335
Job Number: 21-69911
Date Sampled: Not Given
Date Received: 20/04/2021
Date Tested: 07/05/2021
Sampled By: Client

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

Test Results:

Laboratory Reference: 1843894
Hole No.: TP01
Sample Reference: 3
Sample Description: Brownish grey slightly clayey gravelly SAND
Sample Preparation: Sample was quartered, oven dried at 107.6 °C and broken down by hand.

Depth Top [m]: 1.00
Depth Base [m]: Not Given
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	94		
14	89		
10	87		
6.3	85		
5	84		
3.35	81		
2	79		
1.18	76		
0.6	62		
0.425	48		
0.3	27		
0.212	13		
0.15	9		
0.063	6		

Sample Proportions	% dry mass
Very coarse	0
Gravel	21
Sand	73
Fines <0.063mm	6

Grading Analysis	
D100	mm 37.5
D60	mm 0.568
D30	mm 0.317
D10	mm 0.167
Uniformity Coefficient	3.4
Curvature Coefficient	1.1

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Janoszek

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

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



Tested in Accordance with: BS 1377-2: 1990

Client: Soiltechnics Limited
Client Address: Cedar Barn, White Lodge,
Walgrave, Northampton,
NN6 9PY
Contact: Alexa Band
Site Address: Greenfinch, Didsbury

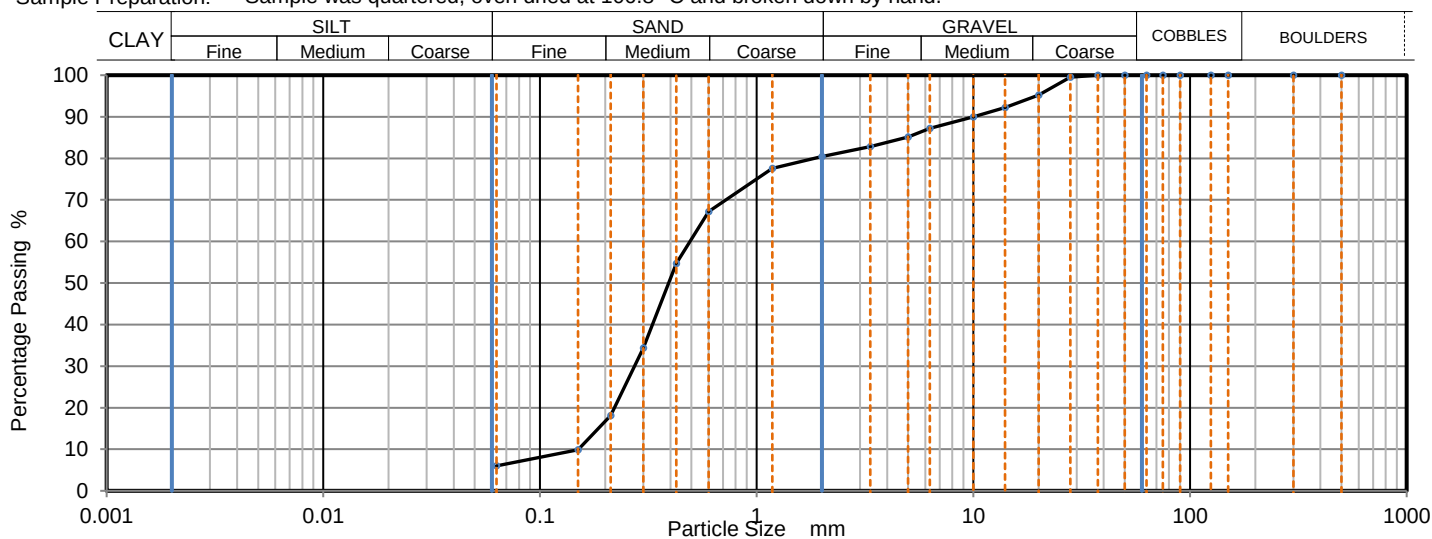
Client Reference: STT5335
Job Number: 21-69911
Date Sampled: Not Given
Date Received: 20/04/2021
Date Tested: 07/05/2021
Sampled By: Client

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

Test Results:

Laboratory Reference: 1843895
Hole No.: TP01
Sample Reference: 5
Sample Description: Brown slightly clayey gravelly SAND
Sample Preparation: Sample was quartered, oven dried at 106.8 °C and broken down by hand.

Depth Top [m]: 2.50
Depth Base [m]: Not Given
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	95		
14	92		
10	90		
6.3	87		
5	85		
3.35	83		
2	80		
1.18	78		
0.6	67		
0.425	55		
0.3	34		
0.212	18		
0.15	10		
0.063	6		

Sample Proportions	% dry mass
Very coarse	0
Gravel	20
Sand	74
Fines <0.063mm	6

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	3.3
Curvature Coefficient	1

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Janoszek

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

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Particle Size Distribution

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



Tested in Accordance with: BS 1377-2: 1990

Client: Soiltechnics Limited
Client Address: Cedar Barn, White Lodge,
Walgrave, Northampton,
NN6 9PY
Contact: Alexa Band
Site Address: Greenfinch, Didsbury

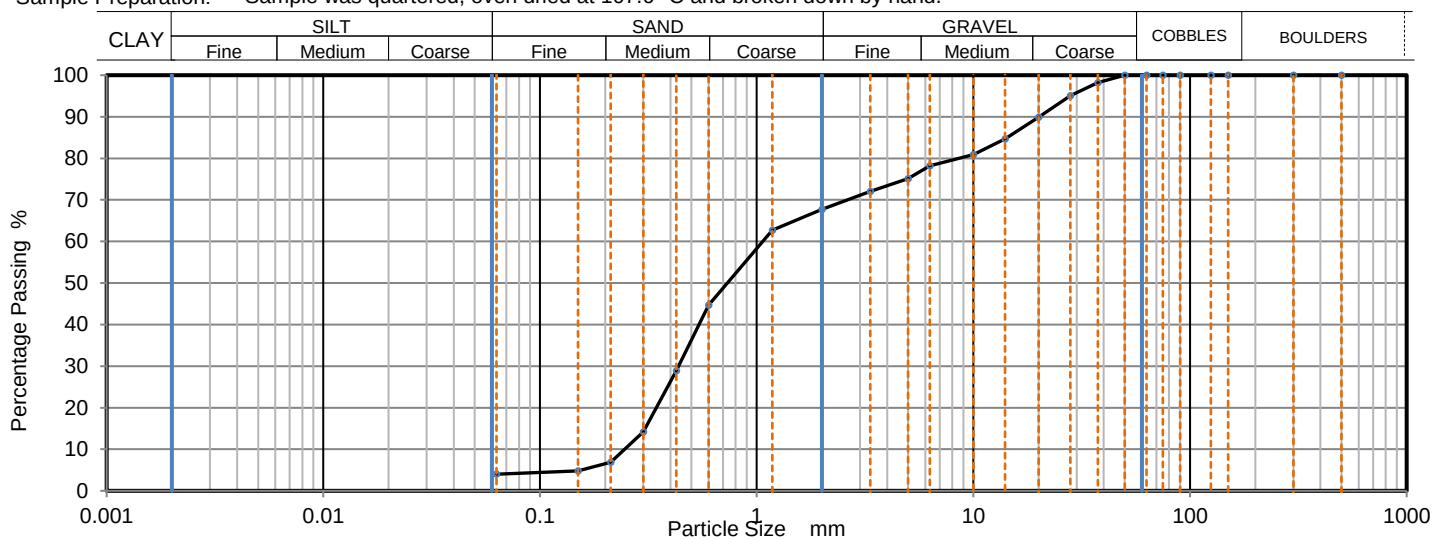
Client Reference: STT5335
Job Number: 21-69911
Date Sampled: Not Given
Date Received: 20/04/2021
Date Tested: 07/05/2021
Sampled By: Client

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

Test Results:

Laboratory Reference: 1843898
Hole No.: TP04
Sample Reference: 4
Sample Description: Brownish grey slightly clayey gravelly SAND
Sample Preparation: Sample was quartered, oven dried at 107.6 °C and broken down by hand.

Depth Top [m]: 1.30
Depth Base [m]: Not Given
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	95		
20	90		
14	85		
10	81		
6.3	78		
5	75		
3.35	72		
2	68		
1.18	63		
0.6	45		
0.425	29		
0.3	14		
0.212	7		
0.15	5		
0.063	4		

Sample Proportions	% dry mass
Very coarse	0
Gravel	32
Sand	64
Fines <0.063mm	4

Grading Analysis	
D100	mm 50
D60	mm 1.07
D30	mm 0.435
D10	mm 0.246
Uniformity Coefficient	4.3
Curvature Coefficient	0.72

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

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



Tested in Accordance with: BS 1377-2: 1990

Client: Soiltechnics Limited
Client Address: Cedar Barn, White Lodge,
Walgrave, Northampton,
NN6 9PY
Contact: Alexa Band
Site Address: Greenfinch, Didsbury

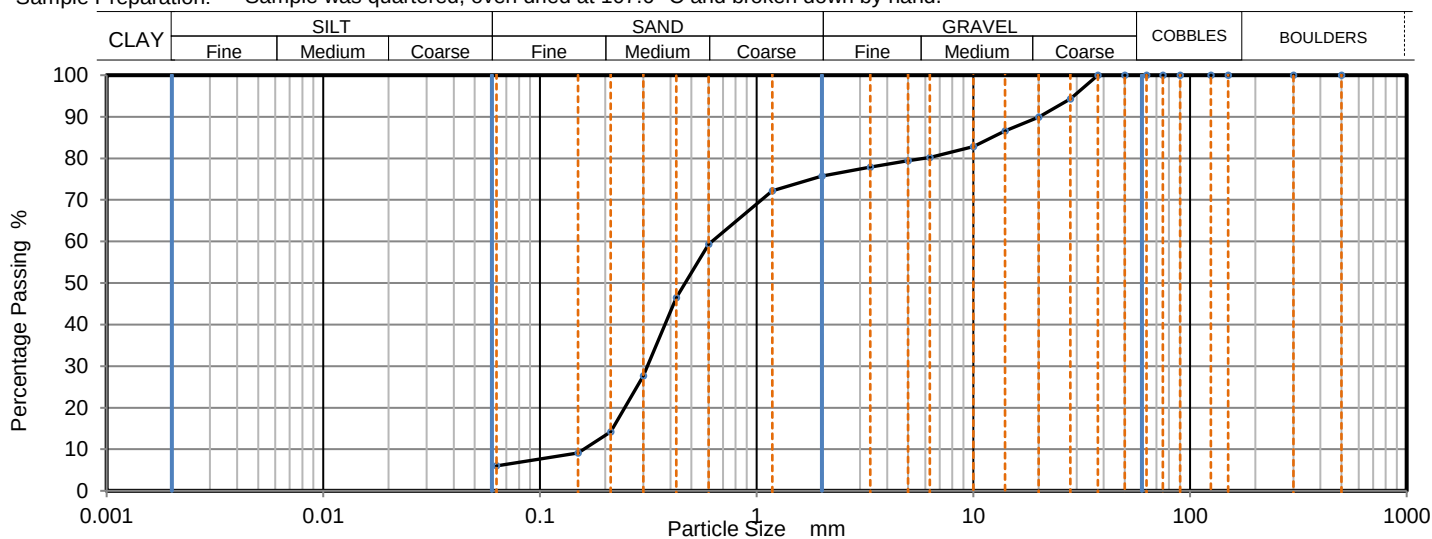
Client Reference: STT5335
Job Number: 21-69911
Date Sampled: Not Given
Date Received: 20/04/2021
Date Tested: 07/05/2021
Sampled By: Client

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

Test Results:

Laboratory Reference: 1843899
Hole No.: TP05
Sample Reference: 5
Sample Description: Brownish grey slightly clayey gravelly SAND
Sample Preparation: Sample was quartered, oven dried at 107.6 °C and broken down by hand.

Depth Top [m]: 1.80
Depth Base [m]: Not Given
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	94		
20	90		
14	87		
10	83		
6.3	80		
5	79		
3.35	78		
2	76		
1.18	72		
0.6	59		
0.425	47		
0.3	28		
0.212	14		
0.15	9		
0.063	7		

Sample Proportions	% dry mass
Very coarse	0
Gravel	24
Sand	69
Fines <0.063mm	7

Grading Analysis	
D100	mm 37.5
D60	mm 0.622
D30	mm 0.313
D10	mm 0.159
Uniformity Coefficient	3.9
Curvature Coefficient	0.99

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Janoszek

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

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



Determination of California Bearing Ratio

Tested in Accordance with: BS 1377-4: 1990: Clause 7

Client: Soiltechnics Limited
Client Address: Cedar Barn, White Lodge,
Walgrave, Northampton,
NN6 9PY
Contact: Alexa Band
Site Address: Greenfinch, Didsbury

Client Reference: STT5335
Job Number: 21-69911
Date Sampled: Not Given
Date Received: 20/04/2021
Date Tested: 12/05/2021
Sampled By: Client

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

Test Results:

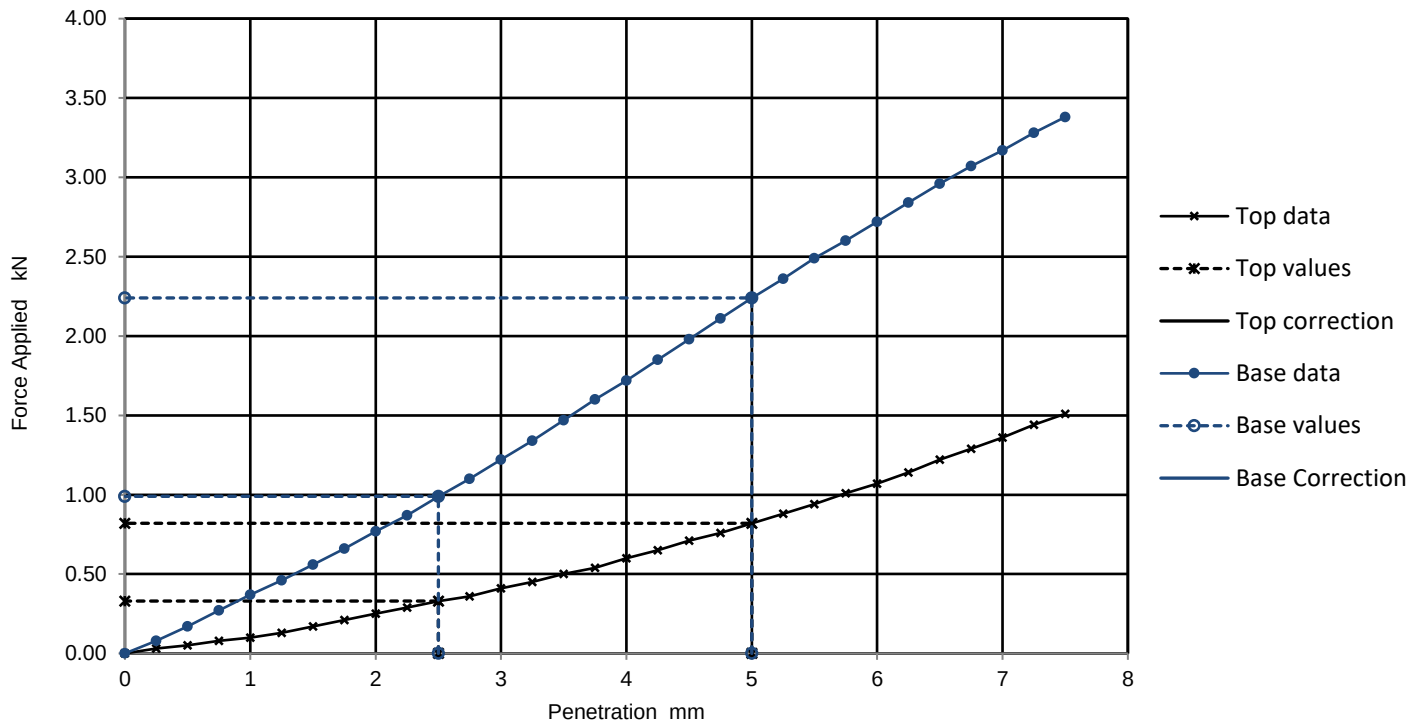
Laboratory Reference: 1843896
Hole No.: TP02
Sample Reference: 3
Sample Description: Yellowish brown SAND

Depth Top [m]: 0.80
Depth Base [m]: Not Given
Sample Type: B

Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 2.5kg rammer	Period of soaking	days
		Time to surface	days
		Amount of swell recorded	mm
Material retained on 20mm sieve removed	0 %	Dry density after soaking	Mg/m3
Initial Specimen details	Bulk density	1.80	Mg/m3
	Dry density	1.72	Mg/m3
	Moisture content	4.4	%
		Surcharge applied	8 kg
			4.9 kPa

Force v Penetration Plots



Results

TOP
BASE

Curve correction applied	CBR Values, %			
	2.5mm	5mm	Highest	Average
No	2.5	4.1	4.1	
No	7.5	11.0	11.0	

Moisture Content %
4.4
4.2

Remarks:

Test/ Specimen specific remarks:

Signed:

Monika Janoszek

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

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



Determination of California Bearing Ratio

4041

Tested in Accordance with: BS 1377-4: 1990: Clause 7

Client: Soiltechnics Limited
Client Address: Cedar Barn, White Lodge,
Walgrave, Northampton,
NN6 9PY
Contact: Alexa Band
Site Address: Greenfinch, Didsbury

Client Reference: STT5335
Job Number: 21-69911
Date Sampled: Not Given
Date Received: 20/04/2021
Date Tested: 12/05/2021
Sampled By: Client

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

Test Results:

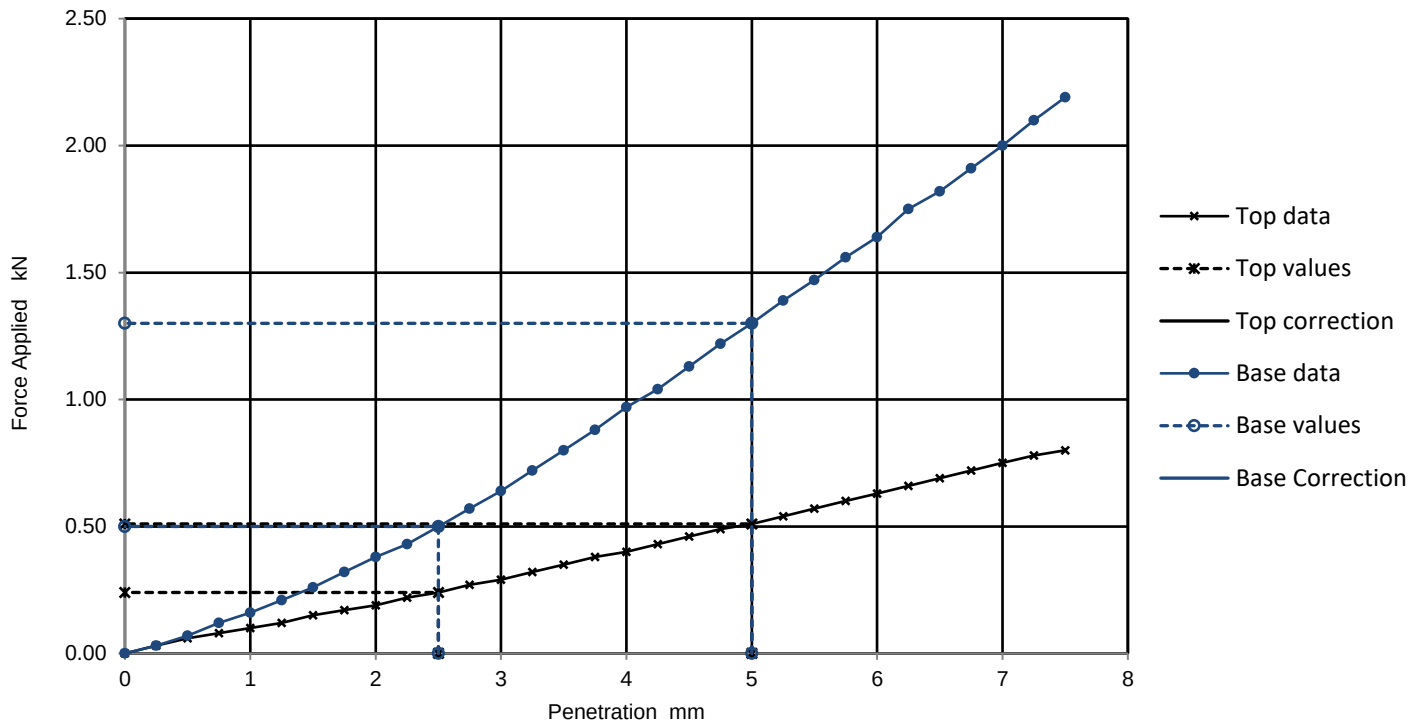
Laboratory Reference: 1843897
Hole No.: TP04
Sample Reference: 3
Sample Description: Brownish grey gravelly SAND

Depth Top [m]: 0.80
Depth Base [m]: Not Given
Sample Type: B

Specimen Preparation:

Condition	Remoulded	Soaking details	Not soaked
Details	Recompacted with specified standard effort using 2.5kg rammer	Period of soaking	days
		Time to surface	days
		Amount of swell recorded	mm
		Dry density after soaking	Mg/m3
Material retained on 20mm sieve removed	11 %		
Initial Specimen details	Bulk density	1.90	Mg/m3
	Dry density	1.82	Mg/m3
	Moisture content	4.6	%
		Surcharge applied	8 kg
			4.9 kPa

Force v Penetration Plots



Results

TOP
BASE

Curve correction applied	CBR Values, %			
	2.5mm	5mm	Highest	Average
No	1.8	2.6	2.6	
No	3.8	6.5	6.5	

Moisture Content %
4.5
3.9

Remarks:

Test/ Specimen
specific remarks:

Signed:

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

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Alexa Band

Soiltechnics Limited
Cedar Barn
White Lodge
Walgrave
Northampton
NN6 9PY

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

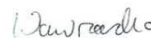
e: reception@i2analytical.com

e: Alexa.Band@soiltechnics.net

Analytical Report Number : 21-69972

Project / Site name:	Greenfinch, Didsbury	Samples received on:	20/04/2021
Your job number:	STT5335	Samples instructed on/ Analysis started on:	20/04/2021
Your order number:	POR10032	Analysis completed by:	07/05/2021
Report Issue Number:	1	Report issued on:	07/05/2021
Samples Analysed:	4 soil samples		

Signed:



Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils - 4 weeks from reporting
	leachates - 2 weeks from reporting
	waters - 2 weeks from reporting
	asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 21-69972
 Project / Site name: Greenfinch, Didsbury
 Your Order No: POR10032

Lab Sample Number				1844221	1844222	1844223	1844224
Sample Reference				TP01	TP02	TP02	TP02
Sample Number				1	2	3	4
Depth (m)				0.30	0.40	0.80	1.20
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	2.7	0.80	3.2	3.3
Total mass of sample received	kg	0.001	NONE	0.50	0.70	1.0	0.90

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.5	8.7	7.6	7.5
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.021	0.022	0.017	0.014
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	20.5	21.5	17.2	13.6
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	5.9	5.2	6.1	4.3
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	11	< 5.0	5.5	5.8
Magnesium (leachate equivalent)	mg/l	2.5	NONE	5.3	< 2.5	2.8	2.9

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 21-69972

Project / Site name: Greenfinch, Didsbury

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1844221	TP01	1	0.3	Brown sandy loam with gravel and vegetation.
1844222	TP02	2	0.4	Brown sand with gravel.
1844223	TP02	3	0.8	Brown sandy loam with gravel.
1844224	TP02	4	1.2	Brown sandy loam with gravel.

Analytical Report Number : 21-69972
Project / Site name: Greenfinch, Didsbury

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Sample Deviation Report



Analytical Report Number : 21-69972
Project / Site name: Greenfinch, Didsbury

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
TP01	1	S	1844221	a	None Supplied	None Supplied	None Supplied
TP02	2	S	1844222	a	None Supplied	None Supplied	None Supplied
TP02	3	S	1844223	a	None Supplied	None Supplied	None Supplied
TP02	4	S	1844224	a	None Supplied	None Supplied	None Supplied



Alexa Band
Soiltechnics Ltd
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Cedar Barn
Walgrave
NN6 9PY

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DETS Report No: 21-05199

Site Reference: Greenfinch, Didsbury

Project / Job Ref: STT5335

Order No: POR010031

Sample Receipt Date: 22/04/2021

Sample Scheduled Date: 22/04/2021

Report Issue Number: 1

Reporting Date: 28/04/2021

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

For Topsoil and WAC analysis the expanded uncertainty measurement should be considered while evaluating results against compliance values.



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Soil Analysis Certificate						
DETS Report No: 21-05199	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soiltechnics Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Greenfinch, Didsbury	TP / BH No	TP010.602	TP020.201	TP040.201	TP040.502	TP050.302
Project / Job Ref: STT5335	Additional Refs	TP01	TP02	TP04	TP04	TP05
Order No: POR010031	Depth (m)	0.60	0.20	0.20	0.50	0.30
Reporting Date: 28/04/2021	DETS Sample No	539007	539008	539009	539010	539011

Determinand	Unit	RL	Accreditation	(n)				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	8.5	8.9	8.2	8.6	8.8
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Complex Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Organic Matter	%	< 0.1	MCERTS	6.0	1.1	3.8	3.1	4.1
Loss on Ignition @ 450°C	%	< 0.01	NONE	5.70	1.50	8.30	5.50	1.40
Arsenic (As)	mg/kg	< 2	MCERTS	21	6	47	21	4
Beryllium (Be)	mg/kg	< 0.5	MCERTS	0.8	< 0.5	1.4	1	< 0.5
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	NONE	0.2	0.7	0.3	0.6	0.6
Chromium (Cr)	mg/kg	< 2	MCERTS	10	6	10	9	6
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	39	14	34	30	12
Lead (Pb)	mg/kg	< 3	MCERTS	142	50	165	123	152
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	11	8	16	14	10
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 1	MCERTS	17	6	21	13	7
Zinc (Zn)	mg/kg	< 3	MCERTS	80	57	71	76	56
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion

Subcontracted analysis (S)

(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 21-05199	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soiltechnics Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Greenfinch, Didsbury	TP / BH No	TP010.602	TP020.201	TP040.201	TP040.502	TP050.302
Project / Job Ref: STT5335	Additional Refs	TP01	TP02	TP04	TP04	TP05
Order No: POR010031	Depth (m)	0.60	0.20	0.20	0.50	0.30
Reporting Date: 28/04/2021	DETS Sample No	539007	539008	539009	539010	539011

Determinand	Unit	RL	Accreditation	(n)				
Naphthalene	mg/kg	< 0.1	MCERTS	0.20	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	1.16	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	0.69	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	8.43	< 0.1	0.87	0.28	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	1.84	< 0.1	0.20	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	9.71	< 0.1	0.98	0.31	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	10.30	< 0.1	1.03	0.48	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	4.44	< 0.1	0.37	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	3.99	< 0.1	0.47	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	4.53	< 0.1	0.42	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	1.59	< 0.1	0.17	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	4.38	< 0.1	0.35	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	2.09	< 0.1	0.16	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.51	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	2.18	< 0.1	0.16	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	56	< 1.6	5.2	< 1.6	< 1.6

(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation



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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 21-05199	Date Sampled	None Supplied	None Supplied			
Soiltechnics Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Greenfinch, Didsbury	TP / BH No	TP010.602	TP050.302			
Project / Job Ref: STT5335	Additional Refs	TP01	TP05			
Order No: POR010031	Depth (m)	0.60	0.30			
Reporting Date: 28/04/2021	DETS Sample No	539007	539011			

Determinand	Unit	RL	Accreditation			
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	3	< 2	
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	8	< 3	
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	18	6	
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	80	145	
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	109	150	
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	8	< 2	
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	25	< 3	
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	47	90	
Aromatic (C5 - C35)	mg/kg	< 21	NONE	80	90	
Total >C5 - C35	mg/kg	< 42	NONE	189	240	



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 21-05199	Date Sampled	None Supplied	None Supplied			
Soiltechnics Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Greenfinch, Didsbury	TP / BH No	TP010.602	TP050.302			
Project / Job Ref: STT5335	Additional Refs	TP01	TP05			
Order No: POR010031	Depth (m)	0.60	0.30			
Reporting Date: 28/04/2021	DETS Sample No	539007	539011			

Determinand	Unit	RL	Accreditation				
Benzene	ug/kg	< 2	MCERTS	< 2	< 2		
Toluene	ug/kg	< 5	MCERTS	< 5	< 5		
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2		
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2		
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2		
MTBE	ug/kg	< 5	MCERTS	< 5	< 5		



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Leachate Analysis Certificate

DETS Report No: 21-05199	Date Sampled	None Supplied				
Soiltechnics Ltd	Time Sampled	None Supplied				
Site Reference: Greenfinch, Didsbury	TP / BH No	TP050.503				
Project / Job Ref: STT5335	Additional Refs	TP05				
Order No: POR010031	Depth (m)	0.50				
Reporting Date: 28/04/2021	DETS Sample No	539012				

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	ISO17025	9.1			
Total Cyanide	ug/l	< 5	NONE	< 5			
Complex Cyanide	ug/l	< 5	NONE	< 5			
Free Cyanide	ug/l	< 5	NONE	< 5			
Sulphate as SO ₄	mg/l	< 1	ISO17025	< 1			
Ammoniacal Nitrogen as NH ₄	ug/l	< 50	NONE	94			
Nitrate as NO ₃	mg/l	< 0.5	ISO17025	< 0.5			
Antimony	ug/l	< 5	ISO17025	< 5			
Arsenic	ug/l	< 5	ISO17025	< 5			
Boron	ug/l	< 5	ISO17025	< 5			
Cadmium	ug/l	< 0.4	ISO17025	< 0.4			
Chromium	ug/l	< 5	ISO17025	< 5			
Chromium (hexavalent)	ug/l	< 20	NONE	< 20			
Chromium III	ug/l	< 20	NONE	< 20			
Copper	ug/l	< 5	ISO17025	< 5			
Iron	ug/l	< 5	ISO17025	57			
Lead	ug/l	< 5	ISO17025	< 5			
Mercury	ug/l	< 0.05	ISO17025	< 0.05			
Nickel	ug/l	< 5	ISO17025	< 5			
Selenium	ug/l	< 5	ISO17025	< 5			
Zinc	ug/l	< 2	ISO17025	< 2			
Total Phenols (monohydric)	ug/l	< 10	NONE	< 10			

Subcontracted analysis ⁽⁵⁾



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Leachate Analysis Certificate - Speciated PAH						
DETS Report No: 21-05199	Date Sampled	None Supplied				
Soiltechnics Ltd	Time Sampled	None Supplied				
Site Reference: Greenfinch, Didsbury	TP / BH No	TP050.503				
Project / Job Ref: STT5335	Additional Refs	TP05				
Order No: POR010031	Depth (m)	0.50				
Reporting Date: 28/04/2021	DETS Sample No	539012				

Determinand	Unit	RL	Accreditation				
Naphthalene	ug/l	< 0.01	NONE	0.09			
Acenaphthylene	ug/l	< 0.01	NONE	< 0.01			
Acenaphthene	ug/l	< 0.01	NONE	0.06			
Fluorene	ug/l	< 0.01	NONE	0.13			
Phenanthrene	ug/l	< 0.01	NONE	0.36			
Anthracene	ug/l	< 0.01	NONE	0.06			
Fluoranthene	ug/l	< 0.01	NONE	0.13			
Pyrene	ug/l	< 0.01	NONE	0.08			
Benzo(a)anthracene	ug/l	< 0.01	NONE	< 0.01			
Chrysene	ug/l	< 0.01	NONE	< 0.01			
Benzo(b)fluoranthene	ug/l	< 0.01	NONE	< 0.01			
Benzo(k)fluoranthene	ug/l	< 0.01	NONE	< 0.01			
Benzo(a)pyrene	ug/l	< 0.01	NONE	< 0.01			
Indeno(1,2,3-cd)pyrene	ug/l	< 0.01	NONE	< 0.01			
Dibenz(a,h)anthracene	ug/l	< 0.01	NONE	< 0.01			
Benzo(ghi)perylene	ug/l	0.008	NONE	< 0.008			
Total EPA-16 PAHs	ug/l	< 0.01	NONE	0.91			



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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3																																							
DETS Report No: 21-05199		Date Sampled	None Supplied		<table border="1"> <thead> <tr> <th colspan="3">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th>Inert Waste Landfill</th> <th>Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th>Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td>3%</td> <td>5%</td> <td>6%</td> </tr> <tr> <td>--</td> <td>--</td> <td>10%</td> </tr> <tr> <td>6</td> <td>--</td> <td>--</td> </tr> <tr> <td>1</td> <td>--</td> <td>--</td> </tr> <tr> <td>500</td> <td>--</td> <td>--</td> </tr> <tr> <td>100</td> <td>--</td> <td>--</td> </tr> <tr> <td>--</td> <td>>6</td> <td>--</td> </tr> <tr> <td>--</td> <td>To be evaluated</td> <td>To be evaluated</td> </tr> </tbody> </table>					Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																							
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill																																					
3%	5%	6%																																					
--	--	10%																																					
6	--	--																																					
1	--	--																																					
500	--	--																																					
100	--	--																																					
--	>6	--																																					
--	To be evaluated	To be evaluated																																					
Soiltechnics Ltd		Time Sampled	None Supplied																																				
Site Reference: Greenfinch, Didsbury		TP / BH No	WAC01.601																																				
Project / Job Ref: STT5335		Additional Refs	WAC01																																				
Order No: POR010031		Depth (m)	0.00																																				
Reporting Date: 28/04/2021		DETS Sample No	539013																																				
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	< 0.1																																				
Loss on Ignition	%	< 0.01	0.90																																				
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	841																																				
Total PAH ^{MU}	mg/kg	< 1.7	16.2																																				
pH ^{MU}	pH Units	N/a	8.7																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	2.3																																				
Eluate Analysis			2:1 mg/l	8:1 mg/l		Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																
Arsenic ^U		< 0.01	< 0.01		< 0.2	0.5	2	25																															
Barium ^U		0.02	0.05		0.5	20	100	300																															
Cadmium ^U		< 0.0005	< 0.0005		< 0.02	0.04	1	5																															
Chromium ^U		< 0.005	< 0.005		< 0.20	0.5	10	70																															
Copper ^U		< 0.01	0.03		< 0.5	2	50	100																															
Mercury ^U		< 0.0005	< 0.0005		< 0.005	0.01	0.2	2																															
Molybdenum ^U		0.010	0.004		< 0.1	0.5	10	30																															
Nickel ^U		< 0.007	< 0.007		< 0.2	0.4	10	40																															
Lead ^U		< 0.005	< 0.005		< 0.2	0.5	10	50																															
Antimony ^U		< 0.005	< 0.005		< 0.05	0.06	0.7	5																															
Selenium ^U		< 0.005	< 0.005		< 0.05	0.1	0.5	7																															
Zinc ^U		< 0.005	0.006		< 0.2	4	50	200																															
Chloride ^U		4	22		203	800	15000	25000																															
Fluoride ^U		0.8	< 0.5		< 1	10	150	500																															
Sulphate ^U		6	13		123	1000	20000	50000																															
TDS		79	56		586	4000	60000	100000																															
Phenol Index		0.01	< 0.01		< 0.5	1	-	-																															
DOC		8.2	22.4		208	500	800	1000																															
Leach Test Information																																							
Sample Mass (kg)		0.18																																					
Dry Matter (%)		99.4																																					
Moisture (%)		0.6																																					
Stage 1																																							
Volume Eluate L2 (litres)		0.35																																					
Filtered Eluate VE1 (litres)		0.20																																					

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
 Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepancies with current legislation
 M Denotes MCERTS accredited test
 U Denotes ISO17025 accredited test



DETS Ltd
Unit 1, Rose Lane Industrial Estate
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Lenham Heath
Maidstone
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Tel : 01622 850410



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 21-05199	
Soiltechnics Ltd	
Site Reference: Greenfinch, Didsbury	
Project / Job Ref: STT5335	
Order No: POR010031	
Reporting Date: 28/04/2021	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 539007	TP010.602	TP01	0.60	10.4	Black sandy clay with concrete
^ 539008	TP020.201	TP02	0.20	0.6	Brown gravel with stones and concrete
^ 539009	TP040.201	TP04	0.20	10.4	Brown loamy sand with stones and concrete
^ 539010	TP040.502	TP04	0.50	6.7	Brown loamy sand with stones and vegetation
^ 539011	TP050.302	TP05	0.30	2.3	Brown sandy gravel with stones and concrete
^ 539013	WAC01.601	WAC01	0.00	0.6	Brown sandy gravel with stones and concrete

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{u/s}

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-05199

Soiltechnics Ltd

Site Reference: Greenfinch, Didsbury

Project / Job Ref: STT5335

Order No: POR010031

Reporting Date: 28/04/2021

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



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Water Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-05199

Soiltechnics Ltd

Site Reference: Greenfinch, Didsbury

Project / Job Ref: STT5335

Order No: POR010031

Reporting Date: 28/04/2021

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detection	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

Parameter	Matrix Type	Suite Reference	Expanded Uncertainty Measurement	Unit
TOC	Soil	BS EN 12457	20.0	%
Loss on Ignition	Soil	BS EN 12457	35.0	%
BTEX	Soil	BS EN 12457	14.0	%
Sum of PCBs	Soil	BS EN 12457	23.0	%
Mineral Oil	Soil	BS EN 12457	9.0	%
Total PAH	Soil	BS EN 12457	11.6	%
pH	Soil	BS EN 12457	0.28	Units
Acid Neutralisation Capacity	Soil	BS EN 12457	18.0	%
Arsenic	Leachate	BS EN 12457	18.7	%
Barium	Leachate	BS EN 12457	11.6	%
Cadmium	Leachate	BS EN 12457	20.3	%
Chromium	Leachate	BS EN 12457	18.3	%
Copper	Leachate	BS EN 12457	24.3	%
Mercury	Leachate	BS EN 12457	23.7	%
Molybdenum	Leachate	BS EN 12457	14.7	%
Nickel	Leachate	BS EN 12457	16.1	%
Lead	Leachate	BS EN 12457	15.7	%
Antimony	Leachate	BS EN 12457	17.9	%
Selenium	Leachate	BS EN 12457	22.0	%
Zinc	Leachate	BS EN 12457	17.4	%
Chloride	Leachate	BS EN 12457	15.3	%
Fluoride	Leachate	BS EN 12457	16.4	%
Sulphate	Leachate	BS EN 12457	20.6	%
TDS	Leachate	BS EN 12457	12.0	%
Phenol Index	Leachate	BS EN 12457	14.0	%
DOC	Leachate	BS EN 12457	10.0	%
Clay Content	Soil	BS 3882: 2015	15.0	%
Silt Content	Soil	BS 3882: 2015	14.0	%
Sand Content	Soil	BS 3882: 2015	13.0	%
Loss on Ignition	Soil	BS 3882: 2015	35.0	%
pH	Soil	BS 3882: 2015	0.14	Units
Carbonate	Soil	BS 3882: 2015	16.0	%
Total Nitrogen	Soil	BS 3882: 2015	12.0	%
Phosphorus (Extractable)	Soil	BS 3882: 2015	24.0	%
Potassium (Extractable)	Soil	BS 3882: 2015	20.0	%
Magnesium (Extractable)	Soil	BS 3882: 2015	26.0	%
Zinc	Soil	BS 3882: 2015	14.9	%
Copper	Soil	BS 3882: 2015	16.0	%
Nickel	Soil	BS 3882: 2015	17.7	%
Available Sodium	Soil	BS 3882: 2015	23.0	%
Available Calcium	Soil	BS 3882: 2015	23.0	%
Electrical Conductivity	Soil	BS 3882: 2015	10.0	%



Final Report

Report No.: 22-39822-1
Initial Date of Issue: 25-Oct-2022
Client Soiltechnics Limited
Client Address: 1st Floor Unit 9 Westpoint Enterprise
Park
Clarence Avenue
Trafford Park
Manchester
M17 1QS
Contact(s): Admin
Project STT5335 Greenfinch, Didsbury
Quotation No.: Q22-29188
Order No.:
No. of Samples: 3
Turnaround (Wkdays): 5
Date Approved: 25-Oct-2022

Date Received: 17-Oct-2022

Date Instructed: 18-Oct-2022

Results Due: 24-Oct-2022

Approved By:

Details: Stuart Henderson, Technical
Manager

Results - Soil

Project: STT5335 Greenfinch, Didsbury

Client: Soiltechnics Limited	Chemtest Job No.:				22-39822	22-39822	22-39822
Quotation No.: Q22-29188	Chemtest Sample ID.:				1527327	1527328	1527329
Order No.:	Client Sample Ref.:				1	2	1
	Client Sample ID.:				TP1050.301	TP1050.702	TP1060.401
	Sample Location:				TP105	TP105	TP106
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.30	0.70	0.40
	Date Sampled:				07-Oct-2022	07-Oct-2022	07-Oct-2022
	Asbestos Lab:				NEW-ASB	NEW-ASB	NEW-ASB
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	15	22	18
Soil Colour	N	2040		N/A	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones and Roots	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand
pH	M	2010		4.0	8.0	8.2	8.3
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	1.1	0.84
Cyanide (Complex)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Arsenic	M	2455	mg/kg	0.5	6.9	6.7	6.1
Beryllium	U	2455	mg/kg	0.5	< 0.5	< 0.5	< 0.5
Cadmium	M	2455	mg/kg	0.10	0.11	< 0.10	< 0.10
Chromium	M	2455	mg/kg	0.5	4.2	6.3	4.7
Copper	M	2455	mg/kg	0.50	17	10	6.9
Mercury	M	2455	mg/kg	0.05	0.18	0.08	0.06
Nickel	M	2455	mg/kg	0.50	4.3	4.6	3.0
Lead	M	2455	mg/kg	0.50	80	33	24
Selenium	M	2455	mg/kg	0.25	0.26	0.29	0.25
Vanadium	U	2455	mg/kg	0.5	6.7	13	9.0
Zinc	M	2455	mg/kg	0.50	48	24	18
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
LOI	M	2610	%	0.10	11	3.7	4.2
Organic Matter	M	2625	%	0.40	13	2.7	2.6
TPH >C5-C6	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0
TPH >C6-C7	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0
TPH >C7-C8	N	2670	mg/kg	1.0	< 1.0	1.3	< 1.0
TPH >C8-C10	N	2670	mg/kg	1.0	< 1.0	130	< 1.0
TPH >C10-C12	N	2670	mg/kg	1.0	< 1.0	250	< 1.0
TPH >C12-C16	N	2670	mg/kg	1.0	< 1.0	190	< 1.0
TPH >C16-C21	N	2670	mg/kg	1.0	< 1.0	1.6	< 1.0
TPH >C21-C35	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Total TPH >C5-C35	N	2670	mg/kg	10	< 10	570	< 10
Naphthalene	M	2800	mg/kg	0.10	0.56	0.74	1.1

Results - Soil

Project: STT5335 Greenfinch, Didsbury

Client: Soiltechnics Limited	Chemtest Job No.:				22-39822	22-39822	22-39822
Quotation No.: Q22-29188	Chemtest Sample ID.:				1527327	1527328	1527329
Order No.:	Client Sample Ref.:				1	2	1
	Client Sample ID.:				TP1050.301	TP1050.702	TP1060.401
	Sample Location:				TP105	TP105	TP106
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.30	0.70	0.40
	Date Sampled:				07-Oct-2022	07-Oct-2022	07-Oct-2022
	Asbestos Lab:				NEW-ASB	NEW-ASB	NEW-ASB
Determinand	Accred.	SOP	Units	LOD			
Acenaphthylene	N	2800	mg/kg	0.10	0.32	1.0	0.47
Acenaphthene	M	2800	mg/kg	0.10	0.64	1.3	2.3
Fluorene	M	2800	mg/kg	0.10	0.55	1.2	2.2
Phenanthrene	M	2800	mg/kg	0.10	6.1	12	13
Anthracene	M	2800	mg/kg	0.10	1.5	2.8	2.6
Fluoranthene	M	2800	mg/kg	0.10	11	17	17
Pyrene	M	2800	mg/kg	0.10	11	17	15
Benzo[a]anthracene	M	2800	mg/kg	0.10	5.4	7.5	8.6
Chrysene	M	2800	mg/kg	0.10	6.2	8.2	9.3
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	6.4	8.4	10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	2.2	3.1	3.4
Benzo[a]pyrene	M	2800	mg/kg	0.10	5.8	7.4	7.7
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	3.0	4.3	4.7
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.73	1.1	0.59
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	3.3	4.2	4.6
Total Of 16 PAH's	N	2800	mg/kg	2.0	65	97	100
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

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.
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.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
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
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	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-MS
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

Analysis of test data in relation to concentrations of **inorganic** chemical contaminants

Adopted Model: Residential without plant uptake
Receptor: Proposed site user

Test procedure			Summary of test data					Initial comparison	Outlier test				Normality test			UCL	
Contaminant	Guideline source	Guideline value	No. of tests	Min.	Max.	Mean	No. of tests above guideline value	Initial screening				Concentration	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean	Contaminant
		mg/kg		mg/kg	mg/kg	mg/kg			Pass outlier test?	Number of outliers	Location of outlier						
Arsenic	S4UL	40	7	4.0	47.0	16.5	1	Mean value below guideline					normal	normal	y	27.6	Arsenic
Beryllium	S4UL	1.7	7	0.5	1.4	0.7	0	Mean value below guideline					not normal	normal	y	1.0	Beryllium
Boron	S4UL	11000	7	0.4	1.1	0.9	0	Mean value below guideline					not normal	not normal	n	1.3	Boron
Cadmium	S4UL	85	7	0.1	0.7	0.4	0	Mean value below guideline					normal	normal	y	0.6	Cadmium
Chromium (III)	S4UL	910	7	4.2	10.0	7.4	0	Mean value below guideline					normal	normal	y	9.0	Chromium (III)
Copper	S4UL	7100	7	10.0	39.0	22.3	0	Mean value below guideline					normal	normal	y	30.9	Copper
Cyanide (total)	ATK	34	7	0.5	2.0	1.6	0	Mean value below guideline					not normal	not normal	n	2.8	Cyanide (total)
Lead	C4SL	330	7	33.0	165.0	106.4	0	Mean value below guideline					normal	normal	y	144.7	Lead
Mercury#	S4UL	1.2	7	0.1	1.0	0.8	0	Mean value below guideline					not normal	not normal	n	1.5	Mercury#
Nickel	S4UL	180	7	4.3	16.0	9.7	0	Mean value below guideline					normal	normal	y	13.0	Nickel
Selenium	S4UL	430	7	0.3	3.0	2.2	0	Mean value below guideline					not normal	not normal	n	4.4	Selenium
Vanadium	S4UL	1200	7	6.0	21.0	12.0	0	Mean value below guideline					normal	normal	y	16.2	Vanadium
Zinc	S4UL	40000	7	24.0	80.0	58.9	0	Mean value below guideline					normal	normal	y	73.0	Zinc

S4UL Suitable for Use Level as published by LQM/CIEH
C4SL Category 4 Screening Level
C4SL (lower) (upper) Category 4 Screening Level for Lead at lower or upper bound of range
ATK Soil Screening Value derived by Atkins
BPG5 Guideline from BPG Note 5 as published by Forest Research

Assumed to be elemental mercury as initial screening value

Title	Table number
Analysis of test data in relation to concentrations of inorganic chemical contaminants.	1

Analysis of test data in relation to concentrations of inorganic chemical contaminants

Adopted Model: Industrial/Commercial
Receptor: Construction operative

Test procedure			Summary of test data					Initial comparison	Outlier test				Normality test			UCL		
Contaminant	Guideline source	Guideline value	No. of tests	Min.	Max.	Mean	No. of tests above guideline value	Initial screening	Pass outlier test?	Number of outliers	Location of outlier	Depth	Concentration	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean	Contaminant
		mg/kg		mg/kg	mg/kg	mg/kg							mg/kg	mg/kg	mg/kg			
Arsenic	S4UL	640	8	4.0	47.0	15.2	0	Mean value below guideline	n	0				not normal	normal	y	24.9	Arsenic
Beryllium	S4UL	12	8	0.5	1.4	0.7	0	Mean value below guideline	n	0				not normal	normal	y	0.9	Beryllium
Boron	S4UL	240000	8	0.4	1.1	0.9	0	Mean value below guideline	y	0				not normal	not normal	n	1.3	Boron
Cadmium	S4UL	190	8	0.1	0.7	0.3	0	Mean value below guideline	y	0				normal	normal	y	0.5	Cadmium
Chromium (III)	S4UL	8600	8	4.2	10.0	7.0	0	Mean value below guideline	y	0				normal	normal	y	8.6	Chromium (III)
Copper	S4UL	68000	8	6.9	39.0	20.4	0	Mean value below guideline	y	0				normal	normal	y	28.5	Copper
Cyanide (total)	ATK	34	8	0.5	2.0	1.4	0	Mean value below guideline	y	0				not normal	not normal	n	2.6	Cyanide (total)
Lead	C4SL	6000	8	24.0	165.0	96.1	0	Mean value below guideline	y	0				normal	normal	y	133.9	Lead
Mercury#	S4UL	58	8	0.1	1.0	0.7	0	Mean value below guideline	y	0				not normal	not normal	n	1.4	Mercury#
Nickel	S4UL	980	8	3.0	16.0	8.9	0	Mean value below guideline	y	0				normal	normal	y	12.0	Nickel
Selenium	S4UL	12000	8	0.3	3.0	2.0	0	Mean value below guideline	y	0				not normal	not normal	n	4.2	Selenium
Vanadium	S4UL	9000	8	6.0	21.0	11.6	0	Mean value below guideline	y	0				normal	normal	y	15.2	Vanadium
Zinc	S4UL	730000	8	18.0	80.0	53.8	0	Mean value below guideline	y	0				normal	normal	y	69.1	Zinc

S4UL Suitable for Use Level as published by LQM/CIEH
C4SL Category 4 Screening Level
C4SL (lower) (upper) Category 4 Screening Level for Lead at lower or upper bound of range
ATK Soil Screening Value derived by Atkins
BPG5 Guideline from BPG Note 5 as published by Forest Research

Assumed to be elemental mercury as initial screening value

Title	Table number
Analysis of test data in relation to concentrations of inorganic chemical contaminants.	2