



SHADBOLT
ENVIRONMENTAL



Nile and Villiers, Sunderland

Ground Investigation Interpretive Report

Town Development Limited

Issue V1

October 2023



SHADBOLT
GROUP

Nile and Villiers, Sunderland

Ground Investigation Interpretive Report

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Client	Town Development Limited
Our Reference	3001 – Nile and Villiers, Sunderland
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1.0 INTRODUCTION

Shadbolt Environmental (SE) part of the Shadbolt Group (SG) were commissioned by Town Development Limited to undertake an intrusive ground investigation at Nile Street and Villiers Street within Sunderland City Centre, Tyne and Wear, SR1 1HA. The investigation was carried out under the supervision of SE. The site works were undertaken between Monday 11th September 2023 and Wednesday 20th September 2023.

This report provides an assessment of the ground conditions encountered at the site with regards to the proposed mixed Commercial and Residential development. The investigation was limited to investigating the nature of shallow Made Ground and superficial soils and potential obstructions in accordance with the clients brief.

1.1 Aims and Objectives

The purpose of the investigation was to determine the existing geotechnical and geochemical ground conditions relating to natural and artificial ground conditions and past uses of the site which may provide constraints to a potential future development.

1.2 Proposed Development

At this stage it is understood that the final development will comprise residential properties with areas of private gardens and public open spaces and associated infrastructure across much of the site with a large commercial unit on the northern boundary. An indicative Plan of Proposals as supplied by the Client's civil engineer is shown below for information. The plan is orientated with North to the left.



Indicative Development Layout

1.3 Scope of Works

The works undertaken by SE to date comprise:

- 3 No. day's windowless sample drilling.
- 2 No. day's trial pitting.
- In-situ testing.
- 3 No. BRE Soakaway Testing
- Chemical laboratory testing.
- Geotechnical laboratory testing.
- Ground gas and groundwater monitoring.
- Contamination risk assessment.

1.4 Limitations

The information presented in this report comprises data the strata observed in the excavations and the results of the site and laboratory tests as detailed within the report. Shadbolt Group take no responsibility for ground conditions which occur between the exploratory hole positions.

Every effort has been made to interpret the conditions between investigation locations; however, such information is indicative. A detailed review of the extent of limitations of this report is included in the **Report Conditions** included in **Appendix A** and the standard terms and conditions of the agreement.

2.0 SITE INFORMATION

2.1 General

The site is located within a mixed residential and commercial area of Sunderland City Centre, Tyne & Wear, to the south of High Street West. The site comprises a rectangular plot of land. The total size of the site is approximately 180m by 55m and has an area of approximately 3 ha (7.4 acres) and currently comprises open land covered with scrub grass with hardstanding and tarmacadam car parking in the north and south.

The approximate National Grid Reference (NGR) for the centre of the site is 440050m E, 557125m N.

A general site location plan of the site is presented as Figure 1 and an aerial photograph as Figure 2.

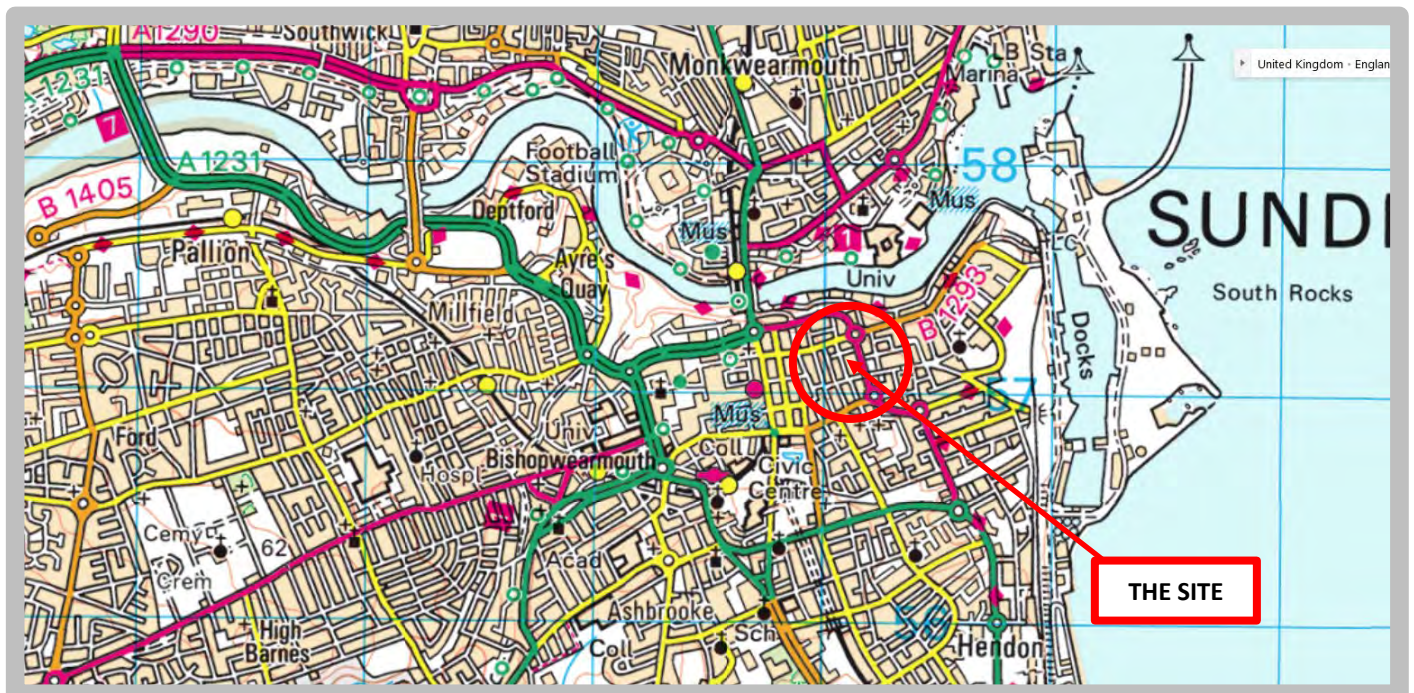


Figure 1 – General Site Location Plan

2.2 Site Description

The site is a rectangular plot of open land, previously commercial properties, and derelict land, covered with scrub grass with hardstanding and tarmacadam car parking in the north and south of the site. An electricity substation is located within the site adjacent to the Nile Street site boundary. The site is generally flat with a slight dip to the south adjacent to Villiers Street. The site is bisected by Little Villiers Street, which appears to be a former narrow lane between Nile Street and Villiers Street. The area surrounding the site is predominately commercial properties with some open public land and residential properties to the west of Nile Street beyond which is the bulk of Sunderland City Centre. To the east of Villiers Street is the A1018, beyond which is the area of Sunderland Docks. To the north of the site is High Street West beyond which there are commercial properties with the River Wear approximately 300m to the north. To the south of the site is Coronation Street beyond which are commercial properties.



Figure 2 – Aerial Photograph Showing the Site's Red Line Boundary.

3.0 HISTORICAL LAND USE

SE has had sight of a Phase 1 Environmental Site Assessment, prepared for Homes England by AECOM Ltd dated February 2020 (60586086_ACM_RP_EN_0001_B).

The report indicates that the earliest mapping, circa 1855, shows the site to be occupied terraced buildings with rear courtyards. The site remained relatively unchanged until circa 1950s when the residential properties were replaced with commercial properties, warehousing and the "Bethel Congregational Church". Further developments followed with a steel frame being erected in 2007/08 in the north of the site for a large L shaped commercial / mixed use development in the order of 4 storeys height on the site of the current northern car park, however this was never completed and was removed in later years and the land brought up to current levels.

Between 2008 and 2018 mapping indicated the buildings on-site were demolished with additional site clearance being undertaken at the time of the AECOM report.

Recently 2 No. units were demolished in the south west of the site after a water leak washed out soils beneath footings (anecdotal evidence from neighbouring property) leaving the site in its current configuration.

4.0 PREVIOUS INVESTIGATIONS

4.1 General

With the exception of the AECOM, Phase 1 Environmental Site Assessment, referenced above, SE has not had sight of any other previous investigation reports at the site.

AECOM noted the presence of ashy Made Ground and demolition rubble with a potential for asbestos fibres to be present across the site. The potential for shallow obstructions relating to previous developments was also considered to be high.

Historical borehole data for the area site, was obtained from the British Geological Survey, Geindex Onshore, website. There are 5 No. historic boreholes within 50m of the site boundary. The general strata encountered comprised Made Ground to a maximum depth of 2.32m below ground level (BGL) (NZ45NW20/21). Fine to medium Sand to a maximum depth of 5.5m BGL (NZ35NE225). The Sand was reported in 3 No. boreholes to be underlain by Boulder Clay (NZ45NW116 and NZ45NW20). 2 No. boreholes (NZ45NW20 and NZ45NW21) were recorded as terminating in Dolomitic Limestone.

The available historic exploratory hole logs are presented in **Appendix B**.

5.0 SITE INVESTIGATION

5.1 Proposed Development

The proposed development at the site is predominantly residential end use with areas of public open spaces and a commercial building in the north of the site.

5.2 Scope of Investigation

The site works comprised the following:

- 9 No. Mechanically Excavated Trial Pits to a maximum depth of 3.00m BGL
- 3 No. Mechanically Excavated Trial Pits for soakaway testing to a maximum depth of 2.00m BGL
- 14 No. Windowless Sample Boreholes drilled to a maximum depth of 5.00m BGL including 4 No. which terminated on shallow obstructions.
- Appropriate sample retrieval.
- Geotechnical and Geo-Environmental laboratory analysis.
- 5 No. gas and groundwater monitoring installations.
- 6 No. gas and groundwater monitoring visits

A total of 22 No. exploratory holes have been undertaken at the site as part of this investigation.

Plans showing the location of the exploratory holes undertaken as part of investigation are presented on **Drawing No. 3001-003 Exploratory Hole Location Plan** in **Appendix B**.

The soils and solid geology encountered during this investigation have been logged in accordance with BS5930:2015 “Code of Practice for Site Investigation”. During excavation, representative samples were taken at regular intervals from the exploratory holes to assist in the identification of the soils and solid geology and allow selected geotechnical and geochemical testing to be programmed.

5.3 In-Situ Testing

Standard Penetration Tests (SPT) were undertaken in suitable deposits during the siteworks. Hand Shear Vane (HSV) testing was not undertaken due to the granular nature of the soils encountered in Trial Pits. Results of the in-situ testing are presented on the relevant exploratory hole logs included in **Appendix B**.

5.4 Geotechnical Laboratory Testing

Selected samples (scheduled by **SE**) were submitted to our nominated geotechnical testing laboratory. Laboratory testing included Atterberg Limits, Particle Size Distribution (PSD), Dry Density/Moisture Content and Californian Bearing Ratio (CBRs). Samples scheduled for geotechnical testing were delivered to Exploration and Testing Associates Ltd in Durham (UKAS Accreditation No. 20632) where testing was carried out in accordance with BS 1377:1990 “Methods of Test for Soils for Civil Engineering Purposes” and any relevant updates to parts.

The results of geotechnical testing are presented in **Appendix E**.

5.5 Chemical Laboratory Testing

A targeted programme of chemical laboratory analysis was scheduled by SE to determine the concentrations of potential contaminants which may be present within the soils encountered at the site. The selected samples were submitted to Derwentside Environmental Testing Services Ltd. (UKAC Accreditation No. 2139)

25 No. soil samples were tested for a range of determinants including heavy and phytotoxic metals, metalloids, inorganic and organic contaminants. These samples, along with an additional 1 No. sample, were also screened for the presence of asbestos.

The results of the chemical analysis undertaken have been compared to the Shadbolt Soil Screening Values, based on LQM and CIEH research and published Soil Guideline Values.

The proposed development comprises a predominantly residential development with private and shared outdoor spaces across much of the site and a commercial building in the north. Assessments will initially be made against criteria for a Residential end use with plant uptake as this represents the most sensitive end user group.

Results of chemical analysis are discussed in **Section 7**.

Shadbolt Soil Screening Values are presented in **Appendix C**.

5.6 Groundwater and Gas Monitoring

6 No. monitoring wells were installed as part of the recent works. 1 No. gas and ground water visits have been completed in accordance with the client's brief.

The monitoring procedure comprised the following measurements:

- Atmospheric temperature, pressure, and ambient oxygen concentration on site immediately prior to and on completion of monitoring
- Emission (flow) rate
- Methane, oxygen, and carbon dioxide concentrations using a GasData infra-red landfill gas analyser.
- Standing water level using a dip meter.

Gas and groundwater monitoring has been undertaken as requested, and an interim assessment is presented in Section 8 based on available data. Results to date are presented in **Appendix F**.

5.7 Limitations

It should be noted that although every effort has been made to ensure the accuracy of the data obtained from the investigation, the possibility exists of variations in ground and groundwater conditions between and around the exploratory hole locations; additionally, groundwater levels and ground gas concentrations will vary seasonally and with changes in weather conditions.

6.0 GROUND CONDITIONS

Reference should be made to the individual exploratory hole logs presented in **Appendix B** for detailed descriptions of strata encountered at each location. The ground conditions encountered at the site are summarised in the following sections.

6.1 Topsoil

With the exception of 5 No. windowless sample boreholes (WS-01B, WS-02, WS-02A and WS-02B which were situated on tarmac and WS-09 which was commenced through concrete), Topsoil was encountered in all exploratory holes between ground level and a minimum of 0.15m BGL (TP-04, TP-04A, TP-06 and TP-07) and a maximum depth of 0.40m BGL (TP-08). The topsoil encountered was generally described as, dark brown to reddish brown or greyish brown slightly silty slightly gravelly fine to medium Sand with high root content. Gravel is angular to sub-round fine to coarse and includes brick, sandstone and coal.

6.2 Made Ground

Made ground was encountered in all exploratory holes between ground level (WS-1A, WS-02 and WS-02A) and 2.00m BGL (TP-03).

Windowless sample boreholes WS-02, WS-02A, WS-02B and WS-01B encountered tarmac between ground level and 0.18m BGL. WS-09 encountered concrete at the surface to a depth of 0.20m BGL.

The Made Ground encountered in the remaining exploratory hole generally consisted of Pinky brown to reddish brown and grey Sand and Gravel to very gravelly fine to medium Sand, with high cobble content and low boulder content. Gravel is angular to sub-angular fine to coarse and includes brick, slate, tile and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete. other constituents included iron, plastic and glass content. The Made Ground encountered was typical of building rubble backfill and included an element of slag or ash materials.

6.3 Superficial Deposits

Superficial deposits were recorded in all trial pits and 6 No. window sample boreholes. Windowless sample boreholes WS-01, WS-01A, WS-02 and WS-02A were terminated in Made Ground on obstructions. The depth to superficial deposits varied from 0.70m BGL (TP-04, WS-04 and WS-07) to a maximum depth 5.00m BGL (WS-06, WS-07 WS-08 and WS-09). The superficial Glaciofluvial deposits were generally described as yellowish brown becoming brown slightly silty slightly gravelly fine to medium Sand, becoming moist with depth. Gravel is sub-angular to sub-round fine to medium of sandstone.

6.4 Solid Deposits

Solid deposits were encountered in WS-01B and WS-02B at 2.60m BGL and at 4.30m BGL in WS-03. Solid geology comprised cream coloured limestone with a thin weathering profile. This is the Roker Limestone which is recorded as a Principal Aquifer.

6.5 Groundwater

Significant groundwater was not encountered during the works on site. Strata encountered in WS-04 below 4.70m were noted to be damp.

In post site works monitoring (1 No. visit) all installations were recorded to be dry.

It should be noted that groundwater levels will vary seasonally.

Gas and groundwater monitoring results are presented in **Appendix F**.

6.6 Ground Obstructions

Ground obstructions were encountered in trial pits TP-04, TP-04A and TP-06 between 0.30m BGL and 0.70m BGL and in windowless sample boreholes WS-01, WS-01A, WS-02 and WS-02A. No other significant ground obstructions were encountered in the remaining exploratory holes other than cobbles and boulders of brick, concrete and sandstone.

6.7 Observed Contamination

No significant visual or olfactory evidence of significant contamination was noted during the site investigation works although the presence of contaminants cannot be ruled out with higher potential noted within the Made Ground based on the prevalence of demolition derived materials and slag/ash content.

6.8 In-Situ Geotechnical Testing

The in-situ and laboratory geotechnical testing has been undertaken for the site are shown in **Table 6.8.1**.

Method	Strata	Parameter	Comments
Atterberg Soil Classification Testing	Natural Cohesive Strata	MC 17% to 20% LL 33% to 35% Modified Plasticity Index 14.5% to 16.5%	Glacial Till is of Low to Intermediate Plasticity with a Low Volume Change Potential
CBR Testing (Laboratory Remoulded)	Made Ground Granular Material	CBR Results (Lab Remoulded) in range of 7.7% to 16.5% (4.5kg Hammer)	A CBR value of at least 7% should be easily achievable utilising site won granular Made Ground.
Particle Size Distribution (PSD)	Made Ground Granular Material	Clay/Silt 18-49% Sand 38-71% Gravel 17-40% Cobbles 0-12%	Made Ground Granular Material Class 1A (SHW600)
Particle Size Distribution (PSD)	Natural Granular Material	Clay/Silt 7-17% Sand 68-88% Gravel 4-16% Cobbles 0%	Natural Granular Material generally Class 1B (SHW600)

Compaction (Dry Density-Moisture Content Relationship)	Made Ground Granular Material	Optimum Moisture Content (OMC) 13% to 15%	Made Ground Granular Materials close to or slightly dry of optimum moisture content at time of SI.
Compaction (Dry Density-Moisture Content Relationship)	Natural Granular Material	Optimum Moisture Content (OMC) 10% to 14%	Granular materials are close to or slightly dry of optimum moisture content at time of SI.
Standard Penetration Test	Made Ground Granular Material	SPT 'N-Values' in range N=4 to N=32 (Average N = 12)	SPTs confirm Made Ground cohesive material to be loose to medium dense.
Standard Penetration Test	Natural Granular Material	SPT 'N-Values' in range N=6 to N=24 (Average N = 13)	SPTs confirm Made Ground Granular material to be loose to medium dense.
Standard Penetration Test	Natural Cohesive Material	SPT 'N-Values' in range N=17 to N=20 (Average N = 12)	HSVs indicate natural cohesive soil strength to be generally Firm to Stiff (Medium to High Strength).
Standard Penetration Test	Limestone Bedrock	SPT Refusals of N=50+	SPTs confirm limestone bedrock to be at least Very Weak with minimal penetration achieved and little to no weathering profile.

Table 6.8.1: Summary of In-situ Laboratory Geotechnical Testing Undertaken

7.0 GROUND CONTAMINATION ASSESSMENT

7.1 Legislation

Part IIA of the Environmental Protection Act 1990 provides for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act, the statutory guidance document and The Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Therefore, land is only “contaminated land” where it appears to the regulatory authority, by reason of substances within, on, or under the land that:

Significant harm is being caused, or there is significant possibility of such harm being caused; or

Pollution of controlled waters is being, or is likely to be, caused.

The guidance defines “risk” as the combination of:

Probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and

Magnitude (including the seriousness) of the consequences.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all the following elements must be present:

Source, i.e. a substance that is capable of causing pollution or harm.

Receptor (or target), i.e. something which could be adversely affected by the contaminant; and

Pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is missing (source, pathway, or receptor) there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

7.2 Assessment Methodology

To assess the environmental risk posed by potential contaminants within the underlying soils to human health and controlled waters, Shadbolt Group undertook an initial screen of the laboratory results using in-house Soil Screening Values (SSVs). This initial screening was undertaken using SSVs developed for the most sensitive anticipated end use, **RESIDENTIAL with Home Grown Produce**.

The proposed development is to comprise predominantly residential properties with private gardens and shared open space, along with a commercial property in the north of the site.

Contaminant concentrations below the SSVs are considered not to warrant further risk assessment. Concentrations of potential contaminants above the SSVs require further consideration of the potential pollutant linkages.

It should be noted that exceedance of the SSVs does not necessarily require that the site be remediated.

7.3 Derivation of Soils SSVs

A discussion on the development of Shadbolt SSVs is presented, along with the relevant values at the time of writing in Appendix C.

7.4 Soil Contamination Assessment

In total 25 No. soil samples from the SE ground investigation were submitted for chemical testing of a suite of common contaminants. The laboratory chemical results have reported the majority of contaminants to be present at concentrations within Shadbolt SGVs.

Reported concentrations exceeding their respective SGV are as follows:

Contaminant (SGV)	Location	Reported Concentration	Exceedance	Material
Lead (200 mg/kg)	TP-01 0.40m	280 mg/kg	1.40x	Demolition MG
	TP-03 1.00m	210 mg/kg	1.05x	Demolition MG
	TP-04 0.50m	270 mg/kg	1.35x	Demolition MG
	TP-05 0.50m	240 mg/kg	1.20x	Demolition MG
	WS-03 0.50m	280 mg/kg	1.40x	Demolition MG
	WS-07 0.50m	390 mg/kg	1.95x	Demolition MG
	WS-09 0.50m	230 mg/kg	1.15x	Demolition MG
Benzo(a)pyrene (2.2 mg/kg)	TP-01 0.40m	2.4 mg/kg	1.09x	Demolition MG
Benzo(a)pyrene Surrogate Marker Approach (1.0 mg/kg)	TP-01 0.40m	2.4 mg/kg	2.40x	Demolition MG
	WS-01B 0.50m	1.5 mg/kg	1.50x	Demolition MG
	WS-06 0.50m	1.6 mg/kg	1.60x	Demolition MG

Table 7.4 – Samples with Contaminants exceeding SGVs

Where higher concentrations of Total Petroleum Hydrocarbons were reported further TPH CWG analysis was scheduled in order to assess risks presented by individual aliphatic and aromatic hydrocarbon bands.

On this basis all TPH bands are within their respective assessment criteria.

Asbestos

26 No. samples were scheduled for Asbestos Screening, of these 2 No. samples identified Chrysotile fibres as bundles and in microscopic bitumen fragments in shallow Made Ground in the north of the site (WS-01B and WS-03).

Quantification testing has been undertaken on the samples with Asbestos detections and has reported Asbestos content as follows:

Location	Material	Asbestos Noted
WS-01B East of northern car park	Granular Made Ground	Chrysotile fibre bundles, 0.004% w/w
WS-03 North of eastern grassed area.	Granular Made Ground	Asbestos Containing Material (ACM) Bitumen fragments with 8% Chrysotile Asbestos content of sample 0.559% w/w

Asbestos fibres detected in WS-01B indicate there is potential for fibre release from Made Ground beneath the car park in the north of the site if exposed or disturbed.

ACMs identified in WS-03 were noted to be microscopic bitumen fragments with asbestos content within. This could be fragments of bitumen products such as roofing felt or floor or roofing tile or may be a bitumen adhesive which has been incorporated into demolition materials. Bitumen products generally have a lower potential for fibre release due to the inherent encapsulation.

The asbestos content reported by weight was based on a sub-sample size of 6.47g of which 0.45g was recorded as ACM. Based on a small sample weight even a small fragment of bitumen ACM would skew the reported content when assessed by weight and may not be representative of the material as a whole.

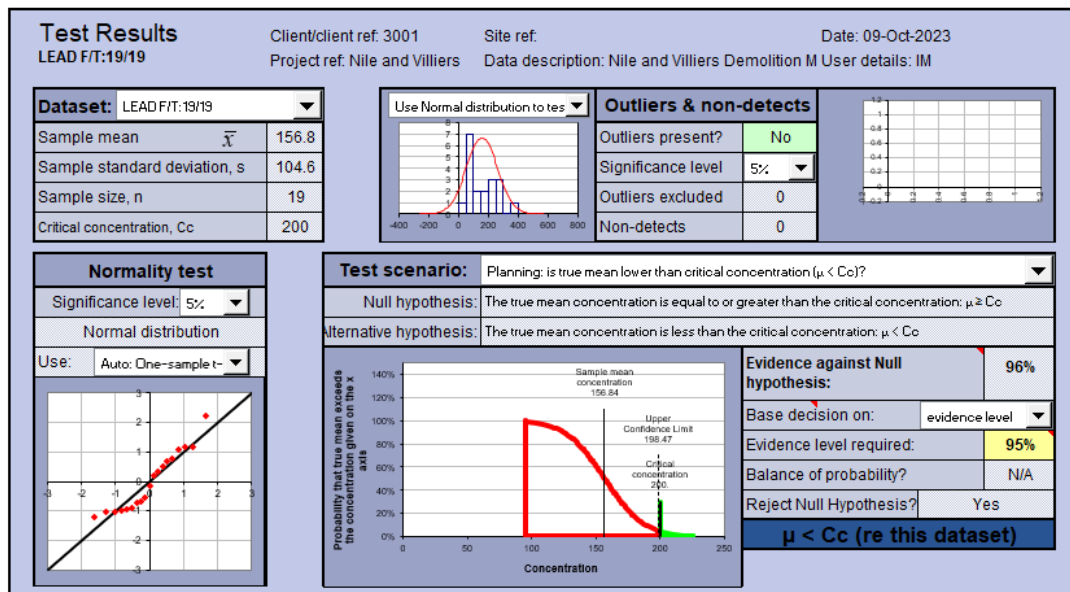
At this stage the reported concentrations should be considered in the context of the site as a whole and 17 No. other similar samples reporting negative asbestos detections. The reported detections currently represent isolated hotspots and should be investigated further by additional confirmatory sampling but also demonstrate the potential for ACMs or fibres to be present sporadically throughout the site.

7.4.1 Soils Statistical Assessment

Soil statistical assessment was carried out on 19 No. samples of Granular Made Ground recovered from the site in respect of concentrations of Lead and Benzo(a)pyrene.

Lead

The statistical analysis of the Lead concentration in the Granular Made Ground indicated a statistical upper confidence limit (U95) of 198.47mg/kg which is below the SGV of 200mg/kg. Therefore, the risk of the reported Lead concentrations posing significant harm to future occupants is considered to be Low on a site wide basis.

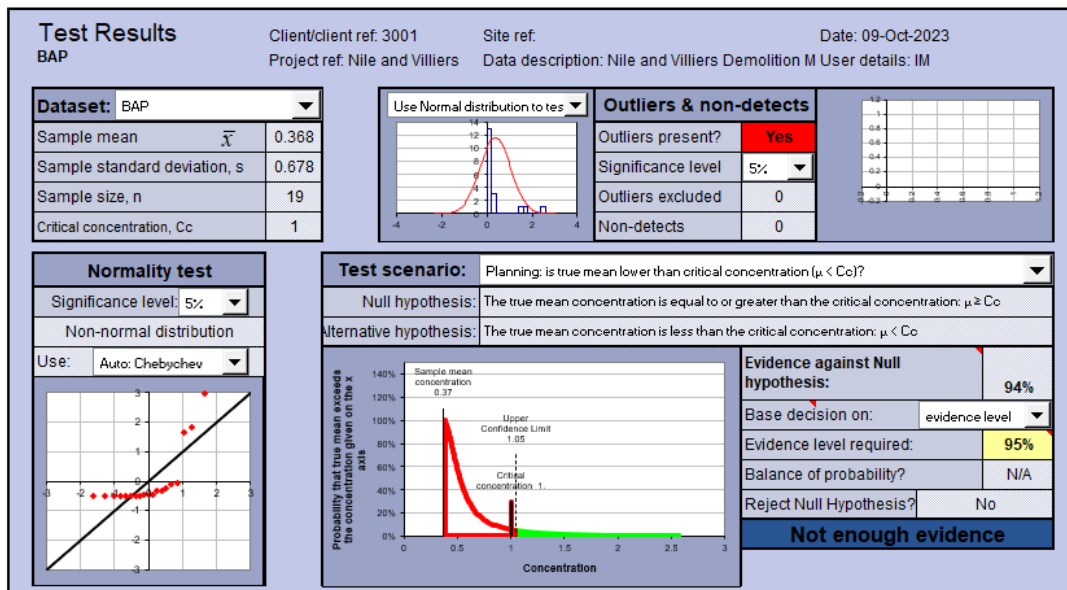


Lead, UCL95% 198.47mg/kg

Benzo(a)pyrene

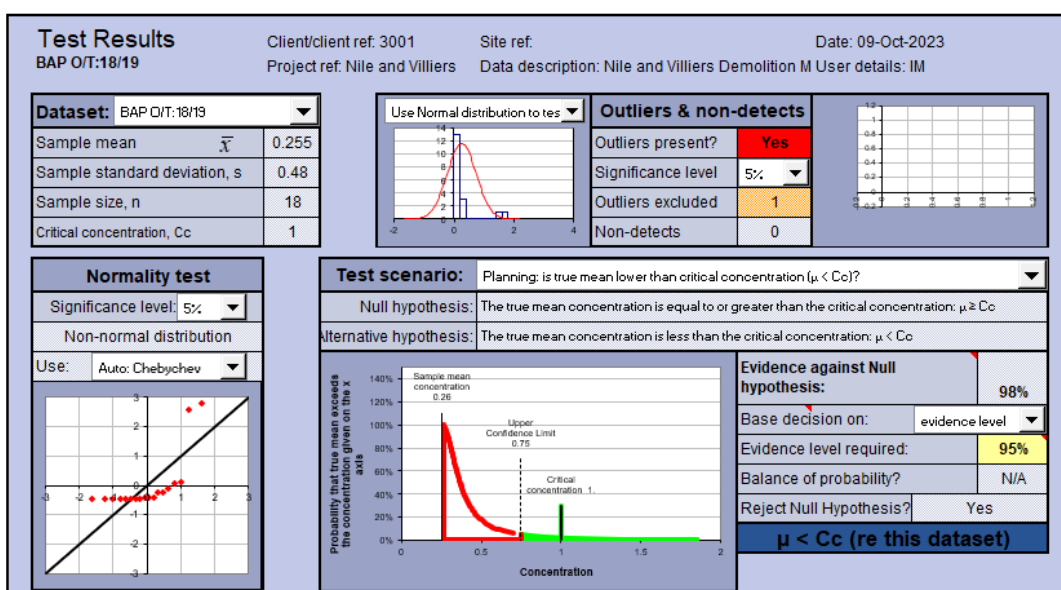
The statistical analysis of the Benzo(a)pyrene (BaP) concentration in the Granular Made Ground indicates a statistical upper confidence limit (U95) of 1.05mg/kg which marginally exceeds the SGV of 1.00mg/kg with statistical outliers noted.

The lower SGV of 1.00mg/kg utilising the surrogate marker approach is considered appropriate based on the PAH profile (LQM Profiling Tool) indicating the potential presence of coal tar or coal tar derivatives such as creosote, however, the profile also fits that of a combustion (soot) source suggesting a coal fire or coal fired boiler is likely and is considered appropriate on review of the site's history.



Benzo(a)pyrene, UCL95% 1.05mg/kg

With the highest statistical outlier (hotspot) removed from the dataset, 2.40mg/kg reported in TP-01 at 0.40m, the upper confidence limit (U95) is 0.75mg/kg which is within the SGV of 1.00mg/kg.



Benzo(a)pyrene, 1st outlier removed, UCL95% 0.75mg/kg

7.4.2 Discussion

With the first outlier removed from the data set the risk to future site users from Benzo(a)pyrene is considered to be low. Due to the nature of materials identified at the site it is likely that imported material will be required in order to provide a suitable growing medium in the proposed private and shared gardens. This will provide further isolation between future site users and potential contaminants present in the underlying Made Ground.

7.5 Leachate Contamination Assessment

No leachate analysis was undertaken at the site due to the predominantly low concentrations of contaminants reported.

7.6 Groundwater Contamination Assessment

Significant groundwater was not encountered during site works or in post site works monitoring.

7.7 Waste Acceptance Criteria

WAC has not been assessed at this time. It is anticipated that the majority of the soils will remain on site as part of the development.

7.8 Gas and Groundwater Monitoring

6 No. monitoring wells were installed by SE as part of the commissioned works. Results of the gas and groundwater monitoring undertaken in these installations to date are reported within **Appendix F**.

8.0 GAS RISK ASSESSMENT

8.1 Gas Monitoring

Ground gas and water monitoring wells have been monitored in accordance with the process outlined in CIRIA C665 and BS8576:2013, however, only 1 No. visit has been undertaken to date at the Client's request.

8.2 Gas Risk Assessment

CIRIA have developed a characterisation system for all buildings except for low-rise housing developments with a clear ventilated sub-floor void. Low-rise housing developments are generally covered by the NHBC's "Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present".

The CIRIA system as detailed in CIRIA Report C665, is a risk-based system which compares gas emission rates to generic Characteristic Situations (CS) derived and expanded on from CIRIA 149. The NHBC guidance uses a concept of 'Traffic Lights' developed by Boyle and Witherington for the assessment of gas emission rates for a residential development.

Each methodology utilises 'Typical Maximum Concentrations' for initial screening purposes and the development of risk-based Gas Screening Values (GSVs) for consideration when the Typical Maximum Concentrations are exceeded. The GSVs are calculated by multiplying the borehole flow rate by the concentration in the air stream of the particular gas being considered.

The Traffic Light and Characteristic Situation systems have been designed for both methane and carbon dioxide, with the worst-case value adopted for assessment.

Ground Gas Monitoring Data

To date 1 No. monitoring visit has been completed. The gas monitoring results are presented in **Appendix F**.

The maximum Methane and Carbon Dioxide emissions, which are representative of the Typical Maximum Concentrations, were as follows:

Methane:	0.0% v/v
Carbon Dioxide:	3.2% v/v

The maximum recorded concentration of methane was 0.0% v/v; however, 0.1% v/v will be used for calculations as this is the limit of detection of the instrument.

The maximum recorded concentration of carbon dioxide to date was 3.2% (peak and steady). Carbon dioxide concentrations at this location (WS-08) and the associated reduced oxygen concentrations may be related to microbial aerobic respiration within the borehole following the increase in available oxygen.

The gas steady flow rate during the gas and groundwater monitoring visit was 0.0 l/hr; however, 0.1 l/hr will be used for the calculations as this is the limit of detection of the instrument.

The calculated GSVs using maximum values for Methane and Carbon Dioxide are as follows:

Methane: $(0.1/100) \times 0.1 = 0.0001$ l/hr

Carbon Dioxide: $(3.2/100) \times 0.1 = 0.0032$ l/hr

When monitoring data to date is compared to the values in Table 8.5 in CIRIA Report C665 and the NHBC Guidance Table 14.1 and Table 14.2. The site is classified under the former as: **Characteristic Situation 1 (CS1)** and **Green** under the later.

The Gas monitoring results to date are presented within **Appendix F**.

8.3 Discussion

Using calculated GSVs for Methane and Carbon Dioxide, the assessment methods classify the site in the lowest risk category, i.e., **CS1** and **Green**.

The site is in an area where 1-3% of properties are above the action level, therefore no Radon Protective Measures are required for new properties or extensions as confirmed in GroundSure Report obtained for the site by AECOM (Dated 29 October 2019).

On this basis it is likely that no specific ground gas protection measures will be required in developments at this site, however this is a preliminary assessment based on the 1 No. monitoring visit completed to date.

For a full assessment to be undertaken guidance recommends a minimum of 6 No. readings over a period of 2-3 months including at times of falling barometric pressure. Further monitoring should be undertaken in order to make a full assessment and allow the development to proceed on a more assured basis.

9.0 ENVIRONMENTAL RISK ASSESSMENT

All available data has been collated and evaluated to establish an initial conceptual model of the site in its current condition and post development identifying sources, pathways and receptors and pollutant linkages. The conceptual site model has been developed in accordance with BS10175: 2011.

The proposed end use has not been confirmed however, it is currently believed to be residential with associated infrastructure and public open spaces. A Tier 1 risk assessment has been undertaken using the appropriate guidelines for a **Residential with Home Grown Produce** end use which is envisaged to be the most sensitive end use in the proposed development.

9.1 Contamination Sources

In total 25 No. soil samples from the **SE** ground investigation were submitted for chemical testing of a suite of common contaminants as discussed in Section 7.4.

The laboratory chemical results have reported the majority of contaminants to be present at concentrations within Shadbolt SGVs.

Isolated instances of elevated Lead were reported in granular Made Ground across the site, but statistical analysis indicates the risk to the end user to be low with respect to Lead.

3 No. elevated concentrations of Benzo(a)pyrene were reported within granular Made Ground; statistical analysis indicates each of the elevated concentrations has the potential to be a statistical outlier (hotspot), but with the largest exceedance excluded (2.4mg/kg in TP-01 at 0.40m) the UCL95% falls within acceptable limits.

Considering the chemical testing undertaken to date and the general prevailing ground conditions it is possible that other significant contamination will be encountered during foreseeable works and post-development occupation including isolated instances of contaminants which may be present on site through leakages, spillages, localised historic importing of contaminants or soils or unrecorded fly-tipping of wastes.

9.2 Potential Contaminant Pathways

The following potential contaminant pathways are possible and should be considered during the construction phase and the post development end use.

- Inhalation / ingestion of dust, gases and vapour.
- Ground gas / vapour migration.
- Dermal contact.
- Ingestion of soils and / or groundwater.
- Leaching of contaminants from made ground soils to groundwater.
- Groundwater flow.
- Soil gas migration through Made Ground, granular soils, fissures and mine entries.
- Migration and leakage through service conduits.

9.3 Potential Contamination Receptors

A number of potential receptors may be affected by contaminants present on the site, based on the current and proposed site usage.

Potential receptors on site and in the surrounding area are considered to be:

Human Health

- Current site users.
- Future site users.
- Site development workers.
- Maintenance workers

Environmental

- Future establishment of flora and fauna.
- Buildings and underground services.
- Controlled waters and aquifers.

9.4 Qualitative Risk Assessment

By considering the sources, pathways and receptors, an assessment of the environmental risks is made with reference to the significance and degree of the risk to the development for current and future site users.

The qualitative risk assessment has been undertaken in accordance with BS10175:2011 and CIRIA Document C552: Contaminated Land Risk assessment, A Guide to Good Practice.

The risk assessment has been carried out by assessing the severity of the potential consequence, taking into account both the potential severity of the hazard and the sensitivity of the target, based on the categories given in Table 9.4.1 below.

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

Table 9.4.1 – Definition of Risk Severity

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given in Table 9.4.2 below.

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

Table 9.4.2 – Definition of Risk Probability

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix, Table 9.4.3 below, in order to give a level of risk for each potential hazard.

		<i>Potential Severity</i>			
		<i>Severe</i>	<i>Medium</i>	<i>Mild</i>	<i>Minor</i>
<i>Probability of Risk</i>	<i>High Likelihood</i>	Very high	High	Moderate	Low/Moderate
	<i>Likely</i>	High	Moderate	Low/Moderate	Low
	<i>Low likelihood</i>	Moderate	Low/Moderate	Low	Very low
	<i>Unlikely</i>	Low/Moderate	Low	Very low	Very low

Table 9.4.3 – Risk Matrix of Potential Hazard

The contamination risk assessment for the site based on identified sources is presented in Table 9.4.4. Further discussion of the more significant pollutant linkages is provided in a discussion below for each receptor in turn.

Hazard / Pollutant	Source	Pathway	Receptor	Potential severity	Probability of risk	Level of risk		
<p>Made Ground / Demolition Fill and site history with substation, garages, workshops, printing, and furniture works.</p> <ul style="list-style-type: none"> • Polyaromatic Hydrocarbons (PAHs) • Phenols • Total Petroleum Hydrocarbons (both aliphatic and aromatic) • Asbestos, • Heavy metals and metalloids • Pesticides • inorganic compounds (pH, sulphates, sulphur, cyanides) • Coal Tars, Burning Residues. 	Potential Contaminants Made Ground, former and current off-site and on-site sources.	Inhalation, Dermal contact, and Ingestion	Current and Future site users.	Medium	Unlikely	Low		
		Direct Contact	Proposed buildings and structures and services.	Medium	Unlikely	Low		
		Inhalation, Dermal contact, and Ingestion	Development workers.	Medium	Low Likelihood	Low/Moderate		
		Root Uptake	Plants	Minor	Low likelihood	Very Low		
		Contaminated Groundwater Migration	Secondary (A) Aquifer (Glaciofluvial Deposits)	Medium	Unlikely	Low		
			Principal Aquifer (Roker Limestone)	Medium	Unlikely	Low		
			Culvert / Water Course	Medium	Unlikely	Low		
		Leaching of Soil Contamination	Secondary (A) Aquifer (Glaciofluvial Deposits)	Mild	Low Likelihood	Very Low		
			Principal Aquifer (Roker Limestone)	Medium	Low Likelihood	Low/Moderate		
			Culvert / Water Course	Medium	Unlikely	Low		
		Migration through service conduits, foundations, drainage solutions	Secondary (A) Aquifer (Glaciofluvial Deposits)	Medium	Low Likelihood	Low/Moderate		
			Principal Aquifer (Roker Limestone)	Medium	Low Likelihood	Low/Moderate		
			Culvert / Water Course	Medium	Unlikely	Low		
		Surface Run-off	Secondary (A) Aquifer (Glaciofluvial Deposits)	Minor	Low Likelihood	Very Low		
			Principal Aquifer (Roker Limestone)	Medium	Low Likelihood	Low/Moderate		
			Culvert / Water Course	Medium	Unlikely	Low		
		Volatilisation (vapour phase migration and partitioning into sorbed / dissolved phase).	Secondary (A) Aquifer (Glaciofluvial Deposits)	Minor	Low Likelihood	Very Low		
			Principal Aquifer (Roker Limestone)	Medium	Low Likelihood	Low/Moderate		
			Culvert / Water Course	Medium	Unlikely	Low		
		Hazardous gas and volatile compounds	Migration from possible Made Ground and buried organic soils	Inhalation, Explosion	Future site users, Structures	Medium	Low Likelihood	Low
					Site development workers	Medium	Unlikely	Low

Table 9.4.4 – Contamination Risk Assessment

9.4.1 Current and Future Site Users

Potential pathways considered significant to current and future site users, including pedestrians, dog walkers, maintenance workers and residents, are dermal contact, ingestion of impacted soils and inhalation of dusts and vapours.

Laboratory chemical analysis has indicated slightly elevated levels of TPH and PAH compounds. Locally elevated reported concentrations of Lead have been shown by statistical analysis to be within acceptable limits on a site wide basis.

2 No. samples of Made Ground of a dataset of 19 No. returned positive tests for Chrysotile Asbestos fibres. While not widespread this indicates the potential for fibres to be present within the granular Made Ground across the site. A suitable cover layer.

Should the site be developed in the future the risk to site users would be **LOW/MODERATE** based on the chemical analysis data to date.

Due to the potential for Asbestos within Made Ground across the site it is considered that at this stage an allowance for a clean cover layer comprising 850mm subsoil and 150mm topsoil within soft landscaping areas (residential gardens and POS). Provision should also be made for a hard dig capillary break layer 150mm thick should be placed at the base of the clean cover with a geo-textile membrane at 1.00m.

The cover layer will also protect future site users from potential contaminants which may be present in areas not investigated to date. With provision of a suitable clean cover system the risk to future site users would be reduced to **VERY LOW to LOW**.

The potential risk to future site users from hazardous gases would be **LOW/MODERATE** based on the current data however, continued gas monitoring is required to confirm the initial findings.

Left undisturbed the Made Ground presents a minimal risk to current site users, however if materials are to be excavated during the construction phase then suitable precautions should be taken to protect the health of construction workers. This should include further sampling and analysis, dust and fibre monitoring and safe systems of work.

In order to further protect construction and maintenance workers services should be laid in clean corridors, backfilled with proven clean soils, extending 0.50m either side of and below the main service corridors or service runs.

Should any materials, including evidence of hydrocarbons or suspected Asbestos Containing Materials, be suspected of being contaminated work should cease and specialist environmental advice sought.

9.4.2 Ground Excavation / Development Workers

Earthworks will likely be undertaken as part of the proposed development. It is considered that the risk to construction workers during redevelopment works is **MODERATE** given the potential for Asbestos fibres within the granular Made Ground.

Safe systems of work should be implemented during any earthworks and clean corridors should be provided for service runs.

The risk to post-development maintenance workers will be **LOW** following the provision of a clean cover layer and clean service corridors. owing to the generally low concentrations of reported contaminants. However, site development workers should remain vigilant for the evidence of contamination.

Should any materials, including evidence of hydrocarbons or suspected Asbestos Containing Materials, be suspected of being contaminated work should cease and specialist environmental advice sought.

9.4.3 Controlled Waters

Low concentrations of potential contaminants have generally been reported in the limited site Investigation undertaken to date. The permeable nature of the granular Made Ground and Superficial deposits offers little in the way of retention or protection with regards potential mobile contaminants.

Therefore it is considered that a LOW to LOW/MODERATE risk is presented to controlled waters within the vicinity of the site and the underlying secondary (Glaciofluvial Deposits) and principal (Roker Limestone) aquifers by identified and potential contaminants on site.

No mobile or free product was noted during the recent SI works.

Further analysis should be carried out ahead of any development works commencing on site in order to investigate areas of the site which have not been addressed at this stage.

Should any material suspected of being contaminated be encountered during the construction phase then works should cease and specialist environmental advice sought.

9.4.4 Flora

Low contaminant concentrations have been reported at shallow depth within topsoil materials across the site and it is therefore considered that there is **LOW** risk to the establishment of flora at the site.

10.0 ENGINEERING CONSIDERATIONS

10.1 Proposed Development

It is understood that the proposed development at the site is predominantly Residential properties with private gardens, shared open space and associated infrastructure across much of the site and a Commercial property in the north of the site. A proposed indicative development layout plan is presented in Section 1.2.

10.2 Ground Obstructions

Trial pits were excavated at locations supplied by the Client’s Engineer with the aim of determining the presence of anticipated obstructions in the form of relic foundations and buried structures.

The Made Ground was found to include a relatively high proportion of demolition derived cobbles and were mainly brick, concrete or sandstone.

A number of buried walls were encountered within trial pits along with foundations, however, these were easily broken and excavated with the bucket on an 8t excavator.

It is also understood that there is a former chapel located in the east of the site between WS-07 and IT-02 which would be expected to be a more substantial structure, and a former crypt is located beneath the SCS car park in the south east of the site.

These areas are within the proposed development area but were not scheduled by the Client’s Engineer to be targeted for investigation at this preliminary stage of intrusive investigations.

The AECOM desk study states the crypt was opened and remains relocated in 2010 and then infilled, but there is no information on the method of infilling or whether the structure was grubbed out.

Notable obstructions identified by SE are listed in Table 10.2 below:

Location	Depth	Obstruction
WS-01	1.10m	Concrete, possible footing (c. 2008).
WS-01A	0.65m	Concrete, possible footing (c. 2008).
WS-02, WS-02A	0.85m	Concrete footing (c. 2008).
WS-06	0.30 – 1.00m	Concrete slabs and brick
WS-07	0.20 – 1.00m	Wall fragments
TP-01	0.40 – 1.20m	Wall in east of pit
TP-06	0.50m	Wall in south of pit
TP-07	0.50m	Wall in north of pit and historic drains

Table 10.2 – Notable Obstructions

10.3 Coal Mining Risk Assessment

The Coal Authority (CA) Online Interactive Mapping indicates that the site is located within a coal mining reporting area.

A CON29M Coal Mining Report was presented in Appendix E of the Desk Study report produced by AECOM (October 2019).

The report confirms the site is located within a coal field area and is in an area that could be affected by past underground mining. This was in 1 seam of coal at 470 to 560m depth and was last worked in 1947. The Coal Authority stated that any movement in the ground due to coal mining activity associated with these workings should have stopped by now.

The site is not in an area that could be affected by present underground mining and is not in an area where the Coal Authority has received an application or granted a license to extract coal in the future. The report adds that the property is not in an area likely to be affected from any planned future underground coal mining, however, reserves of coal exist in the local area which could be worked at some time in the future.

The report adds the following information with respect to potential coal mining legacy:

- No mine entries within the site boundary or within 20m of the site.
- The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by mining.
- The site is not in an area of past, current or potential future extraction by opencast mining.
- The Coal Authority has not received a damage notice or claim within 50m of the site and no remedial or preventative works are in place.
- There are no records of a mine gas emission requiring action.

The Groundsure report for the site, presented in Appendix A of the AECOM Desk Study, notes that historic mining features are indicated on historical mapping within 1000m of the site. The closest of these (Records 1 to 24 of 39) are recorded 283m to 327m West of the site and relate to air shafts. The closest colliery indicated on historic plans is recorded 836m North West of the site and likely relates to the Wearmouth Colliery (937m NW).

Given the depth to recorded workings and rock being recorded as shallow as 2.60m BGL in the recent site investigations the risks to developments at the site from historic coal mining is considered to be Very Low and no specific precautions or further works are anticipated in this regard.

10.4 Foundations and Settlement Issues

Only an outline SI has been undertaken at this stage. Findings to date indicated Made Ground at the site varies in thickness from less than 0.50m to in the order of 2.00m and potentially deeper in former church and crypt footprints in the east of the site.

In its current state the Made Ground is not considered a suitable founding stratum and any foundations should be extended through to bear on the underlying natural ground.

Residential Properties

For the majority of the residential properties this would be expected to be standard strip footings in the west of the site and deepened strip or trench footings in the east. The small extended area in the south west, to the west of Nile Street may require deeper foundations subject to the presence of a cellar and potential lasting erosional damage which required the buildings to be demolished.

The west of the site is relatively level between Nile Street and the central access road but falls by 1.2 to 1.8m across the east of the site down to Villiers Street.

Consideration should be given to surrounding levels in order to make the most efficient use of available materials and avoid significant import or export of materials. Partial sub levels with street level access in the east where levels have the greatest crossfalls would allow the use of shallower foundations and avoid the need for engineered retaining solutions.

Based on the limited SI undertaken at this stage strip or deepened trench footings based on an allowable bearing capacity of 75 kPa are likely to be appropriate. If groundwater is expected within 1.00m of the underside of foundations the allowable bearing capacity may be reduced.

Where properties encountered both cohesive and granular soil at founding depth measures such as additional reinforcement may be required in order to safeguard against potential differential settlement.

Commercial Development

Shallow bedrock was identified in the north of the site where the proposed commercial development is to be sited. The limestone bedrock was identified below at a depth of 2.60m in the northern car park but falls away relatively sharply to the south. Made Ground extended to rockhead in the west (WS-02B) while natural clays were encountered between 1.30m and 2.50m BGL in the centre of the site (WS-01B).

To avoid the potential for differential settlement foundations for the commercial development should be extended through any Made Ground and cohesive natural ground to found on the underlying bedrock.

From WS-01B and WS-02B there is expected to be a thin weathering profile at the upper surface, but a conservative allowable bearing capacity of at least 200 kPa is anticipated at this stage.

10.5 Earthworks

A potential site layout has been provided to **SE** as presented in Section 1. Based on current site levels an element of cut and fill earthworks is anticipated. Ideally levels should allow the majority of materials to remain on site although this may not be possible.

An earthworks model should be developed in order to make most efficient use of available materials and minimise off-site disposal.

The overall site layout and individual property designs, such as the provision of a sub-level living area, garage or parking on the lower side to the east, will also affect the overall balance of materials and requirement for engineered solutions

10.6 Chemical Attack on Buried Structures

The water-soluble sulphate test results in the Made Ground generally recorded concentrations between, 43mg/l (TP-03) and 500mg/l (TP-06) with one sample reported with 1500mg/kg (WS-04 at 0.50m BGL). The soil pH was generally between 7.6 (WS-08) and 11.2 (TP-05, WS-01B) indicating neutral to alkaline conditions.

The results have been assessed in accordance with the guidance given in BRE Special Digest 1:2005. The Made Ground at the site is primarily demolition rubble with no significant groundwater detected, the assessment for the chemical environment has accordingly been made assuming a brownfield site with mobile groundwater. The Design Sulphate Class across the site are between DS-1, ACES Class AC-1.

10.7 Infrastructure

The proposed development is not anticipated to feature significant new highway links although occasional service traffic may be expected in the central portion of the development.

Laboratory geotechnical testing reported remoulded CBR values for granular Made Ground materials recovered from site should provide CBR values in the order of 7%, however a default value of 2-3% should be adopted for design purposes. In-situ testing of the subgrade materials prior to construction may allow an increased CBR value to be utilised.

The results of geotechnical laboratory testing are presented in **Appendix E**.

As the site stands at the time of writing CBR values within Made Ground strata would be expected to be highly variable due to the mixed site history across the site. Without ground improvement earthworks a CBR value in the order of 2% should be assumed for pavement design.

With suitable processing and compaction the Made Ground would be expected to offer CBR values for design in the order of 6%.

Soakaway testing has been undertaken in 3 No. locations across the site and has returned infiltration rates of 2.44×10^{-4} and 2.38×10^{-5} within the underlying natural sand where tests could be successfully completed. These infiltration rates may be sufficient for soakaway drainage of surface waters subject to anticipated volumes and the required land area being available.

However, anecdotal evidence suggests former properties in the south west of the site have been demolished in recent years following a water leak which undermined foundations, therefore, consideration should be given to likely flow paths and potential for washout. Formal drainage should be adopted if required structural risks cannot be mitigated sufficiently.

11.0 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

Shadbolt Environmental (SE) were commissioned by Town Development Limited to undertake a preliminary intrusive geo-environmental site investigation at the proposed residential and commercial development site on land at Nile and Villiers Street in Sunderland, Tyne and Wear.

The site comprises a rectangular plot of land with an area of approximately 3 Ha. The site features 2 areas of grassed land with a central concrete access road and 2 No. car parks, one in the north and one in the south east. A recently cleared plot is present in the south west of the site.

Made Ground was encountered in all locations and generally comprised demolition fill with an element of ash/slag. With the exception of WS-02B, superficial deposits comprising predominantly granular glaciofluvial deposits were encountered across the site extending to depth in excess of 4m.

Superficial deposits were found to thin in the north of the site and were noted to be more cohesive in nature. Roker Limestone bedrock was encountered in WS-01B, WS-02B and WS-03 in the north of the site as shallow as 2.60m BGL in WS-01B and WS-02B.

Significant groundwater was not encountered during the works.

26 No. samples were submitted for analysis for a range of common contaminants. Including metals, metalloids, hydrocarbons and asbestos. Elevated concentrations of Lead and Benzo(a)pyrene were identified along with 2 No. samples returning positive identifications of Asbestos fibres.

Statistical analysis showed that Lead concentrations were within acceptable limits when considered on a site wide basis. Benzo(a)pyrene was assessed utilising the surrogate marker approach and the PAH profiling tool which suggested a history of burning on site which is considered likely arising from historic open fires and boilers on site. Statistical analysis identified 1 No. hotspot to be removed from site or isolated from future site users.

On the basis of chemical testing undertaken to date and the general prevailing ground conditions, it is unlikely that significant contamination will be encountered during potential development works; however, it does indicate the potential for contaminants to be present and it is possible that isolated instances of contaminants may be present on site through leakages, spillages, localised historic importing of contaminants or soils or unrecorded fly-tipping of wastes.

Based on the limited SI undertaken at this stage appropriate foundations for Residential developments are likely to be strip or deepened trench footings based on an allowable bearing capacity of 75 kPa. If groundwater is expected within 1.00m of the underside of foundations the allowable bearing capacity may be reduced.

The Commercial development in the north of the site should be founded on the underlying limestone bedrock with foundations extended through any Made Ground. An allowable bearing capacity of at least 200 kPa should be readily achieved.

Consideration should be given to the design of proposed structures and ground levels to make best use of the available materials on site and allow street level access from Nile Street and Villiers Street.

At the request of the Clients Engineer gas monitoring has been carried out on 1 No. occasion to date. The results of gas monitoring to date indicate that protective measures are not likely to be required with respect to Carbon Dioxide and Methane and the site is not in an area where gas protection measures with respect to Radon are required. However, this is based on just 1 No. monitoring visit and an assessment should not be based on this reading alone.

11.2 Recommendations

Groundworkers should remain vigilant for the presence of potential contaminants and should seek specialist advice if suspected contaminants are identified.

Excavations should be inspected and assessed for potential softer strata prior to construction of foundations. If soft materials are identified the trench should be deepened and the soft spot removed and replaced with well compacted, clean, quarried stone or concrete.

The elevated levels of Benzo(a)pyrene reported by laboratory analysis within the Made Ground underlying the site will require the removal of 1 No. hotspot and the placement of a clean cover layer comprising 450mm of Subsoil and 150mm of Topsoil over Made Ground within private gardens and public open space.

Details of hotspot removal works and any profiling works should be set out in a remediation and earthworks strategy once development proposals are known. Following completion of the groundworks a validation report will be required to document the works undertaken.

Additional investigations will be required to confirm the nature of obstructions in areas of the site not targeted to date and to provide confirmation of foundation requirements in areas of deeper Made Gound.

A further 5-8 No. gas and groundwater monitoring visits should be completed to better understand the ground gas and groundwater regime underlying the site. Following the completion of the monitoring visits a full gas risk assessment may be carried out.

The Shadbolt Group

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APPENDIX A

REPORT CONDITIONS

REPORT CONDITIONS

GEO-ENVIRONMENTAL GROUND INVESTIGATION

*This report is produced for the benefit of **Town Development Limited** in accordance with the terms of the appointment.*

This report has been prepared in accordance with the terms and conditions of the appointment and relates to the condition of the site at the time of ground investigations. No warranty is provided as to the possibility of future changes in the condition of the site.

Shadbolt Environmental takes no responsibility for conditions which occur between the individual exploratory holes.

This report is prepared and written for the purposed uses stated in the report and should not be used in a different context without reference to Shadbolt Environmental. In time, improved practices or amended legislation may necessitate a re-assessment.

The report is limited to the geotechnical and environmental aspects detailed within the report and is necessarily restricted.

APPENDIX B

3001/003 – EXPLORATORY HOLE LOCATION PLAN

EXPLORATORY HOLE LOGS



Trial Pit Log


Project Name: Nile and Villers	Project No. 3001	Co-ords: 440054.28 - 557166.44 Level: 27.13	Date: 12/09/2023
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Location: Sunderland	Dimensions (m): 2.40	Scale: 1:20
Client: TOWN	Depth: 3.00	Logged: TJS

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES		0.30	26.83		Scrub grass over TOPSOIL: Dark brown slightly clayey slightly silty slightly gravelly fine to medium SAND with high root content and low timber and plastic content. Gravel is angular to sub-angular fine to coarse and includes brick, coal and sandstone. TOPSOIL
	0.30 - 0.50	B					
	0.40 - 0.50	ES					
	1.40 - 1.50	ES		1.80	25.33		MADE GROUND: Pinky brown SAND and GRAVEL with high cobble content and low boulder content, low iron and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, slate and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete. MADE GROUND
	1.80 - 1.90	ES					
	2.00 - 2.20	B					
				3.00	24.13		Yellowish brown silty fine to medium SAND.
							End of Pit at 3.00m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground.

Stability: Stable
Plant: 9 Ton tracked 360


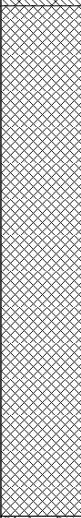


Trial Pit Log

TrialPit No
TP-02
Sheet 1 of 1

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440060.13 - 557156.49 Level: 27.39	Date: 12/09/2023
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Location: Sunderland	Dimensions (m): 2.30 Depth 2.30	Scale 1:20 Logged TJS
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES		0.25	27.14		Scrub grass over TOPSOIL: Dark brown slightly clayey slightly silty slightly gravelly fine to medium SAND with high root content and low timber and plastic content. Gravel is angular to sub-angular fine to coarse and includes brick, coal and sandstone.
	0.30 - 0.40 0.30 - 0.50	ES B					TOPSOIL
	1.00 - 1.10	ES		1.60	25.79		MADE GROUND: Pinky brown SAND and GRAVEL with high cobble content and low boulder content, low iron and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, slate and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete. MADE GROUND
	2.00 - 2.20	B					Yellowish brown slightly silty slightly gravelly fine to medium SAND. Gravel is sub-angular to sub-round fine to medium of sandstone. <i>Very silty with thin to thick laminations below 1.80m bgl. Silt can appear as small to large sub-round nodules.</i>
				2.30	25.09		End of Pit at 2.30m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground.

Stability: Stable
Plant: 9 Ton tracked 360.





Trial Pit Log

TrialPit No
TP-03
Sheet 1 of 1

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440047.01 - 557156.25 Level: 28.25	Date: 12/09/2023
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Location: Sunderland	Dimensions (m): 2.60	Scale: 1:20
Client: TOWN	Depth: 2.50	Logged: TJS

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES		0.30	27.95		Scrub grass over TOPSOIL: Dark brown slightly clayey slightly silty slightly gravelly fine to medium SAND with high root content and low plastic content. Gravel is angular to sub-angular fine to coarse and includes brick, coal and sandstone.
	0.40 - 0.50	ES					TOPSOIL
	0.60 - 0.80	B					MADE GROUND: Pinky brown SAND and GRAVEL with high cobble content and low boulder, wire and porcelain content, low iron and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, slate and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete.
	1.00 - 1.20	ES					MADE GROUND
				2.00	26.25		Yellowish brown slightly silty slightly gravelly fine to medium SAND. Gravel is sub-angular to sub-round fine to medium of sandstone.
				2.50	25.75		End of Pit at 2.50m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground.


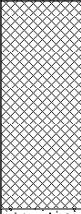
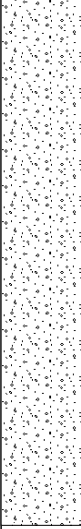
Stability: Stable
Plant: 9 Ton tracked 360.



Trial Pit Log

TrialPit No
TP-04
Sheet 1 of 1


Project Name: Nile and Villers	Project No. 3001	Co-ords: 440033.51 - 557149.59 Level: 29.17	Date: 13/06/2023
Location: Sunderland		Dimensions (m): 0.70 x 3.20	Scale: 1:20
Client: TOWN		Depth: 2.10	Logged HD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
	0.10 - 0.15	ES		0.15	29.02		Grass over TOPSOIL. Soft to firm brown slightly sandy slightly gravelly clay TOPSOIL with low root content. Gravel is fine to medium sub-angular to sub-rounded of brick and concrete.			
	0.40 - 0.50	B		0.70	28.47		MADE GROUND. Grey slightly cobblely gravelly SAND. Gravel is fine to coarse angular to sub-rounded of brick, concrete, coal, slag and sandstone. Cobbles are angular to sub-angular of brick and concrete.			
	0.50 - 0.60	ES					MADE GROUND <i>Sections of brick, possibly footings.</i> <i>Sections of concrete slabs, possibly flooring slabs.</i>			
	1.00 - 1.10	ES		2.10	27.07		Yellowish brown SAND with occasional gravel. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. Frequent brick and concrete cobbles in recovery from collapsing strata above.	1		
	1.50 - 1.60	D								
	2.00 - 2.10	B								2
	End of Pit at 2.10m									

Remarks: No groundwater encountered. Terminated approximately 1.00m into natural strata.

Stability: Stable on East, West and South sides. Some collapse of northern side.

Plant: Hyundai 9 Tonne Tracked Excavator





Trial Pit Log

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440032.67 - 557153.45 Level: 28.95	Date: 13/09/2023
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Location: Sunderland	Dimensions (m): 3.00	Scale: 1:20
Client: TOWN	Depth: 1.50	Logged: HD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.15	28.80		Grass over TOPSOIL. Soft to firm brown slightly sandy slightly gravelly TOPSOIL. Gravel is fine to medium sub-angular to sub-rounded of brick and concrete.
				0.80	28.15		MADE GROUND. Grey gravelly cobbly SAND. Cobbles are angular to sub-angular of concrete and brick. Gravel is fine to coarse angular to sub-rounded of concrete, brick, slag, coal and sandstone.
							MADE GROUND <i>Layer of bricks.</i>
							<i>Concrete slab.</i>
							<i>Disused clay pipe.</i>
				1.50	27.45		Yellowish brown SAND. Frequent brick and concrete cobbles from collapsing strata above.
							End of Pit at 1.50m

Remarks: Re-dig of TP-04 adjacent to the original pit to attempt to chase a possible wall identified in TP-04. No groundwater encountered. Terminated at 1.50m as unable to identify chase the possible identified wall.

Stability: Stable on East, West and South sides. Partial collapse on north side.

Plant: Hyundai 9 Tonne Tracked Excavator.


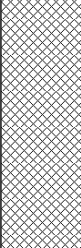

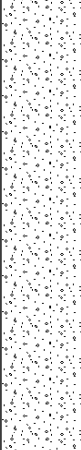




Trial Pit Log

TrialPit No
TP-05
Sheet 1 of 1


Project Name: Nile and Villers	Project No. 3001	Co-ords: 440012.00 - 557154.00 Level: 29.52	Date: 13/09/2023
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Location: Sunderland	Dimensions (m): 2.90 Depth 2.15	Scale 1:20 Logged HD
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES		0.20	29.32		Grass over TOPSOIL with low root content. Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular to sub-rounded of concrete and brick. TOPSOIL
	0.50 - 0.60	ES					MADE GROUND. Grey slightly cobblely gravelly SAND. Gravel is fine to coarse angular to sub-rounded of concrete, brick, coal, slag and sandstone. Cobbles are angular to sub-angular of brick and concrete. MADE GROUND
	0.60 - 0.70	B					
	1.00 - 1.10	ES		0.90	28.62		Yellowish brown SAND with occasional gravel. Gravel is fine to coarse sub-angular to subrounded of sandstone.
	1.10 - 1.20	B					
	1.90 - 2.00	D					
				2.15	27.37		End of Pit at 2.15m

Remarks: No groundwater encountered. Terminated approximately 1.00m into natural strata.


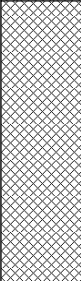
Stability: Stable
Plant: Hyundai 9 Tonne Tracked Excavator.



Trial Pit Log

TrialPit No
TP-06
Sheet 1 of 1

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440088.92 - 557076.17 Level: 28.93	Date: 12/09/2023
Location: Sunderland		Dimensions (m): 2.60 Depth 2.20	Scale 1:20 Logged TJS
Client: TOWN			

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.05 - 0.15	ES		0.15	28.78		Scrub grass over TOPSOIL: Dark brown slightly clayey slightly silty slightly gravelly fine to medium SAND with high root content and low timber, glass and plastic content. Gravel is angular to sub-angular fine to coarse and includes brick, coal and sandstone.
	0.30 - 0.40	ES					
	0.40 - 0.60	B					
	1.00 - 1.10	ES		0.90	28.03		TOPSOIL MADE GROUND: Greyish brown mottled reddish brown very gravelly fine to coarse SAND with high cobble content and low boulder, iron and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, slate and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete. MADE GROUND
	1.40 - 1.60	B					
				2.20	26.73		End of Pit at 2.20m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground. A brick wall obstruction located in the southern end of the trench at 0.30m bgl.

Stability: Stable
Plant: 9 Ton tracked 360.



Project Name: Nile and Villers	Project No. 3001	Co-ords: 440070.47 - 557072.06 Level: 29.44	Date: 12/09/2023
Location: Sunderland		Dimensions (m): 2.30 Depth 2.00	Scale 1:20 Logged TJS
Client: TOWN			

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.05 - 0.15	ES					<p>Scrub grass over TOPSOIL: Dark brown slightly silty SAND and GRAVEL with high root content and low timber, glass, tile and plastic content. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse and includes brick, coal and sandstone.</p> <p>TOPSOIL</p> <p>MADE GROUND: Brownish yellow dolomite angular fine to coarse GRAVEL.</p> <p>MADE GROUND</p> <p>MADE GROUND: Reddish brown slightly silty gravelly fine to coarse SAND with high cobble content and low boulder, iron and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, dolomite, sandstone and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete.</p> <p>MADE GROUND</p>
	0.20 - 0.30	ES		0.15	29.29		
	0.40 - 0.60	B		0.30	29.14		
	0.70 - 0.80	ES					
	1.50 - 1.70	B		1.20	28.24		<p>Reddish brown slightly gravelly fine to medium SAND. Gravel is sub-angular to sub-round fine to medium of sandstone.</p> <p><i>Yellowish brown below 1.40m bgl</i></p>
				2.00	27.44		<p>End of Pit at 2.00m</p>

Remarks: Groundwater not encountered. Trial pit terminated in natural ground. Remnants of a brick wall in the west of a trench.

Stability: Stable

Plant: 9 Ton tracked 360.





Trial Pit Log

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440059.45 - 557057.65 Level: 29.58	Date: 12/09/2023
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Location: Sunderland	Dimensions (m): 2.70	Scale: 1:20
Client: TOWN	Depth: 2.10	Logged: TJS

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES					Scrub grass over TOPSOIL: Stiff reddish brown slightly slightly sandy slightly gravelly CLAY with high root content Gravel is angular to sub-angular fine to coarse and includes brick, chert, coal and sandstone. TOPSOIL
	0.40 - 0.50 0.50 - 0.70	ES B		0.40	29.18		MADE GROUND: Dark brown slightly clayey gravelly fine to coarse SAND with high cobble content and low low iron, wire, plastic and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, slate and concrete. Cobbles are angular small to large of brick and concrete. MADE GROUND <i>Clay appears as thin (0.05 to 0.10m) bands</i>
	1.20 - 1.40	ES		1.20	28.38		Yellowish brown slightly silty slightly gravelly fine to medium SAND. Gravel is sub-angular to sub-round fine to medium of sandstone.
				2.10	27.48		End of Pit at 2.10m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground. Concrete obstruction intruding 0.70m into the north end of the trench at 0.70m bgl.

Stability: Stable
Plant: 9 Ton tracked 360.




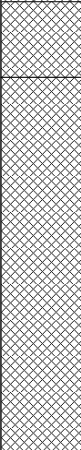
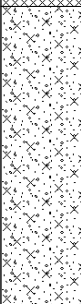
Trial Pit Log

TrialPit No
TP-09
Sheet 1 of 1

Project Name: Nile and Villers Project No. 3001 Co-ords: 440051.55 - 557059.69 Date 12/09/2023
Level: 29.83

Location: Sunderland Dimensions (m): 2.40 Scale 1:20

Client: TOWN Depth 2.30 Logged TJS

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES					Scrub grass over TOPSOIL: Stiff reddish brown slightly slightly sandy slightly gravelly CLAY with high root content Gravel is angular to sub-angular fine to coarse and includes brick, chert, coal and sandstone. TOPSOIL
	0.30 - 0.40	ES		0.30	29.53		MADE GROUND: Grey very gravelly fine to medium SAND with low iron content. Gravel is sub-angular to sub-round fine to coarse and includes chert, brick and concrete.
	0.40 - 0.50	B		0.50	29.33		MADE GROUND <i>Geo-membrane at base of Topsoil.</i>
	0.60 - 0.70	ES					MADE GROUND <i>Concrete boulder (former foundation) at 0.50m bgl.</i>
				1.50	28.33		Yellowish brown slightly silty slightly gravelly fine to medium SAND. Gravel is sub-angular to sub-round fine to medium of sandstone.
				2.30	27.53		End of Pit at 2.30m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground.

Stability: Stable
Plant: 9 Ton tracked 360.





Windowless Sample Log

Borehole No.

WS-01

Sheet 1 of 1

Project Name: Nile and Villers

Project No.
3001

Co-ords: 440038E - 557197N

Hole Type
WS

Location: Sunderland

Level: 26.88

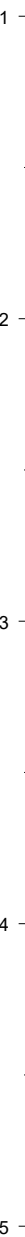
Scale
1:25

Client: TOWN

Dates: 11/09/2023

Logged By
IM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	26.68	<p>Grasses over MADE GROUND: Dark grey brown sandy gravelly TOPSOIL. Gravel is fine to coarse angular to subrounded and includes sandstone brick and concrete.</p> <p>MADE GROUND</p> <p>MADE GROUND: Brown and grey sandy gravelly with low cobble content and occasional rebar. Gravel is fine to coarse angular to subrounded and includes concrete, sandstone and brick. Cobbles include concrete and brick.</p> <p>MADE GROUND</p> <p><i>Clayey below 0.80m</i></p>	
		1.00	SPT	50 (25 for 80mm/50 for 10mm)	1.10	25.78		
End of Borehole at 1.10m								



Remarks

Commenced with Hand Dug Pit. Terminated on foundation or slab at 1.10m bgl.





Windowless Sample Log

Borehole No.

WS-01A

Sheet 1 of 1

Project Name: Nile and Villers

Project No.
3001

Co-ords: 440039E - 557196N

Hole Type
WS

Location: Sunderland

Level: 26.93

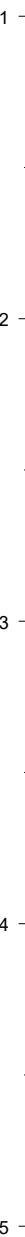
Scale
1:25

Client: TOWN

Dates: 11/09/2023

Logged By
IM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	D		0.65 0.75	26.28 26.18		MADE GROUND: Brown and grey sandy gravely with low cobble content and occasional rebar. Gravel is fine to coarse angular to subrounded and includes concrete, sandstone and brick. Cobbles include concrete and brick. MADE GROUND
		0.40	D					
		0.70	D					
							MADE GROUND: Concrete foundation / slab. MADE GROUND	
End of Borehole at 0.75m								



Remarks

Commenced with Hand Dug Pit. Terminated on foundation or slab encountered at 0.65m bgl.





Windowless Sample Log

Borehole No.

WS-01B

Sheet 1 of 1

Project Name: Nile and Villers

Project No.
3001

Co-ords: 440037E - 557179N

Hole Type
WS

Location: Sunderland

Level: 28.37

Scale
1:25

Client: TOWN

Dates: 20/09/2023

Logged By
HD

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.20	D		0.20	28.17		MADE GROUND: Bitmac surfacing. MADE GROUND	
		0.50 - 0.60	ES					MADE GROUND. Greyish brown gravelly SAND with occasional concrete cobbles. Gravel is fine to coarse angular to sub-rounded of concrete, brick and dolerite. MADE GROUND	
		1.00 - 1.10 1.00	D SPT	N=6 (2,2/2,1,2,1)	0.95	27.42		MADE GROUND. Yellow slightly gravelly SAND. Gravel is fine to coarse angular to sub-rounded of concrete, brick and sandstone. MADE GROUND	1
		1.50 - 1.60	ES		1.30	27.07		Firm to stiff reddish brown slightly silty slightly gravelly CLAY. Gravel is fine to medium, sub-angular to sub-rounded of coal and sandstone.	
		2.00	SPT	N=17 (1,2/2,3,5,7)					2
		2.50 - 2.60 2.50	D SPT	50 (25 for 80mm/50 for 62mm)	2.50 2.63	25.87 25.74		Weathered Limestone bedrock recovered as cream silty sandy GRAVEL. Gravel is fine to medium sub-angular to sub-rounded of limestone. End of Borehole at 2.63m	3
								4	
								5	

Remarks

Hand-dug pit to 1.00m. No groundwater encountered. Terminated at 2.63m due to bedrock obstruction.





Windowless Sample Log

Borehole No.

WS-02

Sheet 1 of 1

Project Name: Nile and Villers

Project No.
3001

Co-ords: 440009E - 557175N

Hole Type
WS

Location: Sunderland

Level: 28.57

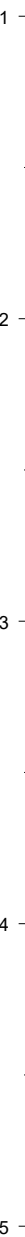
Scale
1:25

Client: TOWN

Dates: 11/09/2023

Logged By
IM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
							MADE GROUND: Bitmac surfacing. MADE GROUND	
		0.30	D		0.18		MADE GROUND: Dark grey sandy GRAVEL. Gravel is fine to coarse angular to subrounded and include ash/slag and sandstone. MADE GROUND	
		0.60	D		0.50		MADE GROUND: Brown sandy GRAVEL with low cobble content. Gravel is fine to coarse angular to subrounded and includes brick, concrete and sandstone. Cobbles include brick and concrete. MADE GROUND	
		0.85	SPT	50 (25 for 75mm/50 for 22mm)	0.85		End of Borehole at 0.85m	



Remarks

Commenced with Hand Dug Pit. Terminated on foundation or slab at 0.85m bgl.





Windowless Sample Log

Borehole No.

WS-02A

Sheet 1 of 1

Project Name: Nile and Villers

Project No.
3001

Co-ords: 440009E - 557174N

Hole Type
WS

Location: Sunderland

Level: 28.61

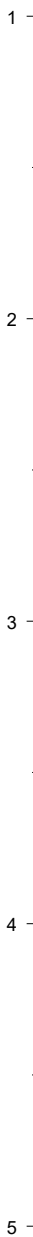
Scale
1:25

Client: TOWN

Dates: 11/09/2023

Logged By
IM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.18	28.43	MADE GROUND: Bitmac surfacing. MADE GROUND	
					0.50	28.11	MADE GROUND: Dark grey sandy GRAVEL. Gravel is fine to coarse angular to subrounded and includes ash/slag and sandstone. MADE GROUND	
		0.85	SPT	50 (25 for 51mm/50 for 43mm)	0.85	27.76	MADE GROUND: Brown sandy GRAVEL with low cobble content. Gravel is fine to coarse angular to subrounded and includes brick, concrete and sandstone. Cobbles include brick, concrete and sandstone. MADE GROUND	
		End of Borehole at 0.85m						



Remarks

Commenced with Hand Dug Pit. Terminated on foundation or slab at 0.85m bgl.





Windowless Sample Log

Borehole No.

WS-03

Sheet 1 of 1

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440054E - 557145N	Hole Type WS
Location: Sunderland		Level: 28.36	Scale 1:25
Client: TOWN		Dates: 21/09/2023	Logged By HD

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.10 - 0.15	ES		0.20	28.16		Grass over TOPSOIL with low root content. Dark brown slightly silty slightly gravelly clay. Gravel is fine to medium sub-angular to sub-rounded of brick, concrete and dolerite.		
		0.50 - 0.60	ES					MADE GROUND. Slightly gravelly cobbly SAND. Gravel is fine to coarse angular to sub-rounded of brick, concrete and dolerite. Cobbles are sub-angular to sub-rounded of concrete and brick.		
		1.00 - 1.10 1.00	D SPT	N=9 (2,3/3,2,2,2)						
		1.50 - 1.60	D							
		2.00	SPT	N=5 (1,0/0,4,0,1)						
		2.50 - 2.60	D			2.30	26.06			Brown SAND.
		3.00	SPT	N=10 (0,2/2,2,3,3)		2.95 3.05	25.41 25.31			Orangish yellow SAND.
		3.50 - 3.60	D			3.30	25.06			Firm to stiff reddish brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular to sub-rounded of sandstone and coal.
		3.70 - 3.80	D			3.70 3.80	24.66 24.56			Yellowish brown slightly gravelly SAND. Gravel is fine to medium angular to sub-angular of coal.
		4.00	SPT	N=50 (2,3/50 for 285mm)						Firm to stiff reddish brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular to sub-rounded of coal and sandstone
				4.30 4.35	24.06 24.01		Weathered limestone bedrock recovered as cream slightly silty GRAVEL. Gravel is fine to medium sub-angular to sub-rounded of limestone.			
								End of Borehole at 4.35m		

Remarks
Hand-dug pit to 1.10m. No groundwater encountered. Terminated at 4.30m due to SPT refusal.





Windowless Sample Log

Borehole No.

WS-04

Sheet 1 of 1

Project Name: Nile and Villers

Project No.
3001

Co-ords: 440028E - 557122N

Hole Type
WS

Location: Sunderland

Level: 29.97

Scale
1:25

Client: TOWN

Dates: 11/09/2023

Logged By
IM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	D		0.20	29.77		Grass over MADE GROUND: Dark brown grey slightly clayey slightly gravelly sandy TOPSOIL. Gravel is fine to coarse angular to subrounded and includes ash/slag, limestone, brick and sandstone.
		0.60	D		0.70	29.27		MADE GROUND: Dark brown gravelly SAND with medium cobble content. Gravel is fine to coarse angular to subrounded and includes ash/slag, brick, concrete, sandstone and limestone. Cobbles include brick, concrete, sandstone and limestone.
		1.20	D					MADE GROUND: Light brown fine to medium grained slightly silty SAND.
		1.20	SPT	N=7 (1,1/2,1,2,2)				Loose
		2.00	SPT	N=10 (1,1/2,2,3,3)				Loose to Medium Dense
		2.20	D					
		3.00	SPT	N=15 (2,3/4,4,3,4)				Medium Dense
		3.20	D					
		4.00	SPT	N=22 (4,4/6,5,6,5)				Medium Dense
		4.20	D					
					4.50	25.47		Brown fine to coarse grained SAND with increasing gravel content. Gravel is fine to coarse subangular to subrounded and includes sandstone, dolerite and limestone.
					4.80	25.17		End of Borehole at 4.80m

Remarks

Hand-dug pit to 1.20m. Strata wet below 4.50m. Sampler refused at 4.80m.





Windowless Sample Log

Borehole No.

WS-05

Sheet 1 of 1

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440067E - 557122N	Hole Type WS
Location: Sunderland		Level: 28.84	Scale 1:25
Client: TOWN		Dates: 21/09/2023	Logged By HD

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.15	D		0.20	28.64		Grass over TOPSOIL with low root content. Firm brown slightly silty slightly gravelly clay. Gravel is fine to medium sub-angular to sub-rounded of concrete, brick and dolerite. TOPSOIL	
		0.50 - 0.60	ES					MADE GROUND. Greyish brown slightly gravelly slightly cobbly SAND. Gravel is fine to coarse angular to sub-rounded of brick, concrete and dolerite. Cobbles are sub-angular to sub-rounded of brick. MADE GROUND	
		1.00 - 1.10 1.00	D SPT	N=32 (5,20/7,13,7,5)					<i>Brick in SPT sample recovered.</i>
					1.40	27.44			Poor Recovery. MADE GROUND
		2.00 - 2.10 2.00	D SPT	N=7 (2,4/3,2,1,1)	2.00	26.84			MADE GROUND. Greyish brown slightly gravelly slightly cobbly SAND. Gravel is fine to coarse angular to sub-rounded of brick, concrete and dolerite. Cobbles are sub-angular to sub-rounded of brick. MADE GROUND
		2.60 - 2.70	ES		2.60	26.24			Yellowish brown SAND.
		3.00 - 3.10 3.00	D SPT	N=7 (1,1/1,2,2,2)					
	3.70 - 3.80	D							
				4.00	24.84			End of Borehole at 4.00m	

Remarks
Hand-dug pit to 1.00m. No groundwater encountered. Terminated at 4.00m due to made ground collapsing into the borehole meaning a sample of strata was unable to be obtained.





Windowless Sample Log

Borehole No.

WS-06

Sheet 1 of 1

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440045E - 557118N	Hole Type WS
Location: Sunderland		Level: 29.79	Scale 1:25
Client: TOWN		Dates: 12/09/2023	Logged By HD

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
Well	Water Strikes	0.10 - 0.15	ES		0.20	29.59	TOPSOIL	Grass over TOPSOIL. Soft to firm dark brown slightly silty slightly gravelly clay TOPSOIL. Gravel is fine to coarse sub-angular to sub-rounded of brick, concrete and sandstone.	1	
		0.50 - 0.60	ES					<i>Yellow sandy band.</i>		
		1.00 - 1.10 1.00	D SPT	N=12 (3 for 300mm/2,3,3,4)	MADE GROUND	MADE GROUND. Grey sandy GRAVEL with frequent cobbles. Gravel is fine to coarse angular to sub-angular of brick, concrete, sandstone, slag and coal. Cobbles are angular to sub-angular of concrete and brick.				
		1.50 - 1.60	ES			<i>Concrete slab in pit corner.</i>				
		2.00	SPT	N=7 (1,2/2,1,2,2)		Brown and dark grey slightly gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and occasional coal.	2			
		2.50 - 2.60	D		SAND	Yellowish brown SAND with occasional brown laminations.				3
		3.00	SPT	N=11 (2,1/2,2,3,4)						
		3.50 - 3.60	D							
		4.00	SPT	N=21 (5,6/5,5,5,6)						4
4.50 - 4.60	D							5		
				5.00	24.79		End of Borehole at 5.00m			

Remarks
Hand-dug pit to 1.05m. No groundwater encountered. Terminated at scheduled depth. Comm. cable warning tape encountered at original location. Moved 1.5m North.





Windowless Sample Log

Borehole No.

WS-07

Sheet 1 of 1

Project Name: Nile and Villers Project No. 3001 Co-ords: 440078E - 557091N Hole Type WS

Location: Sunderland Level: 29.45 Scale 1:25

Client: TOWN Dates: 12/09/2023 Logged By HD

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
Well	Water Strikes	0.10 - 0.15	ES		0.20	29.25		Grass over TOPSOIL with low root content. Soft to firm dark brown slightly sandy slightly gravelly clay TOPSOIL. Gravel is fine to coarse sub-angular to rounded of concrete, sandstone and brick.	1 2 3 4 5
		0.50 - 0.60	ES		0.70	28.75			
		1.00 - 1.10 1.00	ES SPT	N=7 (1,1/2,2,1,2)	1.20	28.25		Brown slightly gravelly SAND. Gravel is fine to medium sub-angular to sub-rounded of sandstone.	
		1.50 - 1.60	D						
		2.00	SPT	N=17 (2,3/3,4,5,5)					
		2.50 - 2.60	D						
		3.00	SPT	N=25 (3,5/5,5,7,8)					
		3.50 - 3.60	D						
		4.00	SPT	N=16 (2,3/3,3,4,6)					
		4.50 - 4.60	D						
				5.00	24.45		End of Borehole at 5.00m		

Remarks
Hand-dug pit to 1.00m. No groundwater encountered. Terminated at scheduled depth.





Windowless Sample Log

Borehole No.

WS-09

Sheet 1 of 1

Project Name: Nile and Villers

Project No.
3001

Co-ords: 440086E - 557053N

Hole Type
WS

Location: Sunderland

Level: 29.12

Scale
1:25

Client: TOWN

Dates: 20/09/2023

Logged By
HD

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10 - 0.20	D		0.20	28.92	CONCRETE. MADE GROUND	
		0.50 - 0.60	ES		0.70	28.42	Grey gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded of concrete, brick and dolerite. MADE GROUND	
		1.00 - 1.10 1.00	ES SPT	N=4 (1,0/1,0,1,2)	1.30	27.82	MADE GROUND. Reddish brown slightly gravelly SAND. Gravel is fine to medium sub-angular to sub-rounded of sandstone with occasional brick and coal. MADE GROUND	
		1.50 - 1.60	D				Yellowish brown SAND.	
		2.00	SPT	N=6 (1,0/1,1,2,2)				
		2.50 - 2.60	D					
		3.00	SPT	N=13 (1,2/3,3,3,4)				
		3.50 - 3.60	D					
		4.00	SPT	N=10 (1,1/1,2,3,4)				
		4.50 - 4.60	D					
				5.00	24.12		End of Borehole at 5.00m	

Material from made ground strata 0.20 - 0.70m fallen into borehole and evidenced in sample.

Sand is moist.

Remarks

Hand-dug pit to 1.20m. No groundwater encountered. Terminated at scheduled depth.





Windowless Sample Log

Borehole No.

WS-10

Sheet 1 of 1

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440065E - 557044N	Hole Type WS
Location: Sunderland		Level: 29.37	Scale 1:25
Client: TOWN		Dates: 12/09/2023	Logged By HD

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.15	D		0.30	29.07		Grass over TOPSOIL with low root content. Dark brown slightly sandy slightly gravelly clay TOPSOIL. Gravel is fine to coarse sub-angular to sub-rounded of concrete, sandstone and brick.	
		0.50 - 0.60	ES		0.70	28.67		TOPSOIL MADE GROUND. Grey slightly gravelly SAND. Gravel is fine to coarse angular to sub-rounded of brick, concrete and slag. MADE GROUND	
		1.00 - 1.10 1.00	ES SPT	N=14 (1,2/3,3,3,5)	1.20	28.17		MADE GROUND. Brown slightly gravelly SAND. Gravel is fine to medium sub-angular to sub-rounded of sandstone and slag. MADE GROUND	
		1.50 - 1.60	ES					Yellowish brown SAND.	
		2.00	SPT	N=10 (1,2/2,2,3,3)				<u>Brown moist SAND.</u>	
		2.40 - 2.50	D						
		3.00	SPT	N=14 (1,2/2,3,4,5)					
		3.50 - 3.60	D						
		4.00	SPT	N=24 (3,4/5,5,6,8)				<u>Brown moist SAND.</u>	
		4.50 - 4.60	D						
				5.00	24.37		End of Borehole at 5.00m	5	

Remarks
Hand-dug pit to 1.00m. No groundwater encountered. Terminated at scheduled depth.





Trial Pit Log

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440036.50 - 557139.30 Level: 29.46	Date 13/09/2023
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Location: Sunderland	Dimensions (m): 1.00 x 1.90	Scale 1:10
Client: TOWN	Depth 1.80	Logged TJS

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES					Scrub grass over TOPSOIL: Dark brown slightly clayey slightly silty slightly gravelly fine to medium SAND with high root content and low timber and plastic. Gravel is angular to sub-angular fine to coarse and includes brick, coal and sandstone. TOPSOIL
	0.30 - 0.40	ES		0.30	29.16		MADE GROUND: Pinky brown SAND and GRAVEL with high cobble content and low boulder wire, iron and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, slate, sandstone, porcelain and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete. MADE GROUND
	0.40 - 0.50	B					Yellowish brown silty fine to medium SAND.
				1.80	27.66		End of Pit at 1.80m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground. Trial pit used for soakaway testing. Spalling from 0.80m bgl during soakaway testing.

Stability: Spalling from 0.80m bgl

Plant: 9 Ton tracked 360





Trial Pit Log

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440063.10 - 557105.00 Level: 29.66	Date: 13/09/2023
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Location: Sunderland	Dimensions (m): 1.70	Scale: 1:10
Client: TOWN	Depth: 2.00	Logged: TJS

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES		0.20	29.46		Scrub grass over TOPSOIL: Dark brown slightly clayey slightly silty slightly gravelly fine to medium SAND with high root content and low timber and plastic content. Gravel is angular to sub-angular fine to coarse and includes brick, coal, tile and sandstone. TOPSOIL
	0.40 - 0.50	ES					MADE GROUND: Pinky brown SAND and GRAVEL with high cobble content and low boulder content, low iron and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, tile and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete. MADE GROUND
	0.80 - 1.00	B		1.10	28.56		Yellowish brown silty fine to medium SAND.
				2.00	27.66		End of Pit at 2.00m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground. Trial pit used for soakaway testing. Spalling from 1.10m bgl during soakaway testing.

Stability: Spalling from 1.00m bgl

Plant: 9 Ton tracked 360.





Trial Pit Log

Project Name: Nile and Villers	Project No. 3001	Co-ords: 440059.10 - 557073.40 Level: 29.72	Date: 13/09/2023
--------------------------------	------------------	------------------------------------------------	------------------

Location: Sunderland	Dimensions (m): 1.00 x 1.70	Scale: 1:10
Client: TOWN	Depth: 2.00	Logged: TJS

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 - 0.20	ES					Scrub grass over TOPSOIL: Stiff reddish brown slightly sandy slightly gravelly CLAY with high root content and low plastic content. Gravel is angular to sub-angular fine to coarse and includes brick, coal, chert and sandstone. TOPSOIL
	0.50 - 0.60	ES		0.40	29.32		MADE GROUND: Pinky brown mottled reddish brown SAND and GRAVELL with high cobble content and low boulder content, low iron and glass content. Gravel is angular to sub-angular fine to coarse and includes brick, slate and concrete. Cobbles are angular small to large of brick and concrete. Boulders are angular to sub-angular small of brick and concrete. MADE GROUND <i>Geo-membrane at base of Topsoil.</i>
	0.60 - 0.70	B					Yellowish brown silty fine to medium SAND.
				2.00	27.72		End of Pit at 2.00m

Remarks: Groundwater not encountered. Trial pit terminated in natural ground. Trial pit used for soakaway testing. Soakaway test terminated after 6 minutes due to trial pit instability.

Stability: Stable
Plant: 9 Ton tracked 360.

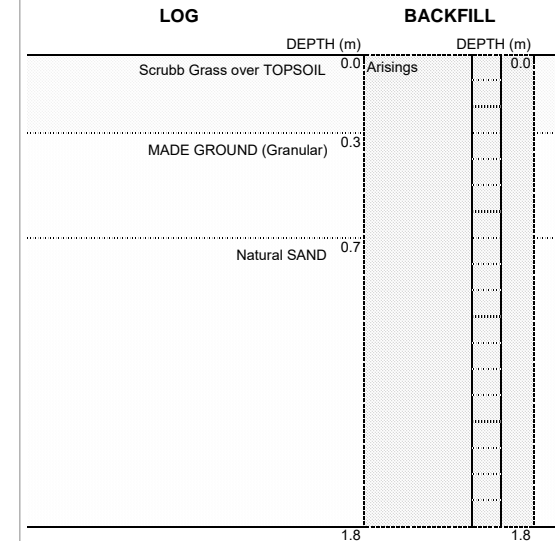
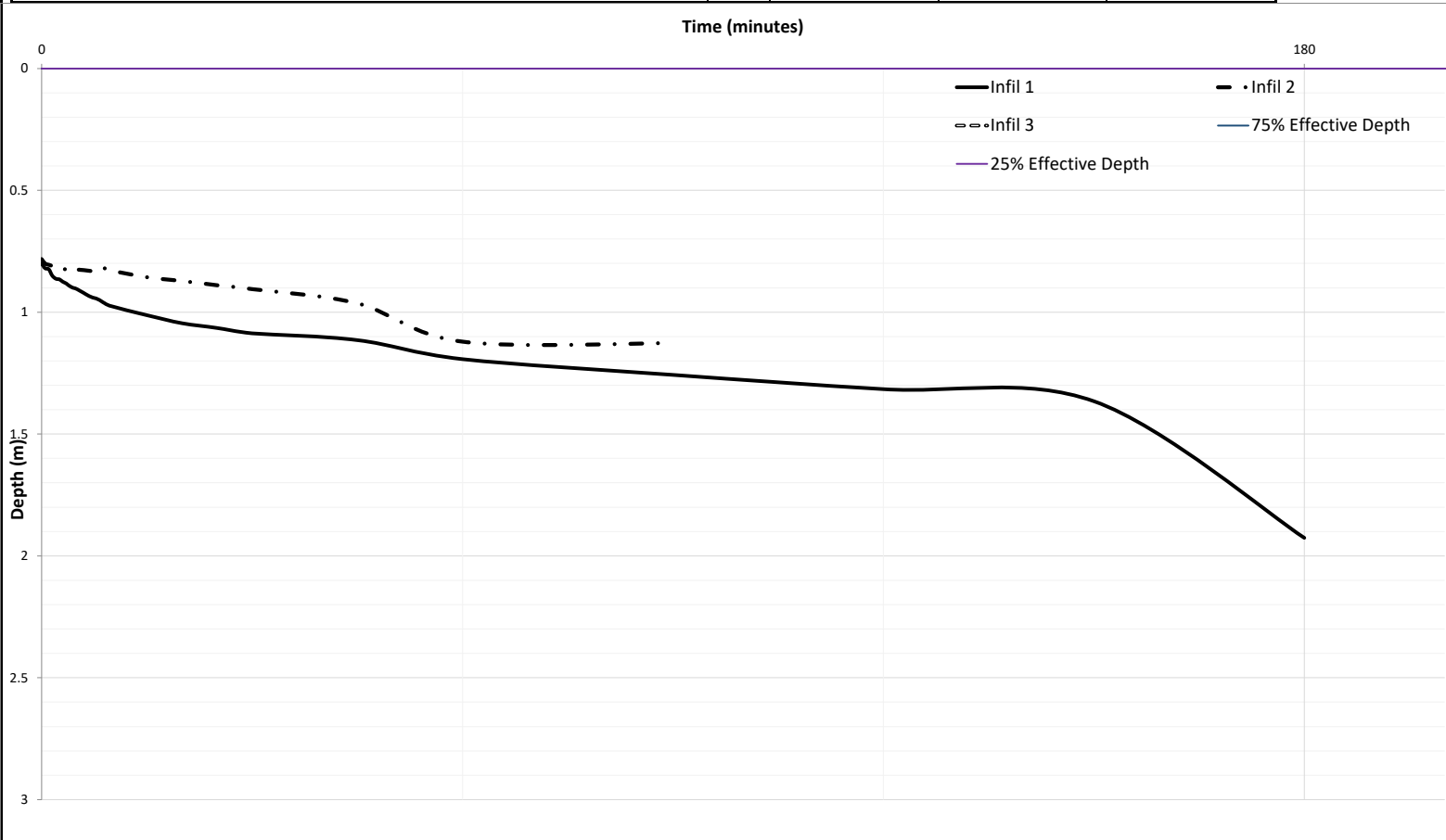


	units	Fill 1	Fill 2	Fill 3
Depth (final reading)	m	1.93	1.13	
Pit depth	m	1.80		
Pit length	m	1.90		
Pit width	m	1.00		
Depth to first reading	m	0.80	0.78	
Maximum effective depth	m	1.13	0.35	
Depth at 75% full	m	1.08	0.87	
Depth at 25% full	m	1.64	1.04	
Time at 75% full	mins	21.32	18.83	
Time at 25% full	mins	159.89	52.33	
Vp75 - 25 (volume outflowing between 75% and 25% effective depth)	m3	0.950	0.328	
Mean surface area for outflow (50% effective depth)	m2	4.80	4.85	
Time for outflow	mins	138.58	33.50	
Soil infiltration rate, f =		0.0000238034	0.0000336006	
or		2.38E-05	3.36E-05	

Recommended soil infiltration rate	
2.38E-05	m/s

NOTE:

Water level did not fall to below the 25% full level within 24 hrs for fills 2 and 3 - Soil infiltration rate based on effective drainage only



PROJECT NAME	Niles and Villiers
CLIENT	Town Development

SOAKAWAY TEST RESULTS

In accordance with BRE Digest 365 (1991 with amendments in 2003 and 2007)

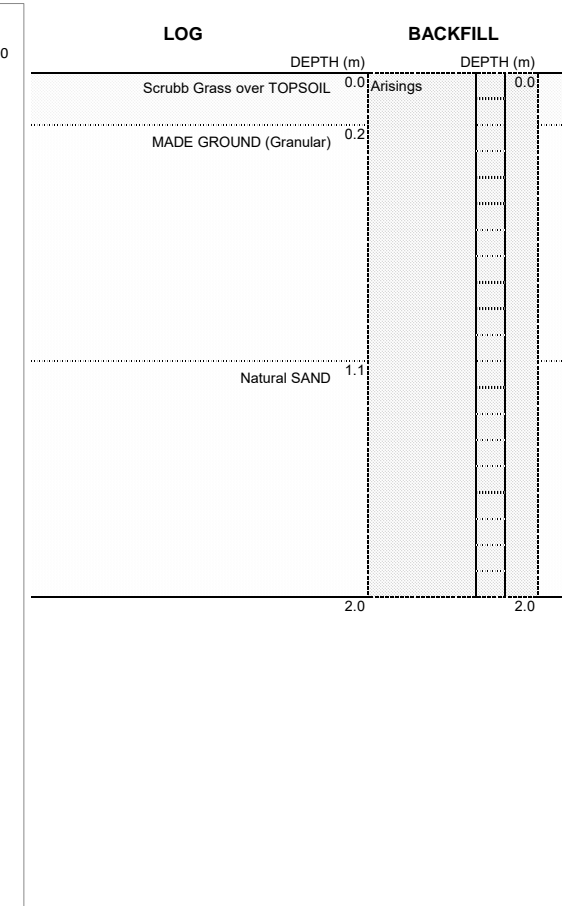
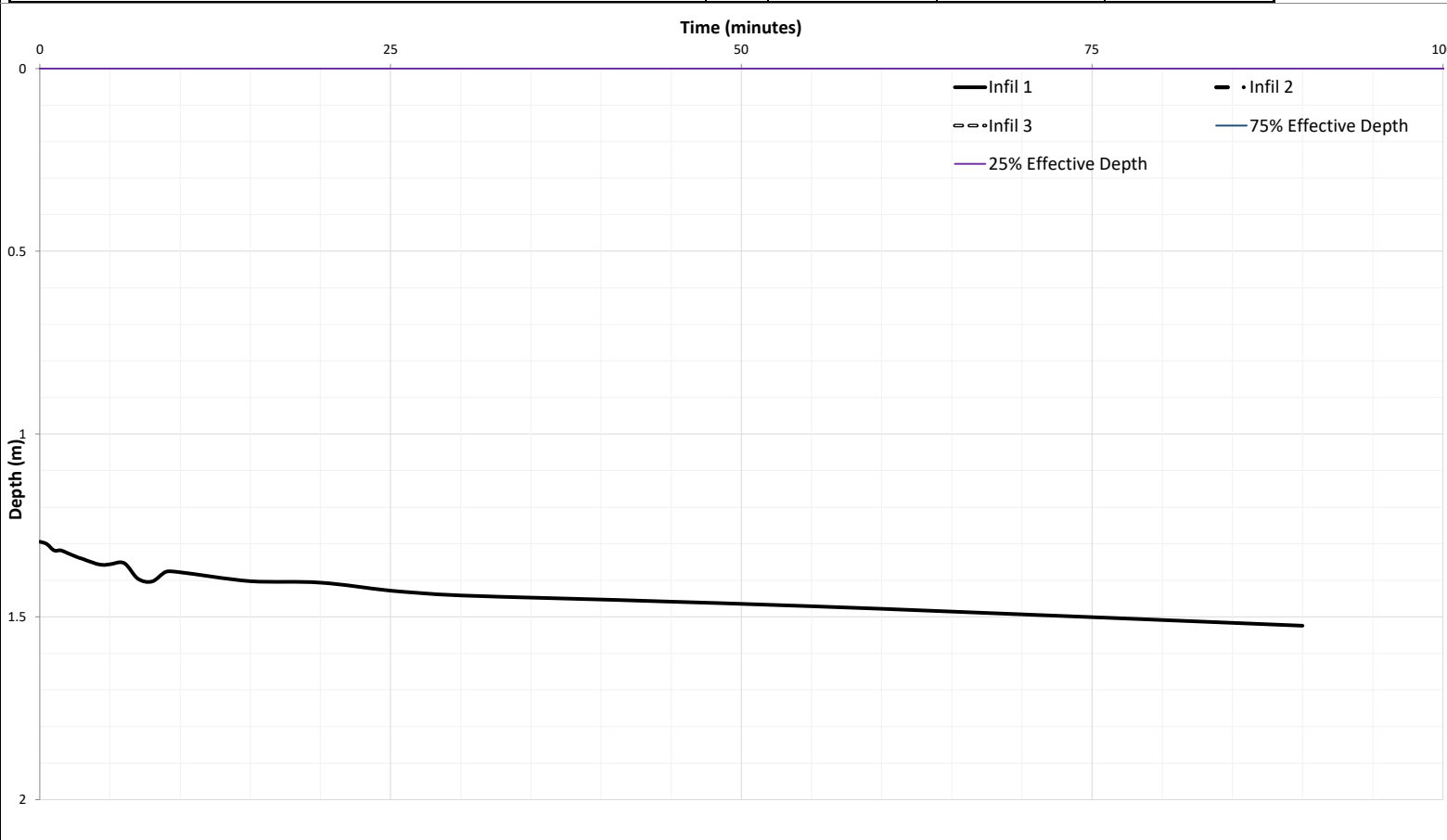
DATE	PROJECT NUMBER
Sep-23	3001.00
SOAKAWAY NUM	FILL NUMBER
IT01	1-2

	units	Fill 1	Fill 2	Fill 3
Depth (final reading)	m	1.52		
Pit depth	m		2.00	
Pit length	m		1.70	
Pit width	m		1.00	
Depth to first reading	m	1.29		
Maximum effective depth	m	0.23		
Depth at 75% full	m	1.35		
Depth at 25% full	m	1.47		
Time at 75% full	mins	3.79		
Time at 25% full	mins	51.38		
Vp75 - 25 (volume outflowing between 75% and 25% effective depth)	m3	0.196		
Mean surface area for outflow (50% effective depth)	m2	3.61		
Time for outflow	mins	47.58		
Soil infiltration rate, f =		0.0000189885		
or		1.90E-05		

Recommended soil infiltration rate	
1.90E-05	m/s

NOTE:

Water level did not fall to below the 25% full level within 24 hrs for fills 1, 2 and 3 - Soil infiltration rate based on effective drainage only



	PROJECT NAME	Niles and Villiers
	CLIENT	Town Development

SOAKAWAY TEST RESULTS

In accordance with BRE Digest 365 (1991 with amendments in 2003 and 2007)

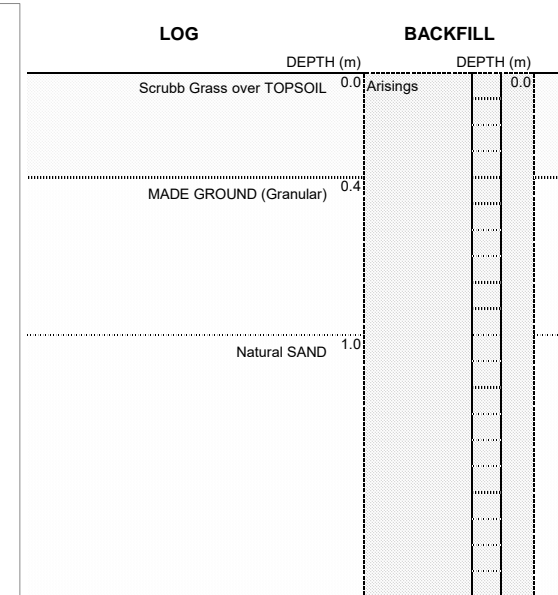
DATE	PROJECT NUMBER
Sep-23	3001.00
SOAKAWAY NUM	FILL NUMBER
IT02	1

	units	Fill 1	Fill 2	Fill 3
Depth (final reading)	m	1.46		
Pit depth	m		2.00	
Pit length	m		1.70	
Pit width	m		1.00	
Depth to first reading	m	1.28		
Maximum effective depth	m	0.18		
Depth at 75% full	m	1.32		
Depth at 25% full	m	1.41		
Time at 75% full	mins	1.28		
Time at 25% full	mins	4.16		
Vp75 - 25 (volume outflowing between 75% and 25% effective depth)	m3	0.154		
Mean surface area for outflow (50% effective depth)	m2	3.66		
Time for outflow	mins	2.88		
Soil infiltration rate, f =		0.0002437131		
or		2.44E-04		

Recommended soil infiltration rate	
2.44E-04	m/s

NOTE:

Water level did not fall to below the 25% full level within 24 hrs for fills 1, 2 and 3 - Soil infiltration rate based on effective drainage only



NOTE

Test terminated after 6 minutes following trial pit collapsed

	PROJECT NAME	Niles and Villiers
	CLIENT	Town Development

SOAKAWAY TEST RESULTS	
<i>In accordance with BRE Digest 365 (1991 with amendments in 2003 and 2007)</i>	

DATE	PROJECT NUMBER
Sep-23	3001.00
SOAKAWAY NUM	FILL NUMBER
IT02	1

APPENDIX C

SHADBOLT SOIL SCREENING VALUES

SHADBOLT WATER SCREENING VALUES

Derivation of Screening Values

In assessing risks to human health arising from materials present on site, environmental testing results are compared to Shadbolt Soil Screening Values (SSVs).

These screening values are drawn from a range of sources including government guidance, research bodies, industry publications and modelling software.

On-going research by the Environment Agency (EA) is being undertaken to produce toxicology reports (TOX series) for each of the contaminants identified within the LCRM framework and then to produce published Soil Guideline Values (SGVs) using the Contaminated Land Exposure Assessment (CLEA) Model. Parallel to the work being undertaken by the EA is research being undertaken by Land Quality Management Limited and the Chartered Institute of Environmental Health (CIEH) to produce similar General Assessment Criteria (GAC) using the CLEA Model. To date, SGVs and GACs have been published for over 80 No. contaminants with SGVs / GACs derived for each contaminant for three different land use scenarios namely:

- Residential
- Allotment
- Commercial

In addition, Shadbolt Group have derived screening values for **Commercial, Parks, Playing Fields and Open Spaces** based on current guidance.

Shadbolt SSVs are based on the SGVs and GACs which are scientifically based generic assessment criteria that can be used to simplify the assessment of human health risks arising from long-term and on-site exposure to chemical contamination in soil.

SGVs and GACs are a screening tool for the generic quantitative risk assessment of land contamination (Defra and Environment Agency, 2004). They are not (unless clearly stated otherwise) relevant for assessing risks to human health from short-term exposure to chemicals in soil including injury arising from direct bodily contact and do not take account of other types of risks to humans such as explosion or suffocation risks (associated with the build-up of gases such as methane and carbon dioxide) or aesthetic issues such as odour or colour. SGVs and GACs do not take account of other non-soil-based sources of contamination such as contamination in groundwater, surface waters or drinking waters. They cannot be used to evaluate risks to non-human receptors such as controlled waters, ecosystems, buildings and services, domestic pets or garden plants. Where, for example, phytotoxic effects are an important consideration in the current or future intended land use further investigation should be undertaken.

SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health. They represent “trigger values” – indicators to a risk assessor that soil concentrations above this level **may** pose a possibility of *significant harm* to human health (Defra, 2008b).

Significance is linked to:

- **Margin** of exceedance;
- **Duration** and frequency of exposure;
- **Other site-specific factors** that the enforcing authority may wish to consider.

SGVs do not of themselves represent the threshold at which there is a *significant possibility of significant harm* (SPOSH). Nor do they automatically represent an unacceptable intake in the context of Part 2A of the Environmental Protection Act 1990. However, they can be a useful starting point for such an assessment.

In order to assess the soil analyses results with regard to potential human health risks, Shadbolt Environmental TSVs have been derived in accordance with the UK framework set out in the most recent LCRM documents (EA 2020) and LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment 2nd Edition 2015 and are “in line” with industry standards.

Assessment Framework

The CLEA model states that, ‘the contamination is assumed to be at or within 1m of the surface’. It is considered that at depths greater than 1.00m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway regarding human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway.

Statistical Analysis

The CLEA guidelines also state that for each contaminant, the upper 95th percentile of the mean measured concentration (95%UCL) should be calculated and this value should be compared to the TSV.

The objective of maximum value tests is to decide whether the maximum concentration observed should be treated as an outlier or whether it can reasonably be considered to come from the same underlying population as the other samples.

It is known that contaminant concentrations often demonstrate lognormal or other distribution forms. Therefore, to calculate what are considered to be more representative 95%UCL values, the contaminant concentrations have first been assessed to determine if each contaminant distribution is closer to a normal or lognormal distribution.

If a dataset was found to be log normally distributed, the geometric mean was used to calculate the 95%UCL, for those that were found to be normally distributed; the arithmetic mean was used to calculate the 95%UCL. Constituent non-detects were assigned a value equal to the reported analytical laboratory limit of detection, considered reasonably conservative. Any identified outliers are excluded from the datasets used in calculation of the 95%UCL value.

Shadbolt Soil Screening Values used in the production of this report are presented below.

SOIL - THE SHADBOLT GROUP SUITABLE FOR USE LEVELS - HUMAN HEALTH



Status		Issue No.		Date									
Issue		Version 8		21/09/2023									
Determinand	Units	Residential with Home Grown Produce (1% SOM)	Residential with Home Grown Produce (6% SOM)	Residential without Home Grown Produce (1% SOM)	Residential without Home Grown Produce (6% SOM)	Allotments (6% SOM)	Commercial (1% SOM)	Commercial (6% SOM)	Public Open Space (res) (1% SOM)	Public Open Space (res) (6% SOM)	Public Open Space (park) (1% SOM)	Public Open Space (park) (6% SOM)	Derivation Tool
pH		<5, >9	<5, >9	<5, >9	<5, >9	<5, >9	<5, >9	<5, >9	<5, >9	<5, >9	<5, >9	<5, >9	Neutral Conditions
Asbestos	%	<0.001%	<0.001%	<0.001%	<0.001%	<0.001%	<0.001%	<0.001%	<0.001%	<0.001%	<0.001%	<0.001%	Lab Screening Level
HEAVY METALS/METALLOIDS													
Arsenic (C4SL)	mg/kg	37	37	39.9	39.9	49	635	635	79.1	79.1	168	168	CLEA MODEL LQM/CIH 2015
Beryllium	mg/kg	1.7	1.7	1.72	1.72	17.8	14	14	2.19	2.19	61	61	CLEA MODEL LQM/CIH 2015
Boron	mg/kg	290	290	11000	11000	45	240000	240000	21000	21000	46000	46000	CLEA MODEL LQM/CIH 2015
Cadmium (C4SL)	mg/kg	22.1	22.1	149	149	3.9	410	410	219	219	882	882	CLEA MODEL LQM/CIH 2015
Chromium (III)	mg/kg	14300	14300	16700	16700	12600	208000	208000	30600	30600	83500	83500	CLEA MODEL LQM/CIH 2015
Chromium (VI) (C4SL)	mg/kg	20.5	20.5	20.5	20.5	171	49.1	49.1	26.1	26.1	251	251	CLEA MODEL LQM/CIH 2015
Chromium (VI) (MRL)	mg/kg	3.62	3.62	3.62	3.62	73.9	19.7	19.7	4.62	4.62	132	132	CLEA MODEL LQM/CIH 2016
Copper	mg/kg	4730	4790	9060	9060	1450	106000	106000	16400	16400	45200	45200	CLEA MODEL LQM/CIH 2015
Lead	mg/kg	200	200	313	313	79.1	2310	2310	62.5	62.5	1340	1340	pC4SL
Mercury (Elemental)	mg/kg	1.2	1.2	1.2	1.2	21	58 ^{pp} (25.8)	58 ^{pp} (25.8)	16	16	30 ^{pp} (25.8)	30 ^{pp} (25.8)	CLEA MODEL LQM/CIH 2015
Mercury (Inorganic)	mg/kg	40	40	56	56	19	1100	1100	120	120	240	240	CLEA MODEL LQM/CIH 2015
Mercury (Methyl)	mg/kg	11	11	15	15	6	320	320	40	40	68	68	CLEA MODEL LQM/CIH 2015
Nickel	mg/kg	136	136	188	188	67.3	1770	1770	347	347	804	804	CLEA MODEL LQM/CIH 2015
Selenium	mg/kg	375	375	595	595	143	13000	13000	1370	1370	2550	2550	CLEA MODEL LQM/CIH 2015
Vanadium	mg/kg	136	136	357	357	33.2	7490	7490	818	818	1550	1550	CLEA MODEL LQM/CIH 2015
Zinc	mg/kg	20000	20000	47000	47000	5230	1100000	1100000	93700	93700	201000	201000	CLEA MODEL LQM/CIH 2015
GENERAL INORGANICS													
Cyanide (Free)	mg/kg	34	34	34	34	34	373	373	34	34	34	34	ATKINS ATRISK
US EPA PRIORITY PAHs													
Acenaphthene	mg/kg	210	1100	3000 (57)	6000 (336)	200	84000 (57)	100000	15000	15000	29000	30000	CLEA MODEL LQM/CIH 2015
Acenaphthylene	mg/kg	170	920	2900 (86.1)	6000 (506)	160	83000 (86.1)	100000	15000	15000	29000	30000	CLEA MODEL LQM/CIH 2015
Anthracene	mg/kg	2400	11000	31000 (1.17)	37000	2200	52000	540000	74000	74000	150000	150000	CLEA MODEL LQM/CIH 2015
Benzo(a)Anthracene	mg/kg	7.2	13	11	15	13	170	180	29	29	49	62	CLEA MODEL LQM/CIH 2015
Benzo(a)pyrene (C4SL)	mg/kg	2.2	3.00	3.2	3.2	3.5	35	36	5.7	5.7	11	13	CLEA MODEL LQM/CIH 2015
Benzo(a)pyrene (MRL)	mg/kg												
Benzo(b)fluoranthene	mg/kg	2.6	3.7	3.9	4	3.9	44	45	7.1	7.2	13	16	CLEA MODEL LQM/CIH 2015
Benzo(k)fluoranthene	mg/kg	320	350	360	360	640	3900	4000	640	640	1400	1600	CLEA MODEL LQM/CIH 2015
Benzo(g,h,i)perylene	mg/kg	77	100	110	110	130	1200	1200	190	190	370	440	CLEA MODEL LQM/CIH 2015
Chrysene	mg/kg	15	27	30	32	19	350	350	57	57	93	120	CLEA MODEL LQM/CIH 2015
Di-benzo(a,h)anthracene	mg/kg	0.24	0.3	0.31	0.32	0.43	3.5	3.6	0.57	0.58	1.1	1.4	CLEA MODEL LQM/CIH 2015
Indeno(1,2,3-cd)pyrene	mg/kg	27	41	45	46	39	500	510	82	82	150	180	CLEA MODEL LQM/CIH 2015
Fluoranthene	mg/kg	280	890	1500	1600	290	23000	23000	3100	3100	6300	6400	CLEA MODEL LQM/CIH 2015
Fluorene	mg/kg	170	860	2800 (30.9)	4500 (183)	160	63000 (30.9)	71000	9900	9900	20000	20000	CLEA MODEL LQM/CIH 2015
Naphthalene	mg/kg	2.3	13	2.3	13	24	190 (76.4)	1100 (432)	4900	4900	1200 (76.4)	300	CLEA MODEL LQM/CIH 2015
Phenanthrene	mg/kg	95	440	1300 (36)	1500	90	22000	23000	3100	3100	6200	6300	CLEA MODEL LQM/CIH 2015
Pyrene	mg/kg	620	2000	3700	3800	620	54000	54000	7400	7400	15000	15000	CLEA MODEL LQM/CIH 2015
Coal Tar (Bap as surrogate marker)	mg/kg	0.79	0.98	1.2	1.2	1.2	15	15	2.2	2.2	4.4	4.8	CLEA MODEL LQM/CIH 2015
Chlorinated Solvents													
1,2 Dichloroethane (DCA)	mg/kg	0.0071	0.019	0.0092	0.023	0.016	0.67	1.7	29	29	21	28	CLEA MODEL LQM/CIH 2015
1,1,1,2 Tetrachloroethane	mg/kg	1.2	6.4	1.5	8.2	4.4	110	560	1400	1400	1500	2100	CLEA MODEL LQM/CIH 2015
1,1,1,2 Tetrachloroethane	mg/kg	1.3	7.5	3.9	17	2	270	1100	1400	1400	1800	2300	CLEA MODEL LQM/CIH 2015
PCE (Tetrachloroethene)	mg/kg	0.18	0.9	0.18	0.92	3.6	19	95	1400	1400	810 (424) sol	1500	CLEA MODEL LQM/CIH 2015
1,1,1 Trichloroethane (111 TCA)	mg/kg	8.8	39	9	40	240	660	3000	140000	140000	57000 (1425) vap	100000 (6392) vap	CLEA MODEL LQM/CIH 2015
Chloroethene (Vinyl Chloride VC)	mg/kg	0.00064	0.0014	0.00077	0.0015	0.0018	0.059	0.12	3.5	3.5	4.8	5.4	CLEA MODEL LQM/CIH 2015
Tetrachloromethane	mg/kg	0.016	0.075	0.017	0.08	0.12	1.2	5.7	120	120	70	120	CLEA MODEL LQM/CIH 2015
Trichloroethene (TCE)	mg/kg	0.91	3.4	1.2	4.2	1.7	99	350	2500	2500	2600	3100	CLEA MODEL LQM/CIH 2015
Trichloromethane (Chloroform)	mg/kg	0.026	0.13	0.026	0.13	2.4	2.9	14	890	890	190	400	CLEA MODEL LQM/CIH 2015
Phenolics													
Phenol	mg/kg	280	1100	750	2300	280	760dir (31000)	3200dir (37000)	760dir (11000)	3200dir (11000)	760dir (8600)	3200dir (11000)	CLEA MODEL LQM/CIH 2015
TPH (Environment Agency 16 Fractions)													
TPH Aliphatic >C5-6	mg/kg	42	160	42	160	3900	3200 (304) sol	12000 (1150) sol	570000 (304) sol	600000	95000 (304) sol	180000 (1150) sol	CLEA MODEL LQM/CIH 2015
TPH Aliphatic >C6-8	mg/kg	100	530	100	530	13000	7800 (144) sol	40000 (736) sol	600000	620000	150000 (144) sol	320000 (736) sol	CLEA MODEL LQM/CIH 2015
TPH Aliphatic >C8-10	mg/kg	27	150	27	150	1700	2000 (78) sol	11000 (451) vap	13000	13000	14000 (78) sol	21000 (451) vap	CLEA MODEL LQM/CIH 2015
TPH Aliphatic >C10-12	mg/kg	130 (48) Vap	760 (283) vap	130 (48) vap	770 (283) vap	7300	9700 (48) sol	47000 (283) vap	13000	13000	21000 (48) sol	24000 (283) vap	CLEA MODEL LQM/CIH 2015
TPH Aliphatic >C12-16	mg/kg	1100 (24) sol	4300 (142) sol	1100 (24) sol	4400 (142) sol	13000	59000 (24) sol	90000 (142) sol	13000	13000	25000 (24) sol	26000 (142) sol	CLEA MODEL LQM/CIH 2015
TPH Aliphatic >C16-35	mg/kg	65000 (8.48) F, sol	110000 F	65000 (8.48) F, sol	110000 F	270000 F	1600000 F	1800000 F	250000 F	250000 F	450000 F	490000 F	CLEA MODEL LQM/CIH 2015
TPH Aliphatic >C35-44	mg/kg	65000 (8.48) F, sol	110000 F	6000 (8.48) F, sol	110000 F	270000 F	1600000 F	1800000 F	250000 F	250000 F	450000 F	490000 F	CLEA MODEL LQM/CIH 2015
TPH Aromatic >EC5-7 (Benzene)	mg/kg	70	300	370	1400	57	26000 (1220) sol	86000 (4710) sol	56000	56000	76000 (1220) sol	92000 (4710) sol	CLEA MODEL LQM/CIH 2015
TPH Aromatic >EC7-8 (Toluene)	mg/kg	130	660	860	3900	120	56000 (869) vap	180000 (4360) vap	56000	56000	87000 (869) vap	100000 (4360) vap	CLEA MODEL LQM/CIH 2015
TPH Aromatic >EC8-10	mg/kg	34	190	47	270	51	3500 (613) vap	17000 (3580) vap	5000	5000	7200 (613) vap	9300 (3580) vap	CLEA MODEL LQM/CIH 2015
TPH Aromatic >EC10-12	mg/kg	74	380	250	1200	74	16000 (364) sol	34000 (2150) sol	5000	5000	9200 (364) sol	10000	CLEA MODEL LQM/CIH 2015
TPH Aromatic >EC12-16	mg/kg	140	660	1800	2500	130	36000 (169) sol	38000	5100	5000	10000	10000	CLEA MODEL LQM/CIH 2015
TPH Aromatic >EC16-21	mg/kg	260 F	930 F	1900 F	1900 F	260 F	28000 F	28000 F	3800 F	3800 F	7600 F	7800 F	CLEA MODEL LQM/CIH 2015
TPH Aromatic >EC21-35	mg/kg	1100 F	1700 F	1900 F	1900 F	1600 F	28000 F	28000 F	3800 F	3800 F	7800 F	7900 F	CLEA MODEL LQM/CIH 2015
TPH Aromatic >EC35-44	mg/kg	1100f	1700 F	1900 F	1900 F	1600 F	28000 F	28000 F	3800 F	3800 F	7800 F	7900 F	CLEA MODEL LQM/CIH 2015
Aliphatic - Aromatic EC44-70	mg/kg	1600 F	1900 F	1900 F	1900 F	3000 F	28000 F	28000 F	3800 F	3800 F	7800 F	7800 F	CLEA MODEL LQM/CIH 2015
Total TPH	mg/kg	100.0	100.0	100.0	100.0	100	1000	1000	1000	1000	1000	1000	NOT a S4U if exceeded speciation required
BTEX													
Benzene	mg/kg	0.087	0.37	0.38	1.4	0.075	27	90	72	73	90	110	CLEA MODEL LQM/CIH 2015
Toluene	mg/kg	130	660	880 (869) vap	3900	120	56000 (869) vap	180000 (4360) vap	56000	56000	87000 (869) vap	100000 (4360) vap	CLEA MODEL LQM/CIH 2015
Ethylbenzene	mg/kg	47	260	83	440	91	5700 (518) vap	27000 (2840) vap	24000	25000	17000 (518) vap	27000 (2840) vap	CLEA MODEL LQM/CIH 2015
Xylenes (ortho)	mg/kg	60	330	88	480	160	6600 (478) sol	33000 (2620) sol	41000	43000	17000 (478) sol	33000 (2620) sol	CLEA MODEL LQM/CIH 2015
Xylenes (meta)	mg/kg	59	320	82	450	160	6200 (625) vap	31000 (3460) vap	41000	43000	17000 (625) vap	32000 (3460) vap	CLEA MODEL LQM/CIH 2015
Xylenes (para)	mg/kg	56	310	79	430	170	5900 (576) sol	30000 (3170) sol	41000	43000	17000 (576) sol	31000 (3170) sol	CLEA MODEL LQM/CIH 2015

NOTES

- 1) Screen individual constituent values initially and if exceedances are noted consider further in relation to averaging areas and statistical analysis
- 2) These values are for initial screening for potential risk to human health only. They are not remediation thresholds. Screening for other receptors to be done separately as appropriate for the site, e.g. for water, ecology, building materials.
- 3) TSVs have been derived for common constituents only to date, pending future issues of this sheet. Research has been undertaken for numerous other constituents already.
- 4) Please note that the TSVs derived for certain compounds may be low in relation to standard laboratory detection limits.

APPENDIX D

CHEMICAL LABORATORY RESULTS

STATISTICAL ANALYSIS RESULTS



DETS

Certificate of Analysis

Certificate Number 23-23140

Issued: 06-Oct-23

Client Shadbolt Group
18 Bewick Road
Gateshead
NE8 4DP

Our Reference 23-23140

Client Reference 3001

Order No (not supplied)

Contract Title NILE AND VILLIERS

Description 26 Soil samples.

Date Received 28-Sep-23

Date Started 28-Sep-23

Date Completed 06-Oct-23

Test Procedures Identified by prefix DETSn (details on request).

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

Approved By



Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis

Soil Samples

Our Ref 23-23140

Client Ref 3001

Contract Title NILE AND VILLIERS

Lab No	2240343	2240344	2240345	2240346	2240347	2240348
Sample ID	TP-01	TP-02	TP-03	TP-03	TP-04	TP-05
Depth	0.40-0.50	1.00-1.10	0.10-0.20	1.00-1.20	0.50-0.60	0.50-0.60
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	n/s	12/09/2023	12/09/2023	12/09/2023	12/09/2023	12/09/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >20mm	DETSC 1003*	1	% m/m	7.0	3.0	4.0	10	13	15
Moisture Content	DETSC 1004	0.1	%	17	13	18	14	12	11
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	10	7.2	15	7.7	8.4	7.2
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	1.0	0.7	0.6	0.9	1.6	0.7
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.2	0.5	0.3	0.2	0.2
Chromium	DETSC 2301#	0.15	mg/kg	15	9.2	18	11	12	13
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	31	19	45	33	28	23
Lead	DETSC 2301#	0.3	mg/kg	280	180	100	210	270	240
Mercury	DETSC 2325#	0.05	mg/kg	0.67	0.23	0.17	0.26	1.7	0.63
Nickel	DETSC 2301#	1	mg/kg	13	11	20	11	11	13
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	100	83	140	280	96	86
Inorganics									
pH	DETSC 2008#		pH	9.0	8.5	7.9	8.7	10.1	11.2
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.4	0.3	0.6	0.8	0.3	0.2
Organic matter	DETSC 2002#	0.1	%	2.7	1.3	5.3	1.8	1.9	2.0
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	160	81	43	470	120	83
Petroleum Hydrocarbons									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	750	19	17	32	140	140
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	0.15	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.36	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	0.31	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	2.7	0.08	0.16	0.25	0.16	0.32
Anthracene	DETSC 3303	0.03	mg/kg	0.54	< 0.03	< 0.03	0.07	0.04	0.07
Fluoranthene	DETSC 3303#	0.03	mg/kg	7.3	0.43	0.38	0.71	0.43	0.58
Pyrene	DETSC 3303#	0.03	mg/kg	6.5	0.41	0.31	0.58	0.40	0.49
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	3.5	0.23	0.14	0.26	0.29	0.30
Chrysene	DETSC 3303	0.03	mg/kg	3.3	0.25	0.19	0.24	0.29	0.28
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	3.4	0.28	0.17	0.21	0.37	0.36
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	1.3	0.11	0.07	0.10	0.16	0.15
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	2.4	0.20	0.09	0.14	0.31	0.28
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.81	0.10	0.06	0.09	0.14	0.14
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.25	< 0.03	< 0.03	< 0.03	0.03	0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.99	0.12	0.06	0.11	0.16	0.16
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	34	2.2	1.6	2.8	2.8	3.1

Summary of Chemical Analysis

Soil Samples

Our Ref 23-23140

Client Ref 3001

Contract Title NILE AND VILLIERS

Lab No	2240349	2240350	2240351	2240352	2240353	2240354
Sample ID	TP-06	TP-07	TP-08	TP-09	WS-01B	WS-01B
Depth	0.30-0.40	0.70-0.80	0.40-0.50	0.60-0.70	0.50-0.60	1.50-1.60
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	12/09/2023	12/09/2023	12/09/2023	12/09/2023	20/09/2023	20/09/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >20mm	DETSC 1003*	1	% m/m	7.0	< 1.0	16	5.0	8.0	< 1.0
Moisture Content	DETSC 1004	0.1	%	12	8.9	12	12	8.8	16
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	6.1	7.1	5.9	8.0	6.2	6.2
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	1.0	0.8	0.6	0.8	1.1	0.9
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.2	0.2	0.1	0.2	0.2
Chromium	DETSC 2301#	0.15	mg/kg	11	10	11	7.8	14	29
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	37	27	18	19	27	24
Lead	DETSC 2301#	0.3	mg/kg	86	100	62	190	50	23
Mercury	DETSC 2325#	0.05	mg/kg	0.18	0.27	0.12	0.41	0.11	< 0.05
Nickel	DETSC 2301#	1	mg/kg	9.3	10	11	8.8	15	49
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	190	90	57	59	160	61
Inorganics									
pH	DETSC 2008#		pH	8.9	9.1	10.3	8.5	11.2	7.8
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.2	0.1	0.2	< 0.1	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%	1.6	1.8	2.1	2.7	2.9	0.8
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	500	62	110	160	200	110
Petroleum Hydrocarbons									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	170	< 10	< 10	< 10	1600	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.06	< 0.03	0.17	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.05	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.84	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.89	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.05	0.08	0.09	0.03	4.6	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	1.3	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.09	0.10	0.12	0.03	6.3	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	0.07	0.08	0.10	< 0.03	4.9	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.05	0.05	0.06	< 0.03	2.2	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.05	0.05	0.07	< 0.03	2.0	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.06	0.05	0.07	< 0.03	2.0	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.81	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.03	0.04	< 0.03	1.5	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.58	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.19	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	0.03	< 0.03	0.69	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.37	0.45	0.61	< 0.10	29	< 0.10

Summary of Chemical Analysis

Soil Samples

Our Ref 23-23140

Client Ref 3001

Contract Title NILE AND VILLIERS

Lab No	2240355	2240356	2240357	2240358	2240359	2240360
Sample ID	WS 02B	WS-03	WS-03	WS-04	WS-06	WS-06
Depth	1.00-1.10	0.10-0.15	0.50-0.60	0.50-0.60	0.50-0.60	1.50-1.60
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	20/09/2023	12/09/2023	12/09/2023	12/09/2023	12/09/2023	12/09/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >20mm	DETSC 1003*	1	% m/m	5.0	2.0	9.0	4.0	5.0	< 1.0
Moisture Content	DETSC 1004	0.1	%	12	16	14	13	14	16
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	2.7	13	8.5	7.4	19	9.9
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.5	0.5	1.0	0.8	0.9	0.9
Cadmium	DETSC 2301#	0.1	mg/kg	1.1	0.4	0.4	0.4	0.2	0.2
Chromium	DETSC 2301#	0.15	mg/kg	5.4	18	11	11	30	10
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	8.6	43	39	28	42	26
Lead	DETSC 2301#	0.3	mg/kg	50	80	280	140	80	100
Mercury	DETSC 2325#	0.05	mg/kg	0.14	0.12	0.46	0.20	0.20	2.8
Nickel	DETSC 2301#	1	mg/kg	4.9	20	11	12	33	13
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	64	110	250	200	91	77
Inorganics									
pH	DETSC 2008#		pH	11.1	7.9	9.3	9.6	8.1	8.5
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.2	0.7	0.2	0.2	0.2	0.2
Organic matter	DETSC 2002#	0.1	%	0.7	5.3	1.8	1.3	4.3	2.5
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	180	31	310	1500	240	86
Petroleum Hydrocarbons									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	12	79	110	140	140	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.37	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.38	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.04	0.28	0.09	0.06	3.9	0.04
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	0.05	< 0.03	< 0.03	1.3	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.06	0.58	0.16	0.10	7.4	0.05
Pyrene	DETSC 3303#	0.03	mg/kg	0.06	0.46	0.14	0.09	6.0	0.05
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.03	0.21	0.08	0.05	2.5	0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.21	0.09	0.07	2.2	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.04	0.22	0.11	0.07	2.1	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.07	0.03	< 0.03	0.78	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.13	0.06	0.04	1.6	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.05	0.05	< 0.03	0.49	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.12	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	0.06	0.12	0.04	0.54	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.19	2.3	0.88	0.53	30	0.14

Summary of Chemical Analysis

Soil Samples

Our Ref 23-23140
 Client Ref 3001
 Contract Title NILE AND VILLIERS

Lab No	2240361	2240362	2240363	2240364	2240366	2240367
Sample ID	WS-07	WS-07	WS-08	WS-08	WS-09	WS-09
Depth	0.50-0.60	1.00-1.10	0.10-0.15	0.60-0.70	0.50-0.60	1.00-1.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	12/09/2023	12/09/2023	12/09/2023	12/09/2023	20/09/2023	20/09/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >20mm	DETSC 1003*	1	% m/m	3.0	< 1.0	< 1.0	1.0	8.0	2.0
Moisture Content	DETSC 1004	0.1	%	11	10	15	13	13	8.1
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	6.6	5.1	8.1	6.8	7.3	3.6
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.5	1.1	0.6	1.2	0.9	0.9
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	< 0.1	0.2	0.1	0.2	< 0.1
Chromium	DETSC 2301#	0.15	mg/kg	14	8.1	28	9.0	8.8	7.6
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	40	15	26	22	43	12
Lead	DETSC 2301#	0.3	mg/kg	390	55	44	60	230	28
Mercury	DETSC 2325#	0.05	mg/kg	0.88	0.31	0.07	0.22	0.57	0.05
Nickel	DETSC 2301#	1	mg/kg	12	8.3	25	10	11	8.3
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	170	49	67	54	71	43
Inorganics									
pH	DETSC 2008#		pH	10.6	8.0	8.0	7.6	10.2	8.2
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	0.2	0.1	0.3	0.1	0.1
Organic matter	DETSC 2002#	0.1	%	1.8	1.6	0.4	2.7	2.8	1.5
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	390	100	72	120	150	52
Petroleum Hydrocarbons									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	64	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.10	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.06	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03	< 0.03	0.40	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.07	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.11	< 0.03	< 0.03	< 0.03	0.45	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	0.09	< 0.03	< 0.03	< 0.03	0.39	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03	< 0.03	< 0.03	0.18	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.07	< 0.03	< 0.03	< 0.03	0.22	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.09	< 0.03	< 0.03	< 0.03	0.19	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03	< 0.03	0.08	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	< 0.03	< 0.03	0.14	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03	< 0.03	0.09	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03	< 0.03	0.09	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.60	< 0.10	< 0.10	< 0.10	2.5	< 0.10

Summary of Chemical Analysis

Soil Samples

Our Ref 23-23140

Client Ref 3001

Contract Title NILE AND VILLIERS

Lab No	2240368
Sample ID	WS-10
Depth	1.00-1.10
Other ID	
Sample Type	SOIL
Sampling Date	20/09/2023
Sampling Time	n/s

Test	Method	LOD	Units	
Preparation				
Stones >20mm	DETS 1003*	1	% m/m	< 1.0
Moisture Content	DETS 1004	0.1	%	7.7
Metals				
Arsenic	DETS 2301#	0.2	mg/kg	4.3
Boron, Water Soluble (2.5:1)	DETS 2311#	0.2	mg/kg	0.7
Cadmium	DETS 2301#	0.1	mg/kg	0.1
Chromium	DETS 2301#	0.15	mg/kg	8.2
Chromium, Hexavalent	DETS 2204*	1	mg/kg	< 1.0
Copper	DETS 2301#	0.2	mg/kg	17
Lead	DETS 2301#	0.3	mg/kg	54
Mercury	DETS 2325#	0.05	mg/kg	0.15
Nickel	DETS 2301#	1	mg/kg	9.5
Selenium	DETS 2301#	0.5	mg/kg	< 0.5
Zinc	DETS 2301#	1	mg/kg	51
Inorganics				
pH	DETS 2008#		pH	8.2
Cyanide, Total	DETS 2130#	0.1	mg/kg	0.2
Organic matter	DETS 2002#	0.1	%	1.1
Sulphate Aqueous Extract as SO ₄ (2:1)	DETS 2076#	10	mg/l	58
Petroleum Hydrocarbons				
EPH (C10-C40)	DETS 3311#	10	mg/kg	< 10
PAHs				
Naphthalene	DETS 3303#	0.03	mg/kg	0.05
Acenaphthylene	DETS 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETS 3303#	0.03	mg/kg	< 0.03
Fluorene	DETS 3303	0.03	mg/kg	< 0.03
Phenanthrene	DETS 3303#	0.03	mg/kg	0.13
Anthracene	DETS 3303	0.03	mg/kg	< 0.03
Fluoranthene	DETS 3303#	0.03	mg/kg	0.14
Pyrene	DETS 3303#	0.03	mg/kg	0.12
Benzo(a)anthracene	DETS 3303#	0.03	mg/kg	0.06
Chrysene	DETS 3303	0.03	mg/kg	0.07
Benzo(b)fluoranthene	DETS 3303#	0.03	mg/kg	0.06
Benzo(k)fluoranthene	DETS 3303#	0.03	mg/kg	0.03
Benzo(a)pyrene	DETS 3303#	0.03	mg/kg	0.05
Indeno(1,2,3-c,d)pyrene	DETS 3303#	0.03	mg/kg	0.04
Dibenzo(a,h)anthracene	DETS 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETS 3303#	0.03	mg/kg	0.03
PAH - USEPA 16, Total	DETS 3303	0.1	mg/kg	0.75

Summary of Asbestos Analysis Soil Samples

Our Ref 23-23140

Client Ref 3001

Contract Title NILE AND VILLIERS

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2240343	TP-01 0.40-0.50	SOIL	NAD	none	Ben Rose
2240344	TP-02 1.00-1.10	SOIL	NAD	none	Ben Rose
2240345	TP-03 0.10-0.20	SOIL	NAD	none	Ben Rose
2240346	TP-03 1.00-1.20	SOIL	NAD	none	Ben Rose
2240347	TP-04 0.50-0.60	SOIL	NAD	none	Ben Rose
2240348	TP-05 0.50-0.60	SOIL	NAD	none	Ben Rose
2240349	TP-06 0.30-0.40	SOIL	NAD	none	Ben Rose
2240350	TP-07 0.70-0.80	SOIL	NAD	none	Ben Rose
2240351	TP-08 0.40-0.50	SOIL	NAD	none	Ben Rose
2240352	TP-09 0.60-0.70	SOIL	NAD	none	Ben Rose
2240353	WS-01B 0.50-0.60	SOIL	Chrysotile	Chrysotile present as fibre bundles	Ben Rose
2240354	WS-01B 1.50-1.60	SOIL	NAD	none	Ben Rose
2240355	WS 02B 1.00-1.10	SOIL	NAD	none	Ben Rose
2240356	WS-03 0.10-0.15	SOIL	Chrysotile	Chrysotile present in microscopic bitumen	Ben Rose
2240357	WS-03 0.50-0.60	SOIL	NAD	none	Ben Rose
2240358	WS-04 0.50-0.60	SOIL	NAD	none	Ben Rose
2240359	WS-06 0.50-0.60	SOIL	NAD	none	Ben Rose
2240360	WS-06 1.50-1.60	SOIL	NAD	none	Ben Rose
2240361	WS-07 0.50-0.60	SOIL	NAD	none	Ben Rose
2240362	WS-07 1.00-1.10	SOIL	NAD	none	Ben Rose
2240363	WS-08 0.10-0.15	SOIL	NAD	none	Ben Rose
2240364	WS-08 0.60-0.70	SOIL	NAD	none	Ben Rose
2240365	WS-09 0.10-0.20	SOIL	NAD	none	Ben Rose
2240366	WS-09 0.50-0.60	SOIL	NAD	none	Ben Rose
2240367	WS-09 1.00-1.10	SOIL	NAD	none	Ben Rose
2240368	WS-10 1.00-1.10	SOIL	NAD	none	Ben Rose

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 23-23140
 Client Ref 3001
 Contract NILE AND VILLIERS

Containers Received & Deviating Samples

Lab No	Sample ID	Date	Containers Received	Holding time exceeded for tests
		Sampled		
2240343	TP-01 0.40-0.50 SOIL		GJ 250ml	
2240344	TP-02 1.00-1.10 SOIL	12/09/23	GJ 250ml	
2240345	TP-03 0.10-0.20 SOIL	12/09/23	GJ 250ml	
2240346	TP-03 1.00-1.20 SOIL	12/09/23	GJ 250ml	
2240347	TP-04 0.50-0.60 SOIL	12/09/23	GJ 250ml	
2240348	TP-05 0.50-0.60 SOIL	12/09/23	GJ 250ml	
2240349	TP-06 0.30-0.40 SOIL	12/09/23	GJ 250ml	
2240350	TP-07 0.70-0.80 SOIL	12/09/23	GJ 250ml	
2240351	TP-08 0.40-0.50 SOIL	12/09/23	GJ 250ml	
2240352	TP-09 0.60-0.70 SOIL	12/09/23	GJ 250ml	
2240353	WS-01B 0.50-0.60 SOIL	20/09/23	GJ 250ml	
2240354	WS-01B 1.50-1.60 SOIL	20/09/23	GJ 250ml	
2240355	WS 02B 1.00-1.10 SOIL	20/09/23	GJ 250ml	
2240356	WS-03 0.10-0.15 SOIL	12/09/23	GJ 250ml	
2240357	WS-03 0.50-0.60 SOIL	12/09/23	GJ 250ml	
2240358	WS-04 0.50-0.60 SOIL	12/09/23	GJ 250ml	

Information in Support of the Analytical Results

Our Ref 23-23140
 Client Ref 3001
 Contract NILE AND VILLIERS

Lab No	Sample ID	Date		Holding time exceeded for tests
		Sampled	Containers Received	
2240359	WS-06 0.50-0.60 SOIL	12/09/23	GJ 250ml	
2240360	WS-06 1.50-1.60 SOIL	12/09/23	GJ 250ml	
2240361	WS-07 0.50-0.60 SOIL	12/09/23	GJ 250ml	
2240362	WS-07 1.00-1.10 SOIL	12/09/23	GJ 250ml	
2240363	WS-08 0.10-0.15 SOIL	12/09/23	GJ 250ml	
2240364	WS-08 0.60-0.70 SOIL	12/09/23	GJ 250ml	
2240365	WS-09 0.10-0.20 SOIL	20/09/23	PT 1L	
2240366	WS-09 0.50-0.60 SOIL	20/09/23	GJ 250ml	
2240367	WS-09 1.00-1.10 SOIL	20/09/23	GJ 250ml	
2240368	WS-10 1.00-1.10 SOIL	20/09/23	GJ 250ml	

Key: G-Glass J-Jar P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate container or deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time) to prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

**Inappropriate
container for
tests**

amples received may be
in compliance on Deviating
containers etc are
deviations. If no
time for waters) this will

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DETS

Certificate of Analysis

Certificate Number 23-23811

Issued: 17-Oct-23

Client Shadbolt Group
18 Bewick Road
Gateshead
NE8 4DP

Our Reference 23-23811

Client Reference 3001

Order No (not supplied)

Contract Title NILE AND VILLIERS

Description 3 Soil samples.

Date Received 28-Sep-23

Date Started 06-Oct-23

Date Completed 17-Oct-23

Test Procedures Identified by prefix DETSn (details on request).

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

Approved By



Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis Soil Samples

Our Ref 23-23811

Client Ref 3001

Contract Title NILE AND VILLIERS

Lab No	2244376	2244377	2244378
Sample ID	TP-01	WS-01B	WS-03
Depth	0.40-0.50	0.50-0.60	0.10-0.15
Other ID			
Sample Type	SOIL	SOIL	SOIL
Sampling Date	n/s	20/09/2023	12/09/2023
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Asbestos Quantification	DETSC 1102	0.001	%		0.004	0.56
Petroleum Hydrocarbons						
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	2.8	
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	9.0	
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	24	
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	220	
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	250	
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	0.9	
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	1.6	8.3	
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	40	49	
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	89	440	
Aromatic C5-C35	DETSC 3072*	10	mg/kg	130	500	
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	130	750	

Summary of Asbestos Analysis

Samples

Our Ref 23-23811

Client Ref 3001

Contract Title NILE AND VILLIERS

Lab No	Sample ID	Sample Location	Material Type	Result	Comment*	Analyst
<p>Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.</p>						

Summary of Asbestos Quantification Analysis

Soil Samples

Our Ref 23-23811

Client Ref 3001

Contract Title NILE AND VILLIERS

Lab No	2244377	2244378
Sample ID	WS-01B	WS-03
Depth	0.50-0.60	0.10-0.15
Other ID		
Sample Type		
Sampling Date	20/09/2023	12/09/2023
Sampling Time		

Test	Method	Units		
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	0.004	0.559
Gravimetric Quantification (a)	DETSC 1102	Mass %	na	0.559
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	0.004	na
Quantification by PCOM (c)	DETSC 1102	Mass %	na	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na	na

Breakdown of Gravimetric Analysis (a)

Mass of Sample		g	11.78	6.47
ACMs present*		type		Bitumen
Mass of ACM in sample		g		0.45
% ACM by mass		%		6.99
% asbestos in ACM		%		8
% asbestos in sample		%		0.559

Breakdown of Detailed Gravimetric Analysis (b)

% Amphibole bundles in sample		Mass %	na	na
% Chrysotile bundles in sample		Mass %	0.004	na

Breakdown of PCOM Analysis (c)

% Amphibole fibres in sample		Mass %	na	na
% Chrysotile fibres in sample		Mass %	na	na

Breakdown of Potentially Respirable Fibre Analysis (d)

Amphibole fibres		Fibres/g	na	na
Chrysotile fibres		Fibres/g	na	na

* Denotes test or material description outside of UKAS accreditation.
 % asbestos in Asbestos Containing Materials (ACMs) is determined by
 by reference to HSG 264.
 Recommended sample size for quantification is approximately 1kg
 # denotes deviating sample

Information in Support of the Analytical Results

Our Ref 23-23811
 Client Ref 3001
 Contract NILE AND VILLIERS

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2244376	TP-01 0.40-0.50 SOIL		GJ 250ml	Sample date not supplied, Aliphatics/Aromatics (14 days), BTEX / C5-C10 (14 days)	BTEX / C5-C10
2244377	WS-01B 0.50-0.60 SOIL	20/09/23	GJ 250ml		BTEX / C5-C10
2244378	WS-03 0.10-0.15 SOIL	12/09/23	GJ 250ml		

Key: G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
 Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



APPENDIX E

GEOTECHNICAL LABORATORY RESULTS

Laboratory Test Report

Client	Shadbolt Environmental
Address	18 Bewick Road Gateshead NE8 4DP
F.A.O	Iain McLean
Project:	Nile & Villiers
Project Number:	D11093
Report Number:	L23-1134
Date Received:	02/10/2023

Testing Required:	Moisture Content - BS:1377-2:1990 Plastic Limit - BS:1377-2:1990 Particle Size Distribution - BS:1377-2:1990 Determination of Maximum Dry Density / Optimum Moisture Content by 2.5kg Rammer - BS:1377-4:1990 Determination of Maximum Dry Density / Optimum Moisture Content by 4.5kg Rammer - BS:1377-4:1990 California Bearing Ratio - BS:1377-4:1990*
Date Started:	02/10/2023
Date Finished:	13/10/2023

Report Issue Date:	13/10/2023
Reviewed By:	 J.Curry - Contracts Manager
Authorised By:	 N.O'Brien - Quality and Technical Manager
Remarks:	(*) denotes testing is outside of UKAS Scope of Accreditation. (+) denotes subcontracted testing.

Samples will be stored for one month after the report has been issue before being disposed of.

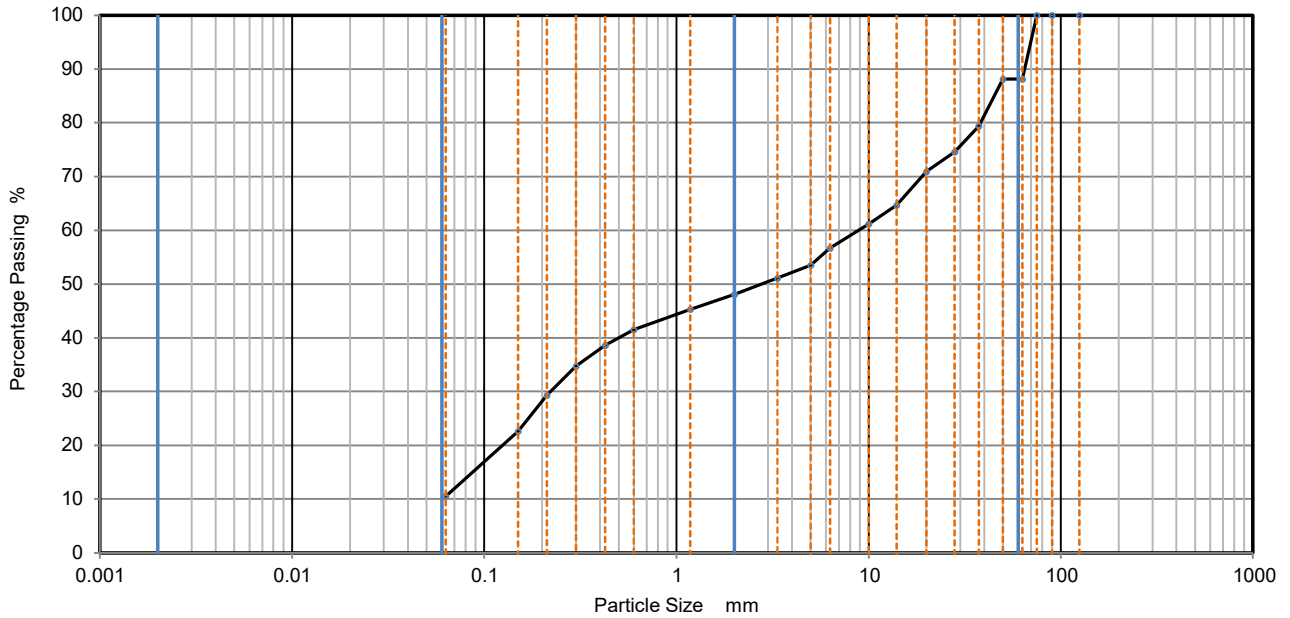
The published results appertain only to the specimens tested.

Exploration and Testing Associates Limited, registered in England and Wales #11803869 at
 8B, Bowburn South Industrial Estate, Bowburn, Durham, DH6 5AD



PARTICLE SIZE DISTRIBUTION

			Job Ref	D11093	
			Borehole/Pit No.	TP-02	
Site Name	3001 Nile and Villiers		Sample No.	6	
Soil Description	MG (Brown Slightly Clayey Gravelly Sand. Gravel Includes Brick & Concrete)		Depth, m	0.30	
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS 1377-2:1990, Washing and Drying, Clauses 9.2		KeyLAB ID	EAT_2023100323	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	88		
50	88		
37.5	79		
28	75		
20	71		
14	65		
10	61		
6.3	57		
5	54		
3.35	51		
2	48		
1.18	45		
0.6	42		
0.425	39		
0.3	35		
0.212	29		
0.15	23		
0.063	11		

Method of Pre-Treatment	None
-------------------------	------

Sample Proportions	% dry mass
Very coarse	12
Gravel	40
Sand	38
Fines <0.063mm	10

Grading Analysis		
D ₁₀₀	mm	
D ₆₀	mm	8.84
D ₃₀	mm	0.222
D ₁₀	mm	
Uniformity Coefficient		
Curvature Coefficient		

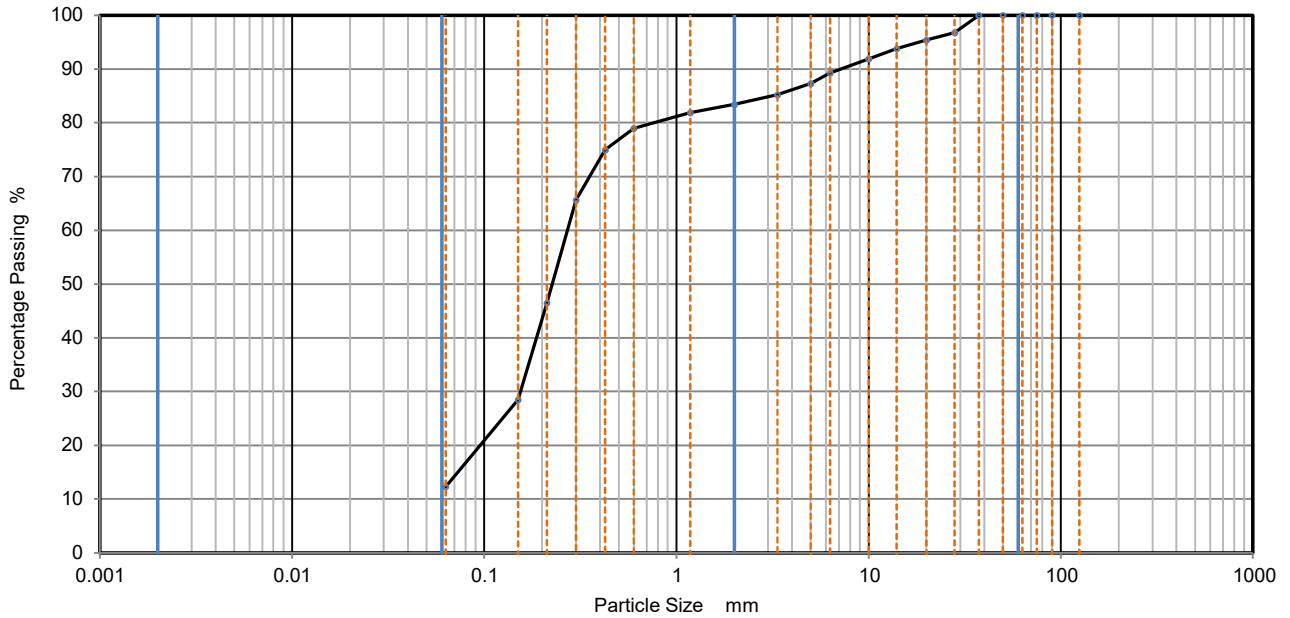
Remarks
Preparation and testing in accordance with BS 1377-2:1990 unless noted below

Date	Approved By		UKAS Accredited Laboratory No. 20632
13/10/2023 07:39	N O'Brien		



PARTICLE SIZE DISTRIBUTION

			Job Ref	D11093	
			Borehole/Pit No.	TP-07	
Site Name	3001 Nile and Villiers		Sample No.	15	
Soil Description	Brown Slightly Clayey Slightly Gravelly Sand		Depth, m	0.40	
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS 1377-2:1990, Washing and Drying, Clauses 9.2		KeyLAB ID	EAT_2023100332	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	95		
14	94		
10	92		
6.3	89		
5	87		
3.35	85		
2	83		
1.18	82		
0.6	79		
0.425	75		
0.3	66		
0.212	47		
0.15	29		
0.063	12		

Method of Pre-Treatment	None
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Sample Proportions	% dry mass
Very coarse	0
Gravel	17
Sand	71
Fines <0.063mm	12

Grading Analysis		
D ₁₀₀	mm	
D ₆₀	mm	0.271
D ₃₀	mm	0.154
D ₁₀	mm	
Uniformity Coefficient		
Curvature Coefficient		

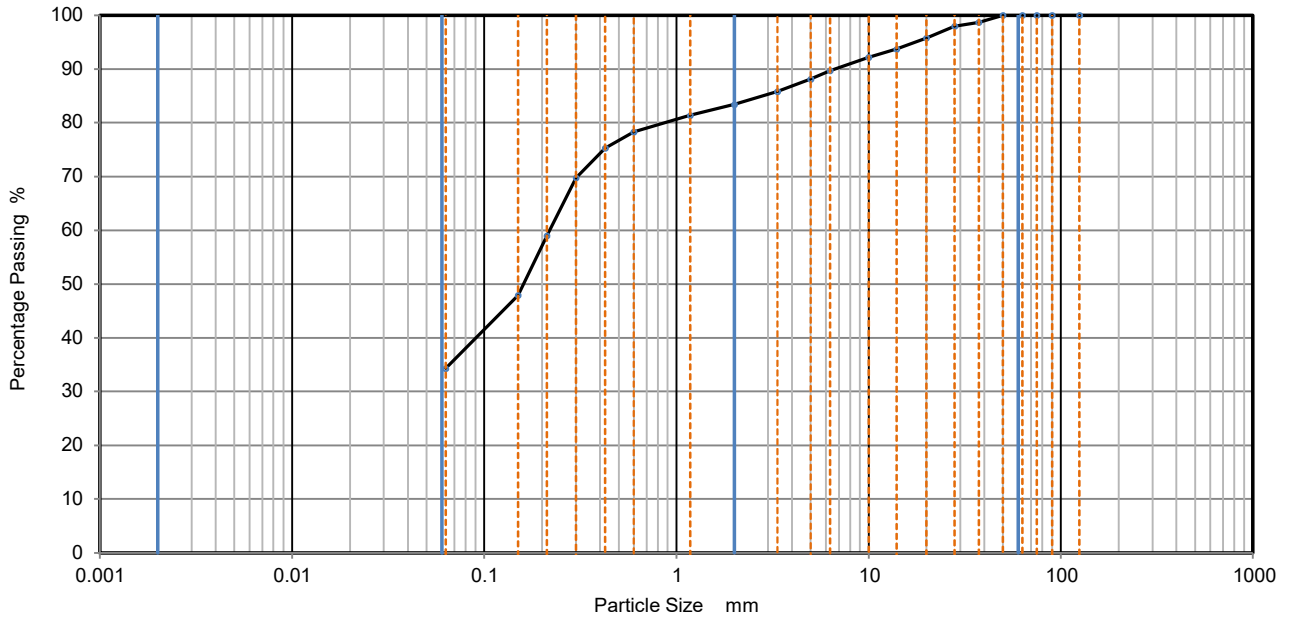
Remarks
Preparation and testing in accordance with BS 1377-2:1990 unless noted below

Date	Approved By		UKAS Accredited Laboratory No. 20632
13/10/2023 07:40	N O'Brien		



PARTICLE SIZE DISTRIBUTION

			Job Ref	D11093	
			Borehole/Pit No.	TP-08	
Site Name	3001 Nile and Villiers		Sample No.	17	
Soil Description	Brown Clayey Gravelly Sand		Depth, m	0.50	
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS 1377-2:1990, Washing and Drying, Clauses 9.2		KeyLAB ID	EAT_2023100334	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	99		
28	98		
20	96		
14	94		
10	92		
6.3	90		
5	88		
3.35	86		
2	83		
1.18	81		
0.6	78		
0.425	75		
0.3	70		
0.212	59		
0.15	48		
0.063	34		

Method of Pre-Treatment	None
-------------------------	------

Sample Proportions	% dry mass
Very coarse	0
Gravel	17
Sand	49
Fines <0.063mm	34

Grading Analysis	
D ₁₀₀	mm
D ₆₀	mm 0.219
D ₃₀	mm
D ₁₀	mm
Uniformity Coefficient	
Curvature Coefficient	

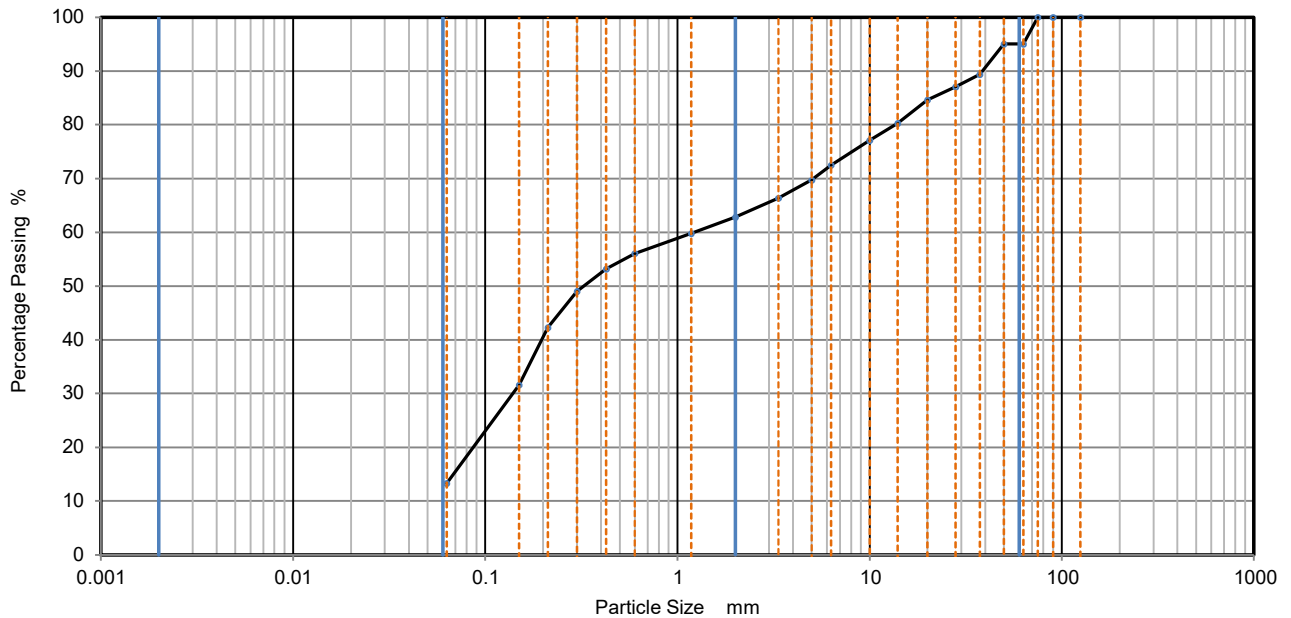
Remarks
Preparation and testing in accordance with BS 1377-2:1990 unless noted below

Date	Approved By		UKAS Accredited Laboratory No. 20632
13/10/2023 07:40	N O'Brien		



PARTICLE SIZE DISTRIBUTION

			Job Ref	D11093	
			Borehole/Pit No.	TP-03	
Site Name	3001 Nile and Villiers		Sample No.	8	
Soil Description	MG (Brown Slightly Clayey Gravelly Sand. Gravel includes Brick & Concrete)		Depth, m	0.60	
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS 1377-2:1990, Washing and Drying, Clauses 9.2		KeyLAB ID	EAT_2023100325	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	95		
50	95		
37.5	89		
28	87		
20	85		
14	80		
10	77		
6.3	73		
5	70		
3.35	66		
2	63		
1.18	60		
0.6	56		
0.425	53		
0.3	49		
0.212	42		
0.15	32		
0.063	13		

Method of Pre-Treatment	None
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Sample Proportions	% dry mass
Very coarse	5
Gravel	32
Sand	50
Fines <0.063mm	13

Grading Analysis	
D ₁₀₀	mm
D ₆₀	mm 1.22
D ₃₀	mm 0.143
D ₁₀	mm
Uniformity Coefficient	
Curvature Coefficient	

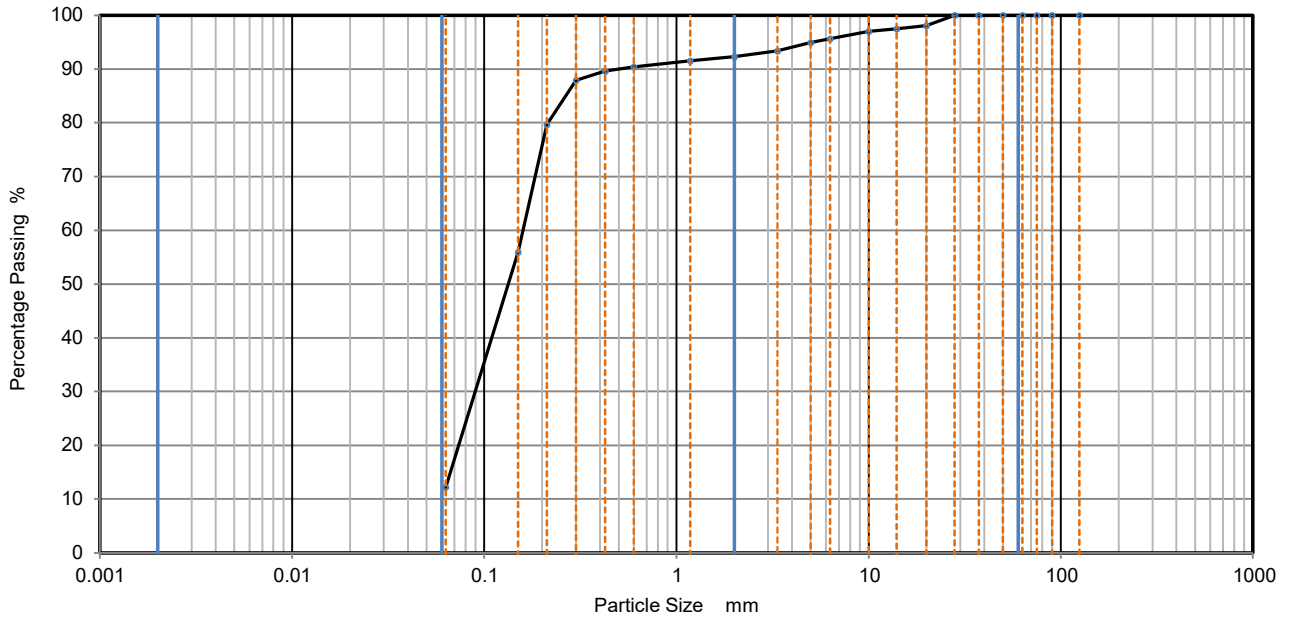
Remarks
Preparation and testing in accordance with BS 1377-2:1990 unless noted below

Date	Approved By		UKAS Accredited Laboratory No. 20632
13/10/2023 07:40	N O'Brien		



PARTICLE SIZE DISTRIBUTION

			Job Ref	D11093	
			Borehole/Pit No.	TP-06	
Site Name	3001 Nile and Villiers		Sample No.	14	
Soil Description	Brown Slightly Clayey Slightly Gravelly Sand		Depth, m	1.40	
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS 1377-2:1990, Washing and Drying, Clauses 9.2		KeyLAB ID	EAT_2023100331	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	98		
14	98		
10	97		
6.3	96		
5	95		
3.35	93		
2	92		
1.18	92		
0.6	90		
0.425	90		
0.3	88		
0.212	80		
0.15	56		
0.063	12		

Method of Pre-Treatment	None
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Sample Proportions	% dry mass
Very coarse	0
Gravel	8
Sand	80
Fines <0.063mm	12

Grading Analysis	
D ₁₀₀	mm
D ₆₀	mm 0.159
D ₃₀	mm 0.102
D ₁₀	mm
Uniformity Coefficient	
Curvature Coefficient	

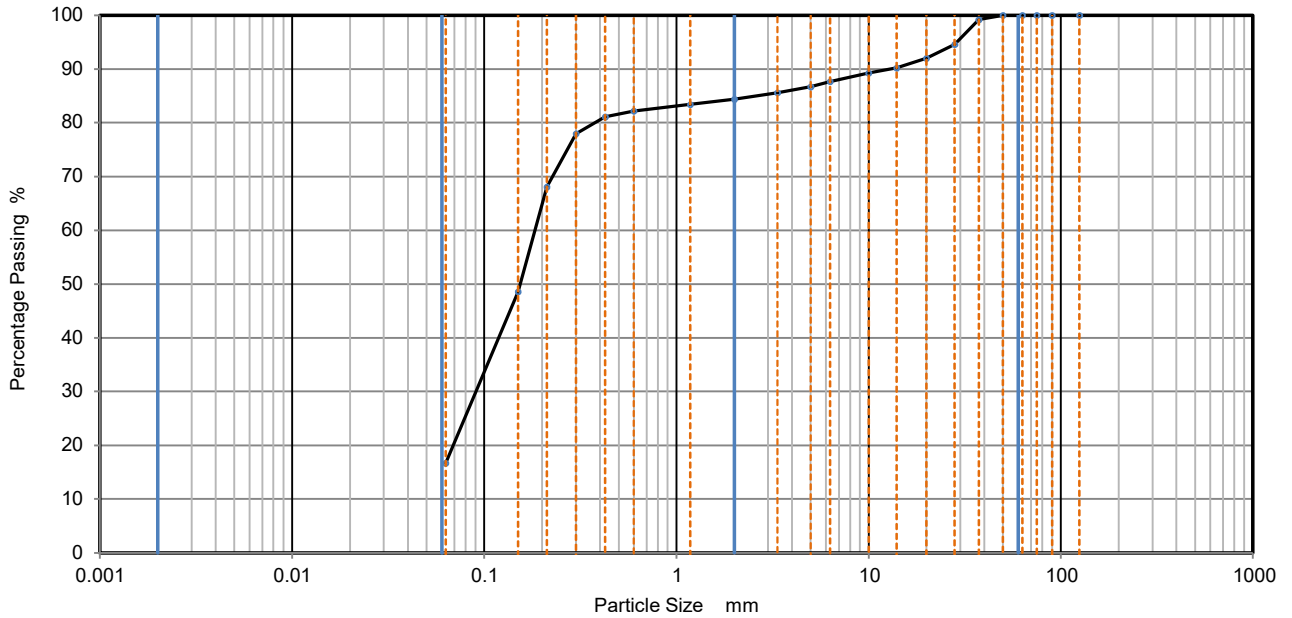
Remarks
Preparation and testing in accordance with BS 1377-2:1990 unless noted below

Date	Approved By		UKAS Accredited Laboratory No. 20632
13/10/2023 07:41	N O'Brien		



PARTICLE SIZE DISTRIBUTION

			Job Ref	D11093	
			Borehole/Pit No.	TP-04	
Site Name	3001 Nile and Villiers		Sample No.	10	
Soil Description	Brown Slightly Clayey Gravelly Sand		Depth, m	2.00	
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS 1377-2:1990, Washing and Drying, Clauses 9.2		KeyLAB ID	EAT_2023100327	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	99		
28	95		
20	92		
14	90		
10	89		
6.3	88		
5	87		
3.35	86		
2	84		
1.18	83		
0.6	82		
0.425	81		
0.3	78		
0.212	68		
0.15	49		
0.063	17		

Method of Pre-Treatment	None
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Sample Proportions	% dry mass
Very coarse	0
Gravel	16
Sand	68
Fines <0.063mm	17

Grading Analysis		
D ₁₀₀	mm	
D ₆₀	mm	0.184
D ₃₀	mm	0.103
D ₁₀	mm	
Uniformity Coefficient		
Curvature Coefficient		

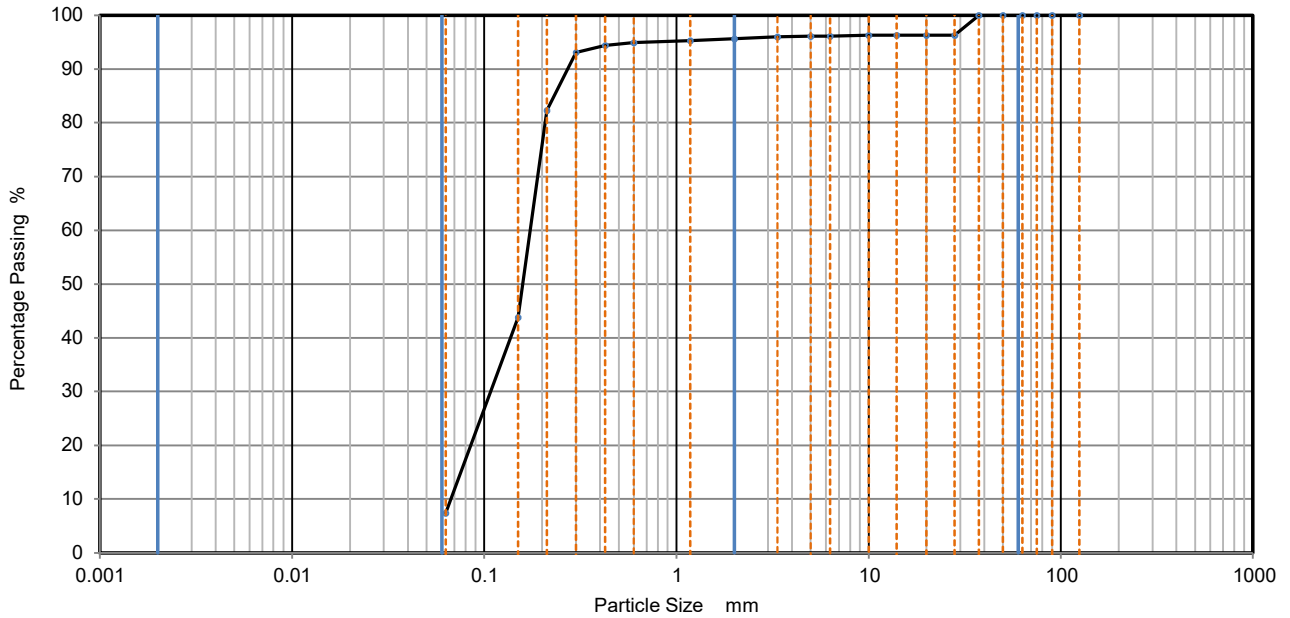
Remarks
Preparation and testing in accordance with BS 1377-2:1990 unless noted below

Date	Approved By		UKAS Accredited Laboratory No. 20632
13/10/2023 07:41	N O'Brien		



PARTICLE SIZE DISTRIBUTION

			Job Ref	D11093	
			Borehole/Pit No.	TP-01	
Site Name	3001 Nile and Villiers		Sample No.	5	
Soil Description	Brown Slightly Clayey Slightly Gravelly Sand		Depth, m	2.00	
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS 1377-2:1990, Washing and Drying, Clauses 9.2		KeyLAB ID	EAT_2023100322	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	96		
20	96		
14	96		
10	96		
6.3	96		
5	96		
3.35	96		
2	96		
1.18	95		
0.6	95		
0.425	94		
0.3	93		
0.212	82		
0.15	44		
0.063	7		

Method of Pre-Treatment	None
-------------------------	------

Sample Proportions	% dry mass
Very coarse	0
Gravel	4
Sand	88
Fines <0.063mm	7

Grading Analysis		
D ₁₀₀	mm	
D ₆₀	mm	0.174
D ₃₀	mm	0.129
D ₁₀	mm	0.0691
Uniformity Coefficient		2.5
Curvature Coefficient		1.4

Remarks
Preparation and testing in accordance with BS 1377-2:1990 unless noted below

Date	Approved By		UKAS Accredited Laboratory No. 20632
13/10/2023 07:41	N O'Brien		



Dry Density / Moisture Content Relationship Light Compaction

Job Ref **D11093**

Borehole / Pit No TP-05

Site Name **3001 Nile and Villiers**

Sample No 12

Soil Description **Brown Slightly Clayey Gravelly Sand**

Depth 1.10 m

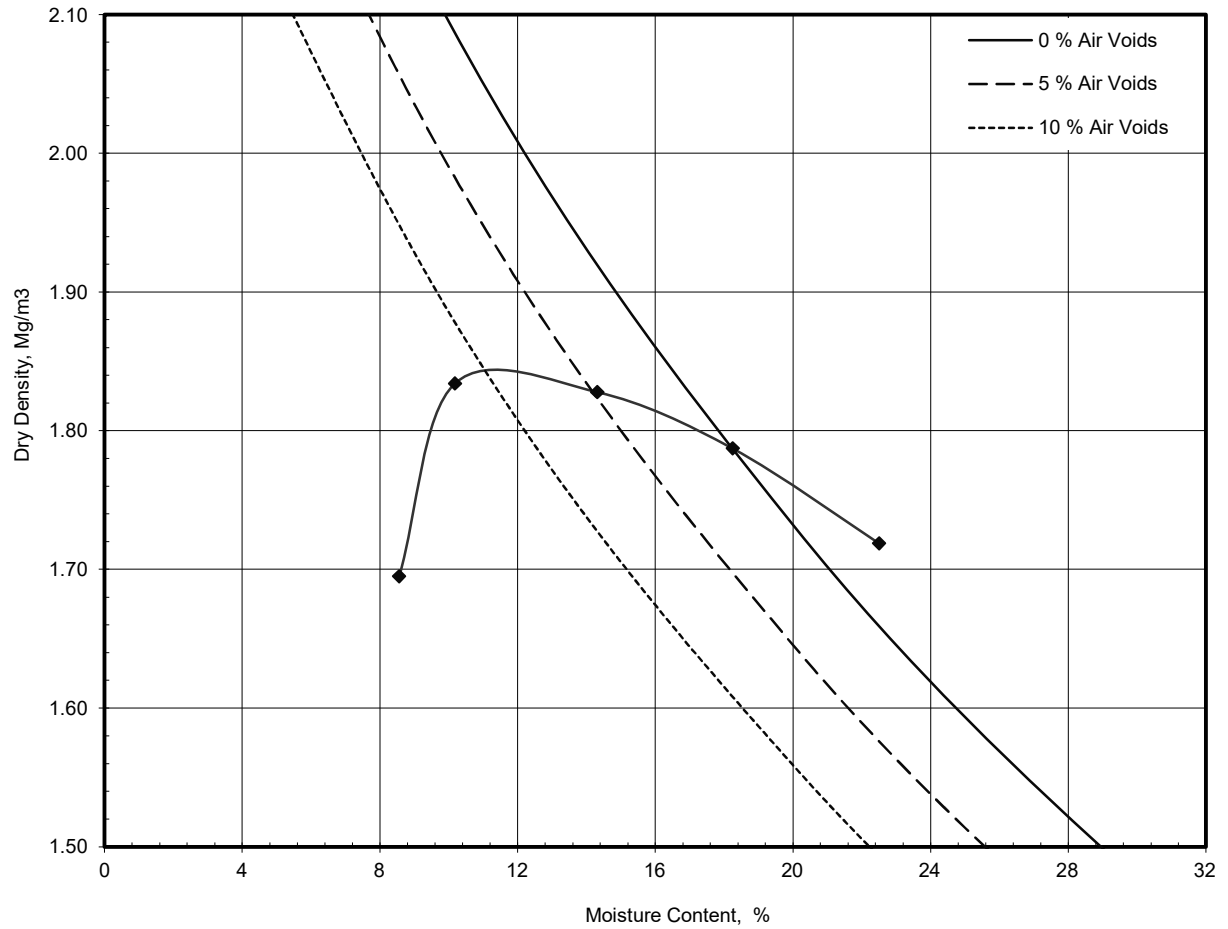
Specimen Ref. Specimen Depth m

Sample Type B

Test Method **BS1377:Part 4:1990, clause 3.3, 2.5kg rammer**

Keylab ID

Compaction Test Reference/No.



Preparation	Material used was air dried
Mould Type	One Litre
Samples Used	Separate specimens tested
Material Retained on 37.5 mm Sieve	%
Material Retained on 20.0 mm Sieve	%
Particle Density - Assumed	Mg/m ³
Grading Zone of Material	2

Maximum Dry Density	1.83
Optimum Moisture Content	10

Comments	Date	Checked By	Approved	UKAS Accredited Laboratory No. 20632
	13/10/2023 07:42	K. Gargett	N. O'Brien	



Dry Density / Moisture Content Relationship Light Compaction

Job Ref **D11093**

Borehole / Pit No TP-07

Site Name **3001 Nile and Villiers**

Sample No 16

Soil Description **Brown Slightly Clayey Slightly Gravelly Sand**

Depth 1.50 m

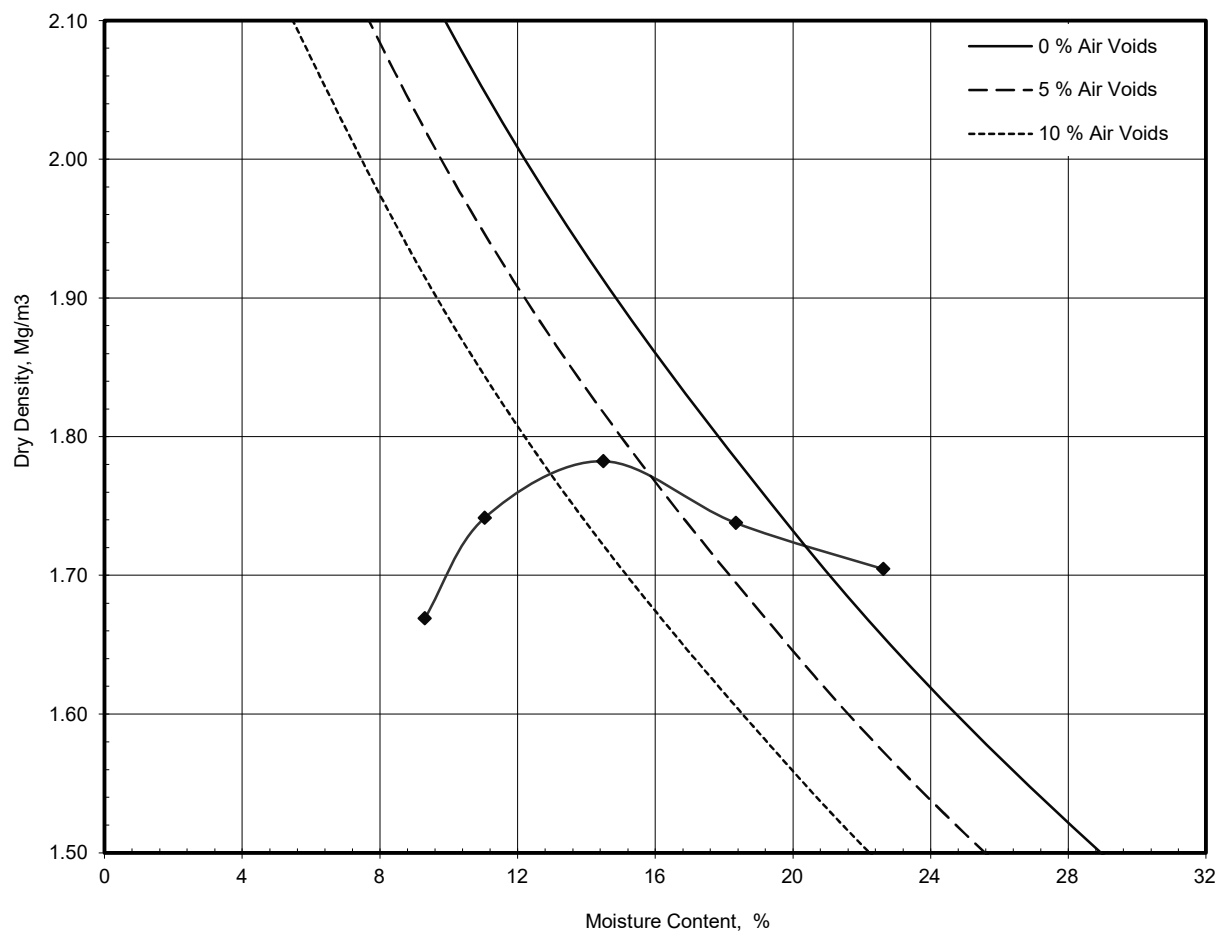
Specimen Ref. Specimen Depth m

Sample Type B

Test Method **BS1377:Part 4:1990, clause 3.3, 2.5kg rammer**

Keylab ID

Compaction Test Reference/No.



Preparation	Material used was air dried
Mould Type	One Litre
Samples Used	Separate specimens tested
Material Retained on 37.5 mm Sieve	0
Material Retained on 20.0 mm Sieve	1
Particle Density - Assumed	2.65
Grading Zone of Material	2
Maximum Dry Density	1.78
Optimum Moisture Content	14

Comments	Date	Checked By	Approved	UKAS Accredited Laboratory No. 20632
	13/10/2023 07:43	K. Gargett	N. O'Brien 	



Dry Density / Moisture Content Relationship Light Compaction

Job Ref **D11093**

Borehole / Pit No TP-02

Site Name **3001 Nile and Villiers**

Sample No **7**

Soil Description **Brown Slightly Clayey Sand**

Depth **2.00 m**

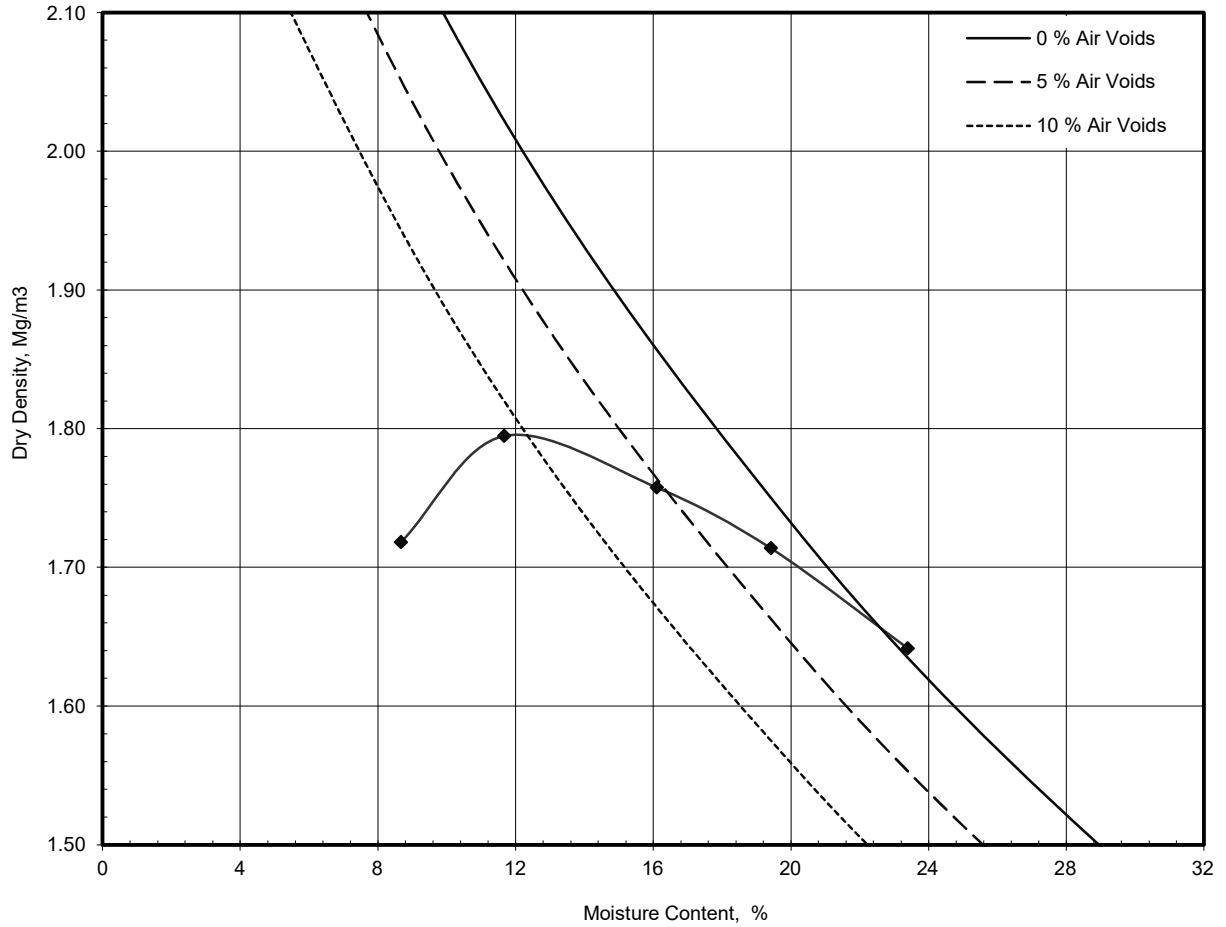
Specimen Ref. Specimen Depth m

Sample Type **B**

Test Method **BS1377:Part 4:1990, clause 3.3, 2.5kg rammer**

Keylab ID

Compaction Test Reference/No.



Preparation	Material used was air dried	
Mould Type	One Litre	
Samples Used	Separate specimens tested	
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m ³	2.65
Grading Zone of Material	1	

Maximum Dry Density	Mg/m ³	1.79
Optimum Moisture Content	%	12

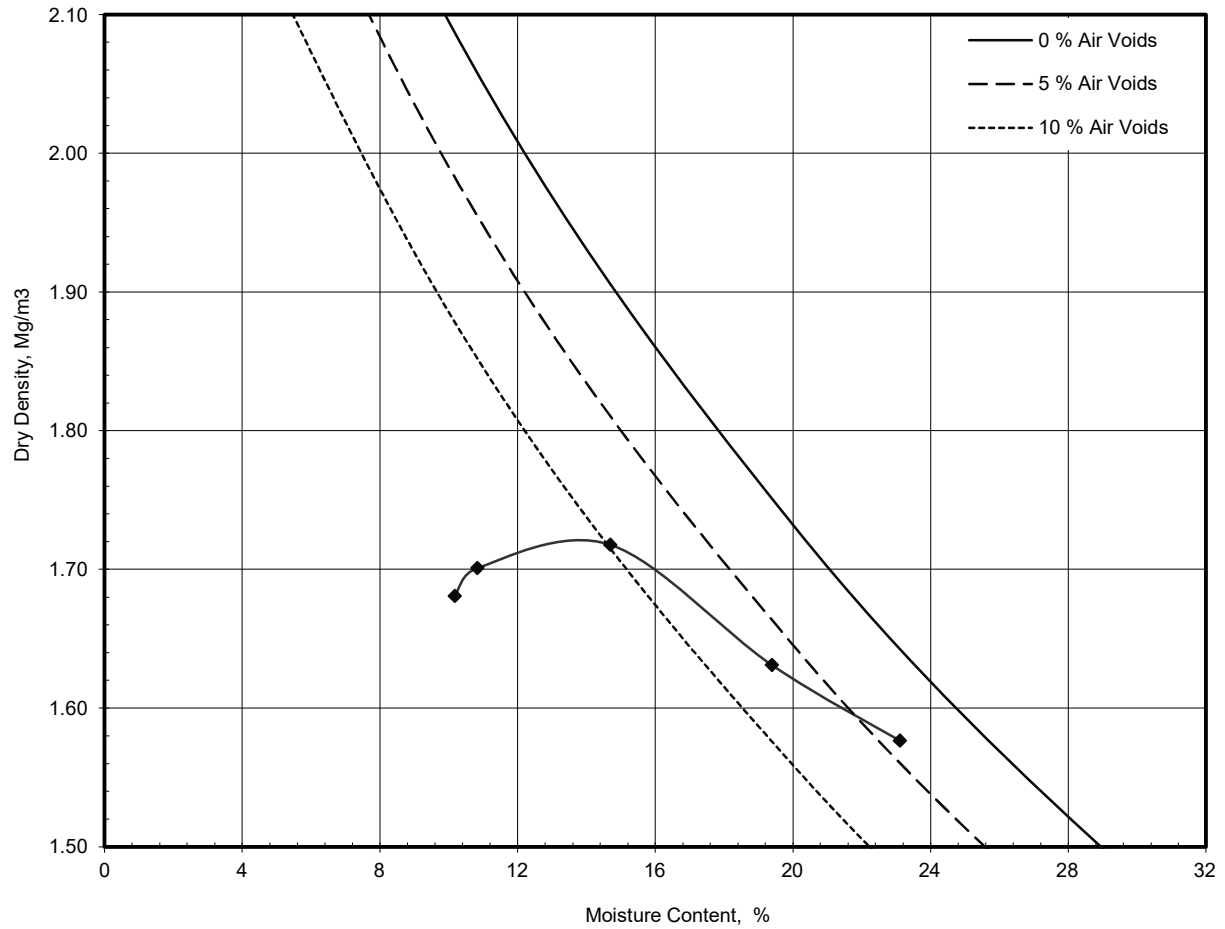
Comments	Date	Checked By	Approved	UKAS Accredited Laboratory No. 20632
	13/10/2023 07:45	K. Gargett	N. O'Brien	

**Dry Density / Moisture Content Relationship
Heavy Compaction**

Job Ref	D11093
Borehole / Pit No	TP-01
Sample No	4
Depth	0.30 m
Sample Type	B
Keylab ID	EAT_2023100321

Site Name	3001 Nile and Villiers	
Soil Description	MG (Brown Slightly Clayey Gravelly Sand. Gravel includes Brick, Glass, Wood & Concrete)	
Specimen Ref.	Specimen Depth	m
Test Method	BS1377:Part 4:1990, clause 3.6, 4.5kg rammer	

Compaction Test Reference/No. _____



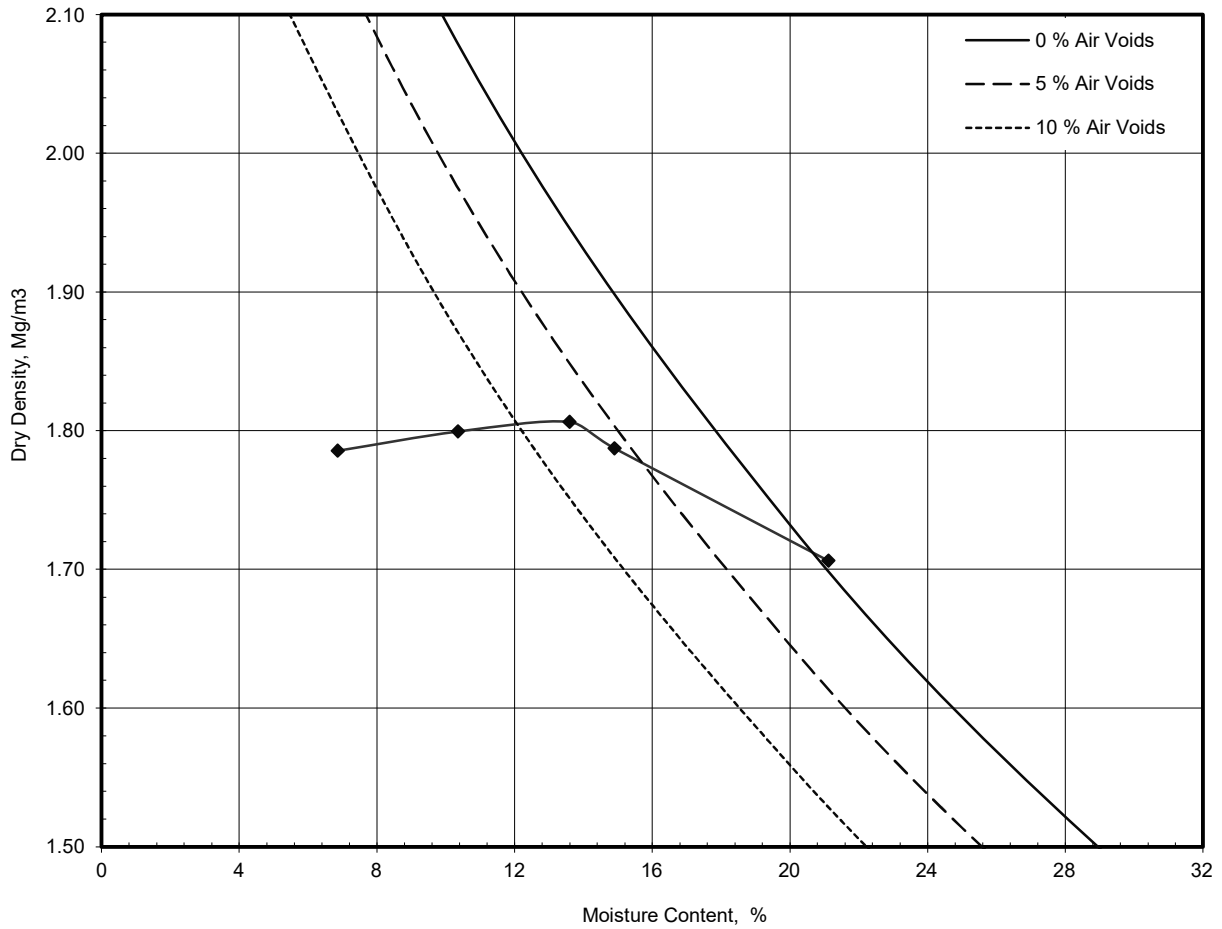
Preparation	Material used was air dried	
Mould Type	CBR	
Samples Used	Separate specimens tested	
Material Retained on 37.5 mm Sieve	%	8
Material Retained on 20.0 mm Sieve	%	13
Particle Density - Assumed	Mg/m³	2.65
Grading Zone of Material	5	
Maximum Dry Density	Mg/m³	1.72
Optimum Moisture Content	%	15

Comments	Date 13/10/2023 12:58	Checked	Approved	UKAS Accredited Laboratory No. 20632
		K Gargett	N. O'Brien	

**Dry Density / Moisture Content Relationship
Heavy Compaction**

Job Ref	D11093
Borehole / Pit No	TP-06
Sample No	13
Depth	0.40 m
Sample Type	B
Keylab ID	EAT_2023100330

Site Name	3001 Nile and Villiers		
Soil Description	Brown Slightly Clayey Gravelly Sand		
Specimen Ref.	Specimen Depth	m	
Test Method	BS1377:Part 4:1990, clause 3.6, 4.5kg rammer		Compaction Test Reference/No.



Preparation	Material used was air dried	
Mould Type	CBR	
Samples Used	Separate specimens tested	
Material Retained on 37.5 mm Sieve	%	10
Material Retained on 20.0 mm Sieve	%	3
Particle Density - Assumed	Mg/m ³	2.65
Grading Zone of Material	X	
Maximum Dry Density	Mg/m ³	1.81
Optimum Moisture Content	%	14

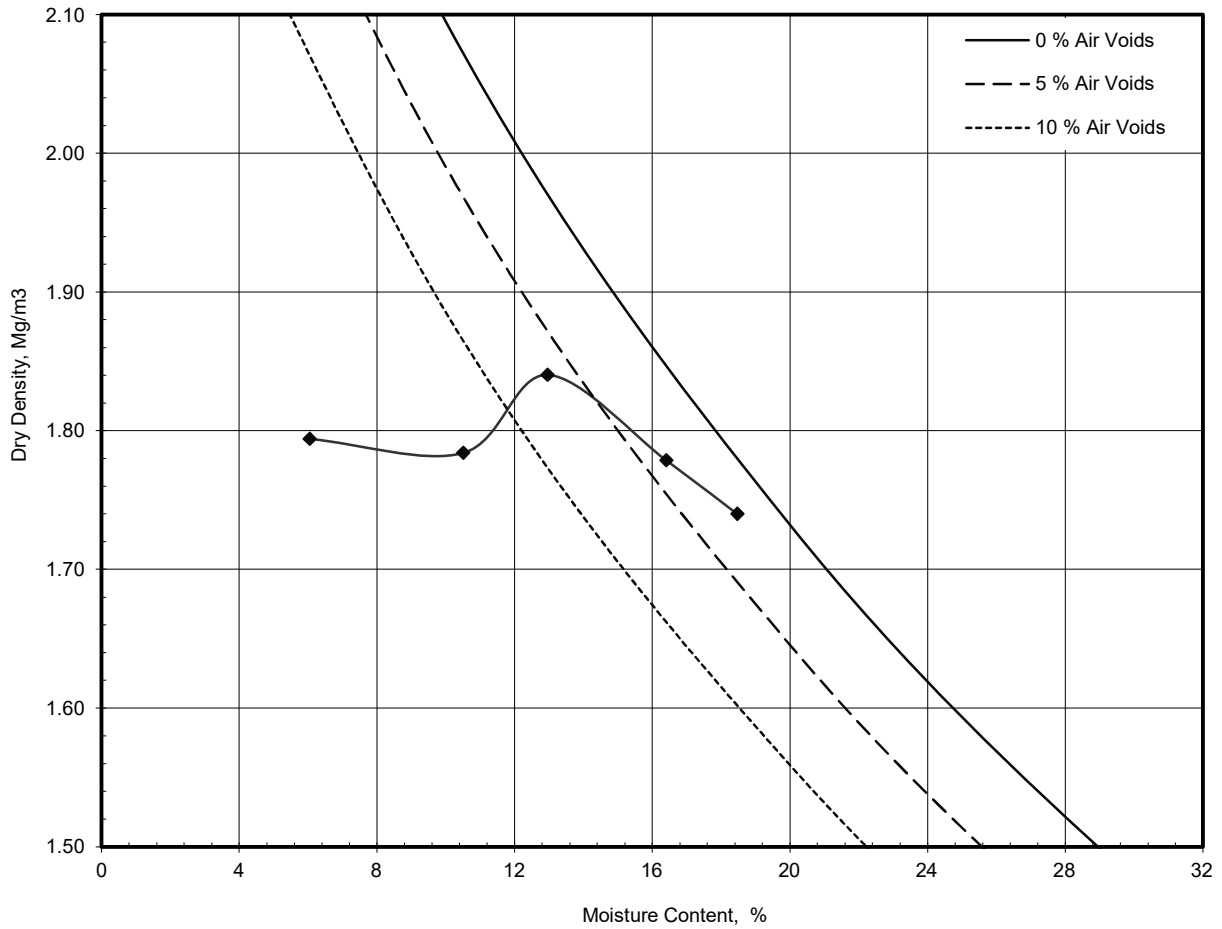
Comments Testing deviates from British Standard due to amount retained on 37.5mm sieve	Date 13/10/2023 07:48	Checked	Approved	UKAS Accredited Laboratory No. 20632
		K Gargett	N. O'Brien	

**Dry Density / Moisture Content Relationship
Heavy Compaction**

Job Ref	D11093
Borehole / Pit No	TP-09
Sample No	18
Depth	0.40 m
Sample Type	B
Keylab ID	EAT_2023100335

Site Name	3001 Nile and Villiers		
Soil Description	Brown Clayey Gravelly Sand		
Specimen Ref.	Specimen Depth	m	
Test Method	BS1377:Part 4:1990, clause 3.6, 4.5kg rammer		

Compaction Test Reference/No. _____



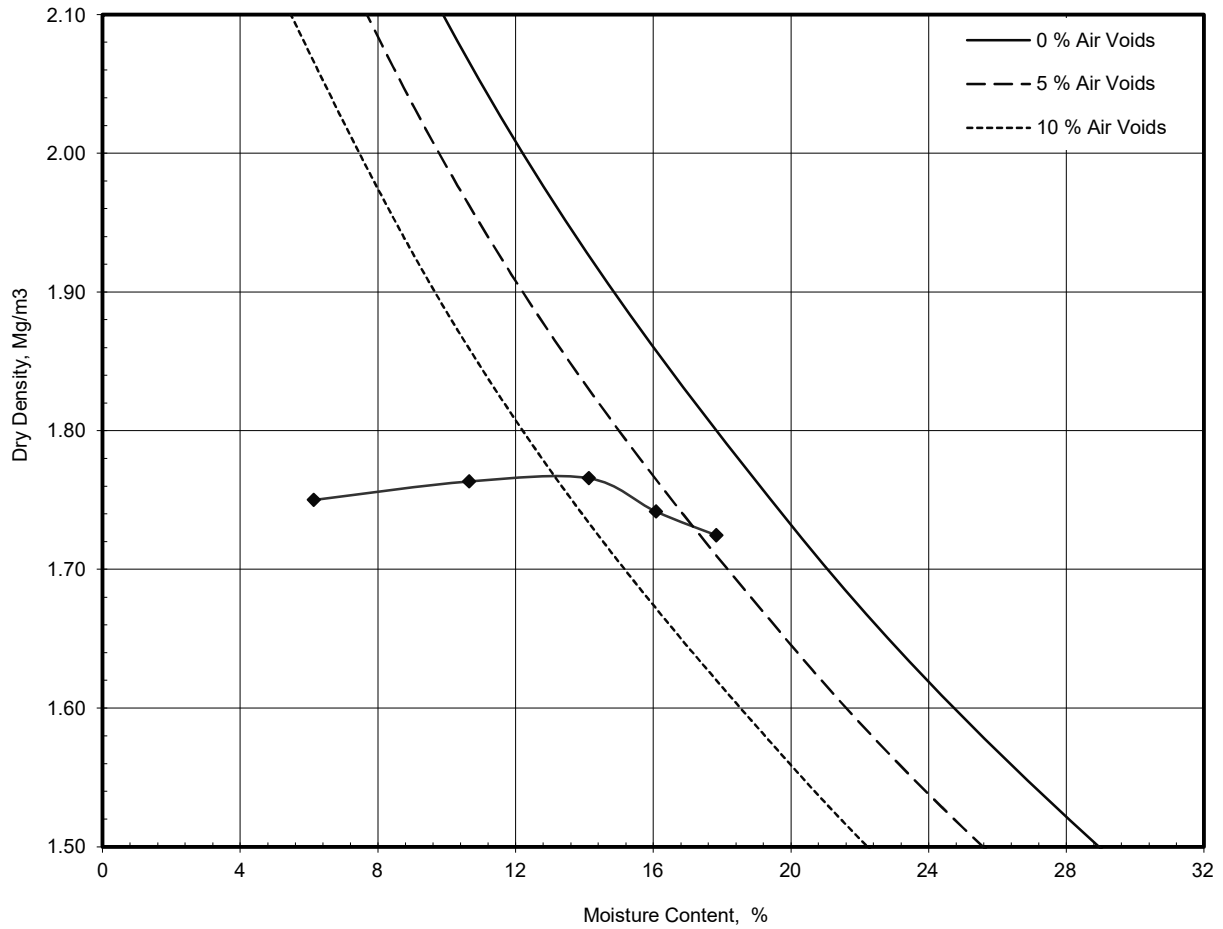
Preparation	Material used was air dried	
Mould Type	CBR	
Samples Used	Separate specimens tested	
Material Retained on 37.5 mm Sieve	%	1
Material Retained on 20.0 mm Sieve	%	3
Particle Density - Assumed	Mg/m³	2.65
Grading Zone of Material	4	
Maximum Dry Density	Mg/m³	1.84
Optimum Moisture Content	%	13

Comments	Date	Checked	Approved	UKAS Accredited Laboratory No. 20632
	13/10/2023 07:51	K Gargett	N. O'Brien	

**Dry Density / Moisture Content Relationship
Heavy Compaction**


Job Ref	D11093
Borehole / Pit No	TP-04
Sample No	9
Depth	0.40 m
Sample Type	B
Keylab ID	EAT_2023100326

Site Name	3001 Nile and Villiers		
Soil Description	MG (Brown Slightly Clayey Gravelly Sand. Gravel includes Brick & Concrete)		
Specimen Ref.	Specimen Depth	m	
Test Method	BS1377:Part 4:1990, clause 3.6, 4.5kg rammer		Compaction Test Reference/No.



Preparation	Material used was air dried	
Mould Type	CBR	
Samples Used	Separate specimens tested	
Material Retained on 37.5 mm Sieve	%	22
Material Retained on 20.0 mm Sieve	%	10
Particle Density - Assumed	Mg/m³	2.65
Grading Zone of Material	X	
Maximum Dry Density	Mg/m³	1.77
Optimum Moisture Content	%	14

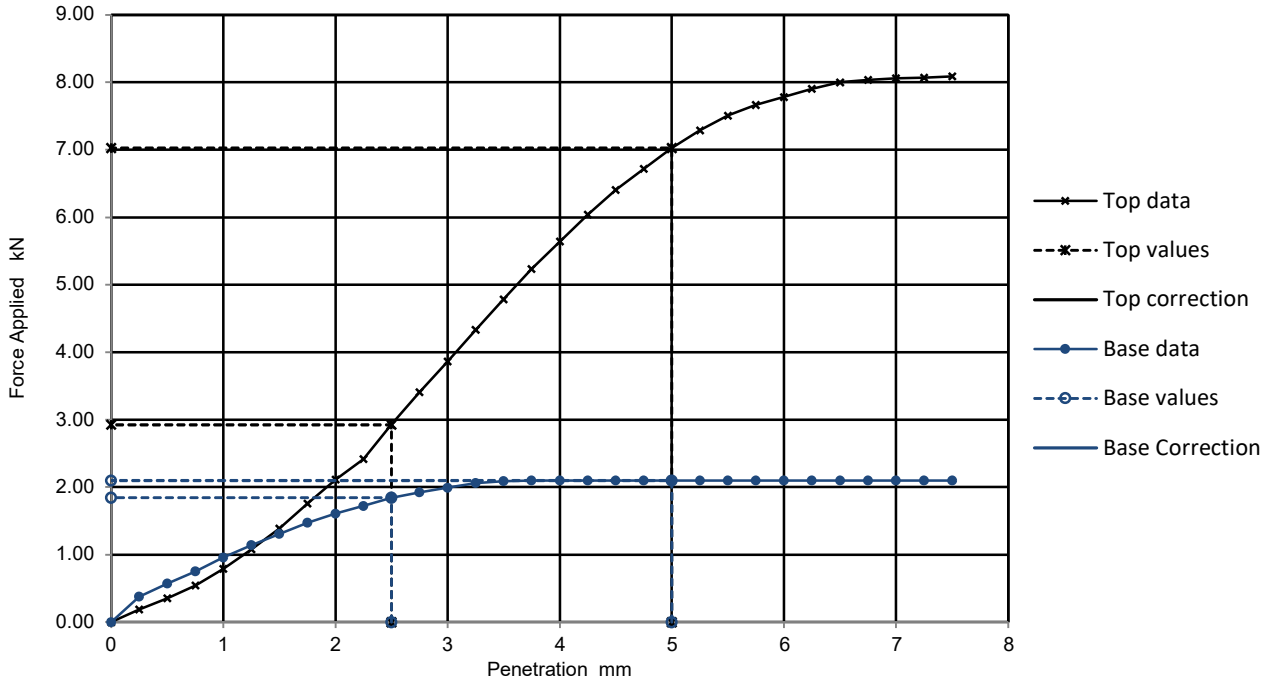
Comments Testing deviates from British Standard due to amount retained on 37.5mm sieve	Date 13/10/2023 13:00	Checked	Approved	UKAS Accredited Laboratory No. 20632
		K Gargett	N. O'Brien	

	California Bearing Ratio (CBR)		Job Ref	D11093
			Borehole/Pit No.	IT-01
Site Name	3001 Nile and Villiers		Sample No.	1
Soil Description	Brown Slightly Clayey Gravelly Sand		Depth m	0.40
Specimen Reference	Specimen Depth	m	Sample Type	B
Specimen Description			KeyLAB ID	EAT_2023100318
Test Method	BS1377 : Part 4 : 1990, clause 7		CBR Test Number	1

Specimen Preparation

Condition	REMOULDED	Soaking details	
Details	Recompacted with specified standard effort using 4.5kg rammer	Period of soaking	N/A days
		Time to surface	N/A days
		Amount of swell recorded	N/A mm
Material retained on 20mm sieve removed	0 %	Dry density after soaking	Mg/m ³
Initial Specimen details	Bulk density	1.92 Mg/m ³	Surcharge applied
	Dry density	Mg/m ³	12 kg
	Moisture content	%	7 kPa


Force v Penetration Plots




Results

Curve correction applied	CBR Values, %				Moisture Content %
	2.5mm	5mm	Highest	Average	
TOP	22	35	35		8.3
BASE	14	10	14		7.7

General remarks

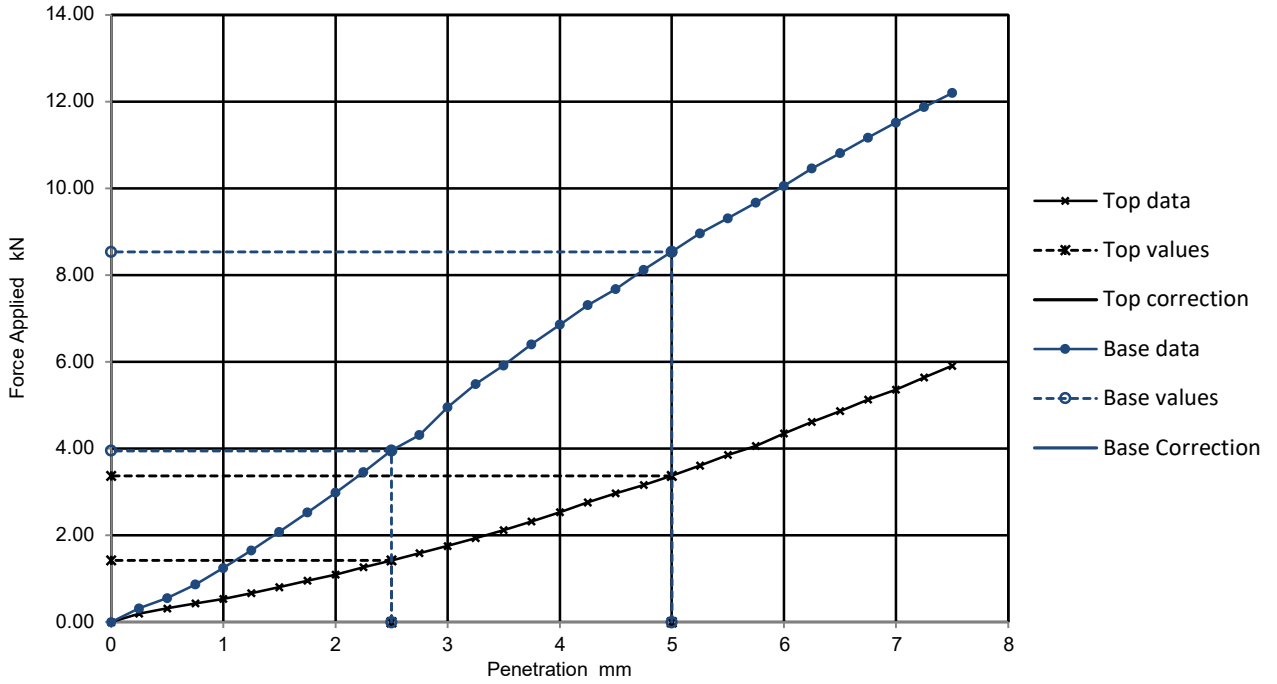
Approved	N O'Brien	
13/10/2023 07:52		

	California Bearing Ratio (CBR)		Job Ref	D11093
			Borehole/Pit No.	IT-03
Site Name	3001 Nile and Villiers		Sample No.	3
Soil Description	Brown Clayey Gravelly Sand		Depth m	0.60
Specimen Reference	Specimen Depth	m	Sample Type	B
Specimen Description			KeyLAB ID	EAT_2023100320
Test Method	BS1377 : Part 4 : 1990, clause 7		CBR Test Number	1

Specimen Preparation

Condition	REMOULDED	Soaking details	
Details	Recompacted with specified standard effort using 4.5kg rammer	Period of soaking	N/A days
		Time to surface	N/A days
		Amount of swell recorded	N/A mm
Material retained on 20mm sieve removed	4 %	Dry density after soaking	Mg/m ³
Initial Specimen details	Bulk density	2.55 Mg/m ³	Surcharge applied
	Dry density	2.26 Mg/m ³	12 kg
	Moisture content	13 %	11 kPa


Force v Penetration Plots




Results

Curve correction applied	CBR Values, %				Moisture Content %
	2.5mm	5mm	Highest	Average	
TOP	11	17	17		13.4
BASE	30	43	43		11.6

General remarks

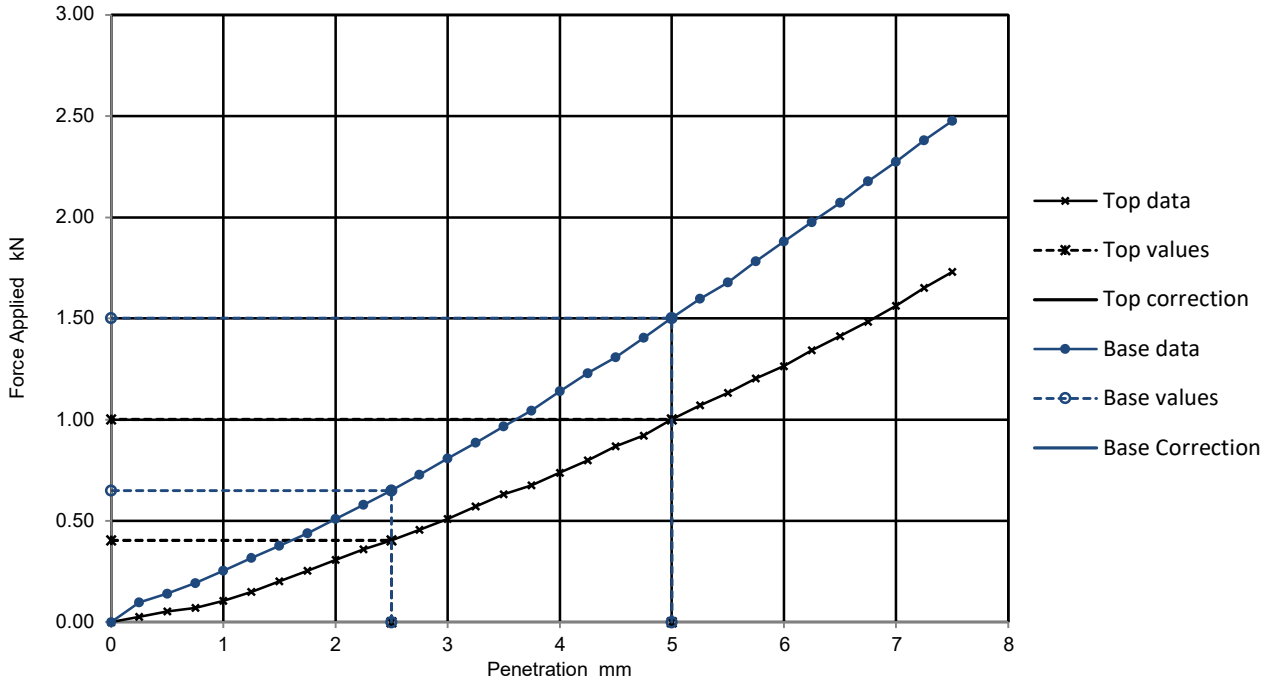
Approved	N O'Brien	
13/10/2023 07:52		

	California Bearing Ratio (CBR)		Job Ref	D11093
			Borehole/Pit No.	IT-02
Site Name	3001 Nile and Villiers		Sample No.	2
Soil Description	Brown Clayey Gravelly Sand		Depth m	0.80
Specimen Reference	Specimen Depth	m	Sample Type	B
Specimen Description			KeyLAB ID	EAT_2023100319
Test Method	BS1377 : Part 4 : 1990, clause 7		CBR Test Number	1

Specimen Preparation

Condition	REMOULDED		Soaking details	
Details	Recompacted with specified standard effort using 4.5kg rammer		Period of soaking	N/A days
			Time to surface	N/A days
			Amount of swell recorded	N/A mm
Material retained on 20mm sieve removed	8	%	Dry density after soaking	Mg/m ³
Initial Specimen details	Bulk density	2.07 Mg/m ³	Surcharge applied	12 kg
	Dry density	1.80 Mg/m ³		7 kPa
	Moisture content	15 %		

Force v Penetration Plots



Results

Curve correction applied	CBR Values, %				Moisture Content %
	2.5mm	5mm	Highest	Average	
TOP	3.1	5.0	5.0		16.5
BASE	4.9	7.5	7.5		13.5

General remarks

Approved	N O'Brien	
13/10/2023 07:53		

APPENDIX F

GAS AND GROUNDWATER MONITORING RESULTS

The Shadbolt Group

18 Bewick Road, Gateshead, Tyne & Wear, NE8 4DP Tel: 0191 478 3330 Email: admin@shadboltgroup.net

GROUNDWATER / GAS MONITORING RECORD SHEET



SHADBOLT

ENVIRONMENTAL

Site:	Nile and Villiers										Job No:	3011			
Client:	Sunderland Council										Date:	28/09/2023			
Monitored by:	JM										Weather:	Cloudy			
											Instruments Used:	GFM 436 + Dipmeter			
											Pressure Trend:	Rising			
Borehole	Borehole surface level (as surveyed)	CH4		CO2		O2		CO	H2S	Flow Rate	Atmospheric Pressure (mbar)	Water Depth (m bgl)	Water Depth (m aOD)	Base Depth (m bgl)	Remarks
		Peak (% vol)	Steady (% vol)	Peak (% vol)	Steady (% vol)	Peak (% vol)	Steady (% vol)	Steady PPM	Steady PPM	Peak (Steady) (l/hr)					
Ambient		0.0	0.0	0.0	0.0	20.3	20.3	0.0	0.0	-	1004	-	-	-	
WS01b		0.0	0.0	2.4	2.4	11.4	11.4	0.0	0.0	0.2(0)	1004	Dry		2.35	
WS02b		0.0	0.0	0.0	0.0	9.3	9.3	0.0	0.0	0.0	1005	Dry		2.47	
WS04		0.0	0.0	2.3	2.3	17.6	17.6	0.0	0.0	0.0	1004	Dry		4.09	
WS05		0.0	0.0	2.4	2.4	17.6	17.6	0.0	0.0	0.0	1004	Dry		2.14	
WS08		0.0	0.0	3.2	3.2	16.0	16.0	0.0	0.0	0.0	1005	Dry		4.08	
WS09		0.0	0.0	1.5	1.5	18.0	18.0	0.0	0.0	0.0	1004	Dry		4.44	Sediment at base

Notes:

- 1 The peak reading is the maximum recorded level during a monitoring event.
- 2 The steady reading is the level which remained constant after approximately 1 minute.



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