LISTERS GEO
Geotechnical and Geoenvironmental Consultants

DRAFT

Anavo Care Ltd

Phase 2 Ground Investigation

Mount Hermon Care Home
89 Brighton Road
Lancing
BN15 8RB

Report No: 21.03.016
May 2021

MAIN OFFICE & LABORATORIES
Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northamptonshire. NN12 8QD
Telephone: (01327) 860060 Fax: (01327) 860430 Email: info@listersgeotechnics.co.uk

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

DOCUMENT RECORD

Report Title	Phase 2 Ground Investigation Report
Development	New Care Home Development
Project Address	Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB
Project Number	21.03.016
Client	Anavo Care Ltd

	Signature	**Name and Qualifications**
Prepared By:		**Tom Johnson** **Associate Director** **BSc(Hons), MSc, FGS, CGeol**
Checked and Approved By:		**David Webster** **Associate Director** **BSc(Hons), MSc, DIC, FGS, CGeol, CSci, RoGEP**

For and on behalf of ListersGeo, trading name of Listers Geotechnical Consultants Ltd

Issue No	Date	Status
1	21st May 2021	Draft
2	26th May 2021	Draft Rev 1 – updated to include final phase of gas/groundwater monitoring

© This Report is the copyright of ListersGeo, trading name of Listers Geotechnical Consultants Ltd. Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

EXECUTIVE SUMMARY

Project Reference	21.03.016
Site Location	Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB
OS Grid Reference	518050, 103710
Development Proposals	New three-storey care home with single-storey basement with associated residents garden areas and car parking
Current Site Usage	Former Mount Hermon Care Home and residential properties No.87 and No.89 Brighton Road
Topography	The site and the surrounding area is generally flat lying
Vegetation	The northeast of the site is covered with overgrown grass with several small trees and brambles in the far northeastern corner
Published Geology	The available BGS information indicates that the site is underlain by Superficial geology, Aeolian Deposits (formerly Brickearth) overlying Raised Beach Deposits, above Bedrock Geology the Lambeth Group. Potentially infilled land is also indicated across the site possibly associated with the backfilling of the former brickfield indicated on site.
Hydrology	The previous desk study identified that the nearest surface water feature is the sea with the mean highwater mark located 138m to the south of the site
Hydrogeology	The available information indicates that the site is located on a Secondary B Aquifer, Aeolian Deposits, onto Secondary A Aquifer, Raised Beach Deposits overlying a Secondary A Aquifer, the Lambeth Group
Site History	The historical maps indicate that the site was occupied as a brickfield from the earliest map dated 1875 until the late 1890s. At this time two buildings were in the southeast and a wind pump was shown in the northwestern corner of the site, possibly associated with a borehole/well. The 1912 map shows a building in the southwest of the site later referred to as No.87 Brighton Road with two small associated outbuildings. By the early 1930s there is a residential building in the southern corner, next door to No.87 Brighton Road. The residential property at No.89 Brighton Road in the east was constructed in the 1950s and the wind pump is no longer shown at this time. By the 1960s, the residential property at No.87a Brighton Road is shown in the southeast. The modern day layout with the two residential houses combined to form Mount Hermon Care Home is shown on the 1999 aerial photograph
Unexploded Ordnance	Low risk
Potential Contamination Sources	The previous desk study research identified several potential contamination sources on the site including Made Ground associated with the construction and demolition of the buildings on site, the potential backfilling of the former brickfield indicated across the entire site and the potential for asbestos within the former and existing buildings on site
Ground Conditions Encountered	The intrusive investigation revealed that the general succession of strata was represented by Fill/Topsoil onto Made Ground down to depths between 0.30m and 1.30m, above the Aeolian Deposits locally in the centre and southeast down to depths between 1.15m and 1.70m, onto Raised Beach Deposits down to depths between8.40m and 8.60m overlying the Lambeth Group proven to the full depth of the investigation at 10.00m
Groundwater Encountered	Groundwater was encountered as slight seepages in CT01 and CT03 at 5.50m and 5.70m respectively, during the fieldwork. Groundwater was also encountered during the previous investigation in WS101 at 5.50m rising to 5.33m after 20 minutes and in WS102 at 5.10m rising to 5.17m after 20 minutes. Monitoring carried out as part of the project recorded the installations as dry, with the exception of WS102 where groundwater was recorded at 5.34m depth below the existing ground level.
Risks to Human Health	Elevated concentrations Lead have been recorded within Topsoil and Made Ground soil samples collected from the site

Ground Gas Risks	No special precautions required for carbon dioxide or methane. Although the site lies within an area where risks from radon gas are low, the property has a basement/underground room. Risks of radon are increased in underground rooms and radon protection measures should be included in the basement design
Risks to Controlled Waters	There are considered to be no significant risks to controlled waters
Remediation Required	Cover system required in areas of proposed gardens or soft landscaping
Chemical Attack on Buried Concrete	Design Sulphate Class DS-1 ACEC Class AC-1
Geotechnical Hazards	Given the former brickfield identified on site there is the potential for deeper Made Ground to be encountered between and beyond the test locations.
Foundations	Outside of basement footprint - Spread foundations at 1.0m depth or 0.2m into the top of the Raised Beach Deposits, whichever is deeper. Required up to at least 1.90m depth based on ground conditions encountered. Within basement footprint – appropriately designed basement raft/slab tied in to retaining walls to form the basement structure
Allowable Bearing Pressure	At the minimum founding depth provided above, an allowable bearing pressure (or net loading intensity increase) of 200kPa may be adopted for conventional 1.0m wide strip footings.
Floor Slabs	Suspended floor slabs are recommended outside of the basement footprint
Roads and Hardstanding Design	Deep Made Ground and low strength Aeolian Deposits were encountered across the south of the site in the areas of the proposed hardstanding. Therefore, geogrids or similar soil reinforcement techniques are recommended to provide a subgrade with a known CBR value.
Infiltration Measures	The infiltration testing indicates that traditional soakaways are considered feasible at this site, constructed in the north of the site within the coarse-grained Raised Beach Deposits, subject to regulatory approval.
Recommendations and Further Work	A watching brief and Discovery Strategy is recommended during the groundwork, particularly during the excavation of the proposed basement. Supplementary investigation including additional trial pits and possibly shallow boreholes following demolition could also be considered to further investigation the depth to the dense granular Raised Beach Deposits across the footprint of the entire proposed building to further assess the suitability of shallow foundations outside of the basement footprint. Additionally, a possible well/borehole was indicated on the historical maps in the northwestern corner of the site. We would recommend that further investigation is carried out in this area following vegetation clearance and demolition and the well/borehole made safe, if present. If a piled basement/foundation solution is required, then further deeper boreholes may be necessary to assist the design. Further sampling and testing of the Topsoil and Made Ground could be considered in order to provide greater confidence of the nature of the Lead contamination across the site. This further testing may potentially negate the implementation of a cover system from some of the proposed areas of gardens or soft landscaping away from previously elevated concentrations of Lead recorded. If excavated soils require landfill disposal then waste classification testing is recommended which is a twofold process using soil chemical testing results and the European Waste Catalogue for off-site disposal, followed by testing under the Waste Acceptance Criteria (WAC).

This executive summary should be read in conjunction with the main report.

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

CONTENTS

INTRODUCTION 1
SCOPE OF THE INVESTIGATION 1
PROPOSALS 2
SITE INFORMATION AND WALKOVER SURVEY 2
PREVIOUS WORK 3
History 3
Geology 3
Superficial Deposits 4
Bedrock 4
Hydrology 4
Hydrogeology 4
Waste Treatment and Landfill sites 5
Unexploded Ordnance 5
Potential Contamination Sources 5
Ground Gas 5
CONCEPTUAL SITE MODEL 6
POTENTIAL CONTAMINATION SOURCES 6
Potential Solid-, Liquid- and Vapour-phase Contamination Sources 6
Potential Ground Gas Contamination Sources 6
RECEPTORS 7
Human Health – Long Term Exposure 7
Human Health – Short Term Exposure 7
Controlled Waters and Environment 7
Infrastructure 7
PATHWAYS 7
ON-SITE SOURCES 9
GEOTECHNICAL CONCEPTUAL SITE MODEL 11
EXPLORATION AND TESTING 12
SAMPLING STRATEGY 12
METHODOLOGY 13
Health and Safety 13
Exploratory Holes 13
Installations 14
In-situ Testing 14
GROUND CONDITIONS 15
TOPSOIL 15
FILL 15
MADE GROUND 16
AEOLIAN DEPOSITS 16
RAISED BEACH DEPOSITS 16
LAMBETH GROUP 17
GROUNDWATER 17
OBSERVED SOIL CONTAMINATION 17
INFILTRATION TESTING 18
GROUND GAS MONITORING 18
CALIFORNIA BEARING RATIO (CBR) TESTS 18
SULPHATE AND PH TESTS 19
GROUND CONTAMINATION ASSESSMENT 20
SOIL TESTING 20
RISK ASSESSMENT GUIDELINES – HUMAN HEALTH 21
Category 4 Screening Levels (C4SLs) 21
Suitable 4 Use Levels (S4ULs) 21
Detailed Quantitative Risk Assessment (DQRA) 21
Data Sources 22
RISK ASSESSMENT GUIDELINES – CONTROLLED WATERS 22

RESULTS OF ASBESTOS SCREENING 22
RESULTS OF TOTAL SOIL TESTS 22
Lead *22*
Polycyclic Aromatic Hydrocarbons (PAHs) *23*
Benzo(b)fluoranthene *23*
Dibenz(a,h)anthracene *23*
HUMAN HEALTH RISK ASSESSMENT 24
SOIL CONTAMINATION RISK 24
CONSTRUCTION / MAINTENANCE WORKERS AND GENERAL PUBLIC (SHORT-TERM EXPOSURE) 25
REGULATORY APPROVAL 25
GROUND GAS RISK ASSESSMENT 26
GROUND GAS SCREENING VALUES 26
GROUND GAS PROTECTION MEASURES 26
Carbon Dioxide and Methane Gas *26*
Radon Gas *27*
REGULATORY APPROVAL 27
CONTROLLED WATERS RISK ASSESSMENT 28
DISCUSSION 28
REGULATORY APPROVAL 28
INFRASTRUCTURE RISK ASSESSMENT 29
SUBSURFACE CONCRETE 29
UNDERGROUND SERVICES 29
REVISED CONCEPTUAL SITE MODEL 30
ON-SITE SOURCES 30
REMEDIATION 32
OPTIONS APPRAISAL 32
Simple Cover System *32*
IMPORTED TOPSOIL AND SUBSOIL SPECIFICATION 32
GROUND GAS PROTECTION MEASURES 33
CONCRETE DESIGN CLASSIFICATION 33
WATER SUPPLY PIPES 33
REMEDIAL STRATEGY 34
DISCOVERY STRATEGY 34
REGULATORY APPROVAL 34
POST REMEDIATION VERIFICATION 34
FURTHER WORK 35
GEOTECHNICAL ENGINEERING CONCLUSIONS 36
STRATA 36
GROUNDWATER 37
SITE EXCAVATION 37
FOUNDATION SOLUTIONS 39
Shallow Foundations - outside of the basement footprint *39*
Pile Foundations *40*
BASEMENT SLAB, GROUND MOVEMENTS AND HEAVE/UPLIFT PRESSURES 40
Hydrostatic Pressure *41*
GROUND FLOOR SLABS 42
WORKING PLATFORMS FOR TRACKED PLANT 43
ACCESS ROADS AND PARKING 43
INFILTRATION MEASURES 44
FURTHER WORK AND RECOMMENDATIONS 45
REFERENCES 46

APPENDICES

APPENDIX A – PLANS AND PHOTOGRAPHS

- Site Location Plan
- Exploratory Hole Location Plan - Existing Site Layout
- Exploratory Hole Location Plan – Showing Development Proposals
- Site Photographs

APPENDIX B – FIELDWORK AND TESTING

- Legends and Abbreviations Log Key
- Trial Pit Logs
- Hand Pit Logs
- Cable-tool Percussive Borehole Logs
- Continuous Tube Sampler Borehole Logs
- In-situ TRL results
- Soil Infiltration Test Results
- Gas and Groundwater Monitoring Results

APPENDIX C – LABORATORY TEST REPORTS

- Geotechnical Laboratory Test Report
- Chemical Laboratory Test Report

APPENDIX D – CONTAMINATION RISK ASSESSMENT AND WORKSHEETS

- Contaminated Land Risk Assessment Methodology
- CLEA 1.071 Settings
- CLEA 1.071 Results
- PAH Double Ratio Plot

APPENDIX E – GEOTECHNICAL PLOTS AND TABLES

- SPT v Depth Plot
- Pile Design Data

PHASE 2 GROUND INVESTIGATION REPORT

INTRODUCTION

A Phase 2 Ground Investigation has been undertaken for a new care home at Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB. A Site Location Plan is provided in Appendix A. The Ordnance Survey National Grid reference for the approximate centre of the site is 518050, 103710.

Instructions to undertake the investigation were received from Ward Associates (Consulting Engineers) Ltd acting on behalf of the client Anavo Care Ltd, in their email dated 15th March 2021.

This report describes the intrusive site investigation activities carried out by ListersGeo in order to provide an evaluation of the ground conditions and the extent of any soil, gas or groundwater contamination present on the site. The report presents initial human health and groundwater risk assessments based on the findings of the desk study information and subsequent contamination laboratory testing. The contamination risk assessment has been carried out using the source-pathway-receptor risk assessment methodology.

The report also discusses the geotechnical implications with regard to the proposed development based on the findings of the fieldwork and subsequent laboratory testing.

This report supplements a previous Desk Study report prepared by Integral Geotechnique, report number 12652/LP/DS, dated May 2020 and a Factual Ground Investigation report by SCI carried out in November 2020, and we have relied on information within these reports to aid our recommendations. This current report should be read in conjunction with the previous report for full details of the investigations undertaken at the site.

This report has been prepared for the sole use of the client and their professional advisors. This report shall not be relied upon by third parties without the express written authority of ListersGeo. If an unauthorised third-party comes into possession of this report, they must not rely on it and the authors owe them no duty of care and skill.

SCOPE OF THE INVESTIGATION

The scope of the investigation as requested by Ward Associates (Consulting Engineers) Ltd was to provide an assessment of the geotechnical engineering properties of the ground and the extent of any soil, gas or groundwater contamination on the site. A contaminated land risk assessment was undertaken based on the Contaminated Land Exposure Assessment (CLEA) and Environment Agency (EA) Remedial Targets Methodology (RTM) guidelines.

The investigation also includes a preliminary assessment of the feasibility of adopting a soakaway drainage solution at the site, as well as providing parameters to aid pavement design.

PROPOSALS

It is proposed to redevelop the site to accommodate a new three-storey care home with single-storey basement with associated residents garden areas and car parking. A proposed site layout plan is provided in Appendix A.

SITE INFORMATION AND WALKOVER SURVEY

A walkover survey of the site and its immediate surrounds was undertaken on the 31st March 2021, preceding the fieldwork. A selection of site photographs is presented in Appendix A along with a plan showing the existing site layout.

The site lies in a predominantly residential area and is currently occupied by the former Mount Hermon Care Home and residential properties No.87 and No.89 Brighton Road.

The site consists of an irregular shaped parcel of land measuring approximately 60m by 70m, extending to approximately 0.26ha.

The site and the surrounding area is generally flat lying with Lancing Beach located approximately 100m to the south.

The site is bordered by:

Direction	Feature
North	A small access road down the site of Beach Green Hotel and residential houses with associated gardens
East	South Street along the southeastern boundary with Premier Express convenience store beyond
South	Brighton Road (A259) along the southern boundary with Albion Hand Car Wash beyond
West	An access road to residential garages along the southwestern boundary with Cavatina Lodge Guest House beyond

The southwestern half of the site is occupied by a disused two-storey building named Mount Hermon Care Home. There is concrete hardstanding surrounded by a low brick wall at the front which was previously used for parking. There are gardens for the former residents to the rear with areas of paving and several wooden sheds and a single-storey brick outbuilding in the northwest of the site. The wooden sheds appeared to have been used for garden equipment and there was a small wooden smoking shelter formerly used by the workers of the care home. The area in the far northwestern corner of the site was inaccessible due to a large pile of recently cut vegetation.

There is a two-storey residential house No.87 Brighton Road located to the east of the former care home with an associated garden to the rear and a gravel area used for parking to the front. The rear garden was occupied by dense brambles which was inaccessible and there is a wooden shed used for garden tools located in northeastern corner.

Another two-storey residential house is located at No.89 Brighton Road on the far eastern corner of the site. The house is surrounded by wooden fencing and there are is a garden at the front and the rear of the property.

The northeast of the site is covered with overgrown grass with several small trees and brambles in the far northeastern corner which was inaccessible. There is a small wooden shed and an area of decking in the north and there appears to be several holes in the surface of the ground in the northeast possibly associated with animal burrows.

PREVIOUS WORK

A Desk Study report was previously undertaken by Integral Geotechnique, report number 12652/LP/DS, dated May 2020 and a Factual Ground Investigation report by SCI carried was carried out in November 2020. The salient points relevant to this report are included here, but the full report should be referred to for more detail.

History

The previous desk study indicated that the majority of the site was occupied by a brickfield (a field where the topsoil has been removed and the clay stripped to create bricks) which extended to the west and southwest from the earliest map dated 1875. At this time, Horseshoe Inn was located adjacent to the northeast of the site and there are two buildings with one named as Bank Cottage located in the southeast. The beach is shown some 100m to the southeast with rough grassland extending to the road adjacent to the southeast boundary of the site. There is another brickfield also shown some 330m to the northeast.

By the late 1890s the site is no longer indicated as a brickfield and there is a small structure later named as a wind pump in the northwestern corner of the site. The wind pump may have been used for pumping water and therefore it may be associated with the BGS borehole/well (TQ10SE28) to 43.9m depth for Bank Cottage indicated in this area of the site. At this time, the building named as Bank Cottage in the southeast of the site appears to have been extended.

The 1912 map shows a building in the southwest of the site later referred to as No.87 Brighton Road with two small associated outbuildings. By the early 1930s, there are residential houses shown to the southwest and a residential building in the southern corner, next door to No.87 Brighton Road. At this time, there are also buildings shown some 15m to the southeast of the site.

Several smaller buildings in the southeast of the site were demolished in the 1950s, residential houses were constructed to the north along with the residential property at No.89 Brighton Road in the east of the site. The wind pump is no longer indicated in the northwestern corner of the site. By the 1960s, the residential property at No.87a Brighton Road is shown in the southeast and the building shown some 15m to the southeast of the site is indicated as a garage. The modern day layout with the two residential houses combined to form Mount Hermon Care Home is shown on the 1999 aerial photograph.

Geology

Reference to the British Geological Survey 1:50,000 scale map, sheet 318/333 for Brighton and Worthing dated 1996, and other published geological information on the area indicates that the site is underlain by Superficial

geology, Aeolian Deposits (formerly Brickearth) overlying Raised Beach Deposits, above Bedrock Geology the Lambeth Group.

The previous Envirocheck report indicates potentially infilled land across the site possibly associated with the backfilling of the former brickfield indicated on site. Therefore, Made Ground is anticipated beneath the site.

The BGS map also indicates Made Ground some 10m to the south of the site considered to be associated with the build-up of the land directly to the north of Lancing Beach.

Superficial Deposits

The Aeolian Deposits (formerly Brickearth) are generally represented by remobilised (windblown) sandy, silty clay with rare pebbles and they can be of varying thickness. These deposits are referred to as River Terrace Deposits on the Envirocheck report. However, it is considered more likely to be Aeolian Deposits (formerly Brickearth) given the brickfield indicated on site and 330m to the northeast. Given that the historical maps indicated a brickfield on site it is considered that some or all of this deposit may have been removed.

The Raised Beach Deposits indicated beneath are generally represented by shingle, sand, silt and clay and can be of varying thickness.

Bedrock

The Lambeth Group is described by the BGS as 'vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones and lignites and occasional sandstone and conglomerate'. Beneath the site itself the formation is expected to be some 20m thick.

BGS Borehole Logs

There is a BGS borehole TQ10SE28 down to 43.9m indicated in the far northwestern corner of the site dated 1899. It is considered that this may be associated with the wind pump shown on the historical maps from the 1890s to the 1950s. The borehole appears to have encountered chalk down to 53.9m depth. The log indicates that the surface level of the borehole was at 7.01mAOD and resting water level was recorded at -0.30mAOD, approximately 7.00m below the existing ground level.

There is another borehole TQ10SE55 located approximately 25m to the west of the site which encountered the Woolwich and Reading Beds (Lambeth Group) to the base of the borehole at 6.78m depth. The log indicates that the surface level of the borehole was at 7.62mAOD and resting water level was recorded at around 1.60mAOD, approximately 6.00m below the existing ground level.

Hydrology

The previous desk study identified that the nearest surface water feature is the sea with the mean highwater mark located 138m to the south of the site.

Hydrogeology

The available information indicates that the site is located on a Secondary B Aquifer, Aeolian Deposits, onto Secondary A Aquifer, Raised Beach Deposits overlying a Secondary A Aquifer, the Lambeth Group.

According to information provided by the Environment Agency the site is outside of any Source Protection Zones. There were no discharge consents recorded within 500m and no groundwater abstraction points identified within 1000m of the site.

Waste Treatment and Landfill sites

The Envirocheck report indicated one historical landfill within 500m of the site. The landfill is shown at Beach Green located 290m to the east of the site and was used for unknown materials. A Licensed Waste Management Facility is also shown 500m to the northwest associated with special waste transfer stations.

Unexploded Ordnance

The previous desk study indicates that the site is located in an area where there is a low risk of unexploded ordnance based on the Zetica UXO Risk maps. Low-risk regions are those with a bombing density of up to 15 bombs per 1,000 acres and there is a low potential for encountering UXO on the site. Works can normally proceed without any special precautions.

Potential Contamination Sources

The previous desk study research identified several potential contamination sources on the site including Made Ground associated with the construction and demolition of the buildings on site, the potential backfilling of the former brickfield indicated across the entire site and the potential for asbestos within the former and existing buildings on site.

The risk to human health and controlled waters was considered to be low/medium, however, confirmatory contamination testing was recommended.

Ground Gas

The previous desk study indicated the potential for ground gas to be present beneath the site and that no radon protection measures are necessary in the construction of new dwellings or extensions without underground rooms on this site.

However, as the property is proposed to have a basement, radon levels may be higher in this underground room and in accordance with BRE Quick Guide 7, Reducing Radon, Underground Rooms – Cellars and Basements, 2015, mitigation measures should be included in the basement design.

CONCEPTUAL SITE MODEL

A qualitative Preliminary Risk Assessment (PRA) has been undertaken in line with the EA's new online guidance, Land Contamination: Risk Management (LCRM), published in October 2020. The new guidance is based upon the principles of CLR11, Model procedures for the management of land contamination, 2004.

It is understood that the development proposals are for a new care home with associated garden areas for the residents.

Potential sources of contamination and potential receptors have been assessed using the source-pathway-receptor principle to create a Conceptual Site Model (CSM). This takes into account the fact that a complete pathway must exist between a potential source of contamination and a potential receptor for there to be considered a risk.

POTENTIAL CONTAMINATION SOURCES

Potential Solid-, Liquid- and Vapour-phase Contamination Sources

The results of the desk study and walkover indicate that the following potential sources of soil or groundwater contamination are present at, or in close proximity to, the site:

- Made Ground is likely to be present at the site associated with the construction and demolition of the buildings on site and the potential backfilling of the former brickfield indicated across the entire site
- Localised spills and leaks of hydrocarbon fuels or oils from vehicles in the car park in the southeast of the site at the front of the care home and No.87 Brighton Road although these are considered to be limited due to the concrete hardstanding present
- Potential for asbestos from degradation of materials associated with the former and existing buildings on site

Potential Ground Gas Contamination Sources

In consideration of the source-pathway-receptor methodology for ground gas risk assessment set out in CIRIA C665, the sensitivity of the care home development is considered to be high/moderate.

The site lies above a potentially infilled brickfield and within the potential influence of a historical landfill site at Beach Green located 290m to the east.

A single-storey basement is proposed and therefore radon gas protection measure are required.

Therefore, the following potential ground gases have been identified for the site:

- Migrating carbon dioxide and methane gases
- Explosive gases
- Radon gas

RECEPTORS

The following most sensitive receptors have been identified at the site:

Human Health – Long Term Exposure

- End users of the site - the future workers and adult care home residents
- Nearby residents

Human Health – Short Term Exposure

- Construction workers (during redevelopment)
- General Public (during redevelopment)
- Maintenance Workers

Controlled Waters and Environment

- The sea with the mean highwater mark located 138m to the south of the site
- The Secondary B Aquifer, Aeolian Deposits, onto Secondary A Aquifer, Raised Beach Deposits overlying Secondary A Aquifer, the Lambeth Group indicated beneath the site

Infrastructure

- Substructures
- Water supply pipes

PATHWAYS

It is considered that a number of potential pathways exist between these potential sources and the above identified receptors. The viability of these pathways is discussed in the preliminary risk assessment.

Human Health

- Direct soil ingestion in areas of exposed soil
- Ingestion of soil attached to homegrown produce
- Ingestion of homegrown produce with contamination uptake
- Inhalation of indoor and outdoor vapours and dust
- Dermal contact with contaminated soil
- Inhalation of soil gases migrating through permeable strata into the building

Controlled Waters and Environment

- Migration/leaching of contaminants through the unsaturated zone
- Migration of contaminants through the groundwater
- Movement of contaminants through drains or services runs
- Run-off to the nearby sea

Infrastructure

- Leachable or corrosive contaminants within the soil
- Corrosive contaminants within the groundwater

Based on the desk study research, the following potentially-complete pollutant linkages have been assessed and in accordance with CIRIA 552, a consequence and probability rating has been applied to each potential contamination source to create an overall risk rating. The results are presented in the following table.

ON-SITE SOURCES

Potential On-site Source	Pathway	Potential Receptor	Probability	Consequence	Risk Classification	Explanation
Contaminants within the Made Ground from infill of the former brickfield and construction and demolition of buildings - *Including: heavy metals, PAH, petroleum hydrocarbons, asbestos* Localised spills and leaks of fuels or oils from vehicles - *Including petroleum hydrocarbons* Potential for asbestos from degradation of	Ingestion Dermal Contact Inhalation	End Users - Residents	Low likelihood	Medium	Moderate / Low	On-site contamination is anticipated to be minimal and much of the site will be surfaced with hardstanding with soft landscaping limited to communal garden areas for the care home residents. Excavation of the basement will remove a significant amount of the Made Ground.
		Nearby Residents	Unlikely	Medium	Low	
		Construction Workers	Low likelihood	Mild	Low	Exposure to maintenance and construction workers can be mitigated by use of appropriate PPE and maintaining good hygiene levels.
	Migration through unsaturated zone Migration through groundwater Migration through drains or service runs Run-off to the sea	Secondary B Aquifer, Aeolian Deposits, Secondary A Aquifer onto Raised Beach Deposits overlying Secondary A Aquifer, the Lambeth Group	Low likelihood	Mild	Low	Gross levels of contamination (that pose a risk to controlled waters) are not anticipated in the Made Ground, and the site is not within a Source Protection Zone and there are no known groundwater abstractions within 1000m of the site. Furthermore, the majority of the site will be surfaced with hardstanding which will significantly reduce infiltration and any leaching potential.
		The sea with the mean highwater mark located 138m to the south	Low likelihood	Mild	Low	It is considered a low likelihood that significant site-derived contaminated groundwater would migrate to the sea due to the distance from the site.

Potential On-site Source	Pathway	Potential Receptor	Probability	Consequence	Risk Classification	Explanation
materials associated with the former and existing buildings on site	Direct contact	Substructures Water supply pipes	Low likelihood	Mild	Low	The Made Ground, Aeolian Deposits, Raised Beach Deposits and Lambeth Group may contain sulphates at concentrations that may accelerate the degradation of buried concrete. Limited contamination which may impact pipes is anticipated.
Ground gas in organic rich soils - *Carbon dioxide or methane* Potentially from backfill of former brickfield	Inhalation	End Users – Residents	Low likelihood	Medium	Moderate / Low	If organic soils or a significant thickness of Made Ground are present then further testing, monitoring or gas protection measures may be required.
	Accumulation in building	On-site buildings	Unlikely	Severe		
Radon gas	Inhalation	End Users – Care Home Residents	Low likelihood	Medium	Moderate / Low	As the property is proposed to have a basement, radon levels may be higher in this underground room and in accordance with BRE Quick Guide 7, Reducing Radon, Underground Rooms – Cellars and Basements, 2015, mitigation measures should be included in the basement design.

The geoenvironmental investigation and risk assessment detailed in the remainder of this report have been conducted to validate this CSM.

GEOTECHNICAL CONCEPTUAL SITE MODEL

The ground conditions beneath the site are indicated as Made Ground onto Aeolian Deposits (formerly Brickearth) overlying Raised Beach Deposits, above Bedrock Geology the Lambeth Group. The above strata maybe suitable for shallow foundations depending upon the thickness of Made Ground/Aeolian Deposits and density of the soils at a shallow depth.

The Aeolian Deposits if present are usually fine-grained and therefore if present then the risk of shrinking and swelling clays will need to be assess by intrusive investigation.

A former brickfield has been indicated across the entire site and potentially infilled. Therefore, there may be Made Ground on the site, that may be highly compressible, of low strength, or poorly compacted, or contain hard obstructions. Additionally, the Aeolian Deposits may be potentially compressible/collapsible.

Several buildings have been demolished particularly from the southeast of the site and therefore there may be former foundations/structures present beneath the ground which may require removal and the proposed foundations potentially extending.

There is also the potential for groundwater to be present within the Raised Beach Deposits which may cause instability of excavations, potential issues for foundation construction and possible running sand hazards. The former BGS boreholes indicate groundwater at depths between 6.0m and 7.0m. However, further groundwater monitoring is recommended to further assess the depth to groundwater.

The intrusive investigation has been implemented to address these main issues and establish any potential problems for foundations and the general development of the site.

EXPLORATION AND TESTING

A total of fifteen exploratory holes were formed at the site between the 31st March to 22nd April 2021. These included three machine excavated trial pits, two cable percussion boreholes, three continuous tube sample boreholes, five hand excavated trial pits and two TRL probe tests.

Exploratory Hole Type	Reference
Cable percussion boreholes	BH01 and BH02
Continuous tube sampler boreholes	CT01 to CT03
Machine excavated trial pits	TP01 to TP03
Hand excavated trial pits	HP01 to HP05
TRL probes	TRL01 and TRL02

The positions of all exploratory holes undertaken at the site as part of this investigation can be seen on the Exploratory Hole Location Plans in Appendix A. The logs are provided in Appendix B and the results of the geotechnical laboratory testing are provided in Appendix C.

The exploratory excavations were surveyed using several manhole covers as a temporary datums, as provided on survey drawing 19023T-100, dated March 2020 produced by XACT Surveys.

Gas and groundwater monitoring was undertaken on two occasions over the first month following the fieldwork. The monitoring results are provided in Appendix B.

Engineering and geoenvironmental conclusions given in this report are based on data obtained from these sources but it should be noted that variations, which affect these conclusions, may inevitably occur between and beyond the test locations. Also, water levels may vary seasonally and with other factors.

SAMPLING STRATEGY

The investigation was undertaken in accordance with the scope of works agreed with Ward Associates (Consulting Engineers) Ltd. The positions of the exploratory holes were selected by Ward Associates (Consulting Engineers) Ltd to provide a wide coverage of information on the site area.

Access was limited to external areas of the site, away from areas of dense vegetation in the centre and northwest and storage of recently removed vegetation in the west of the site, as shown on the Existing Exploratory Hole Location Plan in Appendix A.

As the previous desk study had identified several potential pollution sources at the site several of the exploratory holes were also targeted on these sources. These included:

Potential Source	Exploratory Hole
Made Ground associated with the construction and demolition of the existing buildings	All

Potential Source	Exploratory Hole
Potential for leaks and spills associated with parked cars	HP01, HP04, TP01, TP02, BH01 and BH02
Potential for asbestos from degradation of construction materials.	CT01, CT03, TP01, TP02, HP01 to HP05, BH01 and BH02

METHODOLOGY

Health and Safety

Prior to commencement of boring/testing, and in order to minimise the dangers from/to buried services, the proposed locations were scanned using a Cable Avoidance Tool. At the borehole and probe locations, a service avoidance pit was dug, using hand tools, to a depth of around 1.2m below ground level (bgl).

Exploratory Holes

At positions located on existing hardstanding, the surfacing was broken-out using a machine operated hand-held hydraulic breaker.

Shallow trial holes HP01 to HP05, were excavated by hand using hand tools to depths of between 0.80m and 1.55m below ground level. Disturbed samples were taken at selected depths down to the base of the holes for subsequent laboratory testing and inspection. On completion, all trial pits were carefully backfilled with arisings, ensuring that excavated material was replaced in the same order as it had been removed.

Trial pits TP01 to TP03, were excavated with an tracked mini backhoe excavator to depths of between 1.60m and 2.22m bgl, under the supervision of a geotechnical engineer, who made a record of the arisings. Disturbed samples were taken at selected depths down to the base of the holes for subsequent laboratory testing and inspection. On completion, all trial pits were carefully backfilled with arisings in thin layers, ensuring that excavated material was replaced in the same order as it had been removed.

Continuous tube sample boreholes CT01 to CT03, were put down using an Archway Competitor Dart rig to a maximum depth of 6.00m. Boreholes were advanced using a plastic lined steel tube sampling system, driven into the ground by a top drive percussive hammer. A near continuous 85mm to 65mm diameter core sample was recovered for subsequent examination, sub-sampling and laboratory testing. Standard Penetration Tests (SPTs) were taken at 1.0m intervals. Measurements of unconfined compressive strength were made in the tube samples in the field using a pocket penetrometer.

Boreholes BH01 and BH02, were drilled utilising a standard cable percussion rig, at a diameter of 150mm, down to a maximum depth of 10.00m below ground level. Metal casing was extended to a maximum depth of 9.00m, to avoid potential collapse and to seal out groundwater inflows. Disturbed samples were collected at regular intervals throughout the borehole for future laboratory inspection and testing. Standard Penetration Tests (SPTs) were taken at 1.0m intervals.

Installations

On completion of the boring, boreholes BH01 and BH02 were utilised for the installation of a 50mm diameter slotted uPVC standpipe from 1.50m (BH01) and 2.00m (BH02) up to within 1.00m below existing ground level. From 1.00m depth up to ground level a plain pipe was added. The slotted section of the standpipe was surrounded with pea gravel, while expansive bentonite clay was added around the plain pipe and below the slotted section to seal the borehole. The standpipe was finished with a rubber bung and gas tap and protected with a stopcock cover, which was then concreted flush with ground level.

In-situ Testing

Two TRL probes TRL01 and TRL02 were carried out to provide indicative CBR values for pavement design. Infiltration testing was undertaken in trial pits TP01 to TP03 in accord with BRE Digest 365 'Soakaway Design'.

GROUND CONDITIONS

The intrusive investigation revealed that the general succession of strata was represented by Fill/Topsoil onto Made Ground, above the Aeolian Deposits locally in the centre and southeast, onto Raised Beach Deposits overlying the Lambeth Group proven to the full depth of the investigation at 10.00m.

The general succession of strata revealed by the fieldwork is summarised in the table below, followed by a discussion of the Ground Model for the site:

Stratum	Locations encountered	Top of stratum (m)	Base of stratum (m)	Thickness (m)	Comments
Topsoil	HP01, HP02, CT01, CT02 and TP03	0.0	0.30 to 0.40	0.30 to 0.40	In the north to the rear of the care home and No.87 Brighton Road
Fill	HP03, HP04, HP05, CT03, TP01, BH01 and BH02	0.0	0.05 to 0.20	0.05 to 0.20	In the southeast at the front of the care home and No.87 Brighton Road and to the rear associated with paved areas
Made Ground	All	0.10 to 0.30	0.30 to 1.30	0.25 to 1.10	Appeared to be deeper in the centre of the site. Possibly associated with removal of the Aeolian Deposits and infill from the former brickfield
Aeolian Deposits	BH01, TP01, TP02, HP03, HP04 and HP05	0.25 to 0.90	1.15 to 1.70	0.80 to 1.40	Encountered locally in the centre and south of the site
Raised Beach Deposits	All (apart from HP03, HP05 and TP01)	0.50 to 1.70	8.40 to 8.60	6.70 to 7.30	-
Lambeth Group	BH01 and BH02	8.40 to 8.60	>10.00	>1.40 to >1.60	-

TOPSOIL

Encountered at HP01, HP02, CT01, CT02 and TP03 from ground level down to depths of between 0.30m to 0.40m. Represented in general by soft dark brown sandy gravely organic clay with gravel of flint, brick, ceramic tile, glass, coal ash and clinker. Frequent roots were noted between 5mm and 10mm.

FILL

Fill was encountered at each HP03, HP04, HP05, CT03, TP01, BH01 and BH02, from ground level down to depths of between 0.05m to 0.20m and comprised a layer of concrete (100mm to 200mm thick) located in front of the care home, loose gravel of quartz and concrete (50mm to 100mm thick) in front of No.87 Brighton Road and paving 50mm thick onto 150mm of weak concrete, to the rear of the care home.

MADE GROUND

Encountered at each test location from depths between 0.10m to 0.30m, to depths of between 0.30m to 1.30m. The Made Ground soils comprised a mix of soft to firm brown and dark brown sandy gravelly clay or clayey gravel with gravel of brick, flint, concrete, clinker, ceramic tile, quartzite and coal ash.

AEOLIAN DEPOSITS

Encountered at BH01, TP01, TP02, HP03, HP04 and HP05 in the centre and south of the site, from depths between 0.25m to 0.90m, down to depths of between 1.15m to 1.70m. The Aeolian Deposits generally comprised soft locally laminated silty sandy slightly gravelly clay with gravel of quartz and flint with rare roots, organic material and shells.

The results of the field strength tests, and other relevant data, are summarised below:

Parameter	Range	Comments
SPT Field 'N' Value	6	Low Strength

Laboratory testing revealed the following:

Parameter	Range	Comments
Water Content (%)	6 to 23	-
Liquid Limit (%)	24 to 36	CLAY of Low plasticity (BS5930 Casagrande)
Plastic Limit (%)	14 to 21	
Plasticity Index (%)	12 to 15	
Modified Plasticity Index (%)	12 to 15	Shrinkable soil of Low Volume Change Potential (NHBC Standards)
Retained on 425µm sieve (%)	1 to 6	BS1377 'coarse soil' fraction
Passing 63µm sieve (%)	55 to 96	Fines (silt/clay) fraction

RAISED BEACH DEPOSITS

Encountered at all locations apart from HP03, HP05 and TP01, from between 0.50m to 1.70m depth, proven in the cable percussion boreholes down to depths of between 8.40m to 8.60m. Represented in general by medium dense to dense brown and dark brown sandy gravel or gravelly sand with gravel of sub-rounded to sub-angular flint. The deposit was encountered as soft and firm orange brown sandy clay in CT01 and HP02 in the centre of the site.

The results of the field strength tests, and other relevant data, are summarised below:

Parameter	Range	Comments
SPT Field 'N' Value	11 to 50	Medium Dense to Dense

Laboratory testing revealed the following:

Parameter	Range	Comments
Portion <63mm and >2mm (%)	1 to 97	Gravel fraction
Portion <2mm and >63µm (%)	2 to 76	Sand fraction

LAMBETH GROUP

Encountered at the cable percussion borehole locations BH01 and BH02, from 8.40m and 8.60m depth, proven down to the base of the boreholes at 10.00m depth. Represented in general by stiff grey brown slightly silty clay.

The results of the field strength tests, and other relevant data, are summarised below:

Parameter	Range	Comments
SPT Field 'N' Value	26 to 36	High to very high strength

Laboratory testing revealed the following:

Parameter	Range	Comments
Water Content (%)	25 to 28	-
Liquid Limit (%)	54 and 63	CLAY of High plasticity (BS5930 Casagrande)
Plastic Limit (%)	20 and 26	
Plasticity Index (%)	34 and 37	
Modified Plasticity Index (%)	33 and 37	Shrinkable soil of Medium Volume Change Potential (NHBC Standards)
Retained on 425µm sieve (%)	1 to 3	BS1377 'coarse soil' fraction
Passing 63µm sieve (%)	88 to 95	Fines (silt/clay) fraction

GROUNDWATER

Groundwater was encountered as slight seepages in CT01 and CT03 at 5.50m and 5.70m respectively, during the fieldwork.

Groundwater was also encountered during the previous investigation in WS101 at 5.50m rising to 5.33m after 20 minutes and in WS102 at 5.10m rising to 5.17m after 20 minutes.

Monitoring carried out as part of the project recorded the installations as dry, with the exception of WS102 where groundwater was recorded at 5.34m depth below the existing ground level.

OBSERVED SOIL CONTAMINATION

No significant visual or olfactory signs of contamination or obvious visual evidence of asbestos containing material (ACM) were encountered during the site works other than clinker encountered in the Made Ground,

which can contain PAHs. Clinker is an industrial waste product, usually resulting from the incomplete combustion of coal, but also from metal smelting. It should not, however, be taken as sole evidence of contamination as the material is, by its nature, a fused product and the constituents are likely to be of very low mobility.

INFILTRATION TESTING

To assess the infiltration capacity of the soils, infiltration testing was carried out at the site in accord with BRE Digest 365, Soakaway Design.

Infiltration tests were carried out in trial pits TP01 to TP03. The infiltration rates could not be calculated for TP01 and TP02 as the infiltration was so slow. There was a drop of 0.015m in 95 minutes for TP01 and just 0.10m in 194 minutes in TP02.

Results for TP03 were as follows:

Location	Depth of trial pit (m)	Soil Infiltration Rate (m/s)		
		Test 1	Test 2	Test 3
TP03	1.40	$2.5x10^{-5}$	$2.7x10^{-5}$	$2.6x10^{-5}$

The results of the infiltration tests are included in Appendix B.

GROUND GAS MONITORING

Ground gas monitoring was carried out in boreholes BH01 and BH02 as well as previous boreholes WS101 and WS102 as part of this investigation, on two occasions, using a calibrated Geotech GA 5000 gas analyser.

The results have revealed oxygen levels of between 13.8%v/v and 20.2%v/v, carbon dioxide levels of between 0.3%v/v and 2.1%v/v, and methane levels below detectable limits. Flow rates ranged between -0.1l/hr and 0.6l/hr.

The low flow rates are indicative of the soils encountered which did not include any significant thicknesses of Made Ground or have any significant quantities of organic matter or materials which can decay.

Weather reports for the time preceding the testing was referred to and both rising and falling pressure conditions were encountered prior to the testing.

CALIFORNIA BEARING RATIO (CBR) TESTS

In-situ testing was undertaken using a TRL probe to obtain equivalent CBR with depth profiles to around 1m depth, at two locations in the south of the site, TRL01 and TRL02 as shown on the Exploratory Hole Location Plan in Appendix A. Graphs of the penetration rates with depth are provided in Appendix B.

The results of the testing are summarised in the table below, together with derived approximate CBR values for the subgrade soils:

Stratum	Depth (m)	CBR (%)
Made Ground	0.0 – 1.3	3 - >40
Aeolian Deposits	0.3 – 1.7	3 - 5

SULPHATE AND PH TESTS

The results of the laboratory pH and water-soluble sulphate tests on samples of soil are summarised below:

Stratum	Water-soluble Sulphate SO_4 (mg/l)	pH (pH units)	Number tested
Topsoil	<10	8.0 to 8.2	2
Made Ground	<10 to 290	7.7 to 8.0	3
Aeolian Deposits	100 and 290	7.1 and 7.6	2
Raised Beach Deposits	120 to 380	7.0 to 7.8	4

The results of the tests from this investigation are included in Appendix C.

GROUND CONTAMINATION ASSESSMENT

The results of the laboratory tests from this investigation are included in Appendix C. The following is a description of the testing schedule (number of tests from each stratum and the tests performed); the guidelines adopted for assessing the results, and a comparison of the test results from this investigation with those adopted guideline values. The implications of these comparisons are provided in the Risk Assessment sections that follow.

The contamination risk assessment has been undertaken in line with the EA's new online guidance Land Contamination: Risk Management (LCRM) published in October 2020. The guidance is based upon the principles of CLR11, Model procedures for the management of land contamination, 2004, now withdrawn.

The assessment has been undertaken in order to validate the Preliminary Risk Assessment (PRA) using a Generic Quantitative Risk Assessment (GQRA) followed by a Detailed Quantitative Risk Assessment (DQRA), if required.

SOIL TESTING

Three samples of the Made Ground and two samples of the Topsoil collected on site during this investigation were tested for a range of constituents of potential concern (CoPC). The majority of the samples to be tested were recovered from the test locations targeting the potential sources of contamination listed in the Conceptual Site Model.

The suite of testing carried out on the samples was decided upon following consultation of R&D CLR Publications, published as part of the Contaminated Land Exposure Assessment (CLEA), a joint venture between the Department for Environment, Food and Rural Affairs (DEFRA) and the EA.

The test suite included:

Group	Details
Asbestos	Screening for ACMs and fibres with the naked eye and microscopy
Inorganic substances	Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc Sulphates
Organic substances	Total Petroleum Hydrocarbons (TPH) with eight-band
Other	pH Total organic carbon (TOC)

Unless explicitly stated on the laboratory report, the soil samples were tested to obtain 'Total' values within the soil.

The results of the tests from this investigation are included in Appendix C.

RISK ASSESSMENT GUIDELINES – HUMAN HEALTH

The human health risk assessment has been undertaken using the guidance provided in the EA's LCRM guidance, published October 2020 and the CLEA guidelines.

This assesses risks associated with the ingestion, dermal contact, and vapour inhalation pathways related to contaminated soils and groundwater. Risks associated with the inhalation of Ground Gas, for example that resulting from landfill, is not addressed by LCRM. The assessment for ground gases has been undertaken separately in the Ground Gas Risk Assessment section of this report.

Human health assessment criteria used are based upon the proposed final land use of the site. As the site is to be redeveloped to accommodate a care home the Generic Assessment Criteria (GACs) for the standard land-use, 'Residential without homegrown produce' have been used as a preliminary screening tool.

Consideration has also been given to potential risks to groundworkers coming into contact with the soil during demolition or construction phases.

The results of the soil samples tested have been compared to the following published assessment criteria:

Category 4 Screening Levels (C4SLs)

Published in March 2014 by DEFRA, a limited number of generic Category 4 Screening Levels (C4SLs) were produced to support the revised Statutory Guidance to support Part 2A of the Environmental Protection Act 1990, which was published in April 2012. This Guidance introduced a new four-category system for classifying land under Part 2A for cases of a Significant Possibility of Significant Harm to human health, where Category 1 includes land where the level of risk is clearly unacceptable, and Category 4 includes land where the level of risk posed is acceptably low.

Although not the primary purpose, the DEFRA letter dated 3rd September 2014 from Lord de Mauley established that the C4SLs are also suitable for use in planning situations, as did the Department for Communities and Local Government (DCLG)'s 'Planning Portal' document from June 2014.

Suitable 4 Use Levels (S4ULs)

To supplement the small number of C4SL, a set of Suitable for Use Levels (S4UL) were produced, in 2015, by Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH), using the EA's Contaminated Land Exposure Assessment (CLEA) software, version 1.06 (2009), and the revised assumptions used in deriving the C4SL. The S4UL are more conservative than the C4SL and are derived to represent the minimal levels of risk to human health as described in the EA's SR2 guidance, with the intention of being 'suitable for use' under planning.

Detailed Quantitative Risk Assessment (DQRA)

Should any results exceed the C4SLs or S4ULs used in the GQRA, or if a more site-specific model is required, then a Detailed Quantitative Risk Assessment (DQRA) is undertaken to establish site specific assessment criteria. This final stage uses specific information regarding the contamination and its potential receptors and pathways. The CLEA software was updated to version 1.071 in November 2015 to enable both site specific

C4SLs and S4ULs to be determined by contaminated land practitioners, which produces less conservative, more accurate, site specific soil assessment criteria (SACs).

The model is based on the most sensitive receptor being female and aged between 16 to 75 years old. A medium/large terrace type building has been used to model the care home and a sandy clay loam of 1% soil organic matter (SOM) to model the soils at the site. The worksheets for the CLEA model settings are provided in Appendix D.

Data Sources

Where chemical specific data has been used in the above assessments, data has been sourced from available TOX reports, published by DEFRA, The Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) literature and toxicological and physical data obtained from EA Publication, 'Human Health Toxicological Assessment of Contaminants in Soil', August 2008.

RISK ASSESSMENT GUIDELINES – CONTROLLED WATERS

The procedures set out in EA's RTM *Hydrogeological risk assessment for contaminated land* (2006), have been followed.

RESULTS OF ASBESTOS SCREENING

Screening for the presence of asbestos did not reveal any asbestos containing material (ACM) or fibres in the two samples of Made Ground and two samples of Topsoil tested.

RESULTS OF TOTAL SOIL TESTS

Results of the total soil testing have been compared to relevant published GAC as discussed above. For S4ULs, a range of values have been published for the organic contaminants based on the soil's organic matter content.

As site-specific soil organic content was not determined for the site, where S4ULs have been adopted for the organic contaminants, analytical results have been compared to the most conservative value, which is that for soils of 1% soil organic matter (SOM) as a preliminary screening tool.

Of the remaining determinands tested for, Lead and several PAHs recorded values higher than their relevant GAC for human health for a residential without homegrown produce setting as a preliminary screening tool. These contaminants are discussed further below.

Lead

Of the five samples tested, the values of Lead obtained ranged from 49mg/kg to 2400mg/kg. The C4SL for Lead is 310mg/kg for a residential without homegrown produce setting. Three of the samples recorded values over the C4SL including samples from CT01 at 0.25m to 0.50m, CT02 at 0.10m to 0.30 and CT03 at 0.20m to 0.55m. Such elevated concentrations of Lead are not considered untypical for the ash and clinker deposits encountered within the Made Ground soils at the site.

The CLEA v1.071 software was then used and based on a residential care home with lifetime exposure to derive a site-specific assessment criteria (SAC) for the site for Lead of 428mg/kg. The CLEA 1.071 worksheets are provided in Appendix D.

The values for Lead recorded between 510mg/kg and 2400mg/kg from the three elevated samples from the site were all above the SAC of 428mg/kg derived for the site.

Polycyclic Aromatic Hydrocarbons (PAHs)

Of the five samples tested, a couple of the polycyclic aromatic hydrocarbon (PAH) compounds recorded values exceeding the GACs for residential without homegrown produce setting. These were benzo(b)fluoranthene and dibenz(a,h)anthracene.

The origin of the PAH in the soil was ascertained by plotting the results on a double ratio plot, provided in Appendix D. The PAH identified at this site has been attributed to coal derived products. As these substances are not readily mobile in the environment, it is considered that the levels of benzo(b)fluoranthene and dibenz(a,h)anthracene at this site do not pose a significant risk to controlled waters.

Benzo(b)fluoranthene

Of the five samples tested, the values of benzo(b)fluoranthene obtained ranged from 0.20mg/kg to 4.10mg/kg. The S4UL for benzo(b)fluoranthene is 3.90mg/kg for a residential without homegrown produce setting. One of the samples recorded a value over the S4UL from CT01 at 0.25m to 0.50m.

The CLEA v1.071 software was then used and based on a residential care home with lifetime exposure to derive a site-specific assessment criteria (SAC) for the site for benzo(b)fluoranthene of 16.60mg/kg. The CLEA 1.071 worksheets are provided in Appendix D.

The value for benzo(b)fluoranthene recorded 4.10mg/kg from the elevated sample which was below the SAC of 16.60mg/kg derived for the site.

Dibenz(a,h)anthracene

Of the five samples tested, the values of dibenz(a,h)anthracene obtained ranged from <0.10mg/kg to 0.48mg/kg. The S4UL for benzo(b)fluoranthene is 0.31mg/kg for a residential without homegrown produce setting. Two of the samples recorded a value over the S4UL from CT01 at 0.25m to 0.50m and CT02 at 0.10m to 0.30m.

The CLEA v1.071 software was then used and based on a residential care home with lifetime exposure to derive a site-specific assessment criteria (SAC) for the site for dibenz(a,h)anthracene of 1.70mg/kg. The CLEA 1.071 worksheets are provided in Appendix D.

The values for dibenz(a,h)anthracene recorded 0.35mg/kg and 0.48mg/kg from the elevated samples from the site which were both recorded below the SAC of 1.70mg/kg derived for the site.

HUMAN HEALTH RISK ASSESSMENT

The following quantitative risk assessment has been carried out using the source-pathway-receptor principle. Potential sources of contamination identified in the Conceptual Site Model (CSM) have been assessed using the CLEA Guidelines. This takes into account the fact that a complete pathway must exist between a potential source of contamination and a potential receptor for there to be considered a risk.

The potential human receptors evaluated for their individual risk are:

Long-Term Exposure

- End users of the site – the future workers and adult care home residents.
- Nearby residents.

Short-Term Exposure

- Construction workers and the general public (during redevelopment).
- Maintenance workers

If the proposed site use or layout should alter significantly, then the human health risk assessment will require re-evaluation.

SOIL CONTAMINATION RISK

The qualitative preliminary risk assessment (PRA) identified a number of potential sources of contamination at the site. Following the intrusive investigation and contamination testing the CSM has thus been reassessed

The desk study research identified some potential contamination sources on the site including Made Ground associated with the construction and demolition of the buildings on site and the potential backfilling of the former brickfield indicated across the entire site, localised spills and leaks of hydrocarbon fuels or oils from vehicles in the car park in the southeast of the site and the potential for asbestos from degradation of materials associated with the former and existing buildings on site. The majority of the samples tested were recovered from the test locations targeting these potential sources of contamination.

The intrusive investigation encountered Made Ground to depths of between 0.30m to 1.30m. The Aeolian Deposits (Brickearth) appeared to have been removed in the areas of deeper Made Ground which may be associated with the former brickfield identified on site.

The soil contamination tests carried out as part of this investigation revealed elevated concentrations of Lead and PAHs in the soil when compared to the relevant GACs and Lead when compared to the SACs.

It is therefore considered that it is necessary to implement remedial measures at the site to break the source-pathway-receptor linkage between the elevated concentrations of Lead within the soils and the end users. Further sampling and testing could be considered which may allow for potential zoning of the site. Please see the Remediation section of the report.

CONSTRUCTION / MAINTENANCE WORKERS AND GENERAL PUBLIC (SHORT-TERM EXPOSURE)

For construction workers and maintenance workers that are exposed to the ground, there is a short-term exposure risk (at each site they attend, which contributes to an overall lifetime exposure risk) and the pathway of primary concern is 'direct soil ingestion'. Protective measures that are different to those taken to protect the long-term exposure group (such as end-users of the site) are, therefore, required and these are outlined below.

Demolition and redevelopment activities have the potential to create short-term pollutant linkages to the general public. These risks should be managed by means of the Construction Phase (Health & Safety) Plan.

To reduce the risk to as low as reasonably practicable for the construction workers it is recommended that appropriate health and safety measures be implemented along with the use of Personal Protective Equipment (PPE). All personnel coming into contact with the soil, ground workers in particular, should be instructed to use gloves when on site to avoid dermal contact and restrict inadvertent hand-to-mouth ingestion. Washing facilities should be provided for the site staff to use and should be used prior to eating or smoking. Suitable guidance can be found in the HSE Document, "Protection of Workers and the General Public during Development of Contaminated Land".

Although no asbestos was identified in the soils at the site, the presence of ACM and fibres within Made Ground at any site cannot be ruled out. Groundworkers should be made aware of potential risks of asbestos during the groundworks prior to beginning work.

REGULATORY APPROVAL

We recommend that the conclusions of this report are agreed with the relevant Local Authority at the earliest stage, to reduce potential delays to the development.

GROUND GAS RISK ASSESSMENT

The preliminary ground gas risk assessment indicated that gas monitoring was considered necessary for the site given the potential on site sources of ground gas identified as the infill associated with the former brickfield and the off-site source as the historical landfill site at Beach Green located 290m to the east.

The contamination testing of the soil samples carried out during the site investigation did not record any significant volatile contaminants and no significant visual or olfactory signs of contamination were encountered during the site works.

The intrusive investigation did not encounter any significant thickness of Made Ground >3.0m or significant organic rich soil beneath the site.

Groundwater monitoring standpipes were installed within BH01 and BH02 and ground gas monitoring was carried out on two occasions, using a calibrated Geotech GA 5000 gas analyser. The response zones of the standpipes were between 1.00m and 1.50m (BH01) / 2.00m (BH02) within the Made Ground, Aeolian Deposits and Raised Beach Deposits. The previous boreholes WS01 and WS02 were also monitored.

The results have revealed oxygen levels of between 13.8%v/v and 20.1%v/v, carbon dioxide levels of between 0.3%v/v and 2.1%v/v, and methane levels below detectable limits. Flow rates ranged between -0.1l/hr and 0.1l/hr.

GROUND GAS SCREENING VALUES

The results have been evaluated with reference to Code of practice for the characterization and remediation from ground gas in affected developments, BS8485.

Using the maximum carbon dioxide reading of 2.1%v/v with the highest recorded absolute flow rate of ±0.6l/hr, the maximum gas screening value is 0.0126l/hr. There were no carbon dioxide levels above 5% and no methane levels above 1%.

This classifies the site as Characteristic Situation (CS) 1.

GROUND GAS PROTECTION MEASURES

Carbon Dioxide and Methane Gas

This classifies the site as Characteristic Gas Situation (CS) 1 in accordance with BS8485. Therefore, it is considered that gas protection measures are not necessary with regard to methane or carbon dioxide gas for this care home development.

If deep Made Ground >3.0m or significant organic soils that differ from our ground model are encountered during the groundwork, then work should cease in that area and further assessment will be necessary by a suitably qualified geoenvironmental engineer. This may require further intrusive investigation or soil sampling along with supplementary ground gas risk assessment and potentially gas remediation measures. Any further recommendations will require regulatory approval.

Radon Gas

Although the site lies within an area where risks from radon gas are low, the property has a basement/underground room. Risks of radon are increased in underground rooms and radon protection measures should be included in the basement design.

REGULATORY APPROVAL

The above conclusions regarding ground gases should be agreed with the relevant local Regulatory Authority as soon as possible prior to development, to reduce any potential delays to the development should they require further clarification of this report or further ground gas monitoring.

CONTROLLED WATERS RISK ASSESSMENT

The following Controlled Waters risk assessment has been carried out in accordance with the procedures set out in the EA's RTM *Hydrogeological risk assessment for contaminated land* (2006). Using the source-pathway-receptor principle, this takes into account the fact that a complete pathway must exist between a potential source of contamination and a potential receptor for there to be considered a risk.

The potential Controlled Waters receptor/s considered during this risk assessment were:

- The sea with the mean highwater mark located 138m to the south of the site
- The Secondary B Aquifer, Aeolian Deposits, onto Secondary A Aquifer, Raised Beach Deposits overlying Secondary A Aquifer, the Lambeth Group indicated beneath the site

Following the intrusive investigation and contamination testing, the CSM can now be revised.

DISCUSSION

The desk study identified that there are no surface water or groundwater abstraction points within 1000m, and the site is outside of any Source Protection Zones. The Secondary A Aquifer, Raised Beach Deposits and locally the Secondary B Aquifer, Aeolian Deposits are considered to be present beneath the shallow Topsoil and/or Made Ground.

However, the fieldwork did not encounter any significant visual or olfactory signs of mobile contaminants. The results of the soil testing did not identify any significantly elevated concentrations of hydrocarbons and there is not considered to be significant potential mobile contaminants in the soils. Additionally, the excavation of the proposed single-storey basement some 16m wide by 52m in length will remove a significant amount of the Made Ground soils from the site and the additional areas of hard standing will limit rainfall infiltration and therefore leaching potential.

It is, therefore, considered that the above recognised Controlled Waters receptors will not be at any significant risk from potential groundwater pollution at the site.

REGULATORY APPROVAL

We recommend that the conclusions of this report are agreed with the relevant Local Authority at the earliest stage, to reduce potential delays to the development.

INFRASTRUCTURE RISK ASSESSMENT

SUBSURFACE CONCRETE

The concrete design mix recommendations for subsurface concrete have been assessed in terms of BRE Special Digest 1, as follows:

Type of Site	Groundwater	Characteristic Sulphate	Characteristic	
		Soil Soluble (mg/l)	Design Sulphate Class	pH (pH units)
Brownfield	Mobile	330	DS-1	7.0

The above assessment provides an Aggressive Chemical Environment for Concrete (ACEC) class of **AC-1**.

UNDERGROUND SERVICES

Organic contaminants, such as petroleum or polycyclic aromatic hydrocarbons, may attack plastic pipes and remedial measures may be required. The pathway with the contaminated soils could be removed by sleeving the pipe with another material or by removing the contamination source itself.

It should be noted that the utility companies often have their own local guidelines and standards on levels of shallow soil contamination in the ground that may or may not be acceptable for the installation of below ground services. These standards may be different to those specified for assessing risks to human health and groundwater.

The local requirements should be obtained from the particular service supply company as soon as possible to avoid unexpected delays or additional development costs.

Approval should be sought for the type of pipes proposed before they are installed.

REVISED CONCEPTUAL SITE MODEL

Following GQRA and DQRA, the CSM has been updated and the Relevant Pollutant Linkages (RPLs) are presented in the following table.

ON-SITE SOURCES

Potential On-site Source	Pathway	Potential Receptor	Probability	Consequence	Risk Classification	Explanation
Contaminants within the Made Ground from infill of the former brickfield and construction and demolition of buildings - *Including: heavy metals, PAH, petroleum hydrocarbons, asbestos* Localised spills and leaks of fuels or oils from vehicles - *Including petroleum hydrocarbons* Potential for asbestos from degradation of materials	Ingestion Dermal Contact Inhalation	End Users - Residents	Known	Medium	Moderate	The soil contamination tests revealed elevated concentrations of Lead in the soil when compared to the SACs. Remedial measures are required at the site to break the source-pathway-receptor linkage between the contaminated soils and the end users.
		Nearby Residents	Low likelihood	Medium	Low	
		Construction Workers	Low likelihood	Mild	Low	Exposure to maintenance and construction workers can be mitigated by use of appropriate PPE and maintaining good hygiene levels.
	Migration through unsaturated zone Migration through groundwater Migration through drains or service runs Run-off to the sea	Secondary B Aquifer, Aeolian Deposits, Secondary A Aquifer onto Raised Beach Deposits overlying Secondary A Aquifer, the Lambeth Group	Low likelihood	Mild	Low	The fieldwork did not encounter any significant visual or olfactory signs of mobile contaminants. The results of the soil testing did not identify any significantly elevated concentrations of hydrocarbons and there is not considered to be significant potential mobile contaminants in the soils. The site is not within a Source Protection Zone and there are no known groundwater abstractions within 1000m of the site. Furthermore, the majority of the site will be surfaced with hardstanding which will significantly reduce infiltration and any leaching potential.
		The sea with the mean highwater mark located 138m to the south	Low likelihood	Mild	Low	It is considered a low likelihood that significant site-derived contaminated groundwater would migrate to the sea.

Potential On-site Source	Pathway	Potential Receptor	Probability	Consequence	Risk Classification	Explanation
associated with the former and existing buildings on site	Direct contact	Substructures Water supply pipes	Low likelihood	Mild	Low	Use appropriate Concrete Design Classification Check water pipe specification with regional water supply company be anticipated.
Ground gas in organic rich soils - *Carbon dioxide or methane* Potentially from backfill of former brickfield	Inhalation	End Users – Residents	Low likelihood	Medium	Low	Gas protection measures are not considered necessary with regard to methane or carbon dioxide gas for this development.
	Accumulation in building	On-site buildings	Unlikely	Severe		
Radon gas	Inhalation	End Users – Care Home Residents	Low likelihood	Medium	Moderate / Low	As the care home is proposed to have a basement, radon levels may be higher in this underground room and in accordance with BRE Quick Guide 7, Reducing Radon, Underground Rooms – Cellars and Basements, 2015, mitigation measures should be included in the basement design.

The revised CSM indicates that remedial measures are required at this site to mitigate risks to human health. The further work and remedial options are presented below.

REMEDIATION

Elevated concentrations of Lead have been recorded within soil samples collected from the site.

From the revised CSM, it has been established that these pose a significant long-term risk to the end users of the site and the surrounding residents. The main pathway of concern for these contaminants has been shown to be direct soil ingestion.

Therefore, it is the exposed areas of soil at the site that will pose the greatest risk to human health, which, for this development, includes gardens and areas of soft landscaping.

OPTIONS APPRAISAL

Contamination in soils can be remediated in a number of ways, including chemical or biological processes, or physical removal, physical blocking of the pathway or reducing the exposure to acceptable levels.

For this site, the following remedial solution is recommended.

Simple Cover System

This method involves the reducing the exposure risks to acceptable levels, by adding a simple cover layer in any gardens or soft landscaped areas on the site.

Using the latest guidance document, BRE 465, 'Cover Thickness Design for Regeneration', produced by ENSR International Ltd, on behalf of the BRE, AGS and DTI, a cover thickness of 600mm should be adopted, assuming the imported material is certified clean prior to use. This cover layer would consist of a combination of at least 180mm of clean Topsoil and 420mm of clean Subsoil.

This may be undertaken by either raising site levels or removing some of the soil to create the depth required.

A geotextile break layer should be placed on the proof rolled surface of the reduced level soil to reduce the amount of mixing between the original soils and the simple cover system.

If all of the contaminated Made Ground soils are removed, then the landscaping specification may revert back to the guidelines provided in the NHBC Standards, once the natural soils have been verified.

IMPORTED TOPSOIL AND SUBSOIL SPECIFICATION

Any new Topsoil or Subsoil imported to the site requires testing for a range of contaminants to ensure that the soil is suitable for the particular development. The analysis should include a range of inorganic and organic contaminants and samples should be screened for asbestos.

If there are no chemical testing results available for the soils to be imported, then testing for contaminants must be undertaken to demonstrate that the imported soils are clean and suitable for use. The geoenvironmental engineer performing the remediation verification will need a copy of the chemical testing results to validate the imported soil prior to the cover system being constructed.

If the imported soil is found to be unsuitable, it will need removal and replacing with new clean soil.

To ensure that the requirements of the 600mm cover system are fulfilled, any Imported Subsoil or Topsoil should contain levels of contaminants at or below the current C4SLs or S4ULs or the SACs established for this site.

Following the EA regulatory position statement, *RPS 190 Use of manufactured topsoil*, up to 1,000 tonnes of manufactured Topsoil may be imported without an environmental permit. The Topsoil must follow *BS 3882:2015 Specification for topsoil*. It is recommended that confirmation on the soil quality is sought from a landscape architect.

It should be noted that newly placed Topsoil will settle over time and may not then fulfil the full thickness requirement of the cover system. Compaction of fine-grained Topsoil may also lead to reduced drainage capacity. Consideration to a combination of Topsoil and Subsoil, or overfilling of the areas, should be given to reduce these effects.

GROUND GAS PROTECTION MEASURES

As described in the Ground Gas Risk Assessment, it is considered that gas protection measures are not necessary with regard to methane or carbon dioxide gas for this care home development.

If deep Made Ground >3.0m or significant organic soils that differ from our ground model are encountered during the groundwork, then work should cease in that area and further assessment will be necessary by a suitably qualified geoenvironmental engineer. This may require further intrusive investigation or soil sampling along with supplementary ground gas risk assessment and potentially gas remediation measures. Any further recommendations will require regulatory approval.

Although the site lies within an area where risks from radon gas are low, the property has a basement/underground room. Risks of radon are increased in underground rooms and radon protection measures should be included in the basement design.

CONCRETE DESIGN CLASSIFICATION

In terms of BRE Special Digest 1, the site assessment corresponds to the following classifications:

BRE Special Digest 1 Category	Class
Design Sulphate	DS-1
Aggressive Chemical Environment for Concrete (ACEC)	AC-1

WATER SUPPLY PIPES

The water supply service pipes on site will be installed to a suitable specification as agreed with the local water supply company.

REMEDIAL STRATEGY

Once remediation methods have been finalised it is recommended that a Remediation Strategy is prepared so that all parties involved in the development are clear about the chosen methods, implementation programmes and verification testing regimes that are required.

Should unexpected contamination be encountered during the groundworks or remediation, then the Human Health Risk Assessment and Remedial Strategy will require updating.

DISCOVERY STRATEGY

As the Made Ground varies across the site area, and a former brickfield has been identified on site the developer should prepare a method statement to cater for unexpected contamination uncovered during the groundworks. Should any suspicious soils be encountered that differ from our ground model, work should cease in that area and further assessment will be necessary by a suitably qualified geoenvironmental engineer. This may require further intrusive investigation or soil sampling along with supplementary contamination risk assessment and potentially remediation. Any further recommendations will require regulatory approval.

The Discovery Strategy should be implemented throughout the groundworks and the Remediation Strategy updated and approved by the regulators if necessary.

REGULATORY APPROVAL

With regard to soil contamination, it is considered that there is a significant possibility of significant harm (SPOSH) to human health at this site and consequently the remedial measures detailed above are considered to be necessary.

Any remedial measures concerning human health will need to be approved by the relevant Local Authority Environmental Health Department or warranty provider prior to development, who should be provided with a copy of this report and any other related reports as soon as possible prior to development to avoid delays.

POST REMEDIATION VERIFICATION

Any remedial measures undertaken at the site will require independent verification once completed to ensure the pollutant linkage to the end users of the site has been removed. This is undertaken to satisfy the relevant regulatory authorities and other interested parties, including future owners of the site, banks, insurers and mortgage companies.

This usually involves a small verification investigation to confirm that the remediation has been implemented in accordance with the Remedial Strategy.

A statement to support the findings during the implementation of the Discovery Strategy must be provided with the reporting.

Waste consignment notes for waste soils removed from the remediated areas, and transfer notes for any asbestos removed, should be retained for inclusion in the Verification report.

Delivery notes for any imported soils will be included in the Verification report.

A Post Remediation Verification Report will be prepared detailing the verification works listed above.

FURTHER WORK

Further sampling and testing of the Topsoil and Made Ground could be considered in order to provide greater confidence of the nature of the Lead contamination across the site. This further testing may potentially negate the implementation of a cover system from some of the proposed areas of gardens or soft landscaping away from previously elevated concentrations of Lead recorded.

GEOTECHNICAL ENGINEERING CONCLUSIONS

We understand the proposed re-development comprises the demolition of the existing care home and residential buildings and the construction of a new three-storey care home with single-storey basement with associated residents garden areas and car parking.

STRATA

The investigation has revealed that the site is underlain by Fill/Topsoil onto Made Ground, above the Aeolian Deposits locally in the centre and south, onto Raised Beach Deposits overlying the Lambeth Group proven to the full depth of the investigation at 10.00m. The generalised depths to the base (and thickness) of each stratum encountered in our exploratory holes, is summarised below:

Stratum	Base	Thickness
Topsoil	0.30 to 0.40	0.30 to 0.40
Fill	0.05 to 0.20	0.05 to 0.20
Made Ground	0.30 to 1.30	0.25 to 1.10
Aeolian Deposits	1.15 to 1.70	0.80 to 1.40
Raised Beach Deposits	8.40 to 8.60	6.70 to 7.30
Lambeth Group	>10.00	>1.40 to >1.60

The Topsoil was encountered in the north to the rear of the care home and No.87 Brighton Road and generally comprised soft dark brown sandy gravely organic clay with gravel of flint, brick, ceramic tile, glass, coal ash and clinker. Frequent roots were noted between 5mm and 10mm.

The Fill comprised a layer of concrete (100mm to 200mm thick) located in front of the care home, loose gravel of quartz and concrete (50mm to 100mm thick) in front of No.87 Brighton Road and paving 50mm thick onto 150mm of weak concrete to the rear of the care home.

The Made Ground appeared to be deeper in the centre of the site possibly associated with removal of the Aeolian Deposits and infill from the former brickfield. The Made Ground comprised a mix of soft to firm brown and dark brown sandy gravelly clay or clayey gravel with gravel of brick, flint, concrete, clinker, ceramic tile, quartzite and coal ash.

The Aeolian Deposits generally comprised low strength, soft silty sandy slightly gravelly clay with gravel of quartz and flint with rare roots, organic material and shells. The fine-grained soils were generally recorded as low plasticity clay, of characteristically low volume change potential.

The Raised Beach Deposits generally comprised medium dense to dense brown and dark brown sandy gravel or gravelly sand with gravel of sub-rounded to sub-angular flint

The Lambeth Group encountered in the deeper boreholes generally comprised high to very high strength, stiff grey brown slightly silty clay. The fine-grained soils were generally recorded as high plasticity clay, of characteristically medium volume change potential.

The coarse-grained Raised Beach Deposits should prove suitable for shallow foundation outside of the basement footprint, supporting moderately loaded spread foundations. Alternately, a piled foundation could be considered. Given the former brickfield identified and the limited access across the site we would recommend that a watching brief is carried out by a suitably qualified geotechnical engineer during the groundwork, particularly during the excavation of the proposed basement to attempt to identify any potential loose/weak ground.

Supplementary investigation including additional trial pits and possibly shallow boreholes following demolition could also be considered to further investigation the depth to the dense Raised Beach Deposits across the footprint of the entire proposed building to further assess the suitability of shallow foundations outside of the basement footprint.

Additionally, a possible well/borehole was indicated on the historical maps in the northwestern corner of the site. Although this is outside the footprint of the proposed care home, we would recommend that further investigation is carried out in this area following vegetation clearance and demolition and the well/borehole made safe if present.

GROUNDWATER

Groundwater was encountered as slight seepages in CT01 and CT03 at 5.50m and 5.70m respectively, during the fieldwork.

Groundwater was also encountered during the previous investigation in WS101 at 5.50m rising to 5.33m after 20 minutes and in WS102 at 5.10m rising to 5.17m after 20 minutes.

Monitoring carried out as part of the project recorded the installations as dry, with the exception of WS102 where groundwater was recorded at 5.34m depth below the existing ground level.

SITE EXCAVATION

Conventional hydraulic plant should be satisfactory for excavating foundation and service trenches within the Fill/Topsoil, Made Ground, Aeolian Deposits, Raised Beach Deposits and the Lambeth Group. Specialist breaking plant will be required to assist in the removal of existing foundations or floor slabs. Excavation was slow in the dense Raised Beach Deposits with the tracked mini excavator, below about 1.00m depth.

In line with HSE guidelines, all excavations requiring personnel access should be adequately supported to avoid the risk of collapse. Consideration should also be given to the stability of open trenches where personnel are working in close proximity.

Groundwater is expected to be encountered at depths greater than about 5.00m. Therefore, the proposed excavations are likely to remain dry in the short term. It should be appreciated, however, that seasonal variations may exist and hence groundwater entries may occur particularly during wetter months or after periods of inclement weather.

Consideration should be given to the effects of trees and shrubs on service runs that cross the site. Soil movements brought on by the influence of vegetation can severely disrupt the drain runs and mains services, and measures should be incorporated into the excavations to allow for future ground movements.

Should any trees be removed from site, care should be taken to ensure the root ball of each tree is completely removed from the ground. Given time, any remnant root fragments may weather down to produce localised areas of soft organic soils which may induce local differential settlements.

Where new foundations are placed over a felled tree, consideration should be given to spanning these features to ensure no soft spots result in localised settlement.

Excavations at the site should be designed so as not to undermine existing structures or affect adjacent buildings.

BASEMENT EXCAVATION AND RETAINING WALL

We understand that a single-storey basement is proposed and therefore we anticipate that the basement excavation depths would be approximately 3.5m below existing ground level. At the time of writing this report, the construction method and exact dimensions were not decided, although these are considered to be in the order of approximately 16m wide by 52m in length. The following factors should be taken into account with regard to the basement construction and design:

On the basis of the exploratory holes, this would involve the total removal of the Fill/Topsoil, Made Ground, the Aeolian Deposits and exposure of the natural Raised Beach Deposits within the basement excavation and at formation level.

Sheet piles may be a viable although they would not provide the vertical capacity afforded by a piled solution. Consideration regarding the penetration of the Raised Beach Deposits, together with the problems associated with noise/vibration will be required, which may make a piled solution a more appropriate option. If a piled basement solution is required, then further deeper boreholes may be necessary to assist the design.

It should be noted that the potential for induced movements of the supported structures will be significantly increased if the method adopted is not well designed and specified. A very high quality of workmanship will be required if the scheme is to be successful; and a well-established specialist who has extensive experience with this type of construction must be used to undertake this work. The key to limiting ground movements during construction will be to adopt a robust arrangement of temporary internal bracings/props.

In the permanent case, the lateral earth pressures are envisaged to be supported by the retaining walls forming the periphery of the new basement and potentially transferred through the basement floor slab.

For the design of both temporary and permanent retaining structures the following design parameters may be used:

Parameter	Made Ground		Aeolian Deposits	Raised Beach Deposits		Lambeth Group
	Coarse Grained	Fine Grained	Fine Grained	Coarse Grained	Fine Grained	Fine Grained
Depth to base (m bgl)	0.55 to 0.70	0.30 to 1.30	1.15 to 1.70	8.40 to 8.60	0.80 to 1.50	>10.00
Effective cohesion (kN/m^2) [c']	0	0	0	0	0	1 to 2
Undrained Shear Strength (kN/m^2) [Cu]	-	20 - 30	20 - 30	-	30 - 50	115 - 160
Angle of shearing resistance (^{o}) [ϕ']	29 - 30	27 - 28	27 - 28	34 - 38	27 - 28	28 - 29
Bulk Unit Weight (kN/m^3) [γb]	19 - 20	17 - 18	17 - 18	20 - 21	19 - 20	21 - 22

The wall designer should use these parameters or their own to derive the active and passive earth pressure coefficients, K_a and K_p. The determination of appropriate earth pressure coefficients, together with factors such as the pattern of earth pressure distribution, will depend upon the type/geometry of the wall and the overall design approach.

We recommend that a specialist contractor be consulted to confirm the most appropriate type of wall and to provide the final wall design, taking in consideration the dense Raised Beach Deposits encountered.

FOUNDATION SOLUTIONS

Shallow Foundations - outside of the basement footprint

The Made Ground, Topsoil, Fill, Aeolian Deposits and fine-grained Raised Beach Deposits are all considered unsuitable as a bearing stratum due to their variability, and potential for unacceptable total and differential settlement under applied foundation loadings.

The coarse-grained Raised Beach Deposits are considered to be a suitable bearing stratum for traditional spread foundations.

A minimum foundation depth of 1.0m below existing ground level is recommended, or 0.20m into the top of the formation, whichever is the deeper. However, the top of the granular Raised Beach Deposits was not encountered until 1.70m in the southeast, requiring at least 1.90m deep spread foundations.

The allowable bearing pressure recommended below is made on the assumption of an acceptable total settlement for the proposed structures of 25mm. Should the building design require a significantly different

serviceability limit state (tolerance to settlement) then it is recommended that these recommendations be revised accordingly.

At the minimum founding depth provided above, an allowable bearing pressure (or net loading intensity increase) of 200kPa may be adopted for conventional 1.0m wide strip footings.

Pile Foundations

Should the above quoted allowable bearing pressure prove insufficient foundations could be supported on piles founded within the Raised Beach Deposits and the underlying Lambeth Group.

A preliminary pile design data sheet of ultimate values is included in Appendix E. The ultimate shaft friction and the end bearing has been calculated using the result of the Standard Penetration Tests, in conjunction with recognised conversion factors and laboratory test data. An SPT against depth plot is presented in Appendix E. We recommend that any support from the Made Ground/Aeolian Deposits is ignored. In addition, consideration will be required to final site levels when designing piles.

Estimated pile working loads are shown below as a guide for single in-situ bored piles, using an overall factor of safety of 3. A lower factor of safety may be permissible following pile load tests. The examples are for illustration purposes only and do not constitute recommendations as to the diameter or length of piles to be constructed. A pile length of 7.0m has been used to limit the stress onto the underlying Lambeth Group clay soils encountered at depths of 8.40m and 8.60m. Depending upon the proposed loads of the building deeper boreholes may be necessary to assist the pile design.

Typical single bored pile working loads			
Pile diameter (mm)	**Pile toe depth (m)**	**Ultimate Load (kN)**	**Working Load (FOS=3) (kN)**
300	7	390	130
450	7	780	260
600	7	1305	435

A specialist piling contractor should be consulted as to the efficiency and suitability of piles installed using their particular systems in these ground conditions and consideration of possible obstructions, vibrations effecting the surrounding residential houses during pile installation, punching of piles through the gravel into the Lambeth Group and the presence of groundwater in the gravels will be required.

BASEMENT SLAB, GROUND MOVEMENTS AND HEAVE/UPLIFT PRESSURES

Medium dense to dense coarse-grained Raised Beach Deposits are expected to be exposed at basement level (circa. 3.0m bgl) across the basement footprint.

Any spread foundations in this area will probably comprise either discrete pads/strips or, more probably, reinforced thickenings within the basement slab. Based on our findings, moderate sized strip or pad

foundations (say, up to 2.0m width), may be designed at an allowable bearing pressure of 180kPa. This design pressure allows for localised variations in the deposits and should ensure that load induced settlement remains within tolerable limits.

Consideration could be given to the use of a basement raft. This would be a significantly more robust structure than the basement slab and could be designed to effectively distribute the loads over the whole basement footprint. The raft should be directly bearing on the natural coarse-grained Raised Beach Deposits following proof-rolling of the formation and removal of any soft spots and replacement with well compacted coarse-grained fill or lean-mix concrete. Where the building loads are higher than the theoretical uplift pressure, long-term heave problems are not anticipated. Settlements are expected to be within tolerable limits (below 25mm) for a lightly-loaded raft.

It is recommended that a watching brief be put in place during the ground works and excavation of the basement by a suitably qualified geotechnical engineer, to identify any deep Made Ground/Aeolian Deposits as these may potentially impact the design. Should any deep Made Ground/Aeolian Deposits be encountered during the basement excavation works, the basement slab design may need to be altered and it is recommended that the advice of a qualified geotechnical and structural engineer is sought immediately.

This report does not include a comprehensive ground movement analysis, which will be required if construction-induced movements need to be assessed in detail.

Should a basement be considered, the design of new basement floor slabs must ensure that potential uplift forces caused by any groundwater and/or soil heave are adequately resisted, either by the dead weight of the structure or by anchor/tension piles.

From the exploratory work, there will be some 5.0m thickness of coarse-grained medium dense to dense sands and gravels remaining beneath such a basement excavation: through which heave pressure would be dissipated, reducing significantly the portion transferred to the underside of the structure. Therefore, basement heave is unlikely to be significant for this development.

Hydrostatic Pressure

Groundwater was encountered at depths between 5.10m and 5.70m during the investigation. The monitoring recorded the installations as dry with the exception of WS102 where groundwater was recorded at 5.34m depth. However, further groundwater monitoring could be considered to determine the range of seasonal water level fluctuations as this may be required. Therefore, the groundwater is considered to be below the anticipated depth of the proposed single-storey basement. With appropriate groundwater control, hydrostatic pressures (due to natural groundwater) are not anticipated during temporary or short term working conditions. However, following construction, the possibility of hydrostatic pressures developing as a result of seasonal variations or due to burst water pipes and flooding should be considered. These potential water pressures imposed on the basement would require consideration at the design stage.

Hydrostatic pressures should be reassessed once the final basement design has been established and the final design approach may need to be agreed with Local Building Control.

GROUND FLOOR SLABS

The Made Ground and Aeolian Deposits are unsuitable as a bearing layer and therefore suspended ground floors should be used outside of the basement footprint.

WORKING PLATFORMS FOR TRACKED PLANT

If construction on the site requires the use of heavy tracked plant then reference will need to be made to the most recent guide for the design of 'Working Platforms for Tracked Plant', 2004, produced by the BRE.

Use of such plant will require construction of either a working platform or an adequate running surface if the subgrade is determined as being already adequate to support the anticipated plant loadings.

The following soil characteristics should be used for preliminary Working Platform design in accord with the most recent guidance given by the Building Research Establishment. The subgrade down to 2.00m depth should be considered as essentially both fine and coarse soil.

Anticipated Subgrade Characteristics	**Made Ground**	**Aeolian Deposits**	**Raised Beach Deposits**
Typical Depth Range (m)	0.10 to 1.30	0.25 to 1.70	0.50 to >2.00
Soil Type (fine or coarse)	Fine	Fine	Coarse
Angle of shearing resistance (φ'_s)	27 º - 28 º	27 º - 28 º	34º - 38º
Undrained Shear Strength (kN/m^2)	20 - 30	20 - 30	-
Effective unit weight (γ'_s)	17-18kN/m^3	17-18kN/m^3	20-21kN/m^3

It should be noted that soft spots and zones of poor subgrade may exist on any site at shallow depth that will have a significant influence on the instability of tracked plant. The location of such features will not readily be determined by a general ground investigation for foundation design and more specific investigation at shallow depth may be required before the design of a working platform can be completed.

The advice of a specialist contractor should be sought to determine the most suitable size and thickness of platform required for their specific plant. This will take into account the size of the plant and anticipated loadings imposed on the working platform.

ACCESS ROADS AND PARKING

Deep Made Ground/Aeolian Deposits were encountered across the south of the site in the areas of the proposed hardstanding. Pavement construction may be considered on this existing Made Ground/Aeolian Deposits by employing appropriate mitigation measures. Where deep Made Ground/Aeolian Deposits are encountered beneath the area of proposed pavement it is recommended that geogrids or similar soil reinforcement techniques be employed to provide a subgrade with a known CBR value. Reinforcement measures will also mitigate lateral and vertical displacement from traffic loadings and differential settlement over variable ground. Discussions should be held with a soil reinforcement company (such as Tensar) who would design a subgrade to a specified CBR value.

In-situ testing was undertaken using a TRL probe to obtain equivalent CBR with depth profiles to around 1m depth, at two locations in the south of the site, TRL01 and TRL02. The results of the testing derived

approximate CBR values of between 3% and >40% within the Made Ground and between 3% and 5% within the Aeolian Deposits. However, at this stage given the low strengths encountered and the potential variability of the soils we would recommend a pavement design based upon an equilibrium CBR of less than 2%.

As the Made Ground/Aeolian Deposits are likely to be frost susceptible the pavement thickness will need to accommodate this effect.

The following should also be taken into consideration:

- Inspection of the formation and removal of any surface areas of soft, organic or other unsuitable materials.
- 'Heavy' proof rolling of the resultant formation, to compact loose coarse materials and locate any soft spots at shallow depth beneath the formation for subsequent removal.
- Removal of intact or loose obstructions where noted at surface, or known based on the investigation, to a depth of at least 600mm beneath the formation to prevent the creation of hard spots or voiding.
- Backfilling of any excavation with well-compacted inert coarse material.

INFILTRATION MEASURES

Appropriately designed sustainable drainage systems (SuDS) are more sustainable than using piped drainage to local sewer systems. However, infiltration measures close to buildings may result in undermining of foundations and softening of soils leading to instability. Attenuation measures should be located at suitable distances from foundations and infrastructure and consideration given to the effects on slopes, flooding and mobilisation of contaminants.

The best infiltration potential was recorded in TP03, where the pit was excavated into the Raised Beach Deposits in the north of the site. The infiltration rates could not be calculated for TP01 and TP02 in the south of the site predominantly within the Aeolian Deposits due to the slow rate of infiltration indicating Poor infiltration potential.

Infiltration rates generally reduce as the soil become saturated and the worse-case infiltration rate for each test should be used for design. The worse-case infiltration rate for TP03 carried out within the Raised Beach Deposits was established to be $2.5x10^{-5}$m/s in the north of the site, indicating soils with generally Good infiltration potential (in accordance with CIRIA C573 – The SuDS Manual).

The infiltration testing indicates that traditional soakaways are considered feasible at this site, constructed in the north of the site within the coarse-grained Raised Beach Deposits, subject to regulatory approval.

The NHBC require soakaways to be a minimum of 5m away from a house and as far away as possible.

FURTHER WORK AND RECOMMENDATIONS

Given the former brickfield identified and the limited access across the entire site we would recommend that a watching brief is carried out by a suitably qualified geotechnical engineer during the groundwork, particularly during the excavation of the proposed basement to attempt to identify any potential loose/weak ground.

Supplementary investigation including additional trial pits and possibly shallow boreholes following demolition could also be considered to further investigation the depth to the medium dense and dense coarse-grained Raised Beach Deposits across the footprint of the entire proposed building, which would further assess the suitability of shallow foundations outside of the basement footprint. Additionally, a possible well/borehole was indicated on the historical maps in the northwestern corner of the site. Although this is outside the footprint of the proposed care home building, we would recommend that further investigation is carried out in this area following vegetation clearance and demolition and the well/borehole made safe, if present.

The developer should prepare a method statement to cater for unexpected contamination uncovered during the groundworks. Should any suspicious soils be encountered that differ from our ground model, work should cease in that area and further assessment will be necessary by a suitably qualified geoenvironmental engineer. This may require further intrusive investigation or soil sampling along with supplementary contamination risk assessment and potentially remediation. Any further recommendations will require regulatory approval.

If a piled basement/foundation solution is required, then further deeper boreholes may be necessary to assist the design.

Further sampling and testing of the Topsoil and Made Ground could be considered in order to provide greater confidence of the nature of the Lead contamination across the site. This further testing may potentially negate the implementation of a cover system from some of the proposed areas of gardens or soft landscaping away from previously elevated concentrations of Lead recorded.

If excavated soils require landfill disposal then waste classification testing is recommended which is a twofold process using soil chemical testing results and the European Waste Catalogue for off-site disposal, followed by testing under the Waste Acceptance Criteria (WAC).

REFERENCES

1. British Standards Institution (BSI), Site Investigations: Code of Practice, BS5930:2015+A1:2020, 2020
2. BSI, Investigation of Potentially Contaminated Sites: Code of Practice, BS10175:2011+A2:2017, 2017
3. Association of Geotechnical and Geoenvironmental Specialists, Site Investigation Asbestos Risk Assessment, AGS Interim Guidance, 2013
4. CIRIA, Asbestos in soil and made ground: good practice site guide, C765, 2017
5. BRE, Radon: Guidance on Protective Measures for New Buildings, BR211, 2015
6. BRE, Reducing Radon: Underground Rooms – Cellars and Basements, Quick Guide 7, 2015
7. NHBC, NHBC Standards, Chapter 4.2 Building Near Trees, 2020
8. NHBC, NHBC Standards, Chapter 4.1 Land Quality – Managing Ground Conditions, 2020
9. CIRIA, Unexploded Ordnance (UXO), A Guide for the Construction Industry, C681, 2009
10. Environment Agency, Land contamination: risk management, October 2020 *https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm*
11. CIRIA, Contamination Land Risk Assessment – A Guide to Good Practice, C552, 2001
12. Environment Agency, Human Health Toxicological Assessment of Contaminants in Soil, SR2, 2009
13. Amherst Scientific Publishers, The Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) Series - Volumes 1-5, 1998
14. Department for Environment, Food and Rural Affairs, SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document, 2014
15. Land Quality Management, The LQM/CIEH S4ULs for Human Health Risk Assessment, S4UL3032, 2015
16. Health and Safety Executive, Protection of Workers and the General Public during Development of Contaminated Land, HS(G) 66, 1991
17. Health and Safety Executive (HSE), Health and safety in construction, HSG150. HMSO London 2006. https://www.hse.gov.uk/pubns/priced/hsg150.pdf
18. CAR-SOIL™, Control of Asbestos Regulations, 2012, Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials, CL:AIRE 2016
19. Environment Agency, Remedial Target Methodology, Hydrogeological Risk Assessment for Contaminated Land, 2006
20. The Water Supply (Water Quality) Regulations 2016
21. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015

22. BRE, Cover Thickness Design for Regeneration, BR 465, 2004
23. Card G, Wilson S, Mortimer S, A Pragmatic Approach to Ground Gas Risk Assessment, CL:AIRE Research Bulletin RB17, 2012
24. CIRIA, Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665, 2007
25. BSI, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, BS 8485:2015+A1:2019, 2019
26. CIRIA, Good practice on the testing and verification of protection systems for buildings against hazardous ground gases, C735, 2013
27. BSI, Soils for Civil Engineering Purposes, BS 1377-1:2016, 2016
28. BRE, Concrete in Aggressive Ground, BRE Special Digest 1, 2005
29. BSI, Foundations, BS 8004:2015, 2015
30. BRE, Soakaway design, DG 365, 2016
31. CIRIA, The SuDS Manual, C753, 2015
32. BRE, Working Platforms for Tracked Plant, BR 470, 2004
33. UK Water Industry Research (UKWIR), Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites, 10/WM/03/21, 2010

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

APPENDIX A
PLANS & PHOTOGRAPHS

Extract of 1:50,000 Ordnance Survey Explorer Map



Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved (Licence No: 100006010)

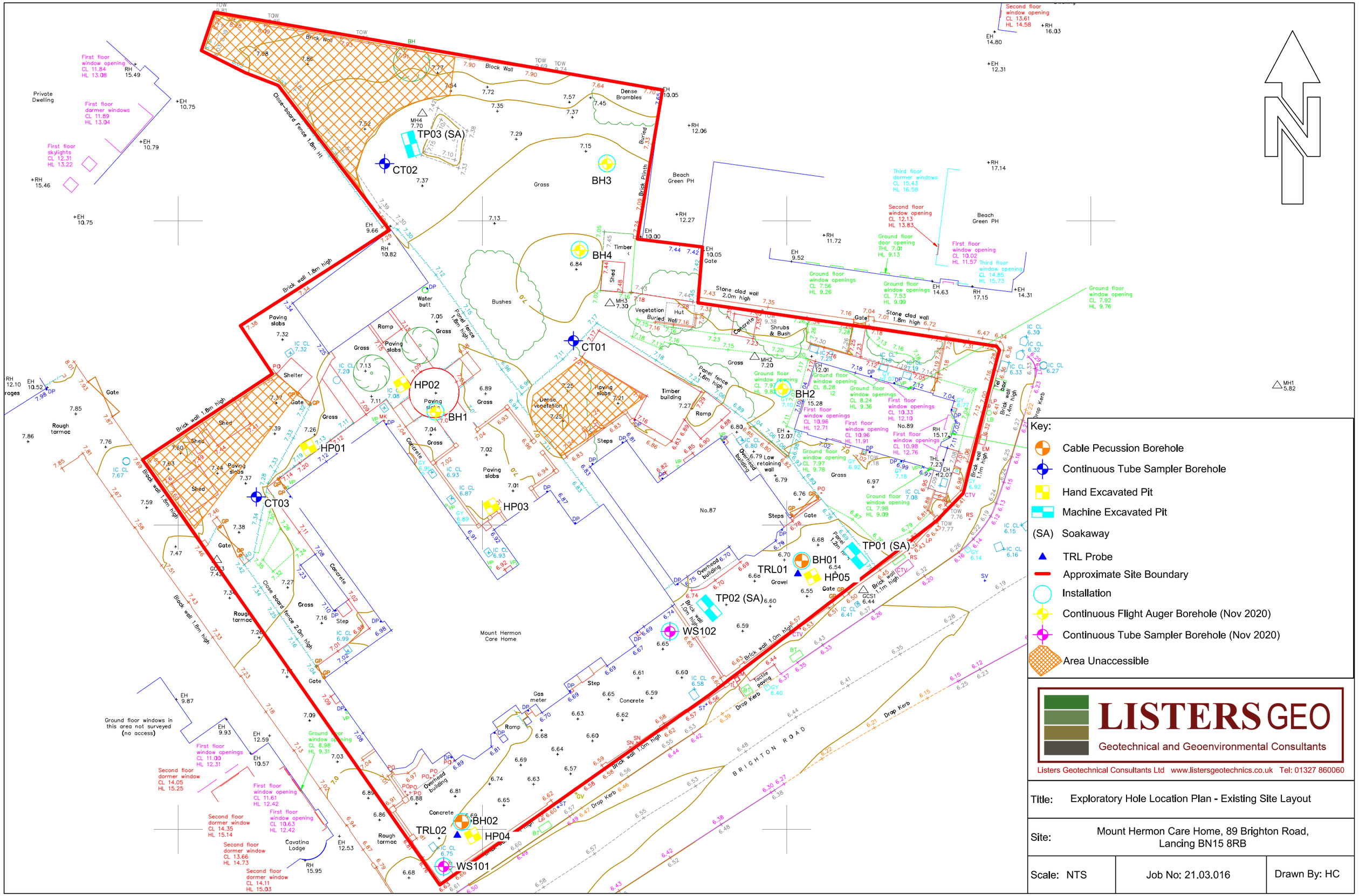
Key: Approximate Site Location

LISTERS GEO
Geotechnical and Geoenvironmental Consultants
Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

Title:	Site Location Plan
Site:	Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Scale: NTS	Job No: 21.03.016	Drawn By: HC

N



Key:
Cable Pecussion Borehole
Continuous Tube Sampler Borehole
Hand Excavated Pit
Machine Excavated Pit
(SA) Soakaway
TRL Probe
Approximate Site Boundary
Installation
Continuous Flight Auger Borehole (Nov 2020)
Continuous Tube Sampler Borehole (Nov 2020)
Area Unaccessible
LISTERS GEO
Geotechnical and Geoenvironmental Consultants
Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060
Title: Exploratory Hole Location Plan - Existing Site Layout
Site: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB
Scale: NTS
Job No: 21.03.016
Drawn By: HC
TP03 (SA)
CT02
BH3
BH4
CT01
HP02
BH1
HP01
CT03
HP03
BH2
TP01 (SA)
BH01
TRL01
HP05
TP02 (SA)
WS102
BH02
TRL02
HP04
WS101
Mount Hermon Care Home
BRIGHTON ROAD
Private Dwelling
Beach Green PH
Cavatina Lodge
Ground floor windows in this area not surveyed (no access)



Key:

- Cable Pecussion Borehole
- Continuous Tube Sampler Borehole
- Hand Excavated Pit
- Machine Excavated Pit
- (SA) Soakaway
- TRL Probe
- Approximate Site Boundary
- Installation
- Continuous Flight Auger Borehole (Nov 2020)
- Continuous Tube Sampler Borehole (Nov 2020)

LISTERS GEO
Geotechnical and Geoenvironmental Consultants
Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

Title:	Exploratory Hole Location Plan - Proposed Site Layout
Site:	Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB
Scale: NTS	Job No: 21.03.016 / Drawn By: HC



Photo 1: View to the north showing the front of the former care home in the south of the site



Photo 2: View to the north showing the rear garden of No.87 Brighton Road

SITE PHOTOGRAPHS

Report:
21.03.016



Photo 3: View to the southeast showing the location of CT01 in the centre of the site



Photo 4: View to the north showing the dense vegetation in the northwest of the site

SITE PHOTOGRAPHS

Report:
21.03.016



Photo 5: View to the southeast showing the location of HP02 in the rear of the former care home



Photo 6: View to the west showing the location of HP01 in the rear of the former care home

SITE PHOTOGRAPHS

Report: 21.03.016



Photo 7: View to the southwest showing the location of BH02 and HP04 in the area of car parking at the front of the former care home



Photo 8: View to the northwest showing the location of TP03 and CT02 in the north of the site

SITE PHOTOGRAPHS

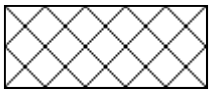
Report:
21.03.016

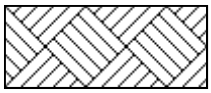
LISTERS GEO
Geotechnical and Geoenvironmental Consultants

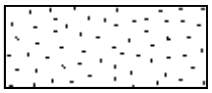
APPENDIX B
FIELDWORK AND TESTING

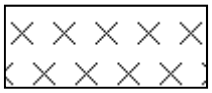
LISTERS GEO
Geotechnical and Geoenvironmental Consultants

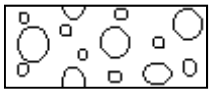
LEGEND - Soils

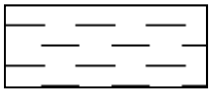

Made Ground

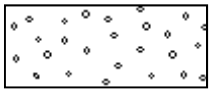

Topsoil

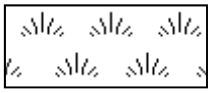

Sand


Silt

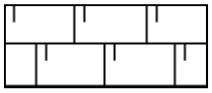

Boulders and Cobbles

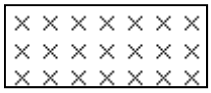

Clay

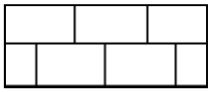

Gravel

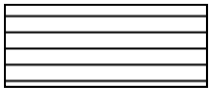

Peat

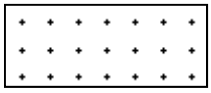
LEGEND - Rocks (Sedimentary)


Chalk


Siltstone


Limestone


Mudstone


Sandstone


Coal


Conglomerate


Breccia

LOG ABREVIATIONS

W	Water Sample	▽	Water Strike
B	Bulk Sample	▼	Water (Standing Level)
D	Disturbed Sample	PP	Pocket Penetrometer
J	Jar Sample	HV	Hand Vane
U	Undisturbed Sample	SPT	Standard Penetration Test
(No. of blows shown in brackets for U100 samples)		CPT	Cone Penetration Test
WAC	Waste Acceptance Criteria Sample	CBR	California Bearing Ratio
		*	Extrapolated Value

Pocket penetrometer testing provides values of unconfined compressive strength. The results have been converted to an approximate equivalent shear strength which should be used with due circumspection. As the pocket penetrometer tends to overestimate shear strength, we have used an appropriate reduction factor.

LOG KEY

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No. TP 01

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518082E - 103693N

Level: 6.61 mAOD

Dates: 22/04/2021

Project Number: 21.03.016

Logged By: Tom Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Result					
				0.10	6.51		FILL Brown GRAVEL. Gravel is medium sub-rounded quartz *- black textile at 0.09m*	
	0.30	D		0.32	6.29		MADE GROUND Soft brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-rounded to angular brick, quartz and concrete. Frequent roots (maximum diameter 20mm)	
	0.60	D					AEOLIAN DEPOSITS Soft friable brown sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular to angular flint. Occasional roots	
							- becoming firm at 0.80m depth	
	1.00	D						1
				1.30	5.31		AEOLIAN DEPOSITS Firm grey mottled orange brown slightly sandy CLAY	
	1.50	D					*- becoming sandy with rare fine to medium sub-angular flint from 1.60m depth*	
	1.70	D						
				1.75	4.86		End of Trial Pit at 1.75m	
								2

Method of excavation: Mini tracked excavator

Dimensions: 0.30m x 1.20m x 1.75m

Stability: Sides Stable

Groundwater: None encountered

Remarks: Roots visible to 1.00m depth

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No.
TP 02

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518071E - 103691N
Level: 6.68 mAOD
Dates: 22/04/2021

Project Number: 21.03.016
Logged By: Tom Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Result					
	0.30	D					MADE GROUND Soft dark brown slightly sandy gravelly organic CLAY. Gravel is fine to coarse sub-rounded to angular quartz, brick, concrete, clinker and ceramic tile. Rare rootlets (maximum diameter 2mm)	
				0.40	6.28		MADE GROUND (Loose) dark brown clayey sandy GRAVEL. Gravel is fine to coarse sub-rounded to angular brick, concrete, clinker and ceramic tile	
	0.60	D						
				0.70	5.98		MADE GROUND Soft grey gravelly CLAY. Gravel is fine to coarse sub-rounded to angular flint, slate, brick and glass	
	0.80	D						
				0.90	5.78		AEOLIAN DEPOSITS Soft friable orange brown mottled grey silty sandy CLAY	1
	1.20	D						
				1.70	4.98		RAISED BEACH DEPOSITS (Medium dense) orange brown silty very gravelly SAND. Gravel is fine to coarse sub-rounded flint	
	2.00	D						2
				2.22	4.46		End of Trial Pit at 2.22m	

Method of excavation: Mini tracked excavator
Dimensions: 0.30m x 1.50m x 2.22m

Stability: Sides Stable

Groundwater: None encountered

Remarks:

ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No.
TP 03

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518044E - 103733N
Level: 7.54 mAOD
Dates: 22/04/2021

Project Number: 21.03.016
Logged By: Tom Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Result					
	0.20	D					TOPSOIL (Loose) dark brown clayey gravelly organic SAND. Gravel is fine to coarse sub-rounded to angular quartz, brick, glass and clinker. Frequent roots (maximum diameter 10mm)	
				0.40	7.14			
	0.50	D					MADE GROUND Soft sandy slightly gravelly CLAY. Gravel is fine to coarse sub-rounded to angular flint with rare brick. Rare rootlets (maximum diameter 2mm)	
				0.60	6.94			
	1.00	D					RAISED BEACH DEPOSITS (Dense) orange brown silty very sandy GRAVEL. Gravel is fine to coarse sub-rounded flint with, low similar cobble content	1
	1.50	D						
				1.60	5.94		End of Trial Pit at 1.60m	2

Method of excavation: Mini tracked excavator
Dimensions: 0.30m x 1.40m x 1.60m
Stability: Sides Stable
Groundwater: None encountered
Remarks: Roots visible to 0.60m depth

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No.
HP 01

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518038E - 103706N
Level: 7.26 mAOD
Dates: 31/03/2021

Project Number: 21.03.016
Logged By: Tom Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Result				
	0.20	D		0.30	6.96		TOPSOIL Soft dark brown sandy gravelly organic CLAY. Gravel is fine to coarse angular to sub-rounded flint, brick, ceramic tile and rare fine clinker. Occasional roots (maximum diameter 5mm)
	0.50	D		0.60	6.66		MADE GROUND Soft reddish brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to sub-angular flint and brick
	0.70	D		0.80	6.46		RAISED BEACH DEPOSITS (Dense) orange brown slightly clayey sandy GRAVEL. Gravel is fine to coarse sub-rounded to sub-angular flint
							End of Trial Pit at 0.80m

Method of excavation: Hand dug
Dimensions: 0.30m x 0.30m x 0.80m
Stability: Sides Stable
Groundwater: None encountered
Remarks: (Density) assessed by ease of excavation

ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No.
HP 02

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518045E - 103711N
Level: 7.06 mAOD
Dates: 01/04/2021

Project Number: 21.03.016
Logged By: Tom Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Result				
	0.20	D					TOPSOIL Soft dark brown sandy gravelly CLAY with abundant roots (maximum diameter 5mm). Gravel is medium to coarse sub-angular to sub-rounded flint with rare clinker
				0.30	6.76		MADE GROUND Soft brown slightly silty slightly gravelly sandy organic CLAY. Gravel is fine to coarse sub-rounded to sub-angular of calcareous nodules and flint. Rare roots
	0.40	D					
				0.50	6.56		RAISED BEACH DEPOSITS Soft brown slightly silty slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint and fine calcareous nodules
	0.60 - 0.70	D					
				0.80	6.26		RAISED BEACH DEPOSITS Dense orange brown slightly clayey sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded flint
	0.85	D		0.85	6.21		End of Trial Pit at 0.85m

1
2

Method of excavation: Hand dug
Dimensions: 0.30m x 0.30m x 0.85m

Stability: Sides Stable

Groundwater: None encountered

Remarks: Maximum depth of visible roots: 0.50m bgl
Trial pit terminated at 0.85m due to refusal
(Density) assessed by ease of excavation

ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No.
HP 03

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518053E - 103701N
Level: 7.01 mAOD
Dates: 01/04/2021

Project Number: 21.03.016
Logged By: Tom Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Result				
	0.00 - 0.06	D		0.05	6.96		FILL Paving
				0.11	6.90		FILL (Dense) dark grey slightly clayey slightly sandy GRAVEL. Gravel is coarse sub-rounded ironstone
	0.40 - 0.50	D					MADE GROUND (Dense) reddish brown slightly silty clayey GRAVEL with rare roots (maximum diameter 5mm). Gravel is fine to coarse sub-rounded to sub-angular quartzite, flint, and rare brick
				0.55	6.46		MADE GROUND (Dense) reddish brown slightly silty clayey GRAVEL. Gravel is fine to coarse sub-rounded to sub-angular quartzite and flint
	0.60	D		0.70	6.31		AEOLIAN DEPOSITS Soft light greenish brown slightly silty sandy slightly gravelly CLAY with rare bits of organic material. Gravel is fine sub-rounded to sub-angular flint
	0.80 - 0.90	D					
	1.10 - 1.20	D					
				1.25	5.76		End of Trial Pit at 1.25m

1
2

Method of excavation: Hand dug
Dimensions: 0.35m x 0.35m x 1.25m

Stability: Sides Stable

Groundwater: None encountered

Remarks: Roots visible to 0.50m bgl
Trial pit terminated at 1.25m due to refusal
(Density) assessed by ease of excavation

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No.
HP 04

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518049E - 103675N
Level: 6.65 mAOD
Dates: 31/03/2021

Project Number: 21.03.016
Logged By: Tom Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Result				
				0.10	6.55		FILL Reinforced concrete
	0.25	D		0.25	6.40		MADE GROUND Soft brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-rounded to angular brick, concrete and flint
	0.50 - 0.60	D					AEOLIAN DEPOSITS Soft brown slightly silty slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular flint. Rare organic material and shells
				0.82	5.83		AEOLIAN DEPOSITS Soft light brown slightly silty slightly gravelly sandy CLAY. Gravel is fine to medium sub-angular flint
	0.90	D					
				1.02	5.63		AEOLIAN DEPOSITS Soft light brown slightly silty slightly gravelly sandy CLAY. Gravel is fine to medium sub-angular to sub-rounded flint
	1.10	D		1.15	5.50		
				1.20	5.45		RAISED BEACH DEPOSITS (Dense) orange brown sandy GRAVEL. Gravel is fine to coarse sub-rounded to angular flint
							End of Trial Pit at 1.20m

1
2

Method of excavation: Hand dug
Dimensions: 0.40m x 0.40m x 1.20m

Stability: Sides Stable

Groundwater: None encountered

Remarks: Terminated at 1.20m on dense gravel
(Density) assessed by ease of excavation

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No. HP 05

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518079E - 103696N

Level: 6.71 mAOD

Dates: 01/04/2021

Project Number: 21.03.016

Logged By: Tom Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Result				
	0.10	D		0.10	6.61		FILL (Loose) brown sandy GRAVEL. Gravel is fine to coarse sub-rounded to sub-angular quartz and concrete
	0.20	D		0.26	6.45		MADE GROUND Firm dark brown slightly silty slightly gravelly CLAY. Gravel is medium to coarse sub-angular to sub-rounded to angular concrete
	0.50	D					AEOLIAN DEPOSITS Firm light brown slightly silty slightly gravelly CLAY with occasional roots and rare organic material. Gravel is fine sub-rounded flint
							- becoming soft from 0.60m depth
	0.80	D					
							- becoming orange brown from 1.00m depth
	1.10	D					
				1.20	5.51		AEOLIAN DEPOSITS Soft thinly laminated orange brown mottled grey slightly silty sandy CLAY with some organic material
	1.30	D		1.35	5.36		AEOLIAN DEPOSITS (Loose) orange brown slightly gravelly clayey SAND. Gravel is fine to medium sub-rounded flint
	1.50	D		1.55	5.16		End of Trial Pit at 1.55m

1

2

Method of excavation: Hand dug

Dimensions: 0.40m x 0.40m x 1.55m

Stability: Sides Stable

Groundwater: None encountered

Remarks: (Density) assessed by ease of excavation

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Cable Percussive Borehole Log

Borehole No. BH 01

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518079E - 103696N

Level: 6.65 mAOD

Dates: 06/04/2021

Project Number: 21.03.016

Logged By: Tom Johnston to BS 5930:2015

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Result	Depth (m)	Level (m)	Legend	Stratum Description
					0.05	6.60		FILL Brown slightly sandy GRAVEL. Gravel is medium to coarse sub-rounded quartz
		0.30	D		0.30	6.35		MADE GROUND Soft brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-rounded to angular brick, flint and concrete
		1.00	D					
		1.20	D					
		1.20	SPT(S)	N=6 (2/1,2,1,2)				AEOLIAN DEPOSITS Brown silty sandy CLAY
		1.70	D		1.70	4.95		RAISED BEACH DEPOSITS Dense brown very silty SAND and GRAVEL. Gravel is fine to coarse sub-rounded to sub-angular flint
		2.00	D					
		2.00	SPT(S)	N=30 (6/3,10,7,10)				
		3.00	D					
		3.00	SPT(C)	N=37 (14/7,10,10,10)				
		4.10	D		4.00	2.65		RAISED BEACH DEPOSITS Dense brown silty sandy GRAVEL. Gravel is fine to coarse sub-rounded to sub-angular flint
		4.10	SPT(S)	N=49 (20/10,13,13,13)				
		5.00	D					
		5.00	SPT(C)	N=45 (19/10,11,11,13)				
		6.10	D					*- medium dense from 6.10m depth*
		6.10	SPT(C)	N=14 (6/3,3,4,4)				
		7.00	D		7.00	-0.35		RAISED BEACH DEPOSITS Dense slightly silty sandy GRAVEL. Gravel is fine to coarse sub-rounded flint
		7.00	SPT(C)	N=39 (14/10,10,10,9)				
		8.00	D					
		8.00	SPT(S)	N=36 (14/10,10,8,8)				
					8.40	-1.75		LAMBETH GROUP Stiff grey brown slightly silty CLAY
		9.50	D					
		9.50	SPT(S)	N=31 (13/7,7,7,10)				
					10.00	-3.35		End of Borehole at 10.00m

Borehole Diameter: 150mm

Casing Depth: 9.00m

Chiselling:

Instrumentation: Gas/groundwater pipe installed to 1.50m bgl

Groundwater: None encountered

Remarks:

ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Cable Percussive Borehole Log

Borehole No. BH 02

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518049E - 103675N

Level: 6.71 mAOD

Dates: 06/04/2021

Project Number: 21.03.016

Logged By: Tom Johnston to BS 5930:2015

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Result	Depth (m)	Level (m)	Legend	Stratum Description
					0.20	6.51		FILL Reinforced concrete
		0.50	D					MADE GROUND Firm brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-rounded to angular flint, brick, clinker and concrete
		1.00	D					
		1.20	D					
		1.20	SPT(C)	N=50 (14/10,10,15,15)	1.30	5.41		RAISED BEACH DEPOSITS Medium dense brown sandy GRAVEL. Gravel is fine to coarse sub-rounded flint
		1.90	D					
		1.90	SPT(C)	N=35 (16/9,9,7,10)				
		3.10	D					
		3.10	SPT(C)	N=25 (10/5,5,7,8)				
		4.00	D					
		4.00	SPT(C)	N=22 (6/3,5,7,7)				
		4.50	D		4.50	2.21		RAISED BEACH DEPOSITS Medium dense dark brown SAND and GRAVEL. Gravel is fine to coarse sub-rounded flint
		5.00	D					
		5.00	SPT(C)	N=41 (11/10,10,10,11)				
		6.10	D					
		6.10	SPT(C)	N=29 (8/4,5,10,10)				
		7.20	D		7.20	-0.49		RAISED BEACH DEPOSITS Dense very dark brown sandy GRAVEL. Gravel is fine to coarse sub-rounded to sub-angular flint
		7.50 - 8.00	B					
		8.10	D					
		8.10	SPT(C)	N=37 (16/9,9,9,10)				
		8.60	D		8.60	-1.89		LAMBETH GROUP Stiff grey brown silty CLAY
		8.90	D					
		8.90	SPT(S)	N=26 (11/6,6,7,7)				
		9.50	D					
		9.50	SPT(S)	N=36 (13/7,9,10,10)				
					10.00	-3.29		End of Borehole at 10.00m

Borehole Diameter: 150mm

Casing Depth: 9.00m

Chiselling:

Instrumentation: Gas/groundwater pipe installed to 2.00m bgl

Groundwater: None encountered

Remarks:

ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Continuous Tube Sampler Log

Borehole No. CT 01

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518060E - 103715N

Level: 7.08 mAOD

Dates: 31/03/2021

Project Number: 21.03.016

Logged By: Tom Johnston to BS 5930:2015

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Result	Depth (m)	Level (m)	Legend	Stratum Description
		0.10 - 0.50	D					TOPSOIL (Loose) dark brown gravelly organic SAND with occasional cobbles, and roots. Gravel is fine to coarse angular flint with occasional brick and ceramic tile
		0.50 - 0.90	D					
		0.90 - 1.30	D		0.90	6.18		MADE GROUND Soft to firm brown sandy gravelly CLAY with roots. Gravel is fine to medium angular flint with occasional brick and rare roots
		1.00	PP	0.8kg/cm²				
		1.00	SPT(S)	N=4 (1/1,1,1,1)				
		1.25	PP	0.8kg/cm²	1.30	5.78		
		1.30 - 1.50	D					RAISED BEACH DEPOSITS Firm orange brown and light brown slightly sandy CLAY with rare rootlets
		1.50 - 2.00	D		1.50	5.58		
		2.00 - 2.50	D					RAISED BEACH DEPOSITS Medium dense orange brown and light brown silt SAND and GRAVEL. Gravel is fine to coarse angular to sub-rounded flint with low similar cobble content
		2.00	SPT(S)	N=34 (14/9,8,8,9)				
		2.50 - 3.00	D					
		3.00 - 3.50	D					
		3.00	SPT(S)	N=22 (8/6,5,5,6)				
		3.50 - 4.00	D					
		4.00 - 4.50	D					
		4.00	SPT(S)	N=24 (14/5,6,7,6)				
		4.50 - 5.00	D					
		5.00 - 5.50	D					
		5.00	SPT(S)	N=20 (11/5,6,5,4)				
	▼	5.50 - 6.00	D					
					6.00	1.08		End of Borehole at 6.00m

Borehole Diameter: 87-57mm

Groundwater: Slight groundwater seepage at 5.50m bgl, dry on completion

Instrumentation: Backfilled with arisings

Remarks: Roots visible to 1.50m bgl
(Density) assessed by ease of excavation

ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Continuous Tube Sampler Log

Borehole No. CT 02

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518043E - 103731N

Level: 7.55 mAOD

Dates: 31/03/2021

Project Number: 21.03.016

Logged By: Tom Johnston to BS 5930:2015

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Result	Depth (m)	Level (m)	Legend	Stratum Description
		0.10 - 0.30	D					TOPSOIL
		0.30 - 0.50	D		0.30	7.25		(Loose) dark brown gravelly organic SAND with roots. Gravel is fine to coarse angular flint with rare brick, coal ash and glass pieces
		0.50 - 0.90	D		0.50	7.05		MADE GROUND
								Firm brown and dark brown slightly sandy gravelly CLAY with roots. Gravel is fine to medium angular flint and brick
		0.90 - 1.50	D		0.90	6.65		RAISED BEACH DEPOSITS
								Very dense brown clayey sandy GRAVEL. Gravel is fine to coarse sub-rounded to angular flint
		1.50 - 2.00	D					RAISED BEACH DEPOSITS
								(Medium dense) orange brown slightly silty sandy GRAVEL. Gravel is fine to coarse angular to sub-rounded flint with low similar cobble content
					2.00	5.55		End of Borehole at 2.00m

1 2 3 4 5 6 7

Borehole Diameter: 87-67mm

Groundwater: None encountered

Instrumentation: Backfilled with arisings

Remarks: Roots visible to 0.50m bgl
(Density) assessed by ease of excavation

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Continuous Tube Sampler Log

Borehole No. CT 03

Project Location: Mount Hermon Care Home, 89 Brighton Road, Lancing BN15 8RB

Co-ords: 518033E - 103699N

Level: 7.38 mAOD

Dates: 31/03/2021

Project Number: 21.03.016

Logged By: Tom Johnston to BS 5930:2015

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Result	Depth (m)	Level (m)	Legend	Stratum Description
					0.05	7.32		FILL Paving
		0.20 - 0.55	D		0.20	7.18		FILL Weak concrete
		0.55 - 0.75	D		0.55	6.82		MADE GROUND (Loose) dark brown very gravelly organic SAND. Gravel is fine to coarse angular flint, coal ash, clinker and brick
		0.75 - 1.00	D		0.75	6.62		
		1.00 - 1.60 1.00	D SPT(S)	N=28 (9/7,7,6,8)				MADE GROUND Firm brown and occasional dark brown sandy slightly gravelly CLAY. Gravel is fine to medium angular flint and rare brick
		1.60 - 2.00	D		1.60	5.78		RAISED BEACH DEPOSITS Medium dense brown silty SAND and GRAVEL with occasional flint cobbles. Gravel is fine to coarse angular flint
		2.00 - 2.50 2.00	D SPT(S)	N=19 (7/4,6,5,4)				RAISED BEACH DEPOSITS Medium dense orange brown and light brown silty gravelly fine to medium SAND. Gravel is fine to coarse angular to sub-rounded flint with low similar cobble content
		2.50 - 3.00	D					
		3.00 - 3.50 3.00	D SPT(S)	N=31 (8/7,8,8,8)				
		3.50 - 4.00	D					
		4.00 - 4.50 4.00	D SPT(S)	N=17 (10/4,5,4,4)				
		4.50 - 5.00	D					
		5.00 - 5.50 5.00	D SPT(S)	N=11 (9/4,2,2,3)				
	▼	5.50 - 6.00	D					
					6.00	1.38		End of Borehole at 6.00m

Borehole Diameter: 87-57mm

Groundwater: Slight groundwater seepage at 5.70m, dry upon completion

Instrumentation: Backfilled with arisings

Remarks: (Density) assessed by ease of excavation

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

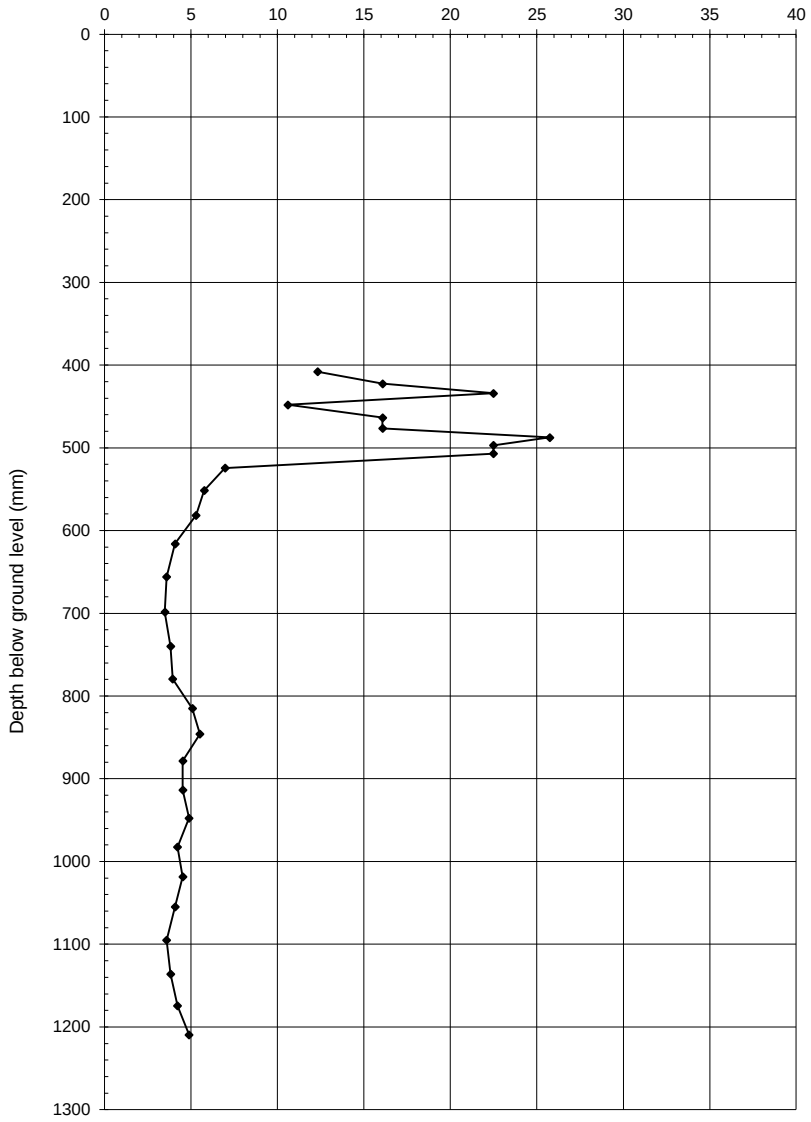
Site : **Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8R**

Test No.: **TRL01**

Date tested: 01/04/2021

Blow Count	Penetration (mm)	mm per blow	Eq. CBR (%)
0	0	0	-
1	16	16	12
2	29	13	16
3	39	10	22
4	57	18	11
5	70	13	16
6	83	13	16
7	92	9.0	26
8	102	10	22
9	112	10	22
10	137	25	7.0
11	166	29	5.8
12	197	31	5.3
13	235	38	4.1
14	277	42	3.6
15	320	43	3.5
16	360	40	3.8
17	399	39	3.9
18	431	32	5.1
19	461	30	5.5
20	496	35	4.5
21	531	35	4.5
22	564	33	4.9
23	601	37	4.2
24	636	35	4.5
25	674	38	4.1
26	716	42	3.6
27	756	40	3.8
28	793	37	4.2
29	826	33	4.9

Plot of Equivalent CBR (%) against Depth



Remarks:

Test commenced from within hand excavated pit at 0.40mbgl

Tested using 60 degree cone and calculated using the Kleyn & Van Heerden method:
Log10(CBR) = 2.632–1.28x Log10(mm/blow) and plotted at mid-point of each depth increment

TRL Dynamic Cone Penetrometer CBR Test

Report: **21.03.016**

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

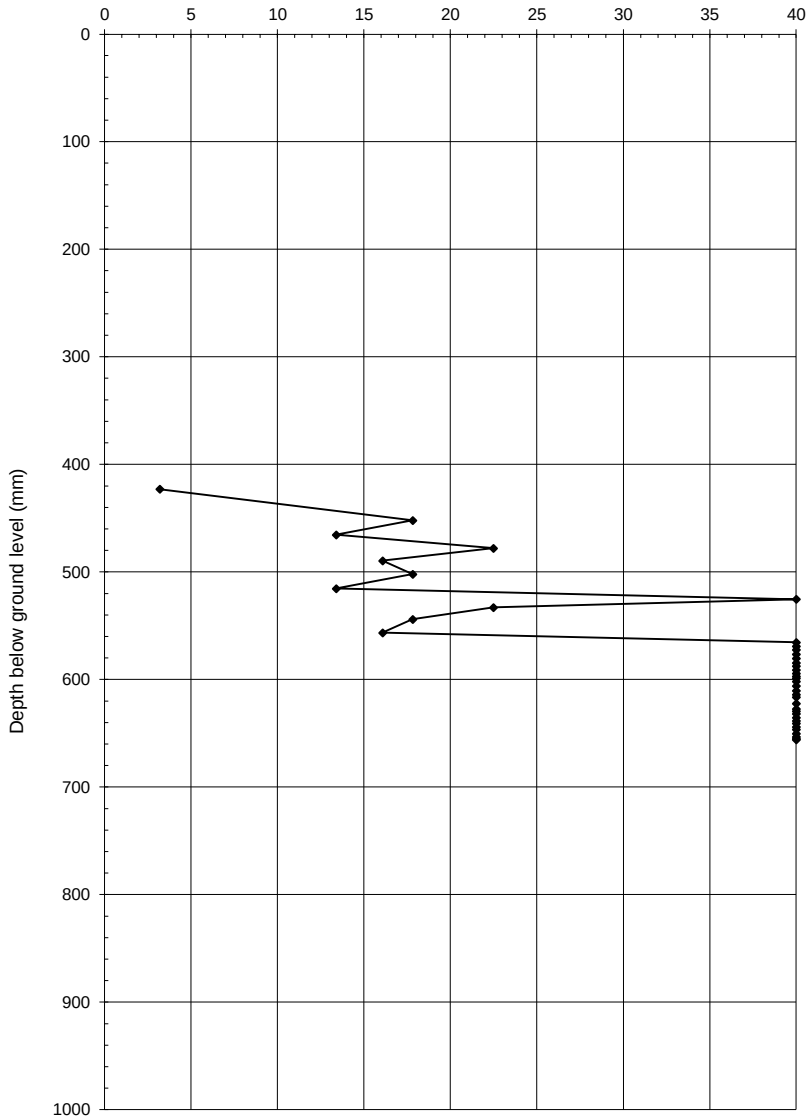
Site : **Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8R**

Test No.: **TRL02**

Date tested: 01/04/2021

Blow Count	Penetration (mm)	mm per blow	Eq. CBR (%)
0	0	0	-
1	46	46	3.2
2	58	12	18
3	73	15	13
4	83	10	22
5	96	13	16
6	108	12	18
7	123	15	13
8	128	5.0	>40
9	138	10	22
10	150	12	18
11	163	13	16
13	168	2.5	>40
14	170	2.0	>40
15	175	5.0	>40
16	178	3.0	>40
17	183	5.0	>40
18	186	3.0	>40
19	189	3.0	>40
20	193	4.0	>40
21	196	3.0	>40
22	198	2.0	>40
23	200	2.0	>40
24	204	4.0	>40
25	208	4.0	>40
26	213	5.0	>40
27	215	2.0	>40
28	218	3.0	>40
33	227	1.8	>40
34	228	1.0	>40
35	231	3.0	>40
36	233	2.0	>40
37	238	5.0	>40
38	239	1.0	>40
39	243	4.0	>40
40	245	2.0	>40
41	248	3.0	>40
42	253	5.0	>40
43	254	1.0	>40
44	256	2.0	>40
45	259	3.0	>40

Plot of Equivalent CBR (%) against Depth



Remarks:

Test commenced from within hand excavated pit at 0.40mbgl

Any data that equates to a CBR of >40% have been calculated and plotted to that value

Tested using 60 degree cone and calculated using the Kleyn & Van Heerden method: Log10(CBR) = 2.632–1.28x Log10(mm/blow) and plotted at mid-point of each depth increment

TRL Dynamic Cone Penetrometer CBR Test

Report: **21.03.016**

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8R

Report No: 21.03.016

Date Tested: 22/04/2021

Test Location: TP01 Test 1

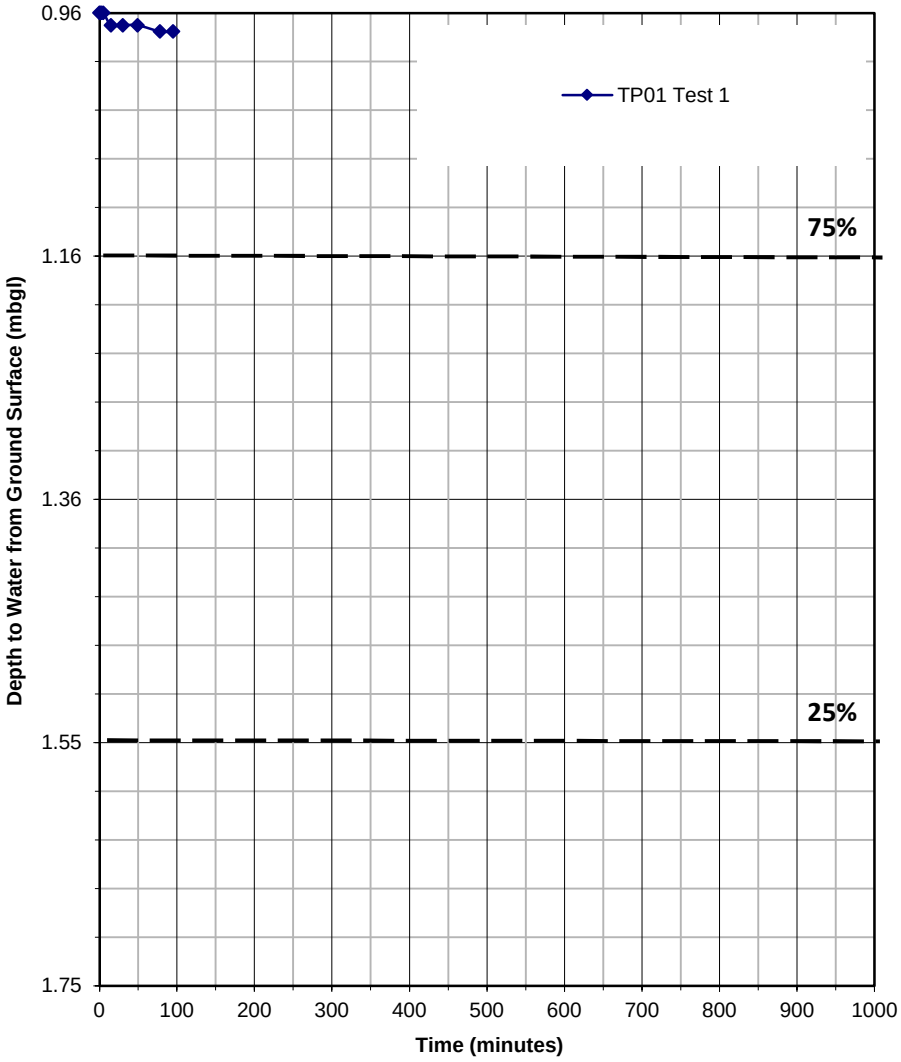
Groundwater: unknown

Dimensions: 0.3mWx1.2mLx1.75mD

Soil Description - test response zone:

0.32m to 1.30m - Soft friable brown sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular o angular flint. Occasional roots.
1.30m to 1.75m - Firm grey mottled orange brown slightly sandy CLAY.

Time (mins)	Depth BGL
0	0.96
1	0.96
3	0.96
5	0.96
15	0.97
30	0.97
49	0.97
78	0.98
95	0.98



Infiltration Rate could not be calculated (0.015m drop in 95 minutes)

TRIAL PIT INFILTRATION TESTING to BRE Digest 365	Report: 21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8R

Report No: 21.03.016

Date Tested: 22/04/2021

Test Location: TP02 Test 1

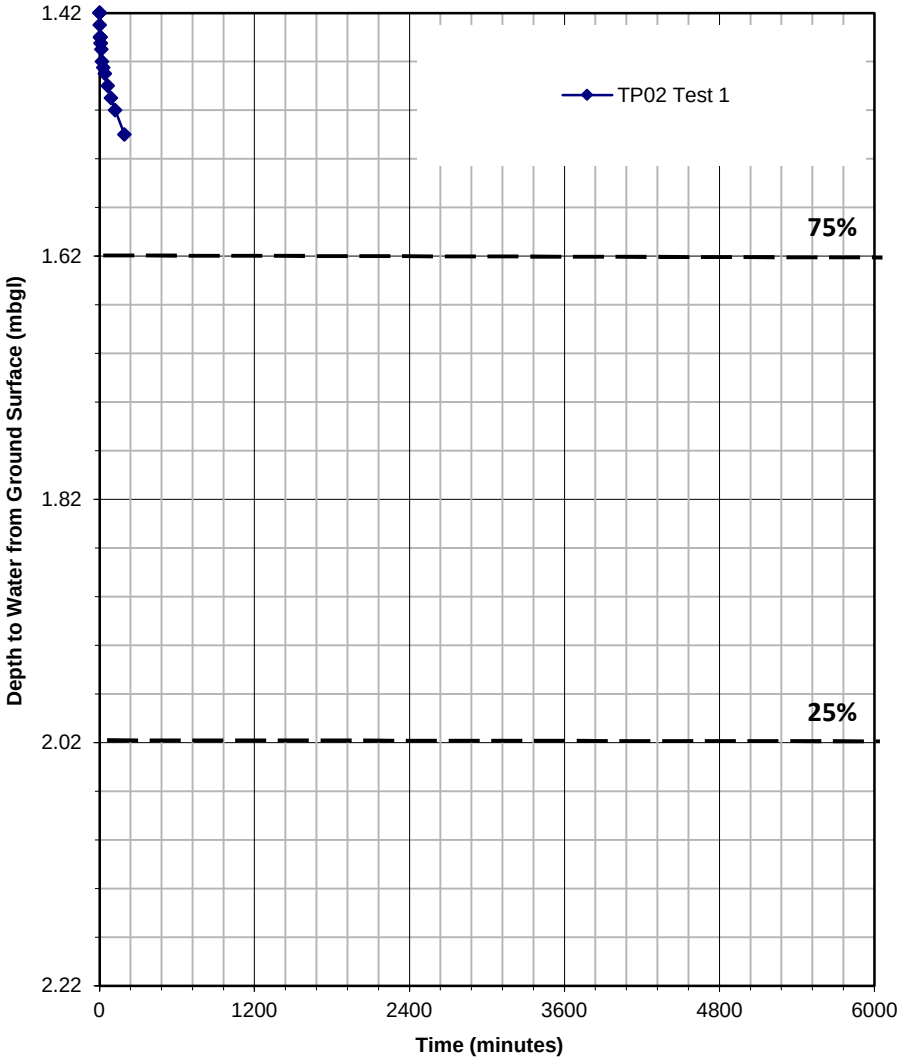
Groundwater: unknown

Dimensions: 0.3mWx1.5mLx2.22mD

Soil Description - test response zone:

0.90m to 1.70m - Soft friable orange brown mottled grey silty sandy CLAY.
1.70m to 2.22m - (Medium dense) orange brown slightly silty gravely SAND. Gravel is fine to coarse sub-rounded flint.

Time (mins)	Depth BGL
0	1.42
1	1.42
2	1.42
3	1.43
4	1.44
5	1.44
6	1.44
7	1.44
8	1.44
9	1.45
10	1.45
15	1.45
20	1.46
30	1.47
42	1.47
63	1.48
90	1.49
122	1.50
194	1.52



Infiltration Rate could not be calculated
(0.10m drop in 194 minutes)

TRIAL PIT INFILTRATION TESTING to BRE Digest 365	Report: 21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Report No: 21.03.016

Date Tested: 22/04/2021

Test Location: TP03 Test 1

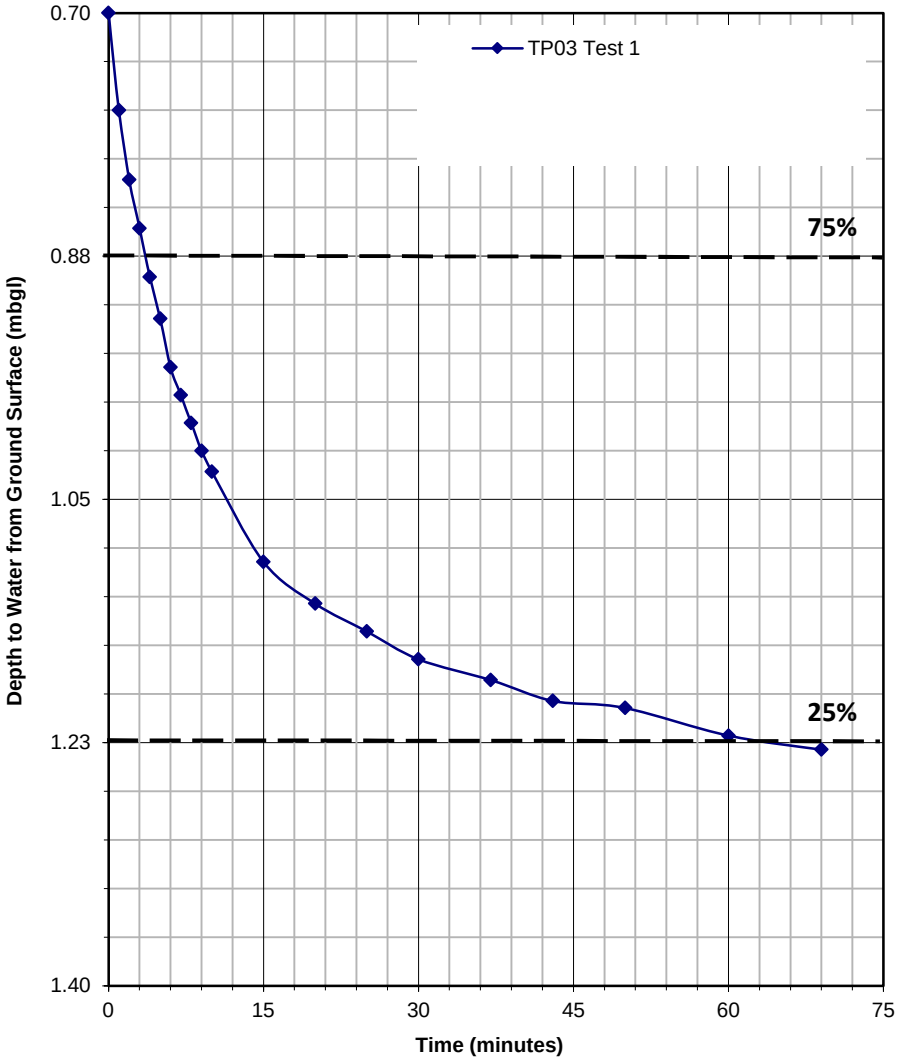
Groundwater: unknown

Dimensions: 0.3mWx1.4mLx1.40mD

Soil Description - test response zone:

0.60m to 1.60m - (Dense) orange brown sandy GRAVEL. Gravel is fine to coarse sub-rounded flint with low similar cobble content

Time (mins)	Depth BGL
0	0.70
1	0.77
2	0.82
3	0.86
4	0.89
5	0.92
6	0.96
7	0.98
8	1.00
9	1.02
10	1.03
15	1.10
20	1.13
25	1.15
30	1.17
37	1.18
43	1.20
50	1.20
60	1.22
69	1.23



Calculated Soil Infiltration Rate, f = 2.5x10^{-5} m/s

TRIAL PIT INFILTRATION TESTING to BRE Digest 365	Report: 21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Report No: 21.03.016

Date Tested: 22/04/2021

Test Location: TP03 Test 2

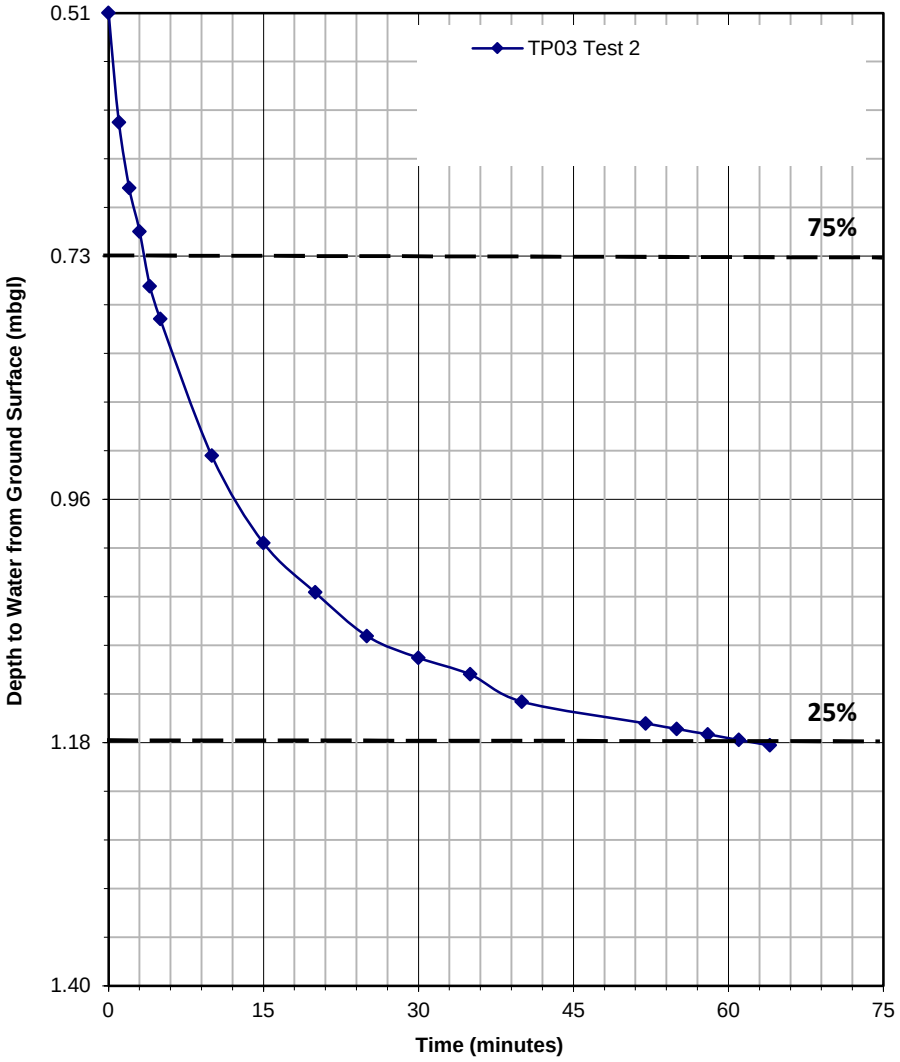
Groundwater: unknown

Dimensions: 0.3mWx1.4mLx1.40mD

Soil Description - test response zone:

0.60m to 1.60m - (Dense) orange brown sandy GRAVEL. Gravel is fine to coarse sub-rounded flint with low similar cobble content

Time (mins)	Depth BGL
0	0.51
1	0.61
2	0.67
3	0.71
4	0.76
5	0.79
10	0.92
15	1.00
20	1.04
25	1.08
30	1.10
35	1.12
40	1.14
52	1.16
55	1.17
58	1.17
61	1.18
64	1.18



Calculated Soil Infiltration Rate, f = 2.7x10^{-5} m/s

TRIAL PIT INFILTRATION TESTING to BRE Digest 365	Report: 21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8R

Report No: 21.03.016

Date Tested: 22/04/2021

Test Location: TP03 Test 3

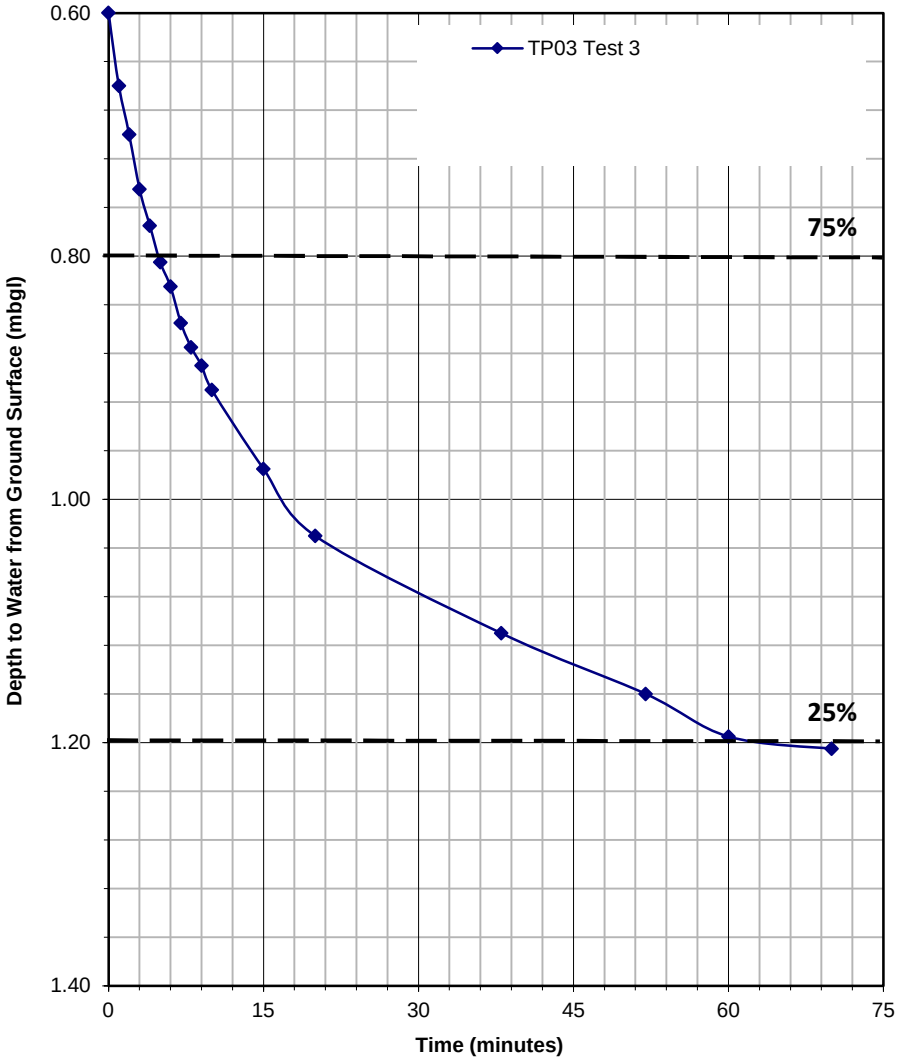
Groundwater: unknown

Dimensions: 0.3mWx1.4mLx1.40mD

Soil Description - test response zone:

0.60m to 1.60m - (Dense) orange brown sandy GRAVEL. Gravel is fine to coarse sub-rounded flint with low similar cobble content

Time (mins)	Depth BGL
0	0.60
1	0.66
2	0.70
3	0.75
4	0.78
5	0.81
6	0.83
7	0.86
8	0.88
9	0.89
10	0.91
15	0.98
20	1.03
38	1.11
52	1.16
60	1.20
70	1.21



Calculated Soil Infiltration Rate, f = 2.6x10^{-5} m/s

TRIAL PIT INFILTRATION TESTING to BRE Digest 365	Report: 21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Project:	Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Date:	22/04/2021	**Ambient air temperature (°C):**	13
Time:	From 11:07 to 11:43	**Barometric pressure (mB):**	1026
Recorded by:	PH	**Barometric trend:**	Rising 24 and 48 hrs prior
Equipment:	Geotech GA5000 gas monitor and dip-meter	**Weather conditions:**	Sunny

Groundwater monitoring

Hole ID	Ground level (mAOD)	Water depth (m)	Water level (mAOD)	Depth of pipe base (m)	Remarks
BH01	+6.65	Dry	-	1.53	
BH02	+6.71	Dry	-	2.10	
WS101	+6.75	Dry	-	5.17	
WS102	+6.70	5.34	+1.36	6.15	

Gas monitoring

Hole ID	Methane CH_4 (%v/v)	Carbon Dioxide CO_2 (%v/v)	Oxygen O_2 (%v/v)	Flow Rate (l/h)	Well Pressure (mBar)	PID* (ppm)	Remarks
BH01	<0.1	0.3	20.1	-0.1	0.12		
BH02	<0.1	0.3	16.8	0.1	0.02		
WS101	<0.1	0.5	20.1	0.0	0.02		
WS102	<0.1	0.4	20.1	-0.1	0.02		

SUMMARY OF GAS & GROUNDWATER MONITORING - 22.Apr.21	**Report No.** 21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Project:	Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Date:	27/04/2021	**Ambient air temperature (°C):**	12
Time:	From 11:55 to 12:26	**Barometric pressure (mB):**	1010
Recorded by:	PH	**Barometric trend:**	Falling 24 and 48 hrs prior
Equipment:	Geotech GA5000 gas monitor and dip-meter	**Weather conditions:**	Sunny

Groundwater monitoring

Hole ID	Ground level (mAOD)	Water depth (m)	Water level (mAOD)	Depth of pipe base (m)	Remarks
BH01	+6.65	Dry	-	1.54	
BH02	+6.71	Dry	-	2.10	
WS101	+6.75	Dry	-	5.17	
WS102	+6.70	5.34	+1.36	6.15	

Gas monitoring

Hole ID	Methane CH_4 (%v/v)	Carbon Dioxide CO_2 (%v/v)	Oxygen O_2 (%v/v)	Flow Rate (l/h)	Well Pressure (mBar)	PID* (ppm)	Remarks
BH01	<0.1	2.1	13.8	0.0	0.02		
BH02	<0.1	0.3	17.0	-0.1	0.02		
WS101	<0.1	2.0	17.1	-0.1	0.03		
WS102	<0.1	1.5	18.0	0.0	0.07		

SUMMARY OF GAS & GROUNDWATER MONITORING - 27.Apr.21	**Report No.** 21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Project:	Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Date:	20/05/2021	**Ambient air temperature (°C):**	12
Time:	From 08:28 to 08:56	**Barometric pressure (mB):**	1017
Recorded by:	PH	**Barometric trend:**	Rising 24 and 48 hrs prior
Equipment:	Geotech GA5000 gas monitor and dip-meter	**Weather conditions:**	Sunny

Groundwater monitoring

Hole ID	Ground level (mAOD)	Water depth (m)	Water level (mAOD)	Depth of pipe base (m)	Remarks
BH01	+6.65	Dry	-	1.53	
BH02	+6.71	Dry	-	2.09	
WS101	+6.75	Dry	-	5.17	
WS102	+6.70	5.34	+1.36	6.15	

Gas monitoring

Hole ID	Methane CH_4 (%v/v)	Carbon Dioxide CO_2 (%v/v)	Oxygen O_2 (%v/v)	Flow Rate (l/h)	Well Pressure (mBar)	PID* (ppm)	Remarks
BH01	<0.1	0.4	20.2	0.6	0.00		
BH02	<0.1	1.0	17.6	0.0	0.02		
WS101	<0.1	1.3	19.2	0.0	0.02		
WS102	<0.1	1.1	19.3	0.1	-0.03		

SUMMARY OF GAS & GROUNDWATER MONITORING - 20.May.21	**Report No.** 21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

APPENDIX C
LABORATORY TEST REPORTS

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone:- 01327 860947/860060 Fax:- 01327 860430 Email: groundtech@listersgeotechnics.co.uk

PROJECT INFORMATION		SAMPLE INFORMATION	
Site Location:-	Mount Hermon Care Home 89 Brighton Road Lancing BN15 8RB	**Laboratory Tests Undertaken:-**	
		TEST TYPE	**TEST METHOD** / **TESTED**
		Natural Water Contents (WC%)	(BS 1377:Part 2:1990 Clause 3.2) ✓
		Liquid Limits (%)	(BS 1377:Part 2:1990 Clause 4.3) ✓
		Plastic Limits (%)	(BS 1377:Part 2:1990 Clause 5.3) ✓
		Plasticity Index (%)	(BS 1377:Part 2:1990 Clause 5.4) ✓
		Linear Shrinkage (%)	(BS 1377:Part 2:1990 Clause 6.5)
		PSD - Wet Sieving	(BS 1377:Part 2:1990 Clause 9.2) ✓
Client Reference:-	-	Engineering Sample Descriptions	(BS 5930 : Section 6)
		Passing 425/63 (μm)	- ✓
		Hydrometer	(BS 1377:Part 2:1990 Clause 9.5)
Date Samples Received:-	6th April 2021	Loss on Ignition (%)	-
Date Testing Completed:-	10th May 2021	Soil Suctions (kPa)	BRE Digest IP 4/93, 1993
		Bulk Density (Mg/m^3)	(BS 1377:Part 2:1990 Clause 7.2)
		Strength Tests	(BS 1377:Part 7:1990 Clause 8 & 9)
		Soluble Sulphate Content (SO_4g/l)	(BS 1377:Part 3:1990 Clause 5.3) ✓
		pH value	(BS 1377:Part 3:1990 Clause 9.4) ✓
		California Bearing Ratios (CBR)	(BS 1377:Part 4:1990 Clause 7)
		Compaction Tests	(BS 1377:Part 4:1990 Clauses 3.0-3.6)
The results relate only to the samples tested			

This test-report may not be reproduced, except with full and written approval of GROUNDTECH LABORATORIES

Laboratory testing in accord with BS EN ISO/IEC 17025-2000 and Quality Management in accord with ISO 9001

Signed on behalf of GroundTech Laboratories:-_____ Technical Signatory

Quality Assured to ISO 9001

GEOTECHNICAL LABORATORY TEST RESULTS

Report No: 21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	WC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	WC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m³	Test Type	Cell Pressure kN/m²	Deviator Stress kN/m²	Apparent Cohesion kN/m²	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
BH 01	D	0.30		11																				
	D	1.00	PI/63	19	36	21	15	99	15	CI	95	0.53	23	-0.13										
	D	1.20		16																				
	D	1.70		12																			7.0	0.13
	D	2.00	PSD	12																				
	D	3.00		16																				
	D	4.10	PSD	12																			7.3	0.12
	D	5.00		4.5																				
	D	6.10		5.6																				
	D	7.00	PSD	3.9																				
	D	8.00		10																				
	D	9.50	PI/63	25	54	20	34	97	33	CH	88	0.46	22	0.15										
BH 02	D	0.50		12																			8.0	0.12
	D	1.00	PI/63	16	31	19	12	54	6	CL	44	0.52	21	-0.25										
	D	1.20		1.3																				
	D	1.90	PSD	3.7																				
	D	3.10		3.9																				
	D	4.00	PSD	27																				
	D	4.50		10																				
	D	5.00		4																				
	D	6.10		4.8																				
	D	7.20	PSD	5.6																				
	B	7.50		7.1																				

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	WC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	WC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m³	Test Type	Cell Pressure kN/m²	Deviator Stress kN/m²	Apparent Cohesion kN/m²	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
BH 02	D	8.10		5.2																				
	D	8.60		25																			7.5	0.15
	D	8.90		26																				
	D	9.50	PI/63	28	63	26	37	99	37	CH	95	0.44	28	0.05										
CT 01	D	0.10		23																				
	D	0.50		14																				
	D	0.90		24																			7.7	0.23
	D	1.30	PI/63	17	23	15	8	86	7	CL	49	0.74	17	0.25										
	D	1.50		7																				
	D	2.00		5.4																				
	D	2.50	PSD	6.3																				
	D	3.00		5.4																				
	D	3.50		6.4																				
	D	4.00		3.8																				
	D	4.50		6.5																				
	D	5.00		5.6																				
	D	5.50	PSD	11																				
CT 02	D	0.10		17																				
	D	0.30		14																				
	D	0.50	PSD	6.7																				
	D	0.90		6																				
	D	1.50	PSD	6																			7.5	0.13
CT 03	D	0.20		21																				

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	WC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	WC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m³	Test Type	Cell Pressure kN/m²	Deviator Stress kN/m²	Apparent Cohesion kN/m²	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
CT 03	D	0.55		18																				
	D	0.75		8.1																				
	D	1.00	PSD	11																				
	D	1.60		11																				
	D	2.00		6.5																				
	D	2.50		5.7																				
	D	3.00	PSD	6.4																			7.8	0.38
	D	3.50		4.2																				
	D	4.00		4.8																				
	D	4.50		6.3																				
	D	5.00		6.6																				
	D	5.50	PSD	14																				
HP 01	D	0.20		26																				
	D	0.50		19																				
	D	0.70	PSD	11																				
HP 02	D	0.20		17																				
	D	0.40		20																				
	D	0.60	PI/63	17	31	17	14	84	12	CL	72	0.55	19	0.00										
	D	0.85		16																				
HP 03	D	0.00		8																				
	D	0.40		14																				
	D	0.60		20																				
	D	0.80	PI/63	19	28	16	12	97	12	CL	74	0.68	18	0.25									7.6	0.29

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	WC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	WC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m³	Test Type	Cell Pressure kN/m²	Deviator Stress kN/m²	Apparent Cohesion kN/m²	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
HP 03	D	1.10		19																				
HP 04	D	0.25		5.8																				
	D	0.50		20																				
	D	0.90		23																				
	D	1.10	PI/63	16	31	18	13	94	12	CL	85	0.52	20	-0.15										
HP 05	D	0.10		6.5																				
	D	0.20		14																				
	D	0.50		21																			7.1	0.10
	D	0.80		21																				
	D	1.10	PI/63	22	33	19	14	97	14	CL	91	0.67	21	0.21										
	D	1.30		16																				
	D	1.50	PI/63	17	24	14	10	99	10	CL	55	0.71	16	0.30										
TP 01	D	0.30		16																				
	D	0.60		22																				
	D	1.00	PI/63	22	35	20	15	99	15	CL	96	0.63	22	0.13										
	D	1.50		22																				
	D	1.70	PSD	22																				
TP 02	D	0.30		18																				
	D	0.60		15																				
	D	0.80	PSD	23																			7.8	0.29
	D	1.20		17																				
	D	2.00	PSD	11																				
TP 03	D	0.20		18																				

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	WC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	WC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m³	Test Type	Cell Pressure kN/m²	Deviator Stress kN/m²	Apparent Cohesion kN/m²	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
TP 03	D	0.50		21																				
	D	1.00		6.6																				
	D	1.50	PSD	7.7																				

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: BH 01

Sample Depth: 2.00m

Sample Description:

Hydrometer No.:

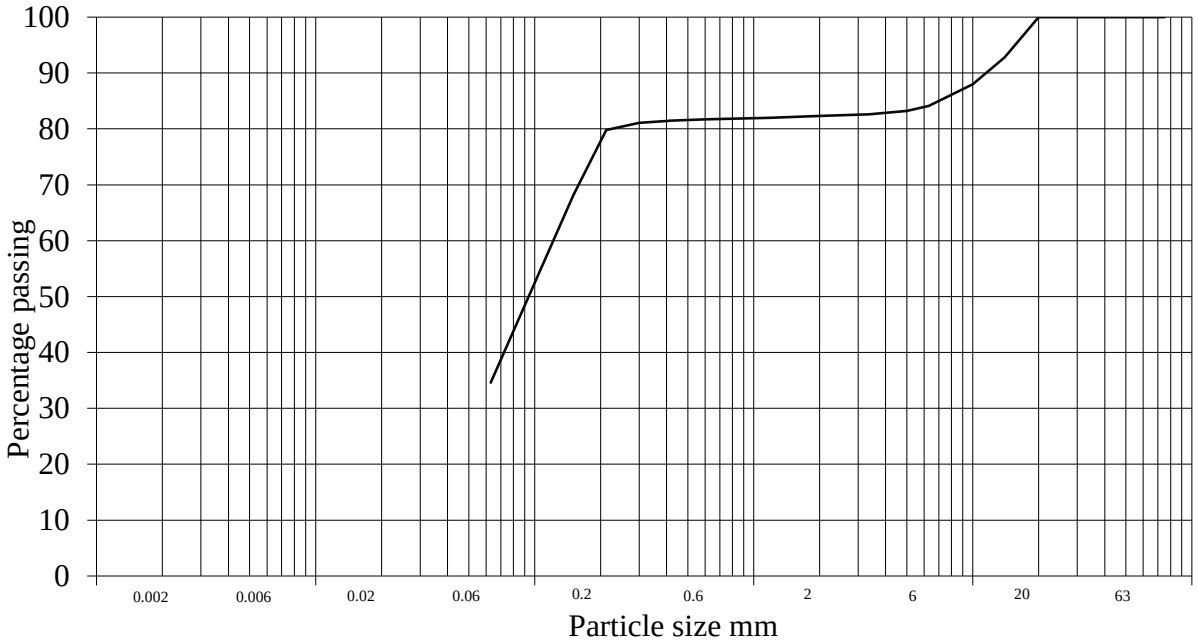
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	92.80		
10mm	88.00		
6.3mm	84.10		
5mm	83.20		
3.5mm	82.60		
2mm	82.30		
1.18mm	82.00		
600µm	81.70		
425µm	81.50		
300µm	81.10		
212µm	79.80		
150µm	68.10		
63µm	34.60		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
35%				48%			18%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: BH 01

Sample Depth: 4.10m

Sample Description:

Hydrometer No.:

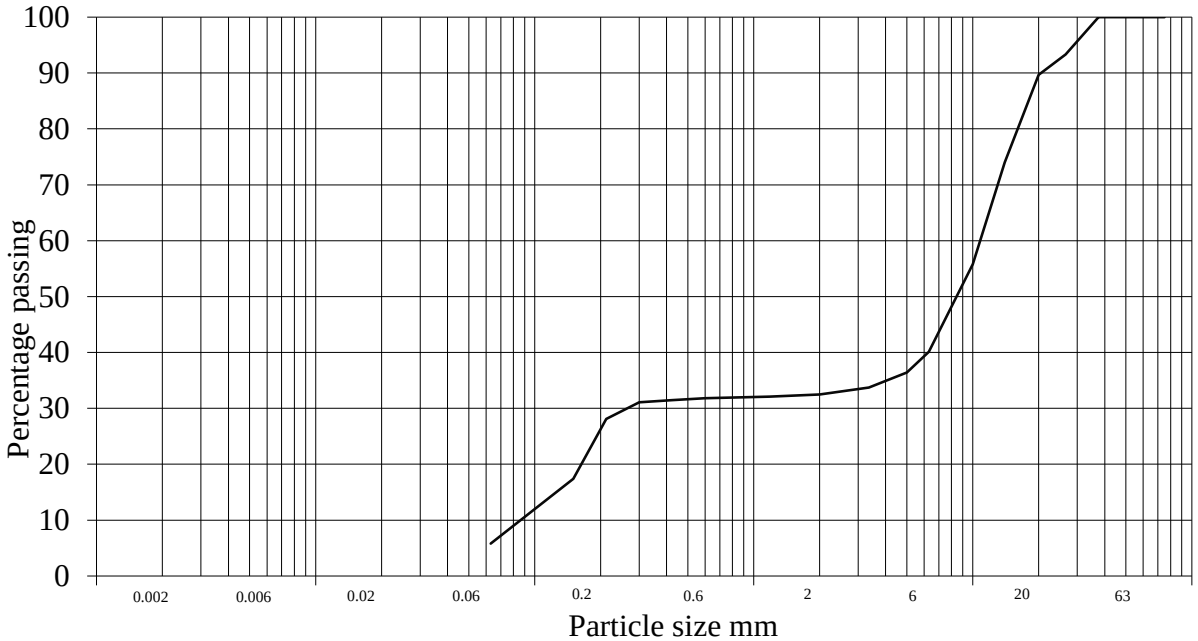
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	93.30		
20mm	89.70		
14mm	74.00		
10mm	55.80		
6.3mm	40.10		
5mm	36.40		
3.5mm	33.70		
2mm	32.50		
1.18mm	32.10		
600µm	31.80		
425µm	31.50		
300µm	31.10		
212µm	28.10		
150µm	17.40		
63µm	5.80		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
6%				27%			68%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: BH 01

Sample Depth: 7.00m

Sample Description:

Hydrometer No.:

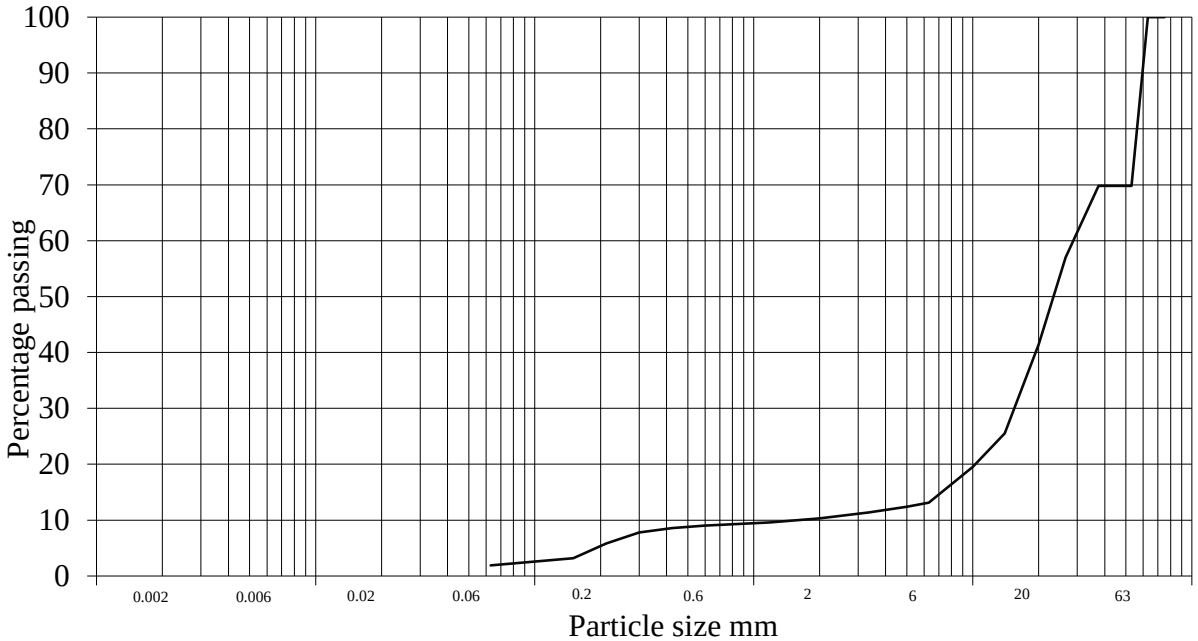
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	69.80		
37.5mm	69.80		
26.5mm	57.00		
20mm	41.40		
14mm	25.50		
10mm	19.50		
6.3mm	13.10		
5mm	12.40		
3.5mm	11.40		
2mm	10.30		
1.18mm	9.60		
600µm	9.00		
425µm	8.60		
300µm	7.80		
212µm	5.80		
150µm	3.20		
63µm	1.90		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
2%				8%			90%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: BH 02

Sample Depth: 1.90m

Sample Description:

Hydrometer No.:

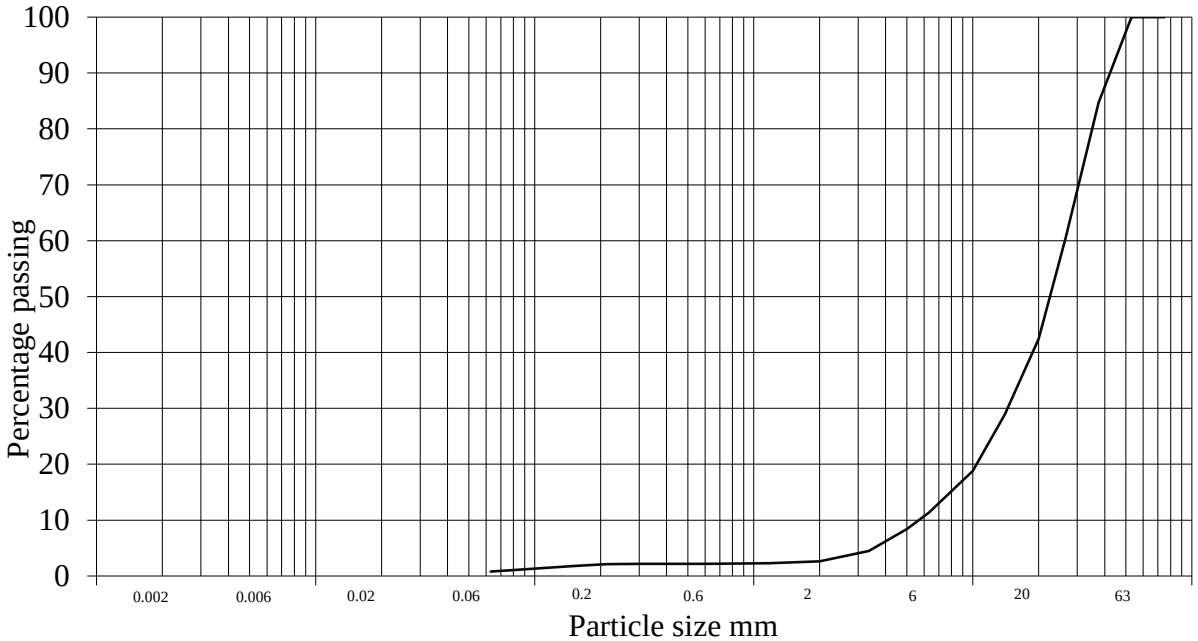
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	84.70		
26.5mm	60.50		
20mm	42.40		
14mm	28.90		
10mm	18.80		
6.3mm	11.30		
5mm	8.40		
3.5mm	4.50		
2mm	2.60		
1.18mm	2.30		
600µm	2.20		
425µm	2.20		
300µm	2.20		
212µm	2.10		
150µm	1.80		
63µm	0.80		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
1%				2%			97%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: BH 02

Sample Depth: 4.00m

Sample Description:

Hydrometer No.:

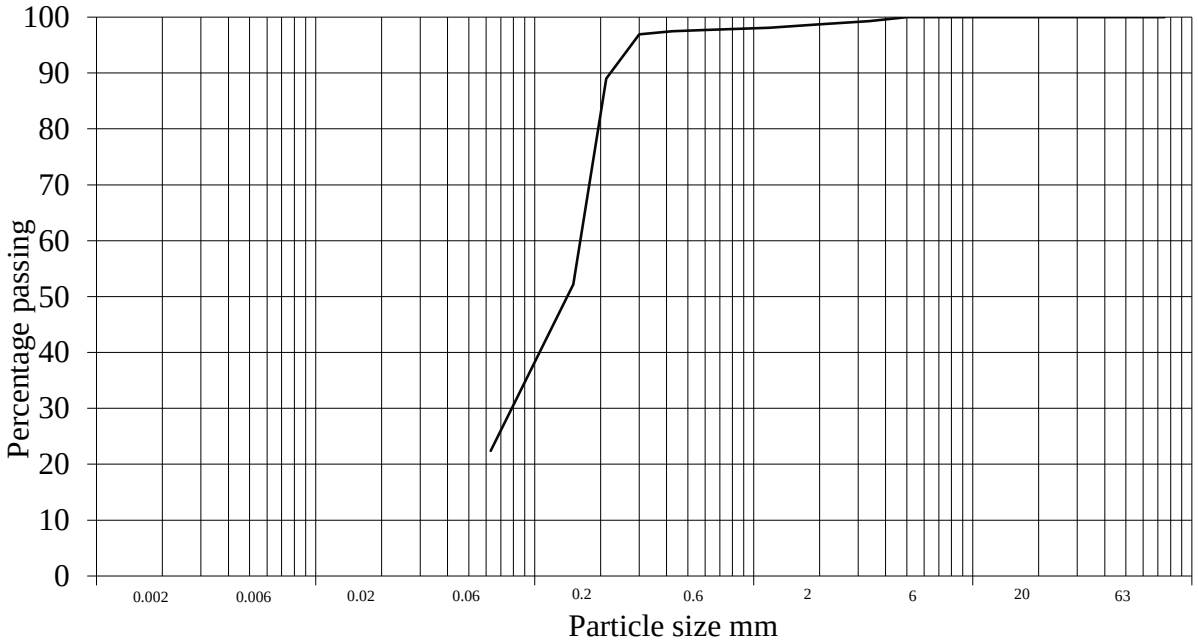
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	100.00		
5mm	100.00		
3.5mm	99.30		
2mm	98.70		
1.18mm	98.10		
600µm	97.70		
425µm	97.50		
300µm	96.90		
212µm	89.00		
150µm	52.20		
63µm	22.40		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
22%				76%			1%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: BH 02

Sample Depth: 7.20m

Sample Description:

Hydrometer No.:

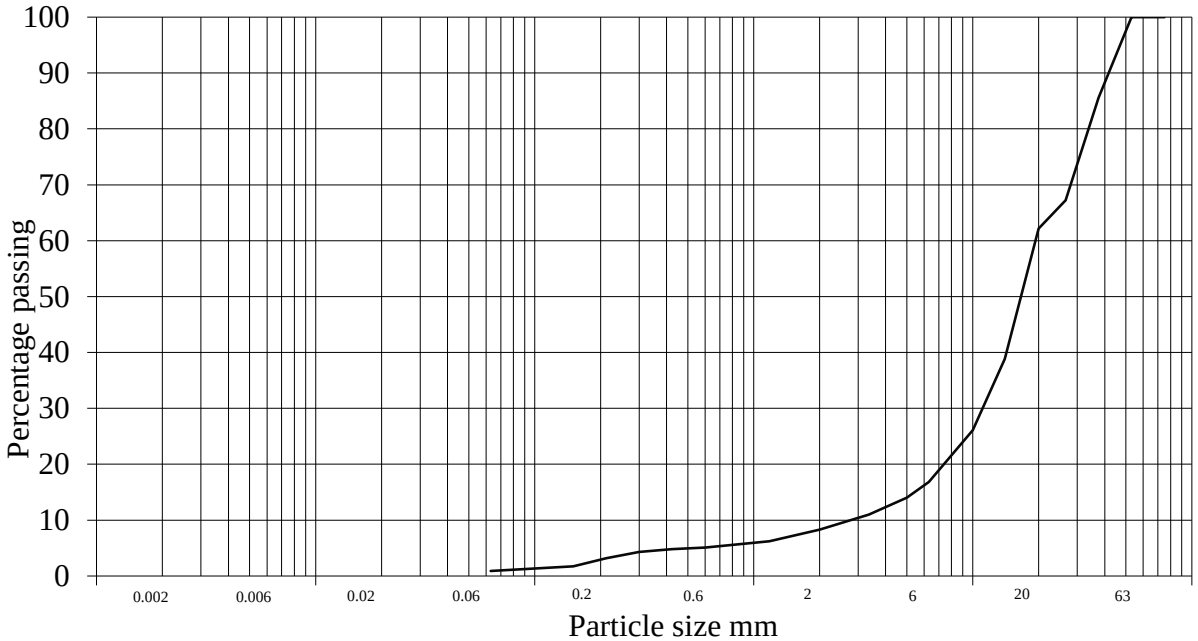
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	85.60		
26.5mm	67.20		
20mm	62.20		
14mm	38.80		
10mm	26.10		
6.3mm	16.80		
5mm	14.00		
3.5mm	11.00		
2mm	8.30		
1.18mm	6.20		
600µm	5.10		
425µm	4.80		
300µm	4.30		
212µm	3.20		
150µm	1.70		
63µm	0.90		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
1%				7%			92%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: CT 01

Sample Depth: 2.50m -3.00m

Sample Description:

Hydrometer No.:

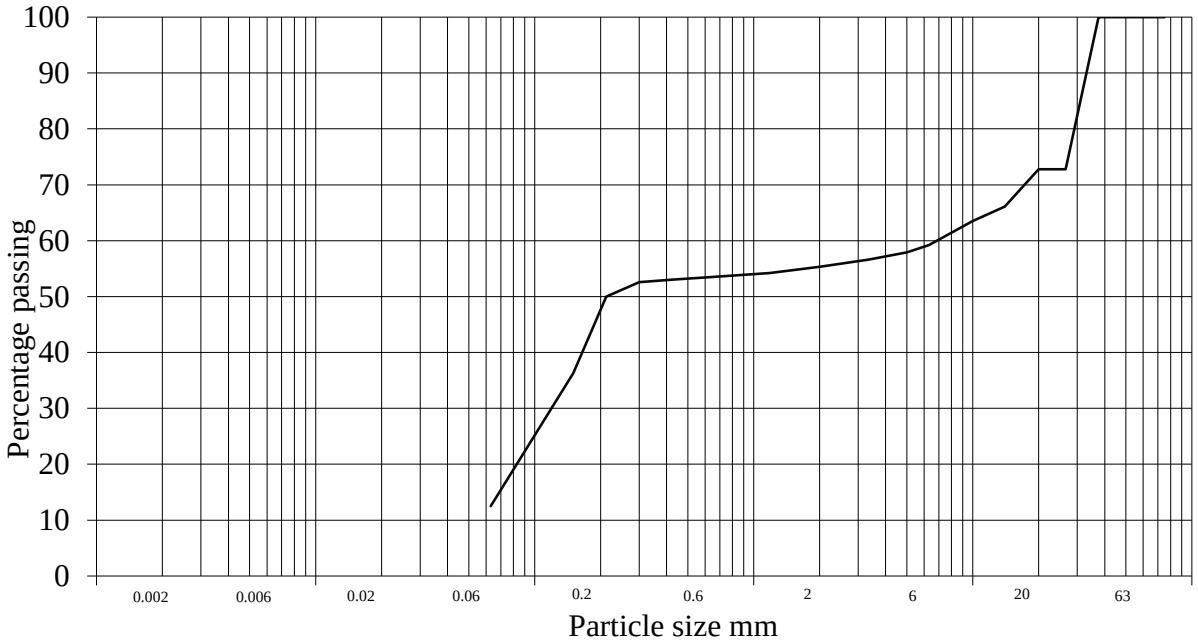
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	72.80		
20mm	72.80		
14mm	66.10		
10mm	63.50		
6.3mm	59.20		
5mm	57.90		
3.5mm	56.60		
2mm	55.30		
1.18mm	54.20		
600µm	53.40		
425µm	53.00		
300µm	52.60		
212µm	50.00		
150µm	36.30		
63µm	12.50		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
13%				43%			45%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: CT 01

Sample Depth: 5.50m -6.00m

Sample Description:

Hydrometer No.:

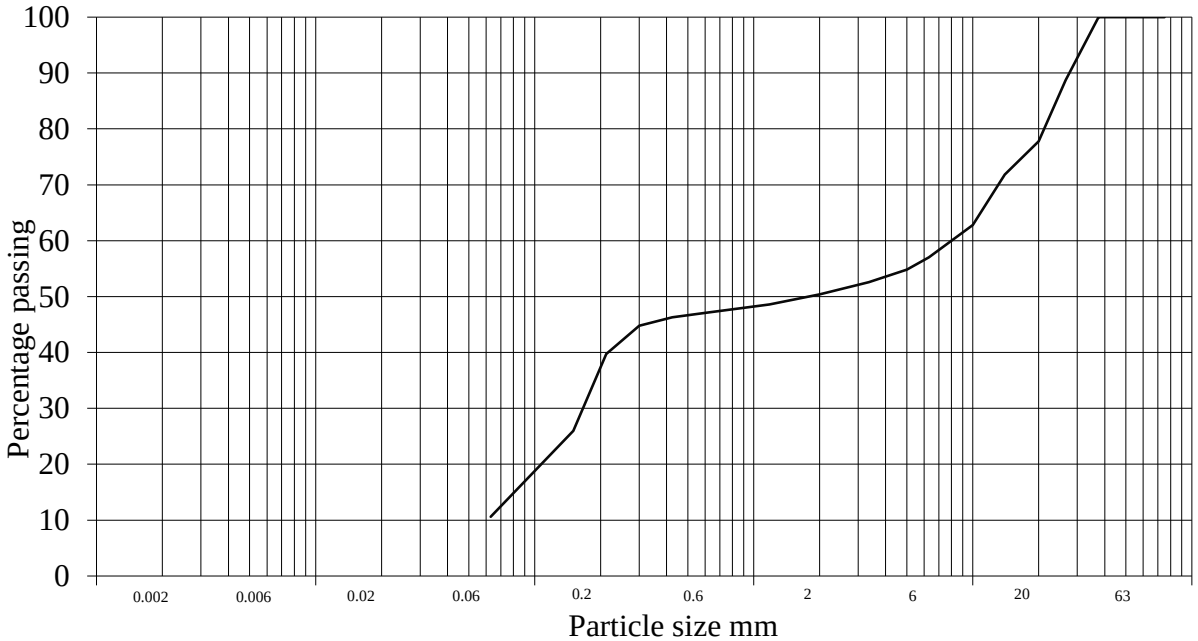
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	88.70		
20mm	77.80		
14mm	71.80		
10mm	62.80		
6.3mm	57.00		
5mm	54.80		
3.5mm	52.60		
2mm	50.40		
1.18mm	48.60		
600µm	47.10		
425µm	46.30		
300µm	44.80		
212µm	39.70		
150µm	26.00		
63µm	10.60		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
11%				40%			50%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference 21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: CT 02

Sample Depth: 0.50m -0.90m

Sample Description:

Hydrometer No.:

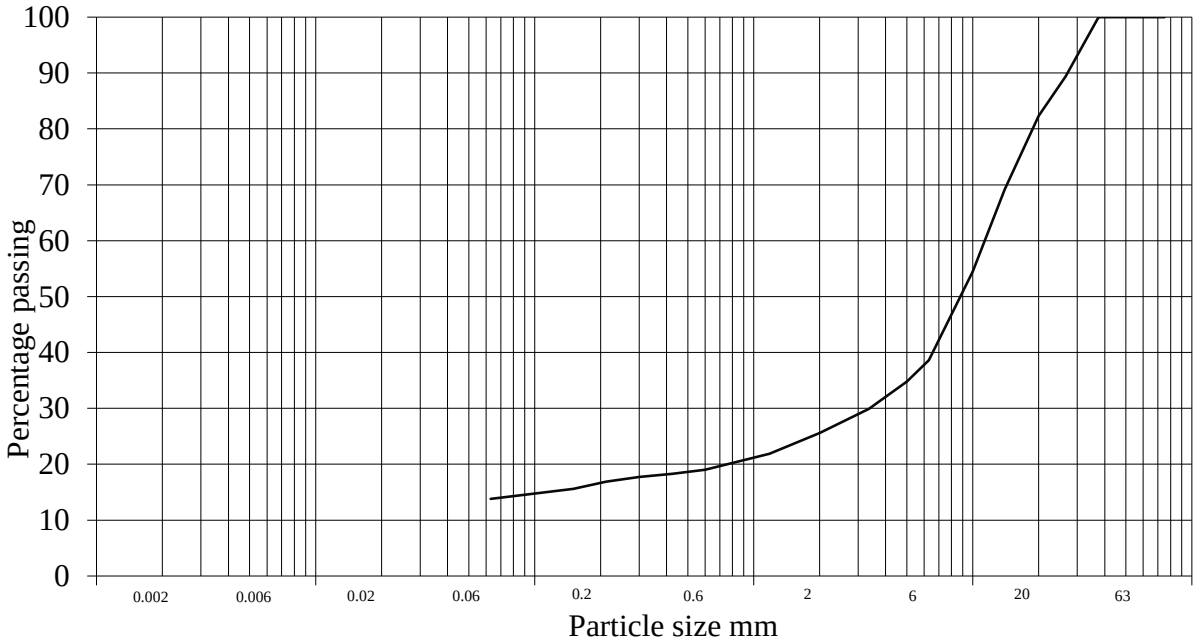
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	89.40		
20mm	82.30		
14mm	69.20		
10mm	54.50		
6.3mm	38.60		
5mm	34.80		
3.5mm	29.90		
2mm	25.60		
1.18mm	21.90		
600µm	19.00		
425µm	18.30		
300µm	17.70		
212µm	16.90		
150µm	15.60		
63µm	13.80		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
14%				12%			74%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: CT 02

Sample Depth: 1.50m -2.00m

Sample Description:

Hydrometer No.:

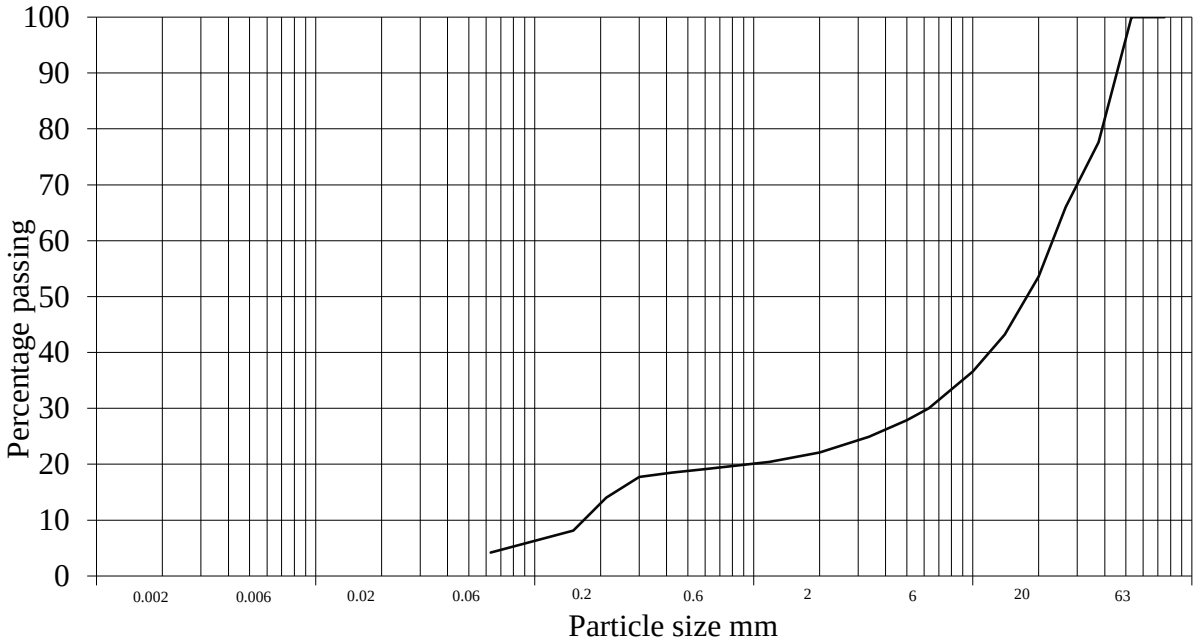
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	77.60		
26.5mm	66.00		
20mm	53.60		
14mm	43.20		
10mm	36.60		
6.3mm	30.00		
5mm	27.90		
3.5mm	24.90		
2mm	22.10		
1.18mm	20.40		
600µm	19.10		
425µm	18.50		
300µm	17.70		
212µm	14.00		
150µm	8.10		
63µm	4.20		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
4%				18%			78%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference 21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: CT 03

Sample Depth: 1.00m -1.60m

Sample Description:

Hydrometer No.:

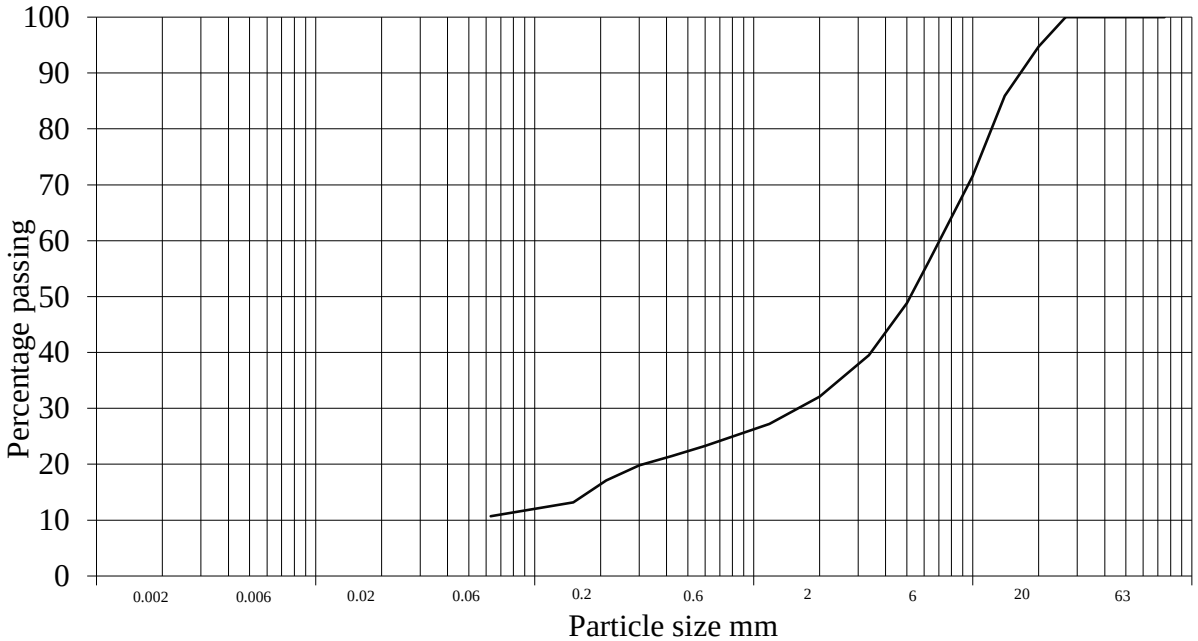
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	94.70		
14mm	85.90		
10mm	71.60		
6.3mm	56.30		
5mm	48.80		
3.5mm	39.50		
2mm	32.10		
1.18mm	27.20		
600µm	23.30		
425µm	21.50		
300µm	19.80		
212µm	17.10		
150µm	13.20		
63µm	10.70		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
11%				21%			68%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference 21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: CT 03

Sample Depth: 3.00m -3.50m

Sample Description:

Hydrometer No.:

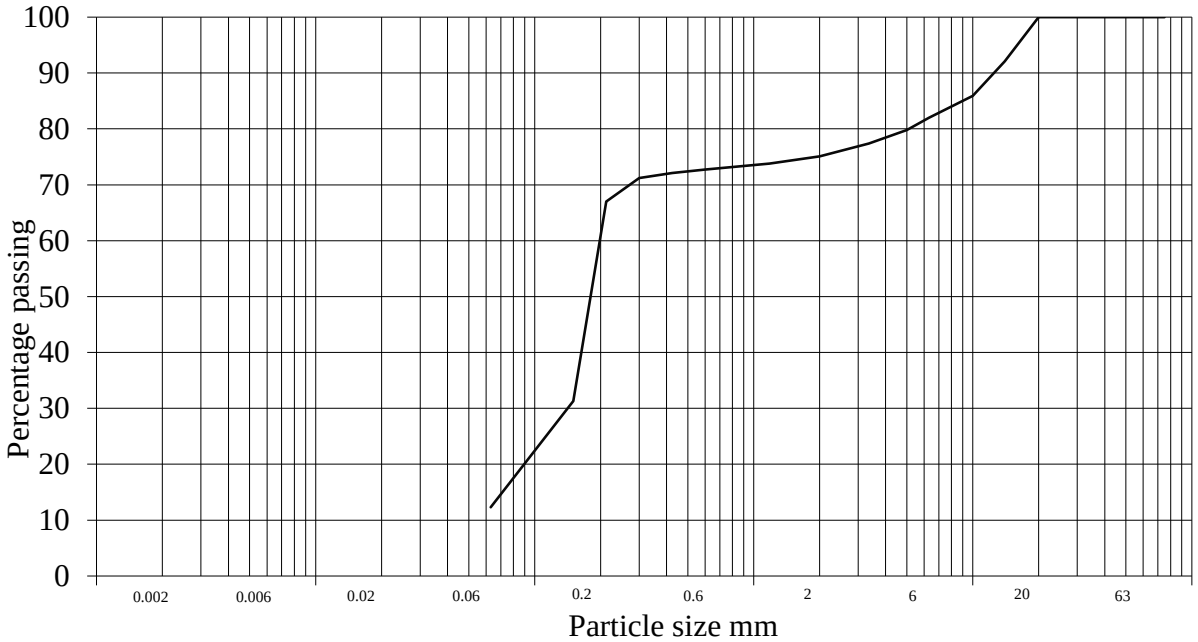
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	92.10		
10mm	85.90		
6.3mm	82.00		
5mm	79.80		
3.5mm	77.40		
2mm	75.10		
1.18mm	73.80		
600µm	72.70		
425µm	72.10		
300µm	71.20		
212µm	67.00		
150µm	31.30		
63µm	12.30		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
12%				63%			25%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference 21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: CT 03

Sample Depth: 5.50m -6.00m

Sample Description:

Hydrometer No.:

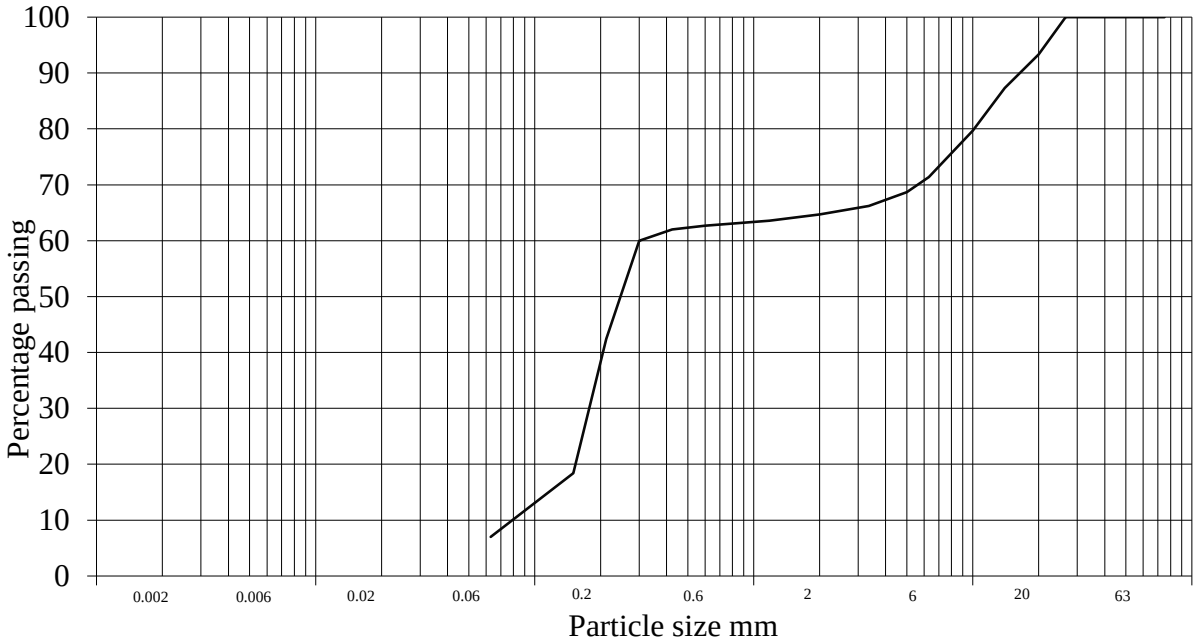
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	93.30		
14mm	87.30		
10mm	79.70		
6.3mm	71.40		
5mm	68.70		
3.5mm	66.20		
2mm	64.70		
1.18mm	63.60		
600µm	62.70		
425µm	62.00		
300µm	60.00		
212µm	42.40		
150µm	18.40		
63µm	7.00		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
7%				58%			35%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: HP 01

Sample Depth: 0.70m

Sample Description:

Hydrometer No.:

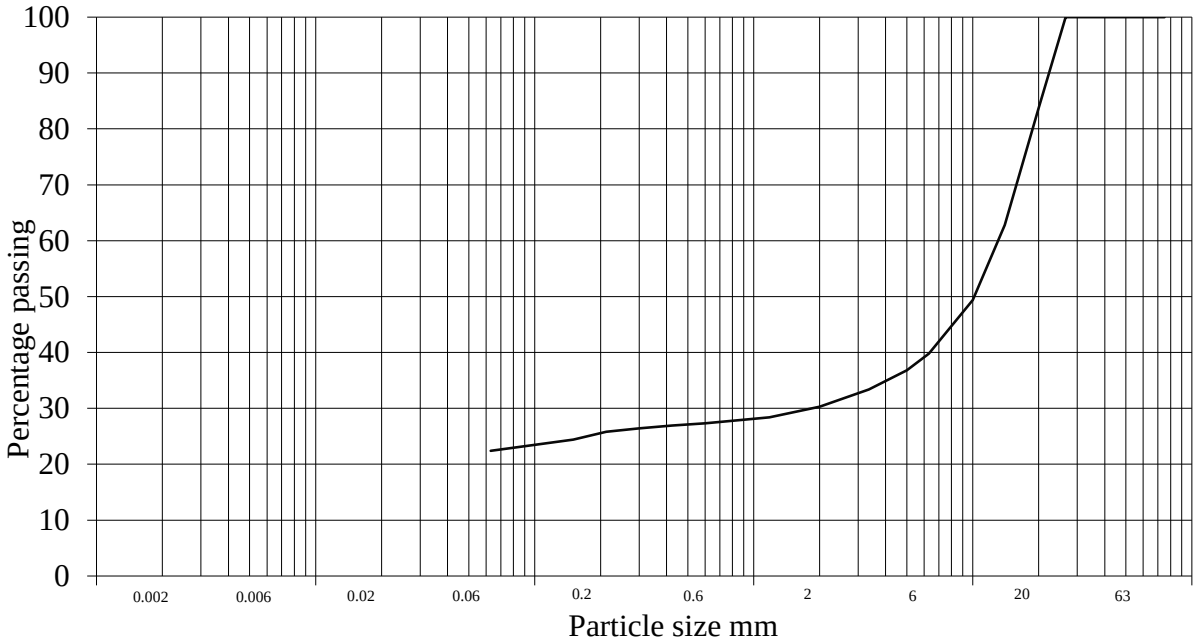
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	83.70		
14mm	62.80		
10mm	49.40		
6.3mm	39.80		
5mm	36.80		
3.5mm	33.40		
2mm	30.30		
1.18mm	28.40		
600µm	27.30		
425µm	26.90		
300µm	26.40		
212µm	25.80		
150µm	24.40		
63µm	22.40		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
22%				8%			70%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference 21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: TP 01

Sample Depth: 1.70m

Sample Description:

Hydrometer No.:

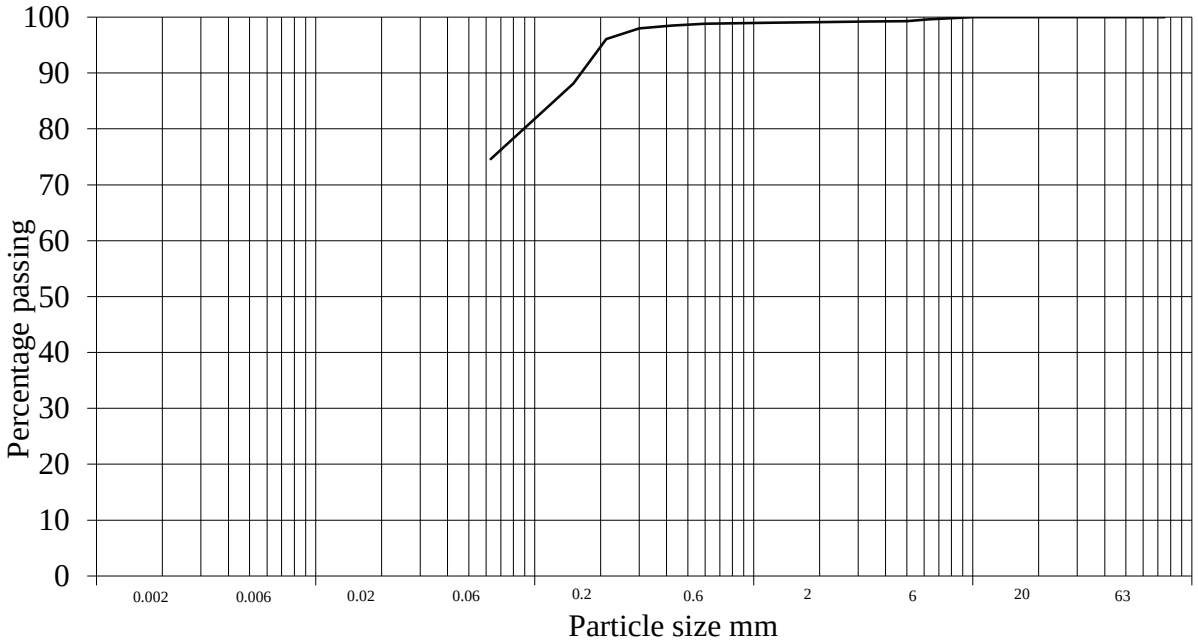
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	99.60		
5mm	99.30		
3.5mm	99.20		
2mm	99.10		
1.18mm	99.00		
600µm	98.80		
425µm	98.50		
300µm	98.00		
212µm	96.10		
150µm	88.10		
63µm	74.60		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
75%				25%			1%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference 21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: TP 02

Sample Depth: 0.80m

Sample Description:

Hydrometer No.:

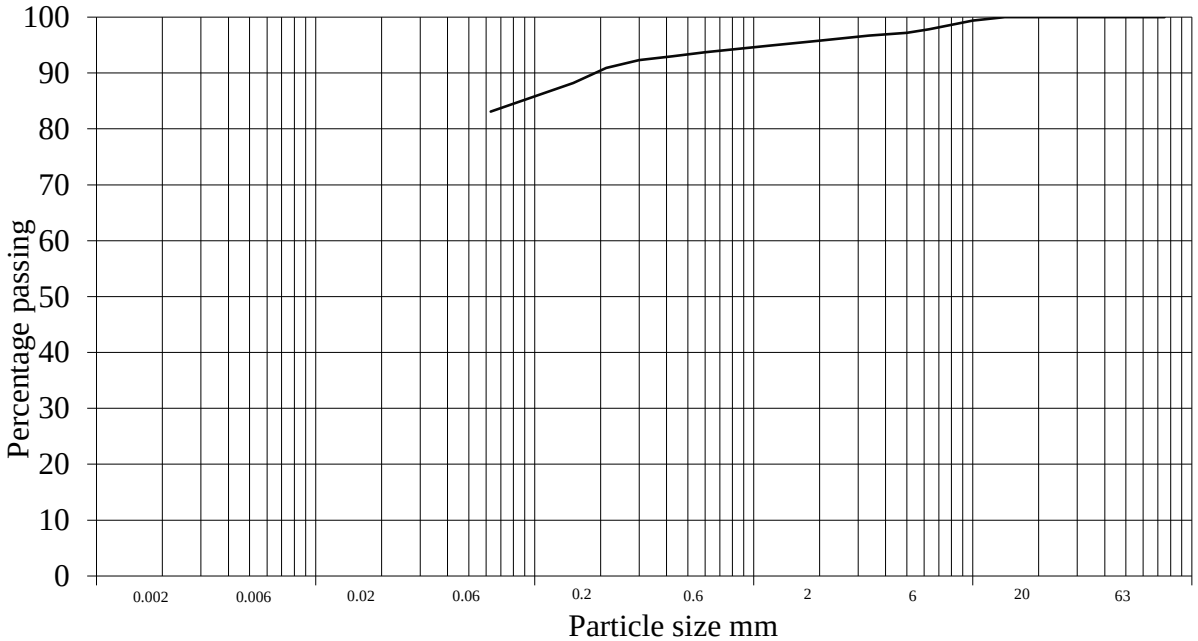
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	99.40		
6.3mm	97.80		
5mm	97.20		
3.5mm	96.70		
2mm	95.80		
1.18mm	94.90		
600µm	93.70		
425µm	93.00		
300µm	92.30		
212µm	90.90		
150µm	88.20		
63µm	83.10		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
83%				13%			4%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: TP 02

Sample Depth: 2.00m

Sample Description:

Hydrometer No.:

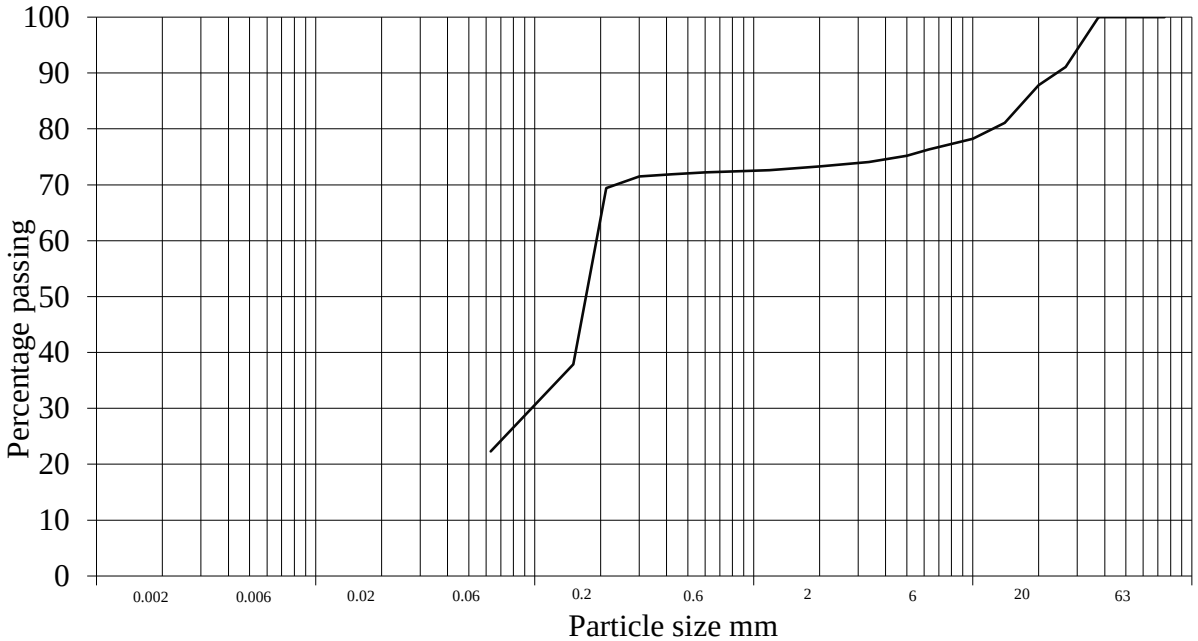
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	91.10		
20mm	87.80		
14mm	81.10		
10mm	78.20		
6.3mm	76.30		
5mm	75.20		
3.5mm	74.10		
2mm	73.30		
1.18mm	72.60		
600µm	72.20		
425µm	71.90		
300µm	71.50		
212µm	69.40		
150µm	37.90		
63µm	22.30		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
22%				51%			27%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB

Test Location: TP 03

Sample Depth: 1.50m

Sample Description:

Hydrometer No.:

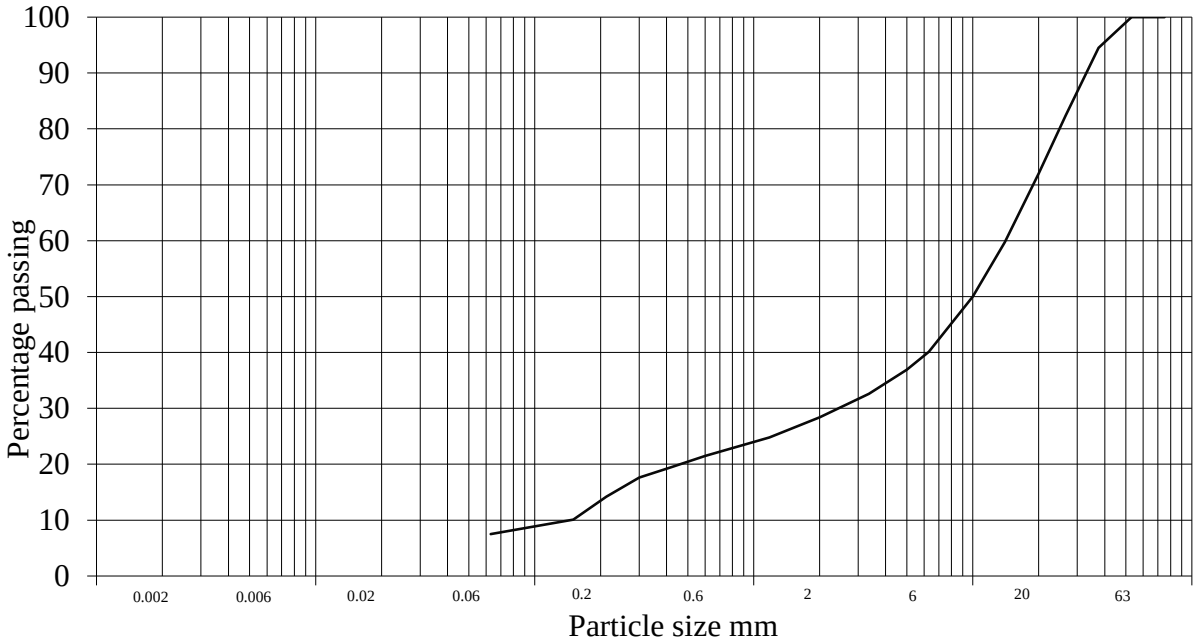
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

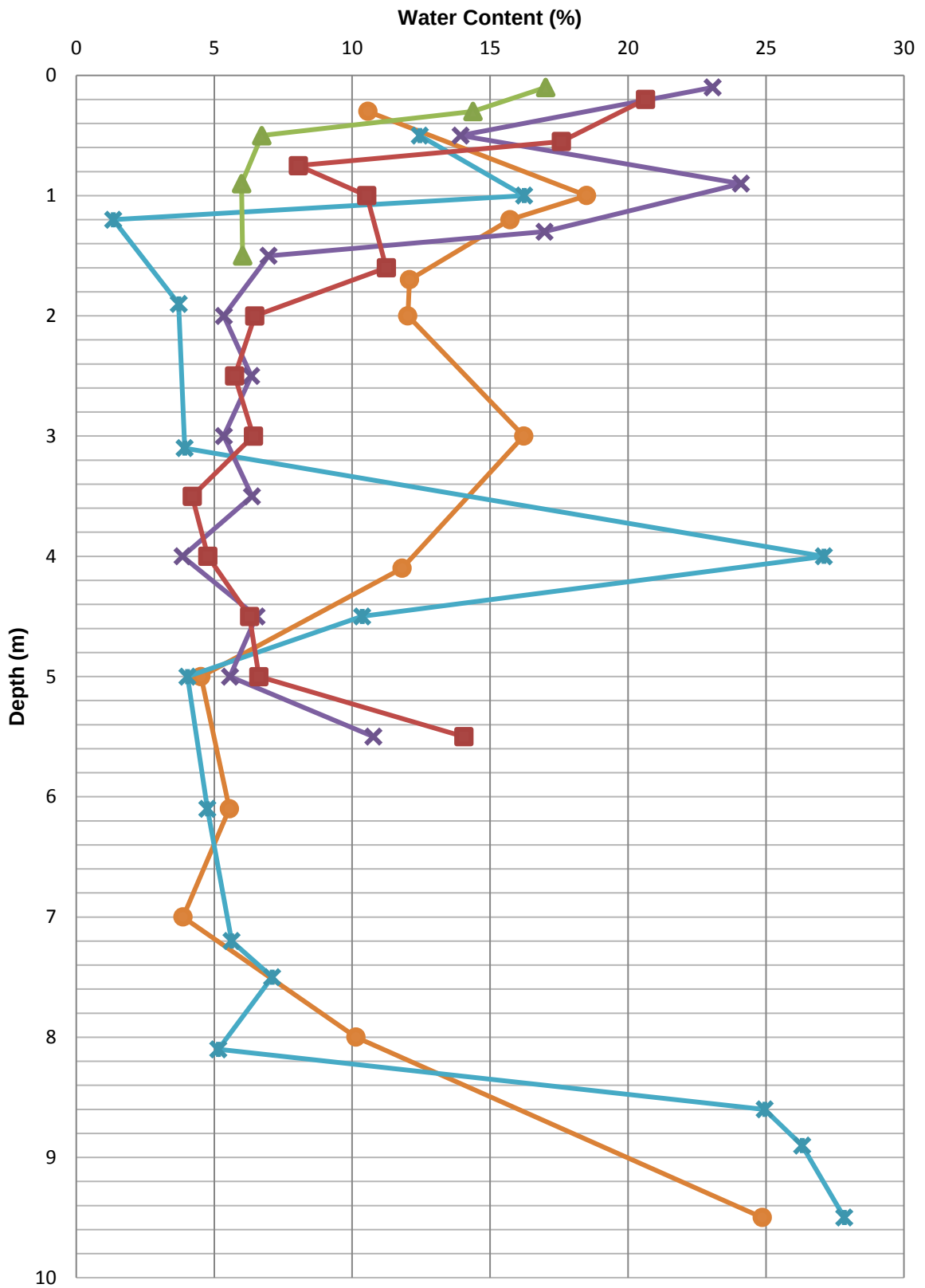
BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	94.50		
26.5mm	82.40		
20mm	72.00		
14mm	59.70		
10mm	50.00		
6.3mm	40.10		
5mm	36.90		
3.5mm	32.60		
2mm	28.40		
1.18mm	24.80		
600µm	21.50		
425µm	19.50		
300µm	17.60		
212µm	14.20		
150µm	10.10		
63µm	7.50		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
8%				21%			72%			0%

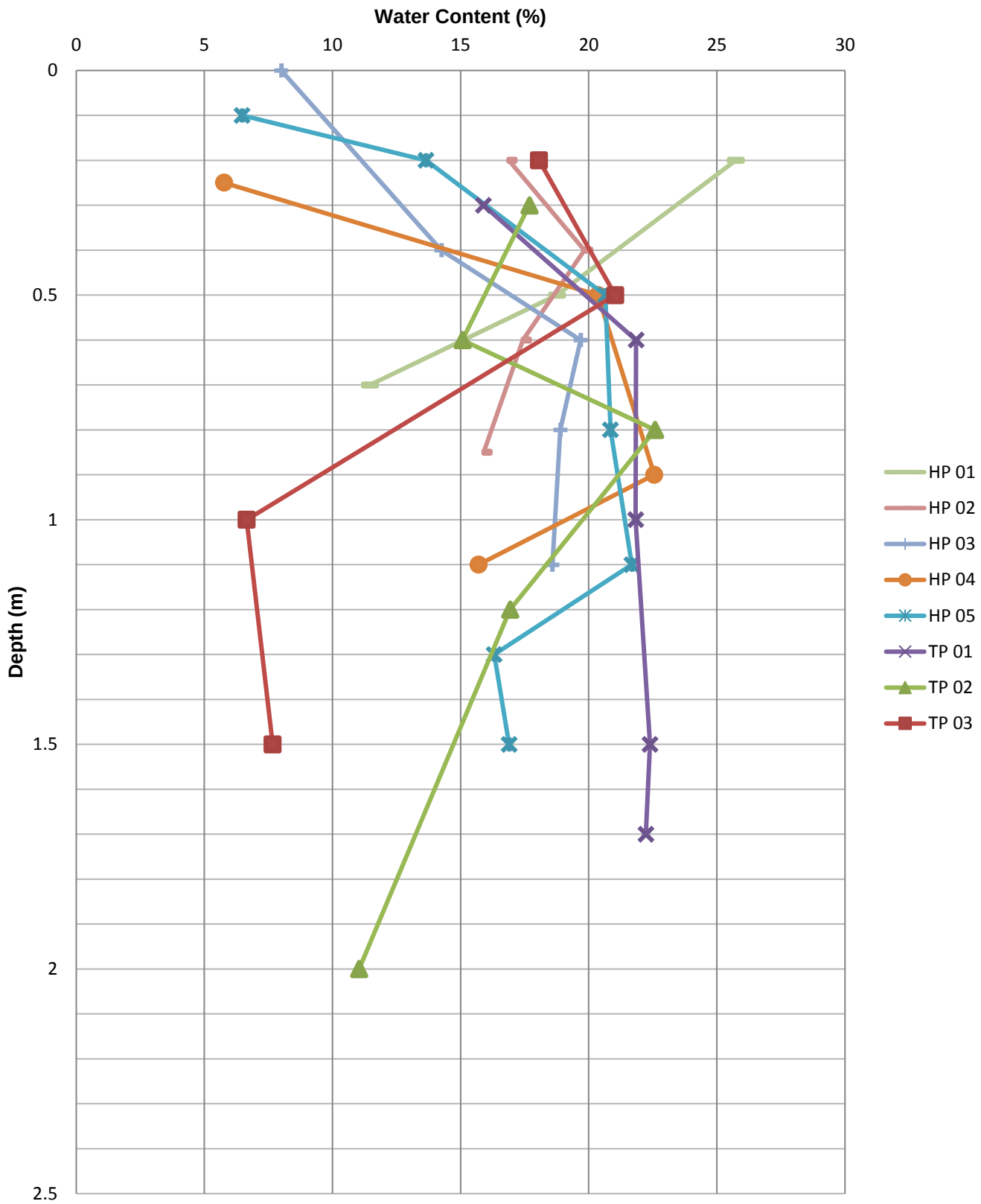
PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.016

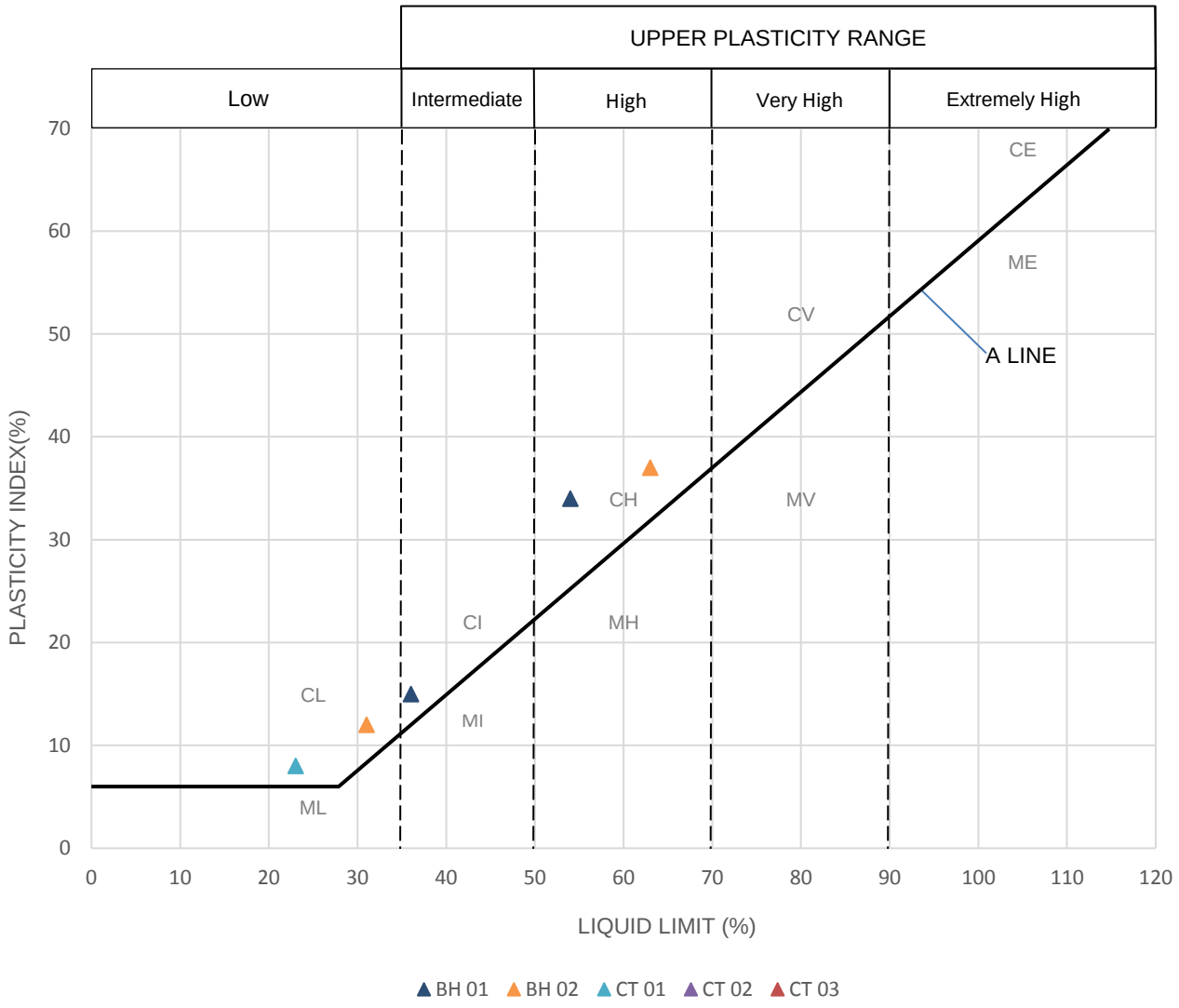


WATER CONTENT v DEPTH

Report:
21.03.016

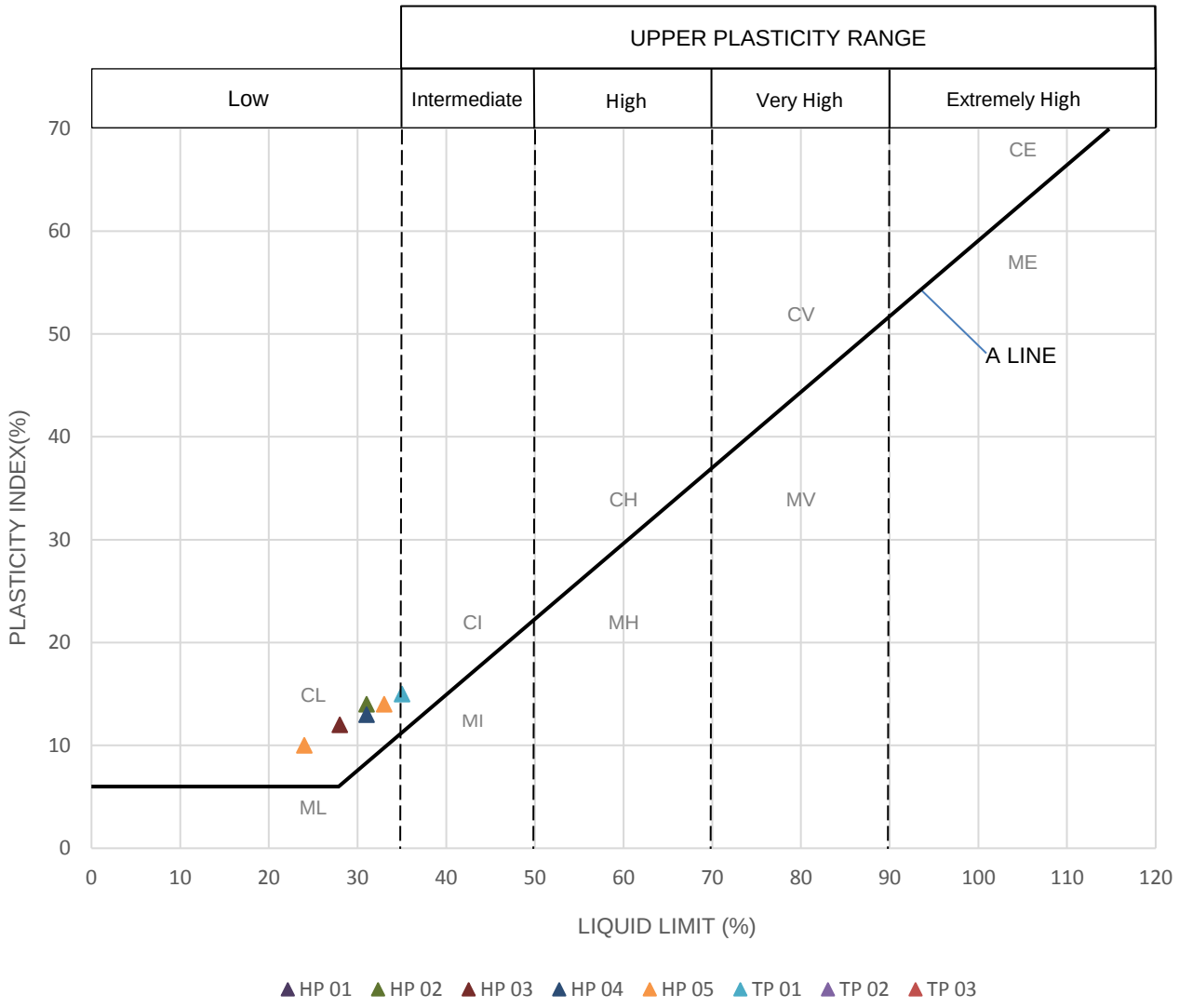


WATER CONTENT v DEPTH	Report: 21.03.016



PLASTICITY CHART

Report:
21.03.016



PLASTICITY CHART

Report:
21.03.016

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-10937-1		
Initial Date of Issue:	13-Apr-2021		
Client	Listers Geotechnical Consultants		
Client Address:	Slapton Hill Barn, Blakesley Road Slapton Towcester Northamptonshire NN12 8QD		
Contact(s):	Tom Johnson		
Project	21.03.016 Lancing		
Quotation No.:	Q18-12046	**Date Received:**	07-Apr-2021
Order No.:	21.03.016	**Date Instructed:**	07-Apr-2021
No. of Samples:	5		
Turnaround (Wkdays):	5	**Results Due:**	13-Apr-2021
Date Approved:	13-Apr-2021		

Approved By:



Details: Glynn Harvey, Technical Manager

Results - Soil

Project: 21.03.016 Lancing

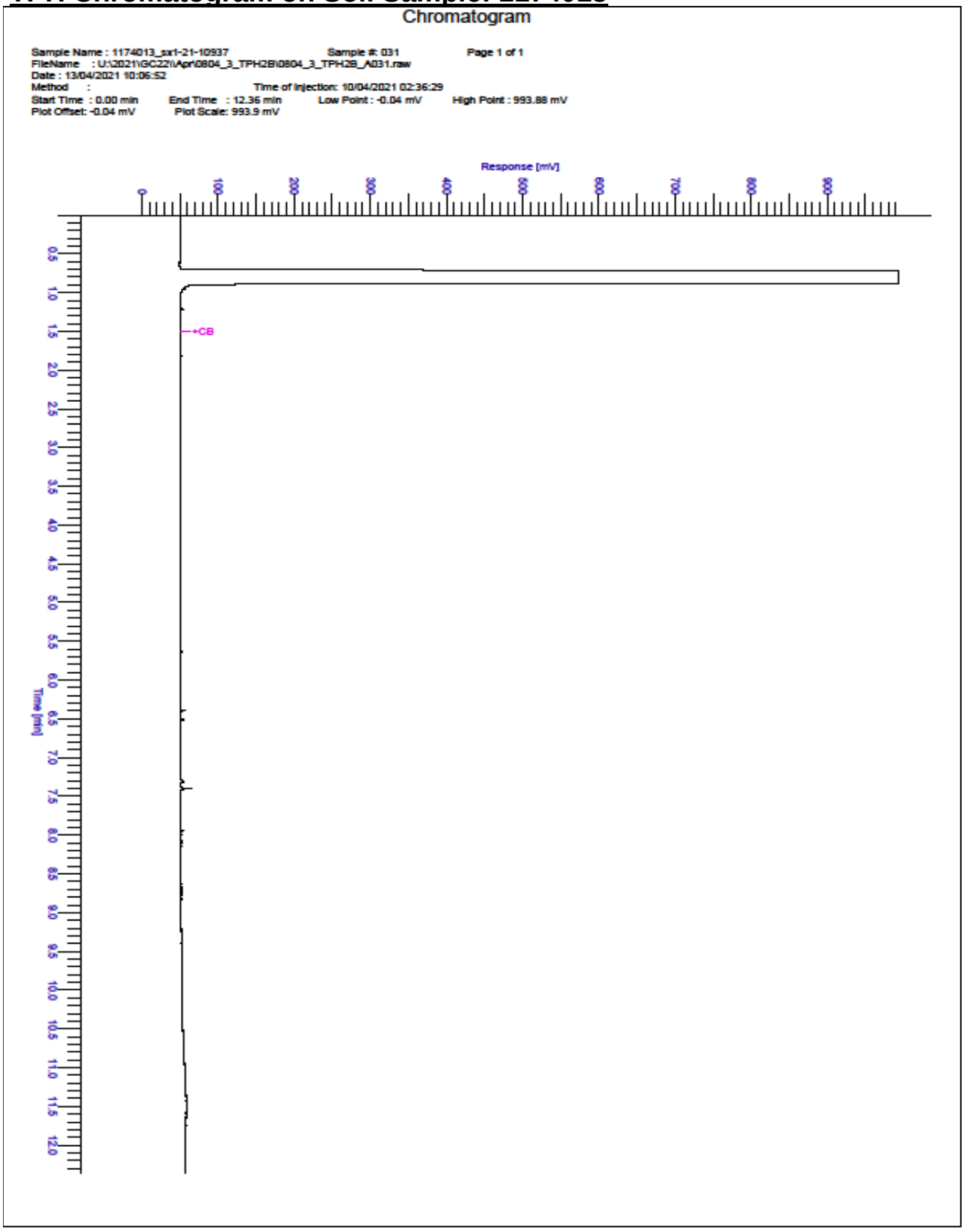
Client: Listers Geotechnical Consultants		**Chemtest Job No.:**			21-10937	21-10937	21-10937	21-10937	21-10937
Quotation No.: Q18-12046		**Chemtest Sample ID.:**			1174013	1174014	1174015	1174016	1174017
		Sample Location:			CT01	CT02	CT03	HP01	HP04
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.25	0.10	0.20	0.50	0.20
		Bottom Depth (m):			0.50	0.30	0.55	0.50	0.20
		Date Sampled:			31-Mar-2021	31-Mar-2021	31-Mar-2021	31-Mar-2021	01-Apr-2021
		Asbestos Lab:			COVENTRY	COVENTRY	COVENTRY		COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
ACM Type	U	2192		N/A	-	-	-		-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-		-
Moisture	N	2030	%	0.020	21	26	14	18	12
Chromatogram (TPH)	N			N/A	See Attached	See Attached	See Attached	See Attached	See Attached
pH	U	2010		4.0	8.0	8.2	8.3	8.1	11.4
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	0.021	< 0.010	0.060
Arsenic	U	2450	mg/kg	1.0	21	30	39	18	9.9
Cadmium	U	2450	mg/kg	0.10	0.38	0.69	0.32	0.15	< 0.10
Chromium	U	2450	mg/kg	1.0	21	27	23	25	17
Copper	U	2450	mg/kg	0.50	45	110	150	28	12
Mercury	U	2450	mg/kg	0.10	0.38	0.29	0.13	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	19	27	33	21	10
Lead	U	2450	mg/kg	0.50	510	2400	910	73	49
Selenium	U	2450	mg/kg	0.20	0.28	0.41	0.47	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.50	240	780	200	75	21
Total Organic Carbon	U	2625	%	0.20	1.5			0.50	2.3
TPH >C6-C8	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C8-C10	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C10-C12	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C12-C16	N	2670	mg/kg	1.0	6.1	2.2	< 1.0	< 1.0	< 1.0
TPH >C16-C21	N	2670	mg/kg	1.0	36	20	18	< 1.0	< 1.0
TPH >C21-C25	N	2670	mg/kg	1.0	39	30	22	< 1.0	< 1.0
TPH >C25-C35	N	2670	mg/kg	1.0	40	28	14	< 1.0	< 1.0
TPH >C35-C40	N	2670	mg/kg	1.0	5.7	< 1.0	< 1.0	< 1.0	< 1.0
Total TPH >C6-C40	U	2670	mg/kg	10	130	79	55	< 10	< 10
Naphthalene	U	2800	mg/kg	0.10	< 0.10	0.26	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	0.14	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10	0.40	< 0.10	< 0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10	0.33	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	2.7	4.6	0.52	0.12	0.20
Anthracene	U	2800	mg/kg	0.10	0.60	0.54	0.11	< 0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10	6.7	5.6	1.1	0.29	0.48
Pyrene	U	2800	mg/kg	0.10	5.4	4.8	1.0	0.26	0.44
Benzo[a]anthracene	U	2800	mg/kg	0.10	2.9	1.9	0.52	0.13	0.24
Chrysene	U	2800	mg/kg	0.10	3.0	2.2	0.57	0.13	0.23

Results - Soil

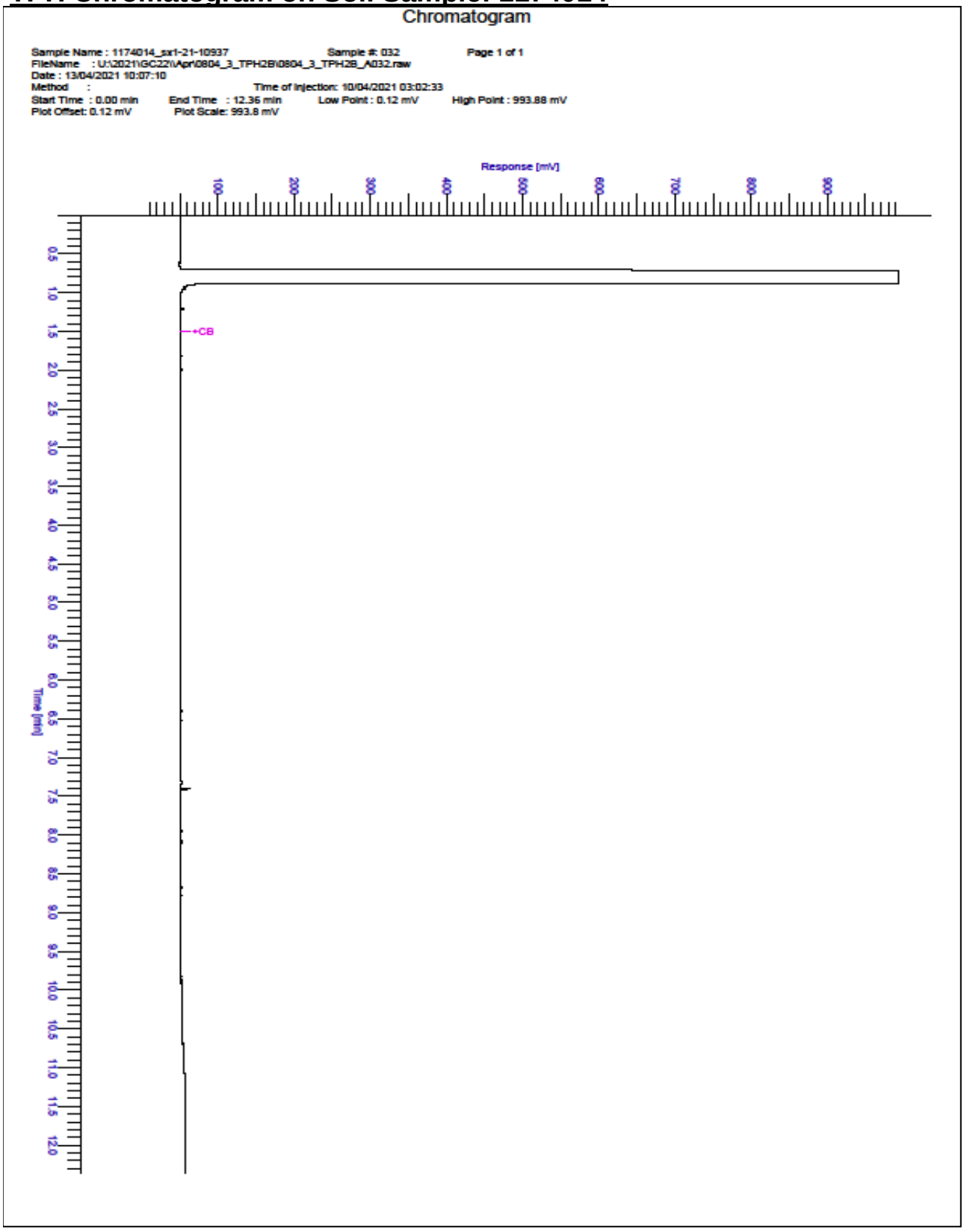
Project: 21.03.016 Lancing

Client: Listers Geotechnical Consultants			**Chemtest Job No.:**		21-10937	21-10937	21-10937	21-10937	21-10937
Quotation No.: Q18-12046			**Chemtest Sample ID.:**		1174013	1174014	1174015	1174016	1174017
			Sample Location:		CT01	CT02	CT03	HP01	HP04
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.25	0.10	0.20	0.50	0.20
			Bottom Depth (m):		0.50	0.30	0.55	0.50	0.20
			Date Sampled:		31-Mar-2021	31-Mar-2021	31-Mar-2021	31-Mar-2021	01-Apr-2021
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY		COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	4.1	3.0	0.87	0.20	0.42
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	1.4	1.1	0.30	< 0.10	0.15
Benzo[a]pyrene	U	2800	mg/kg	0.10	2.9	2.1	0.60	0.17	0.39
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	2.3	1.7	0.55	< 0.10	0.27
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.48	0.35	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	2.0	1.6	0.46	< 0.10	0.27
Total Of 16 PAH's	N	2800	mg/kg	2.0	35	31	6.6	< 2.0	3.1

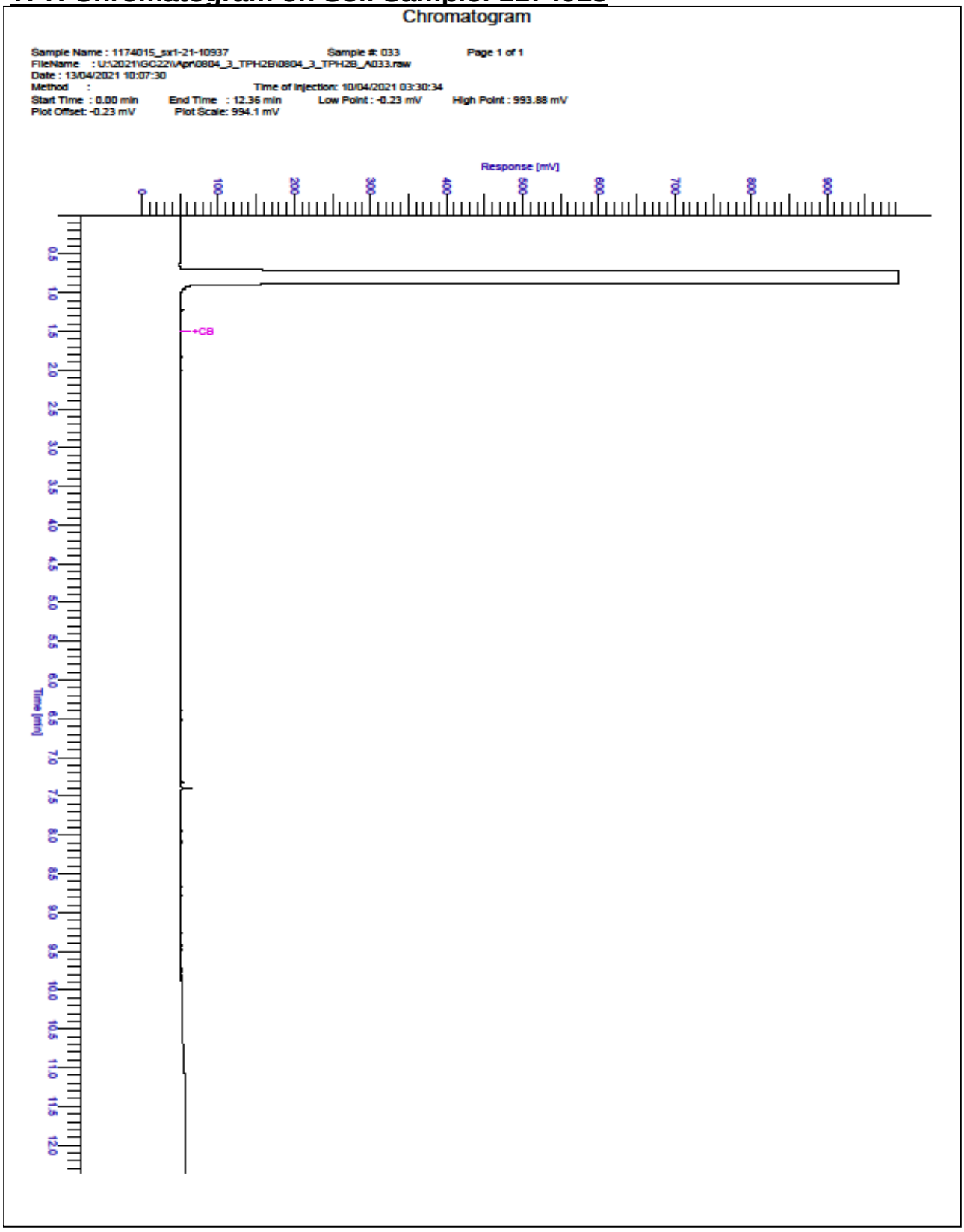
TPH Chromatogram on Soil Sample: 1174013



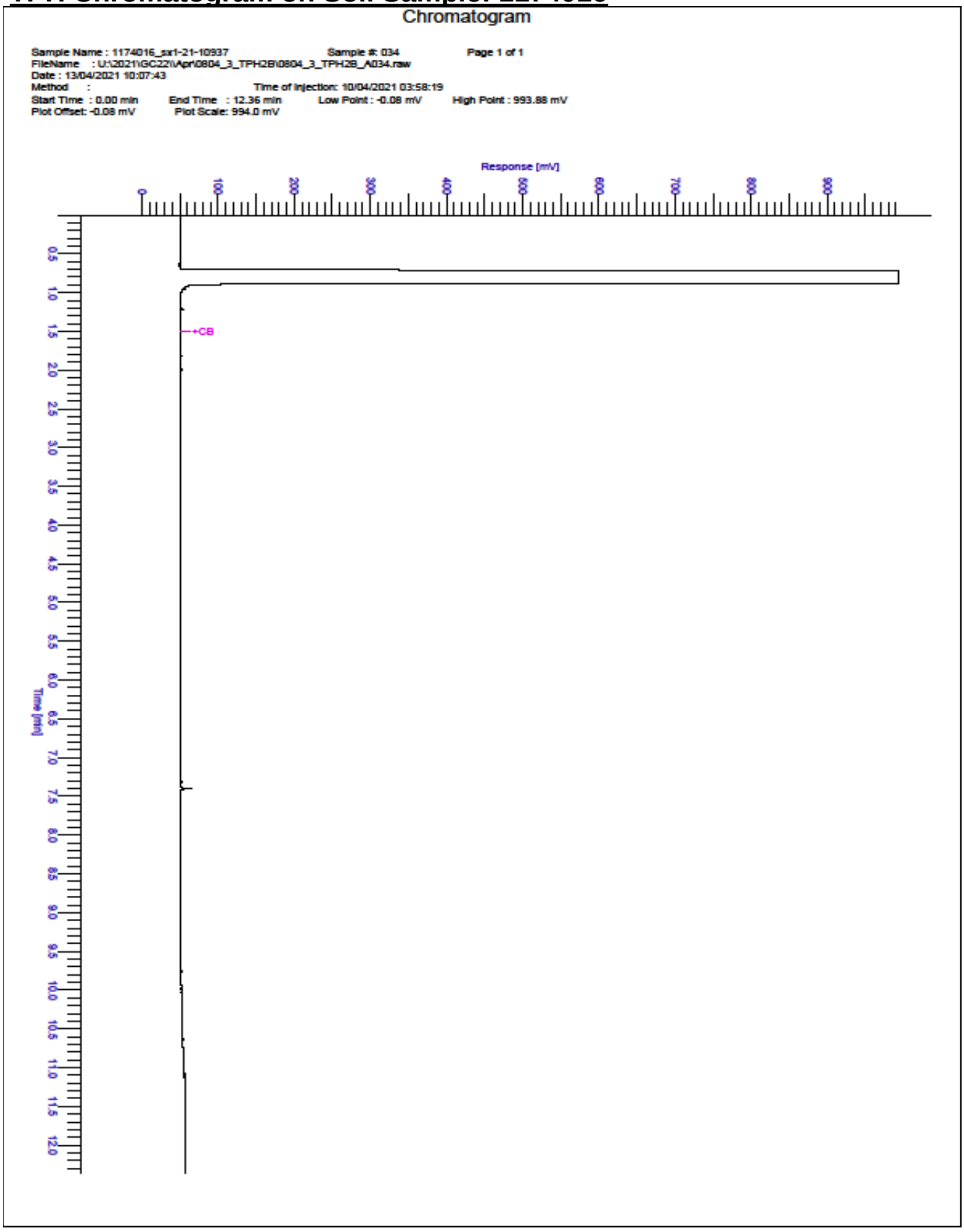
TPH Chromatogram on Soil Sample: 1174014



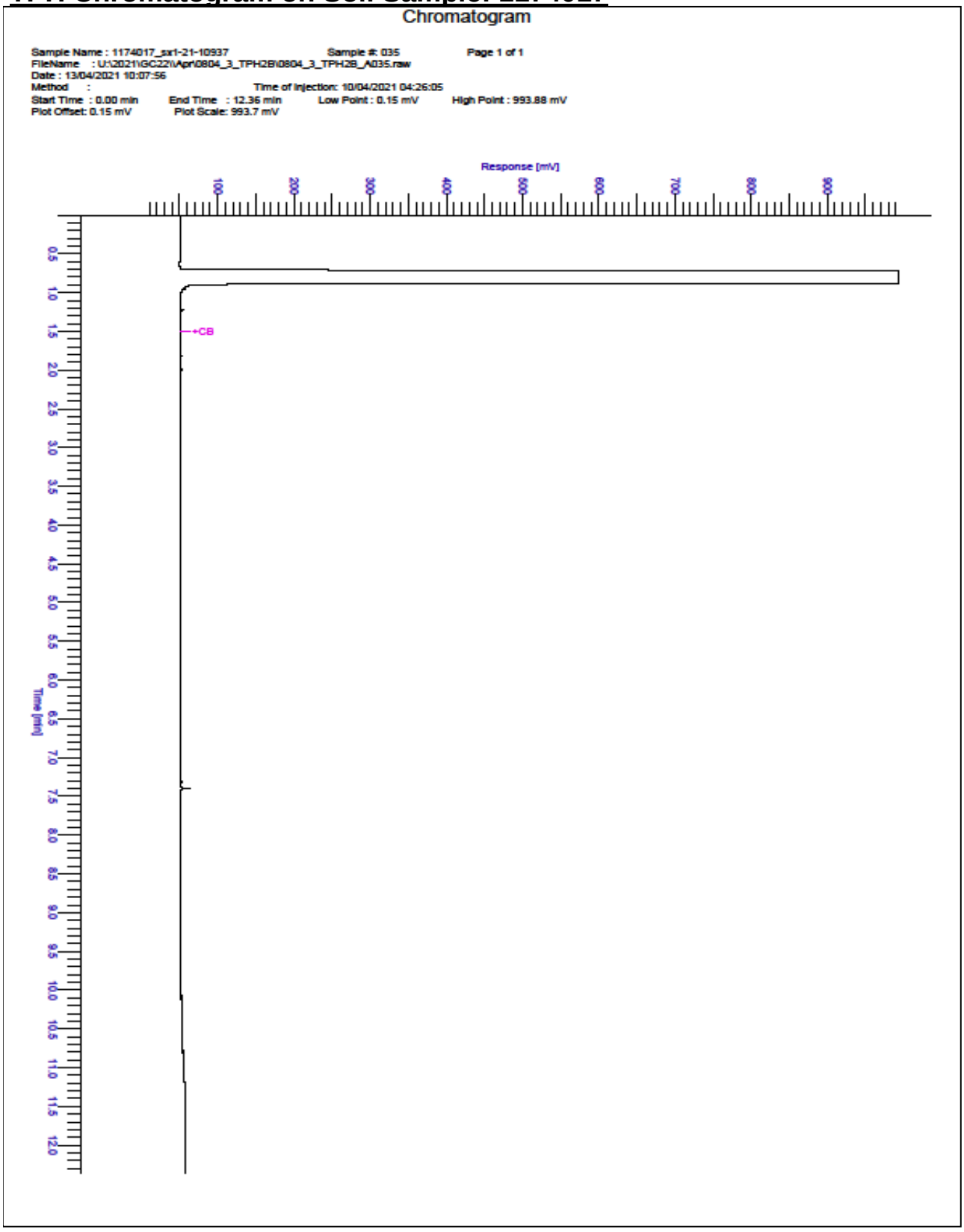
TPH Chromatogram on Soil Sample: 1174015



TPH Chromatogram on Soil Sample: 1174016



TPH Chromatogram on Soil Sample: 1174017



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
2450	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.
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*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

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 45 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

APPENDIX D
CONTAMINATION RISK ASSESSMENT WORKSHEETS

Contaminated Land Risk Assessment – Definition of Methodology

The Contaminated Land Risk Assessment methodology followed in this report is based on Environment Agency's (EA) online guidance, Land Contamination: Risk Management (LCRM), published in June 2019. The new guidance is based upon the principles of the EA's CLR11 guidance, Model procedures for the management of land contamination, published in 2004.

The preliminary Conceptual Site Model (CSM) has been assessed using the methodology set out in CIRIA C552, Contaminated Land Risk Assessment - A Guide to Good Practice, published in 2001, as detailed below.

Risk evaluation determines the magnitude of risks present by assessing the likelihood of a particular risk being present alongside the severity of the consequence, should that event occur. The overall risk classification is a combination of the two and provides a qualitative assessment upon which to base any further work or remedial measures, where deemed necessary.

Where complete pollutant linkages are present, the probability of a contamination risk occurring at the site has been classified in accordance with the terms listed and defined in the table below.

Classification	Definition of Probability
High Likelihood	An event appears very likely in the short term and almost inevitable in the long term; or there is evidence at the receptor that harm or pollution is occurring.
Likely	It is probable that an event will occur, however, the event is not inevitable. It is possible in the short term and is likely over the long term.
Low Likelihood	Circumstances are possible under which an event could occur. However, it is uncertain that the event would occur even over a longer period and even less likely in the short term.
Unlikely	Circumstances are such that it is improbable that an event would occur even in the very long term.

The magnitude of the consequence of a contamination event occurring at this site is classified in accordance with the definitions listed in the following table. The classification of the consequence does not take into account the probability of the consequences being realised.

Classification	Definition of Consequence	Examples
Severe	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment protection Act (1990), Part IIA. Short term risk of pollution of controlled waters. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion causing building collapse (can also equate to a short-term human health risk if buildings are occupied.).
Medium	Chronic damage to Human Health ("significant harm"). Pollution of controlled waters. A significant change in a particular ecosystem, or organism forming part of such ecosystem.	Concentrations of contaminants from site exceeding generic or site-specific screening criteria. Leaching of contaminants into a major or minor aquifer. Death of species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy. (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by measures such as protective clothing etc). Easily reparable effects of damage to buildings, structures and services	The presence of contaminants at such concentration that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discolouration of concrete.

Once the probability and consequence of each pathway has been classified, the potential overall risk classification can be evaluated using the following matrix.

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

The definitions of the risk categories provided in CIRIA C552, together with actions that are likely to be necessary, are presented below.

Classification	Definition of Risk and Likely Actions Required
Very high Risk	• High probability that severe harm could arise or that severe harm is already occurring • This risk, if realised, is likely to result in a substantial liability • Urgent investigation and remediation are likely to be required
High Risk	• Harm is likely to arise • The risk, if realised, is likely to present a substantial liability • Urgent investigation is required and remediation may be necessary in the short term and likely over the longer term
Moderate Risk	• It is possible that harm could arise, however, it is unlikely that any harm would be severe and more likely it would be relatively mild • Investigation is likely to be required to clarify the risk and determine potential liability • Some remediation may be required in the longer term
Low Risk	• It is possible that harm could arise, but is likely that this harm, if realised, would be mild at worst
Very low Risk	• There is a low possibility that harm could arise • If realised, such harm is not likely to be severe

Reference:

Rudland, D J, Lancefield, R M, Mayell, P N, Contaminated land Risk Assessment. A guide to Good Practice, CIRIA Report C552, 2001.

CLEA Software Version 1.071

Report generated	14/05/2021
Report title	Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB
Created by	Tom Johnson at ListersGeo

BASIC SETTINGS

Land Use	Residential (lifetime exposure C4SL)						
Building	Medium/large terraced house						
Receptor	Female (res C4SL)	Start age class	17	End age class	18	Exposure Duration	59 years
Soil	Sandy loam						

Exposure Pathways

Direct soil and dust ingestion	✓	Dermal contact with indoor dust	✓	Inhalation of indoor dust	✓
Consumption of homegrown produce	✓	Dermal contact with soil	✓	Inhalation of soil dust	✓
Soil attached to homegrown produce	✓			Inhalation of indoor vapour	✓
				Inhalation of outdoor vapour	✓

Environment Agency

Land Use Residential (lifetime exposure C4SL) **Receptor** Female (res C4SL)

Age Class	Exposure Frequencies (days yr^{-1})						Occupation Periods (hr day^{-1})		Soil to skin adherence factors (mg cm^{2})		Direct soil ingestion rate (g day^{-1})	Body weight (kg)	Body height (m)	Inhalation rate (m^{3} day^{-1})	Max exposed skin factor		Total skin area (m^{2})
	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with indoor dust	Dermal contact with soil	Inhalation of dust and vapour, indoor	Inhalation of dust and vapour, outdoor	Indoors	Outdoors	Indoor	Outdoor					Indoor (m^{2} m^{-2})	Outdoor (m^{2} m^{-2})	
1	180	180	180	170	365	365	23.0	1.0	0.06	0.10	0.10	5.60	0.7	5.4	0.32	0.26	3.43E-01
2	365	365	365	170	365	365	23.0	1.0	0.06	0.10	0.10	9.80	0.8	8.0	0.33	0.26	4.84E-01
3	365	365	365	170	365	365	23.0	1.0	0.06	0.10	0.10	12.70	0.9	8.9	0.32	0.25	5.82E-01
4	365	365	365	170	365	365	23.0	1.0	0.06	0.10	0.10	15.10	0.9	10.1	0.35	0.28	6.36E-01
5	365	365	365	170	365	365	19.0	1.0	0.06	0.10	0.10	16.90	1.0	10.1	0.35	0.28	7.04E-01
6	365	365	365	170	365	365	19.0	1.0	0.06	0.10	0.10	19.70	1.1	10.1	0.33	0.26	7.94E-01
7	365	365	365	170	365	365	19.0	1.0	0.06	0.10	0.10	22.10	1.2	12.0	0.22	0.15	8.73E-01
8	365	365	365	170	365	365	19.0	1.0	0.06	0.10	0.10	25.30	1.2	12.0	0.22	0.15	9.36E-01
9	365	365	365	170	365	365	19.0	1.0	0.06	0.10	0.10	27.50	1.3	12.0	0.22	0.15	1.01E+00
10	365	365	365	170	365	365	19.0	1.0	0.06	0.10	0.10	31.40	1.3	12.0	0.22	0.15	1.08E+00
11	365	365	365	170	365	365	19.0	1.0	0.06	0.10	0.10	35.70	1.4	12.0	0.22	0.14	1.19E+00
12	365	365	365	170	365	365	19.0	1.0	0.06	0.10	0.10	41.30	1.4	15.2	0.22	0.14	1.29E+00
13	365	365	365	170	365	365	15.0	1.0	0.06	0.30	0.05	47.20	1.5	15.2	0.22	0.14	1.42E+00
14	365	365	365	170	365	365	15.0	1.0	0.06	0.30	0.05	51.20	1.6	15.2	0.22	0.14	1.52E+00
15	365	365	365	170	365	365	15.0	1.0	0.06	0.30	0.05	56.70	1.6	15.2	0.21	0.14	1.60E+00
16	365	365	365	170	365	365	15.0	1.0	0.06	0.30	0.05	59.00	1.6	15.2	0.21	0.14	1.63E+00
17	365	365	365	170	365	365	23.0	1.0	0.06	0.30	0.05	70.00	1.6	15.7	0.33	0.27	1.78E+00
18	365	365	365	170	365	365	23.0	1.0	0.06	0.30	0.05	70.90	1.6	13.6	0.33	0.27	1.80E+00

Consumption Rates

Consumption rates (g FW kg^{-1} bodyweight day^{-1}) by Produce Group

Age Class	MEAN RATES						90TH PERCENTILE RATES					
	Green veg	Root veg	Tuber veg	Herb. Fruit	Shrub fruit	Tree fruit	Green veg	Root veg	Tuber veg	Herb. Fruit	Shrub fruit	Tree fruit
1	3.47E+00	5.22E+00	9.22E+00	8.90E-01	1.07E+00	1.87E+00	7.12E+00	1.07E+01	1.60E+01	1.83E+00	2.23E+00	3.82E+00
2	3.34E+00	1.61E+00	3.14E+00	1.93E+00	2.60E-01	5.84E+00	5.87E+00	2.83E+00	6.60E+00	3.39E+00	4.60E-01	1.03E+01
3	3.34E+00	1.61E+00	3.14E+00	1.93E+00	2.60E-01	5.84E+00	5.87E+00	2.83E+00	6.60E+00	3.39E+00	4.60E-01	1.03E+01
4	3.34E+00	1.61E+00	3.14E+00	1.93E+00	2.60E-01	5.84E+00	5.87E+00	2.83E+00	6.60E+00	3.39E+00	4.60E-01	1.03E+01
5	2.54E+00	1.20E+00	2.65E+00	1.25E+00	1.10E-01	2.89E+00	4.53E+00	2.14E+00	4.95E+00	2.24E+00	1.90E-01	5.16E+00
6	2.54E+00	1.20E+00	2.65E+00	1.25E+00	1.10E-01	2.89E+00	4.53E+00	2.14E+00	4.95E+00	2.24E+00	1.90E-01	5.16E+00
7	2.54E+00	1.20E+00	2.65E+00	1.25E+00	1.10E-01	2.89E+00	4.53E+00	2.14E+00	4.95E+00	2.24E+00	1.90E-01	5.16E+00
8	2.54E+00	1.20E+00	2.65E+00	1.25E+00	1.10E-01	2.89E+00	4.53E+00	2.14E+00	4.95E+00	2.24E+00	1.90E-01	5.16E+00
9	2.54E+00	1.20E+00	2.65E+00	1.25E+00	1.10E-01	2.89E+00	4.53E+00	2.14E+00	4.95E+00	2.24E+00	1.90E-01	5.16E+00
10	2.54E+00	1.20E+00	2.65E+00	1.25E+00	1.10E-01	2.89E+00	4.53E+00	2.14E+00	4.95E+00	2.24E+00	1.90E-01	5.16E+00
11	2.54E+00	1.20E+00	2.65E+00	1.25E+00	1.10E-01	2.89E+00	4.53E+00	2.14E+00	4.95E+00	2.24E+00	1.90E-01	5.16E+00
12	1.03E+00	4.90E-01	1.60E+00	5.10E-01	4.00E-02	1.18E+00	1.87E+00	8.90E-01	3.05E+00	9.30E-01	8.00E-02	2.13E+00
13	1.03E+00	4.90E-01	1.60E+00	5.10E-01	4.00E-02	1.18E+00	1.87E+00	8.90E-01	3.05E+00	9.30E-01	8.00E-02	2.13E+00
14	1.03E+00	4.90E-01	1.60E+00	5.10E-01	4.00E-02	1.18E+00	1.87E+00	8.90E-01	3.05E+00	9.30E-01	8.00E-02	2.13E+00
15	1.03E+00	4.90E-01	1.60E+00	5.10E-01	4.00E-02	1.18E+00	1.87E+00	8.90E-01	3.05E+00	9.30E-01	8.00E-02	2.13E+00
16	1.03E+00	4.90E-01	1.60E+00	5.10E-01	4.00E-02	1.18E+00	1.87E+00	8.90E-01	3.05E+00	9.30E-01	8.00E-02	2.13E+00
17	1.26E+00	6.00E-01	1.18E+00	6.90E-01	9.00E-02	1.27E+00	2.36E+00	1.12E+00	2.35E+00	1.29E+00	1.80E-01	2.38E+00
18	1.35E+00	6.40E-01	1.25E+00	7.40E-01	1.00E-01	1.36E+00	2.34E+00	1.12E+00	2.36E+00	1.28E+00	1.80E-01	2.37E+00

Top 2 applied? Yes

Where top 2 method is applied, two produce categories use 90th percentile rates, while the remainder use the mean. Produce categories vary on a chemical-by-chemical basis. Where top 2 method is not used, all produce categories for all chemicals assume 90th percentile rates.

Building Medium/large terraced house

Soil Sandy loam

Building footprint (m^2)	2.80E+01
Living space air exchange rate (hr^{-1})	5.00E-01
Living space height (above ground, m)	4.80E+00
Living space height (below ground, m)	0.00E+00
Pressure difference (soil to enclosed space, Pa)	3.10E+00
Foundation thickness (m)	1.50E-01
Floor crack area (cm^2)	4.23E+02
Dust loading factor ($\mu g\ m^{-3}$)	5.00E+01

Porosity, Total ($cm^3\ cm^{-3}$)	5.30E-01
Porosity, Air-Filled ($cm^3\ cm^{-3}$)	2.00E-01
Porosity, Water-Filled ($cm^3\ cm^{-3}$)	3.30E-01
Residual soil water content ($cm^3\ cm^{-3}$)	1.20E-01
Saturated hydraulic conductivity ($cm\ s^{-1}$)	3.56E-03
van Genuchten shape parameter *m* (dimensionless)	3.20E-01
Bulk density ($g\ cm^{-3}$)	1.21E+00
Threshold value of wind speed at 10m ($m\ s^{-1}$)	7.20E+00
Empirical function (F_x) for dust model (dimensionless)	1.22E+00
Ambient soil temperature (K)	2.83E+02
Soil pH	7.00E+00
Soil Organic Matter content (%)	1.00E+00
Fraction of organic carbon ($g\ g^{-1}$)	5.80E-03
Effective total fluid saturation (unitless)	5.12E-01
Intrinsic soil permeability (cm^2)	4.75E-08
Relative soil air permeability (unitless)	6.42E-01
Effective air permeability (cm^2)	3.05E-08

Soil - Vapour Model

Depth to top of source (no building) (cm)	0
Depth to top of source (beneath building) (cm)	65
Default soil gas ingress rate?	Yes
Soil gas ingress rate ($cm^3\ s^{-1}$)	2.50E+01
Building ventilation rate ($cm^3\ s^{-1}$)	1.87E+04
Averaging time surface emissions (yr)	59
Finite vapour source model?	No
Thickness of contaminated layer (cm)	200

Air Dispersion Model

Mean annual windspeed at 10m ($m\ s^{-1}$)	5.00
Air dispersion factor at height of 0.8m *	2400.00
Air dispersion factor at height of 1.6m *	19000.00
Fraction of site cover ($m^2\ m^{-2}$)	0.75

* Air dispersion factor in $g\ m^{-2}\ s^{-1}$ per $kg\ m^{-3}$

Soil - Plant Model

	Dry weight conversion factor	Homegrown fraction		Soil loading factor	Preparation correction factor
		Average	High		
	$g\ DW\ g^{-1}\ FW$	dimensionless		$g\ g^{-1}\ DW$	dimensionless
Green vegetables	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	0.103	0.06	0.40	1.00E-03	1.00E+00
Tuber vegetables	0.210	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	0.058	0.06	0.40	1.00E-03	6.00E-01
Shrub fruit	0.166	0.09	0.60	1.00E-03	6.00E-01
Tree fruit	0.157	0.04	0.27	1.00E-03	6.00E-01

Gardener type Average

CLEA Software Version 1.071

Report generated	14-May-21
Report title	Mount Hermon Care Home, 89 Brighton Road, Lancing, BN15 8RB
Created by	Tom Johnson at ListersGeo

RESULTS

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group						
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
1	Arsenic (C4SL adult)	2.86E+02	7.13E+02	NR	1.00	0.40	NR	NR	No	No	Yes	Yes	No	No	No	No	Yes
2	Cadmium (C4SL)	3.38E+01	4.90E+02	3.17E+01	0.94	0.06	1.00	NR	No	No	Yes	Yes	Yes	No	No	No	No
3	Chromium VI (C4SL adult)	5.65E+02	2.81E+01	NR	0.05	1.00	NR	NR	No	No	Yes	No	No	Yes	No	No	Yes
4	Lead (C4SL adult)	4.28E+02	NR	NR	1.00	NR	NR	NR	No	No	Yes	Yes	No	Yes	No	No	No
5	Mercury, inorganic	1.39E+03	1.13E+04	1.24E+03	0.89	0.11	1.00	NR	No	No	Yes	No	No	No	No	No	No
6	Selenium	3.16E+03	NR	NR	1.00	NR	NR	NR	No	No	Yes	No	No	No	No	No	No
7	Naphthalene	1.31E+02	3.49E+00	3.40E+00	0.03	0.97	1.00	2.58E-08 (vap)	No	No	Yes	No	No	No	No	No	No
8	Benzo[a]anthracene	5.54E+01	7.69E+01	3.22E+01	0.58	0.42	1.00	1.71E+00 (sol)	No	No	Yes	No	No	No	No	No	No
9	Chrysene	8.80E+01	3.74E+02	7.12E+01	0.81	0.19	1.00	4.40E-01 (vap)	No	No	Yes	No	No	No	No	No	No
10	Benzo[b]fluoranthene	1.66E+01	6.07E+01	1.31E+01	0.79	0.21	1.00	1.22E+00 (sol)	No	No	Yes	No	No	No	No	No	No
11	Benzo(k)flouranthene	5.15E+02	1.70E+03	3.95E+02	0.77	0.23	1.00	6.87E-01 (sol)	No	No	Yes	No	No	No	No	No	No
12	Benzo[a]pyrene (C4SL adult)	2.84E+01	5.01E+01	NR	1.00	0.57	NR	9.11E-01 (vap)	No	No	Yes	No	Yes	Yes	No	No	No
13	Dibenz[ah]anthracene	1.70E+00	4.52E+00	1.24E+00	0.73	0.27	1.00	3.93E-03 (vap)	No	No	Yes	No	No	No	No	No	No
14	ali 5-6	2.25E+04	1.30E+02	1.30E+02	0.00	1.00	1.00	3.00E+02 (vap)	Yes	Yes	Yes	No	No	No	No	No	No
15	ali 6-8	5.76E+04	3.33E+02	3.33E+02	0.00	1.00	1.00	1.50E+02 (vap)	Yes	Yes	Yes	No	No	No	No	No	No
16	ali 8-10	8.48E+03	8.69E+01	8.67E+01	0.01	0.99	1.00	8.12E+01 (vap)	Yes	Yes	Yes	No	No	No	No	No	No
17	ali 10-12	2.89E+04	4.31E+02	4.30E+02	0.01	0.99	1.00	4.97E+01 (vap)	Yes	Yes	Yes	No	No	No	No	No	No
18	ali 12-16	4.30E+04	3.22E+03	3.16E+03	0.04	0.96	1.00	2.21E+01 (sol)	Yes	Yes	Yes	No	No	No	No	No	No
19	ali 16-35	NR	NR	NR	NR	NR	NR	9.15E+00 (sol)	No	No	Yes	No	No	No	No	No	No
20	arom 5-7	4.44E+02	1.18E+03	3.23E+02	0.73	0.27	1.00	1.22E+03 (sol)	No	No	Yes	No	No	No	No	No	No

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group						
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
21	arom 7-8	7.38E+02	2.81E+03	5.84E+02	0.79	0.21	1.00	8.68E+02 (vap)	No	No	Yes	No	No	No	No	No	No
22	arom 8-10	2.64E+02	1.47E+02	1.21E+02	0.30	0.70	1.00	6.13E+02 (vap)	Yes	Yes	Yes	No	No	No	No	No	No
23	arom 10-12	3.84E+02	8.01E+02	3.27E+02	0.74	0.26	1.00	3.65E+02 (vap)	Yes	Yes	Yes	No	No	No	No	No	No
24	arom 12-16	6.75E+02	8.84E+03	6.62E+02	0.96	0.04	1.00	1.69E+02 (vap)	Yes	Yes	Yes	No	No	No	No	No	No
25	arom 16-21	1.27E+03	NR	NR	1.00	NR	NR	5.34E+01 (sol)	Yes	No	Yes	No	No	No	No	No	No
26	arom 21-35	6.43E+03	NR	NR	1.00	NR	NR	4.82E+00 (sol)	Yes	No	Yes	No	No	No	No	No	No
27																	
28																	
29																	
30																	

Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
1	Arsenic (C4SL adult)	99.9	0.1	0.0	100.0	2.86E+02	NR	1.43E+02	1.22E-07	1.54E-08	0.00E+00	0.00E+00	0.00E+00	1.23E-01	1.15E-01	6.59E-02	9.45E-02	5.73E-02	3.15E-01
2	Cadmium (C4SL)	99.7	0.3	0.0	100.0	3.17E+01	NR	1.59E+01	1.35E-08	1.71E-09	0.00E+00	0.00E+00	0.00E+00	1.65E+00	9.20E-01	9.83E-01	5.08E-01	9.83E-02	4.44E-02
3	Chromium VI (C4SL adult)	96.8	3.2	0.0	100.0	2.81E+01	NR	1.41E+01	1.20E-08	1.51E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4	Lead (C4SL adult)	100.0	0.0	0.0	100.0	4.28E+02	NR	2.14E+02	1.82E-07	2.30E-08	0.00E+00	0.00E+00	0.00E+00	1.79E+00	1.72E+00	3.13E+00	3.20E-01	8.76E-02	9.79E-02
5	Mercury, inorganic	99.9	0.1	0.0	100.0	1.24E+03	NR	6.19E+02	5.27E-07	6.65E-08	0.00E+00	0.00E+00	0.00E+00	4.70E+00	8.54E+00	5.32E+00	1.24E+00	1.36E+00	1.24E+00
6	Selenium	99.5	0.5	0.0	100.0	3.16E+03	NR	1.58E+03	1.34E-06	1.70E-07	0.00E+00	0.00E+00	0.00E+00	3.41E+01	1.15E+01	2.62E+00	8.56E+00	9.47E+00	9.47E+00
7	Naphthalene	93.1	6.8	0.1	100.0	3.40E+00	1.52E+01	1.70E+00	1.45E-09	1.83E-10	3.81E-03	8.74E-07	1.10E-07	3.45E+00	5.01E+00	1.28E+00	0.00E+00	0.00E+00	1.56E+00
8	Benzo[a]anthracene	99.9	0.1	0.0	100.0	3.22E+01	2.26E-03	1.61E+01	1.37E-08	1.73E-09	2.18E-06	1.09E-07	1.38E-08	1.90E-01	7.09E-01	4.90E-01	0.00E+00	0.00E+00	1.80E-03
9	Chrysene	99.9	0.1	0.0	100.0	7.12E+01	7.10E-04	3.56E+01	3.03E-08	3.83E-09	9.13E-07	2.78E-07	3.51E-08	7.27E-01	2.21E+00	1.44E+00	0.00E+00	0.00E+00	9.06E-03
10	Benzo[b]fluoranthene	100.0	0.0	0.0	100.0	1.31E+01	4.40E-05	6.53E+00	5.55E-09	7.02E-10	5.75E-08	3.61E-08	4.56E-09	4.61E-02	2.13E-01	1.47E-01	0.00E+00	0.00E+00	3.37E-04
11	Benzo(k)flouranthene	100.0	0.0	0.0	100.0	3.95E+02	8.02E-04	1.98E+02	1.68E-07	2.13E-08	1.06E-06	9.19E-07	1.16E-07	7.67E-01	4.59E+00	3.25E+00	0.00E+00	0.00E+00	4.24E-03
12	Benzo[a]pyrene (C4SL adult)	100.0	0.0	0.0	100.0	2.84E+01	6.68E-05	1.42E+01	1.21E-08	1.52E-09	8.81E-08	7.11E-08	8.98E-09	1.17E-02	5.05E-02	2.52E-02	1.44E-02	1.60E-04	1.33E-03
13	Dibenz[ah]anthracene	100.0	0.0	0.0	100.0	1.24E+00	6.18E-06	6.18E-01	5.26E-10	6.64E-11	7.67E-09	2.49E-09	3.15E-10	1.59E-03	1.14E-02	7.74E-03	0.00E+00	0.00E+00	7.25E-06
14	ali 5-6	55.2	3.3	41.6	100.0	1.30E+02	3.26E+05	6.48E+01	5.51E-08	6.96E-09	1.19E+01	1.01E-03	1.27E-04	1.05E+02	1.50E+02	2.35E+01	0.00E+00	0.00E+00	2.92E+01
15	ali 6-8	82.8	1.0	16.2	100.0	3.33E+02	3.26E+05	1.66E+02	1.42E-07	1.79E-08	1.19E+01	1.62E-03	2.04E-04	8.72E+01	1.18E+02	3.29E+01	0.00E+00	0.00E+00	1.07E+01
16	ali 8-10	96.3	0.1	3.6	100.0	8.67E+01	1.89E+04	4.33E+01	3.69E-08	4.66E-09	6.90E-01	1.98E-04	2.51E-05	2.39E+00	4.58E+00	3.80E+00	0.00E+00	0.00E+00	6.39E-02
17	ali 10-12	99.3	0.0	0.7	100.0	4.30E+02	1.89E+04	2.15E+02	1.83E-07	2.31E-08	6.89E-01	4.42E-04	5.58E-05	4.63E-01	2.94E+00	5.03E+00	0.00E+00	0.00E+00	2.38E-03
18	ali 12-16	99.9	0.0	0.1	100.0	3.16E+03	1.86E+04	1.58E+03	1.34E-06	1.70E-07	6.78E-01	1.19E-03	1.50E-04	5.29E-03	1.09E+00	2.28E+00	0.00E+00	0.00E+00	1.58E-06
19	ali 16-35	0.0	0.0	0.0	0.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	arom 5-7	57.3	39.9	2.8	100.0	3.23E+02	5.47E+04	1.61E+02	1.37E-07	1.73E-08	1.82E+00	6.12E-04	7.73E-05	6.37E+02	1.50E+03	4.62E+02	0.00E+00	0.00E+00	1.08E+03

Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
21	arom 7-8	80.2	18.5	1.3	100.0	5.84E+02	4.55E+04	2.92E+02	2.49E-07	3.14E-08	1.38E+00	7.07E-04	8.93E-05	9.38E+02	1.59E+03	4.18E+02	0.00E+00	0.00E+00	9.38E+02
22	arom 8-10	96.7	2.9	0.4	100.0	1.21E+02	3.22E+03	6.06E+01	5.16E-08	6.51E-09	1.18E-01	9.71E-05	1.23E-05	6.65E+01	9.12E+01	2.40E+01	0.00E+00	0.00E+00	1.76E+01
23	arom 10-12	98.1	1.8	0.1	100.0	3.27E+02	1.59E+03	1.64E+02	1.39E-07	1.76E-08	5.84E-02	1.12E-04	1.42E-05	1.26E+02	1.71E+02	4.82E+01	0.00E+00	0.00E+00	2.49E+01
24	arom 12-16	99.1	0.9	0.0	100.0	6.62E+02	2.84E+02	3.31E+02	2.82E-07	3.56E-08	1.07E-02	6.87E-05	8.67E-06	1.43E+02	1.97E+02	7.46E+01	0.00E+00	0.00E+00	1.54E+01
25	arom 16-21	99.7	0.3	0.0	100.0	1.27E+03	1.07E+01	6.35E+02	5.41E-07	6.83E-08	5.73E-04	2.41E-05	3.04E-06	9.38E+01	1.46E+02	8.56E+01	0.00E+00	0.00E+00	4.76E+00
26	arom 21-35	100.0	0.0	0.0	100.0	6.43E+03	2.18E-01	3.22E+03	2.74E-06	3.46E-07	2.61E-05	2.75E-05	3.47E-06	2.10E+01	8.74E+01	1.33E+02	0.00E+00	0.00E+00	1.73E-01
27																			
28																			
29																			
30																			

Environment Agency

		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
1	Arsenic (C4SL adult)	2.04E-04	6.10E-05	3.48E-05	1.53E-06	0.00E+00	0.00E+00	0.00E+00	68.06	20.35	11.59	0.00	0.00	0.00	0.00	0.00
2	Cadmium (C4SL)	2.26E-05	3.05E-04	1.28E-07	1.69E-07	0.00E+00	1.91E-04	2.85E-07	4.36	58.73	0.02	0.03	0.00	0.00	36.82	0.03
3	Chromium VI (C4SL adult)	2.01E-05	7.34E-07	1.14E-06	1.50E-07	0.00E+00	0.00E+00	0.00E+00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
4	Lead (C4SL adult)	1.83E-04	4.46E-04	0.00E+00	1.46E-06	0.00E+00	0.00E+00	0.00E+00	29.02	70.75	0.00	0.23	0.00	0.00	0.00	0.00
5	Mercury, inorganic	8.82E-04	8.85E-04	0.00E+00	6.60E-06	0.00E+00	1.43E-05	0.00E+00	49.32	49.51	0.00	0.37	0.00	0.00	0.80	0.00
6	Selenium	2.25E-03	3.63E-03	0.00E+00	1.68E-05	0.00E+00	4.99E-04	8.55E-07	35.16	56.76	0.00	0.26	0.00	0.00	7.80	0.01
7	Naphthalene	2.43E-06	5.13E-04	1.79E-06	1.81E-08	7.99E-04	9.98E-05	3.99E-05	0.17	35.24	0.12	0.00	54.87	0.00	6.86	2.74
8	Benzo[a]anthracene	2.29E-05	5.03E-05	1.69E-05	1.72E-07	4.56E-07	0.00E+00	0.00E+00	25.28	55.37	18.65	0.19	0.50	0.00	0.00	0.00
9	Chrysene	5.08E-05	1.63E-04	3.74E-05	3.80E-07	1.92E-07	0.00E+00	0.00E+00	20.18	64.71	14.88	0.15	0.08	0.00	0.00	0.00
10	Benzo[b]fluoranthene	9.30E-06	1.45E-05	6.86E-06	6.96E-08	1.21E-08	0.00E+00	0.00E+00	30.30	47.08	22.35	0.23	0.04	0.00	0.00	0.00
11	Benzo(k)flouranthene	2.82E-04	3.00E-04	2.08E-04	2.11E-06	2.23E-07	0.00E+00	0.00E+00	35.57	37.91	26.23	0.27	0.03	0.00	0.00	0.00
12	Benzo[a]pyrene (C4SL adult)	2.02E-05	6.71E-06	1.49E-05	1.51E-07	1.85E-08	0.00E+00	0.00E+00	48.12	15.97	35.50	0.36	0.04	0.00	0.00	0.00
13	Dibenz[ah]anthracene	8.81E-07	7.22E-07	6.50E-07	6.59E-09	1.61E-09	0.00E+00	0.00E+00	38.96	31.94	28.74	0.29	0.07	0.00	0.00	0.00
14	ali 5-6	9.23E-05	1.42E-02	5.24E-05	6.91E-07	2.50E+00	1.42E+95	1.42E+95	0.00	0.28	0.00	0.00	49.71	0.00	0.29	49.71
15	ali 6-8	2.37E-04	1.12E-02	1.35E-04	1.77E-06	2.50E+00	1.42E+95	1.42E+95	0.00	0.22	0.00	0.00	49.77	0.00	0.23	49.77
16	ali 8-10	6.18E-05	4.14E-04	3.51E-05	4.62E-07	1.45E-01	1.42E+95	1.42E+95	0.02	0.14	0.01	0.00	49.82	0.00	0.18	49.82
17	ali 10-12	3.06E-04	2.64E-04	1.74E-04	2.29E-06	1.44E-01	1.42E+95	1.42E+95	0.11	0.09	0.06	0.00	49.74	0.00	0.26	49.74
18	ali 12-16	2.25E-03	1.48E-04	1.28E-03	1.68E-05	1.42E-01	1.42E+95	1.42E+95	0.77	0.05	0.44	0.01	48.73	0.00	1.26	48.74
19	ali 16-35	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E+95	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	arom 5-7	2.30E-04	1.62E-01	1.30E-04	1.72E-06	3.81E-01	4.28E-05	2.85E-03	0.04	29.60	0.02	0.00	69.80	0.00	0.01	0.52

Environment Agency

		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
21	arom 7-8	4.17E-04	1.76E-01	2.36E-04	3.12E-06	2.90E-01	1.43E-04	7.41E-03	0.09	37.12	0.05	0.00	61.14	0.00	0.03	1.56
22	arom 8-10	8.64E-05	9.04E-03	4.90E-05	6.46E-07	2.47E-02	1.42E+95	1.42E+95	0.13	13.33	0.07	0.00	36.47	0.00	13.53	36.47
23	arom 10-12	2.33E-04	1.67E-02	1.32E-04	1.74E-06	1.22E-02	1.42E+95	1.42E+95	0.40	28.48	0.23	0.00	20.90	0.00	29.10	20.90
24	arom 12-16	4.72E-04	1.89E-02	2.68E-04	3.53E-06	2.24E-03	1.42E+95	1.42E+95	1.08	43.17	0.61	0.01	5.13	0.00	44.86	5.14
25	arom 16-21	9.06E-04	1.36E-02	5.14E-04	6.77E-06	1.20E-04	1.42E+95	0.00E+00	3.02	45.27	1.71	0.00	0.00	0.00	50.00	0.00
26	arom 21-35	4.58E-03	7.82E-03	2.60E-03	3.43E-05	5.51E-06	1.42E+95	0.00E+00	15.28	26.05	8.67	0.00	0.00	0.00	50.00	0.00
27																
28																
29																
30																

Environment Agency

		Oral Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Inhalation Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}\ DW$)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
1	Arsenic (C4SL adult)	ID	0.3	ID	0.0038	NR	NR	NR	NR	NR	NR	NR	0.03	0.5	1	1	1
2	Cadmium (C4SL)	TDI	0.54	TDI	0.0029	13.4	0.02	NR	NR	NR	NR	NR	0.001	0.5	1	1	1
3	Chromium VI (C4SL adult)	ID	0.44	ID	0.00015	NR	NR	NR	NR	NR	NR	NR	0.01	0.5	1	1	1
4	Lead (C4SL adult)	ID	0.63	NR	0	NR	NR	NR	NR	NR	NR	NR	0	0.5	1	0.6	0.64
5	Mercury, inorganic	TDI	2	TDI	0.06	1	0	NR	NR	NR	NR	NR	0	0.5	1	1	1
6	Selenium	TDI	6.4	NR	0	35	0.06	NR	NR	NR	NR	NR	0	0.5	1	1	1
7	Naphthalene	TDI	20	TDI	0.86	7	2.8	1.80E-02	5.90E-06	7.50E-10	2.81	3.34	0.13	0.5	1	1	1
8	Benzo[a]anthracene	ID	0.155	ID	0.0015	NR	NR	3.16E-05	4.60E-06	3.80E-10	4.89	5.91	0.13	0.5	1	1	1
9	Chrysene	ID	0.31	ID	0.003	NR	NR	3.18E-06	4.57E-06	3.77E-10	4.74	5.73	0.13	0.5	1	1	1
10	Benzo[b]fluoranthene	ID	0.039	ID	0.00038	NR	NR	2.05E-06	4.36E-06	3.62E-10	5.02	6.08	0.13	0.5	1	1	1
11	Benzo(k)flouranthene	ID	1.03	ID	0.01	NR	NR	1.74E-06	4.36E-06	3.62E-10	5.17	6.26	0.13	0.5	1	1	1
12	Benzo[a]pyrene (C4SL adult)	ID	0.042	ID	0.0003	NR	NR	1.76E-06	4.38E-06	3.67E-10	5.11	6.18	0.13	0.5	1	1	1
13	Dibenz[ah]anthracene	ID	0.0031	ID	0.00003	NR	NR	5.40E-06	4.08E-06	3.40E-10	5.27	6.38	0.13	0.5	1	1	1
14	ali 5-6	TDI	5000	TDI	5000	9.99E+99	9.99E+99	2.10E+01	1.00E-05	1.00E-09	2.9	3.3	0.1	0.5	10	1	1
15	ali 6-8	TDI	4000	TDI	5000	9.99E+99	9.99E+99	2.73E+01	1.00E-05	1.00E-09	3.6	4.1	0.1	0.5	10	1	1
16	ali 8-10	TDI	100	TDI	290	9.99E+99	9.99E+99	4.15E+01	1.00E-05	1.00E-09	4.5	5.2	0.1	0.5	10	1	1
17	ali 10-12	TDI	100	TDI	290	9.99E+99	9.99E+99	6.44E+01	1.00E-05	1.00E-09	5.4	6.3	0.1	0.5	10	1	1
18	ali 12-16	TDI	100	TDI	290	9.99E+99	9.99E+99	1.71E+02	1.00E-05	1.00E-09	6.7	7.9	0.1	0.5	10	1	1
19	ali 16-35	NR	2000	NR	0	9.99E+99	0	1.07E+03	1.00E-05	1.00E-09	8.8	10.4	0.1	0.5	10	1	1
20	arom 5-7	TDI	223	TDI	1400	3	200	1.16E-01	8.77E-06	6.64E-10	1.83	2.13	0.1	0.5	10	1	1

Environment Agency

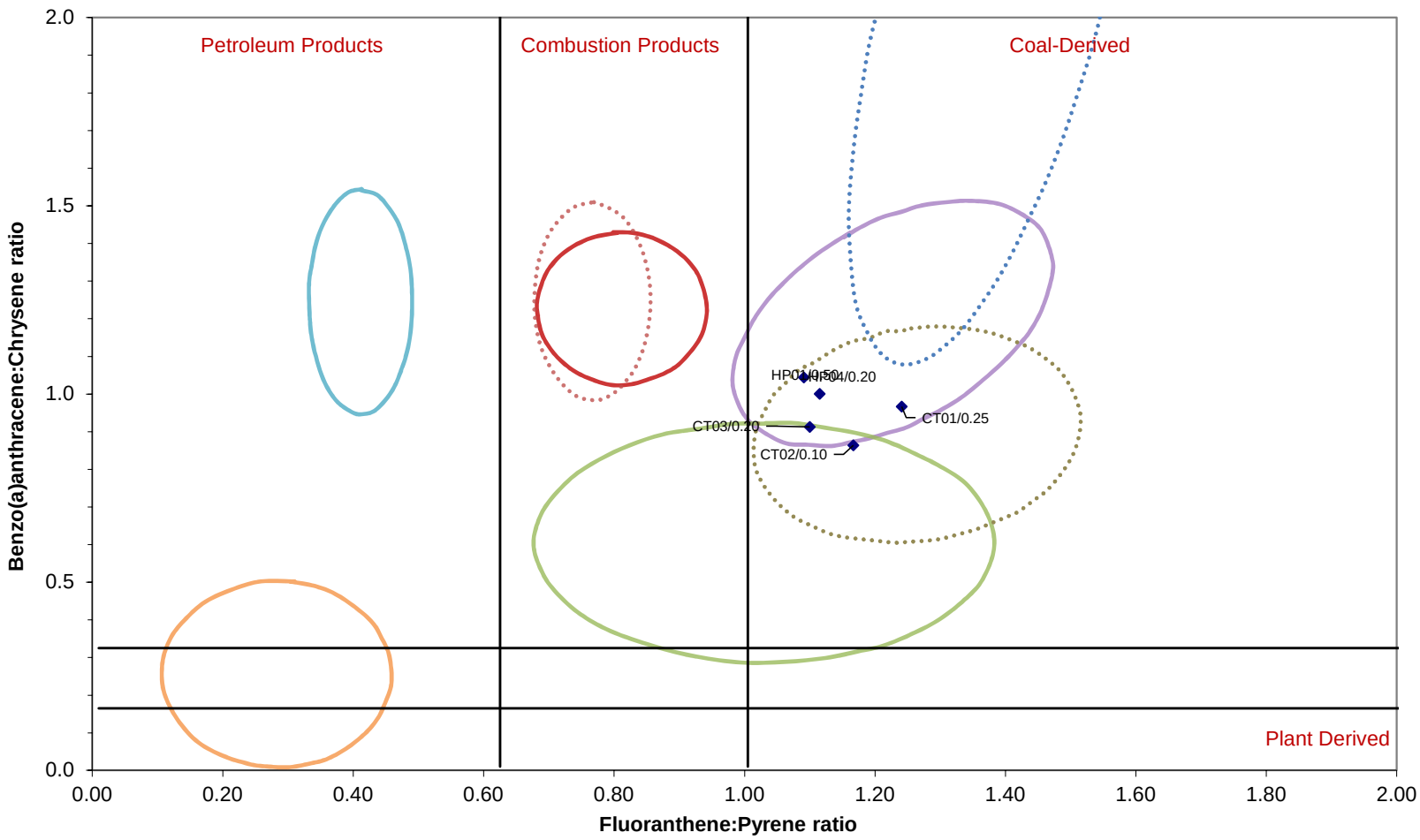
		Oral Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Inhalation Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
21	arom 7-8	TDI	223	TDI	1400	10	520	1.15E-01	7.78E-06	5.88E-10	2.31	2.73	0.1	0.5	10	1	1
22	arom 8-10	TDI	40	TDI	60	9.99E+99	9.99E+99	2.53E-01	1.00E-05	1.00E-09	3.2	3.7	0.1	0.5	10	1	1
23	arom 10-12	TDI	40	TDI	60	9.99E+99	9.99E+99	7.22E-02	1.00E-05	1.00E-09	3.4	3.9	0.1	0.5	10	1	1
24	arom 12-16	TDI	40	TDI	60	9.99E+99	9.99E+99	1.26E-02	1.00E-05	1.00E-09	3.7	4.3	0.1	0.5	10	1	1
25	arom 16-21	TDI	30	NR	0	9.99E+99	0	6.95E-04	1.00E-05	1.00E-09	4.15	4.8	0.1	0.5	10	1	1
26	arom 21-35	TDI	30	NR	0	9.99E+99	0	2.48E-05	1.00E-05	1.00E-09	5.1	6	0.1	0.5	10	1	1
27																	
28																	
29																	
30																	

		Soil-to-water partition coefficient ($cm^3\ g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg\ L^{-1}$)	Soil-to-plant concentration factor for green vegetables ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for root vegetables ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for tuber vegetables ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for herbaceous fruit ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for shrub fruit ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for tree fruit ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)
1	Arsenic (C4SL adult)	5.00E+02	NR	1.25E+06	0.00043 fw	0.0004 fw	0.00023 fw	0.00033 fw	0.0002 fw	0.0011 fw
2	Cadmium (C4SL)	1.00E+02	NR	1.62E+06	0.052 fw	0.029 fw	0.031 fw	0.016 fw	0.0031 fw	0.0014 fw
3	Chromium VI (C4SL adult)	8.50E+00	NR	8.76E+05	0 fw	0 fw	0 fw	0 fw	0 fw	0 fw
4	Lead (C4SL adult)	1.00E+03	NR	2.96E+05	0.00419 fw	0.00402 fw	0.00731 fw	0.00074 fw	0.00020 fw	0.00022 fw
5	Mercury, inorganic	5.00E+02	NR	7.40E+04	0.0038 fw	0.0069 fw	0.0043 fw	0.001 fw	0.0011 fw	0.001 fw
6	Selenium	5.00E+01	NR	2.17E+06	0.0108 fw	0.00364 fw	0.00083 fw	0.00271 fw	0.003 fw	0.003 fw
7	Naphthalene	3.74E+00	2.12E-09	1.90E+01	model	model	model	model	model	model
8	Benzo[a]anthracene	4.50E+02	1.24E-06	3.80E-03	model	model	model	model	model	model
9	Chrysene	3.19E+02	4.52E-08	2.00E-03	model	model	model	model	model	model
10	Benzo[b]fluoranthene	6.07E+02	6.34E-08	2.00E-03	model	model	model	model	model	model
11	Benzo(k)flouranthene	8.58E+02	1.64E-08	8.00E-04	model	model	model	model	model	model
12	Benzo[a]pyrene (C4SL adult)	7.47E+02	2.00E-08	3.80E-03	0.00041 fw	0.00178 fw	0.00088 fw	0.00050 fw	0.00000 fw	0.00004 fw
13	Dibenz[ah]anthracene	1.08E+03	1.66E-10	6.00E-04	model	model	model	model	model	model
14	ali 5-6	4.61E+00	2.19E+04	3.60E+01	model	model	model	model	model	model
15	ali 6-8	2.31E+01	3.45E+03	5.40E+00	model	model	model	model	model	model
16	ali 8-10	1.83E+02	3.20E+02	4.30E-01	model	model	model	model	model	model
17	ali 10-12	1.46E+03	3.21E+01	3.40E-02	model	model	model	model	model	model
18	ali 12-16	2.91E+04	1.53E+00	7.60E-04	model	model	model	model	model	model
19	ali 16-35	3.66E+06	2.38E-02	2.50E-06	model	model	model	model	model	model
20	arom 5-7	3.92E-01	6.24E+03	1.78E+03	model	model	model	model	model	model

Environment Agency

		Soil-to-water partition coefficient ($cm^3\ g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg\ L^{-1}$)	Soil-to-plant concentration factor for green vegetables ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for root vegetables ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for tuber vegetables ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for herbaceous fruit ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for shrub fruit ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)	Soil-to-plant concentration factor for tree fruit ($mg\ g^{-1}$ plant DW or FW basis over $mg\ g^{-1}$ DW soil)
21	arom 7-8	1.18E+00	1.73E+03	5.90E+02	model	model	model	model	model	model
22	arom 8-10	9.19E+00	3.20E+02	6.50E+01	model	model	model	model	model	model
23	arom 10-12	1.46E+01	3.21E+01	2.50E+01	model	model	model	model	model	model
24	arom 12-16	2.91E+01	1.14E+00	5.80E+00	model	model	model	model	model	model
25	arom 16-21	8.19E+01	5.62E-03	6.50E-01	model	model	model	model	model	model
26	arom 21-35	7.30E+02	1.61E-06	6.60E-03	model	model	model	model	model	model
27										
28										
29										
30										

LISTERS GEO
Geotechnical and Geoenvironmental Consultants



ListersGeo data
Used Engine Oil (Fig.6)
Petroleum Products (Fig.6)
Carburetted Water Gas Tar (Fig.6)
Carbonisation & Coke Oven Tar (Fig.6)
Combustion Soot (Fig.6)
Urban Background (Fig.7)
Creosote (Fig.7)
Carburetted Water Gas Tar (Fig.7)

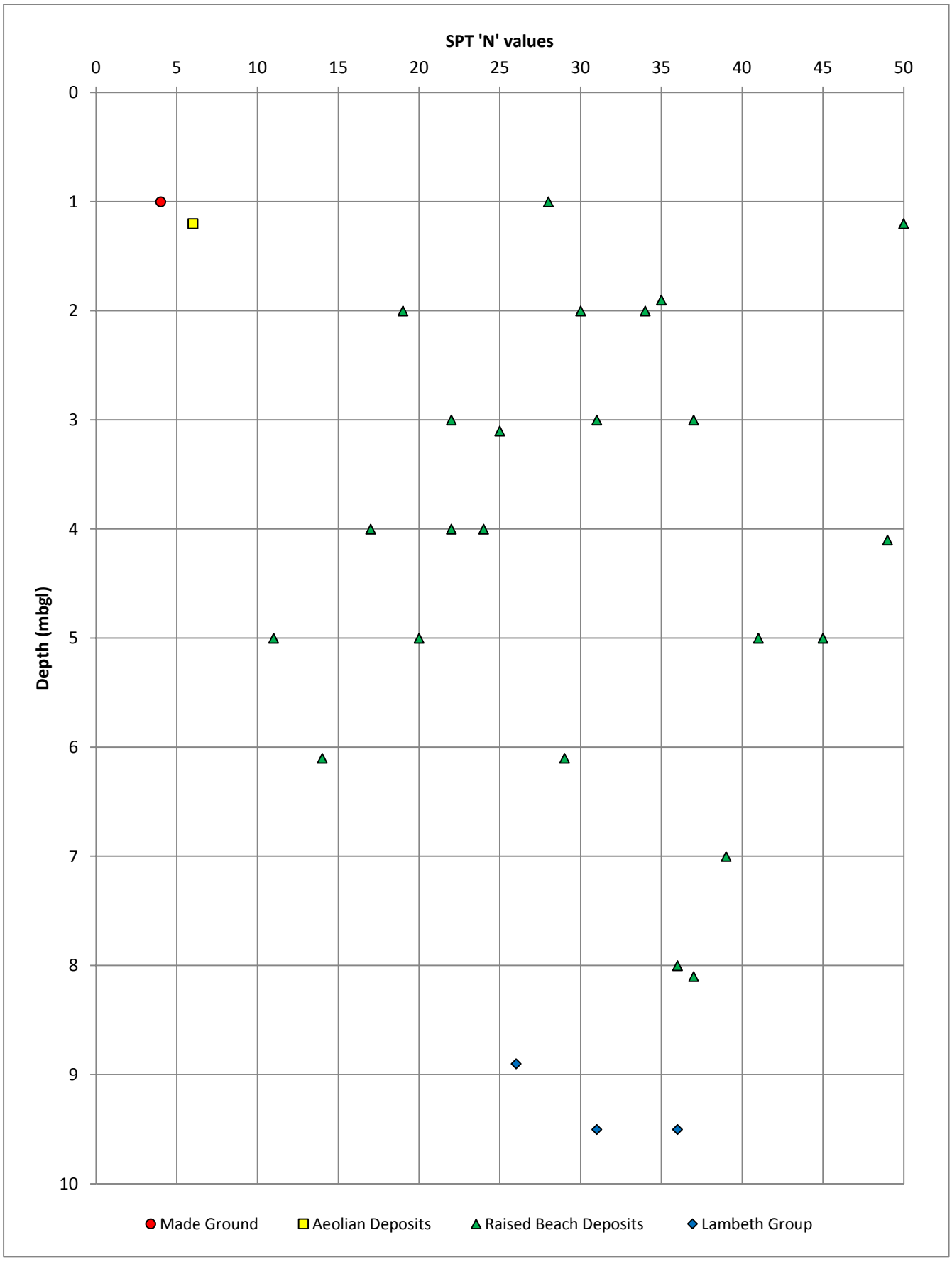
PAH Source Signature Double Ratio Plot

using data from Costa & Sauer, 2005 (Figs 6 & 7)

Report:
21.03.016

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

APPENDIX E
GEOTECHNICAL PLOTS AND TABLES



SPT 'N' VALUES AGAINST DEPTH	Report Number. 21.03.016

The working load of a single pile is the sum of the ultimate shaft resistance and the ultimate end bearing resistance, each divided by an appropriate factor of safety. The following unit ultimate values of shaft resistance and end bearing resistance are proposed for preliminary pile design:

Ultimate Skin Friction	**kN**
Made Ground/Aeolian Deposits From GL to 1.7m bgl	Ignore
Raised Beach Deposits From 1.7m to 7.0m bgl	Increasing linearly from 20 x As at a rate of 4.3 x As per metre

Ultimate End Bearing	**kN**
Raised Beach Deposits At 7.0m bgl	3,600 x Ab

Notes:

As – area of the pile shaft (m^2); Ab – area of pile base (m^2)

The above assumes the use of bored piles

PRELIMINARY PILE DESIGN DATA	**Report No: 21.03.016**