Phase II Ground Investigation Report

at
Grange Road, Hedge End, Southampton, Hampshire SO30 2GD

for
Cleansing Service Group

Reference: 16245/GIR
June 2017

Control Document

Project
Grange Road, Hedge End, Southampton, Hampshire SO30 2GD

Document Type
Phase II Ground Investigation Report

Document Reference
16245/GIR

Document Status
Final

Date
June 2017

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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Commission

Soils Limited was commissioned by Cleansing Service Group to undertake a Phase II Ground Investigation on land at Grange Road, Hedge End, Southampton, Hampshire SO30 2GD. The scope of the investigation was outlined in the Soils Limited quotation reference Q18703, dated 25th April 2017.

This document comprises the Phase II Ground Investigation Report and incorporates the results, discussion and conclusions to this intrusive works.

No Phase I Report had been commissioned by the client.

Standards

The site works, soil descriptions and geotechnical testing was undertaken in accordance with the following standards:

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011 for WS/DP
- BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design
- BS EN ISO 14688-1:2002+A1:2013 - Geotechnical investigation and testing - Identification and description
- BS EN ISO 14688-2:2004+A1:2013 - Geotechnical investigation and testing - Principles for a classification

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice was adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

The chemical analyses were undertaken by QTS Environmental Limited in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sample borehole implies the specific technique used to produce a trial hole.

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Section 1 Introduction

1.1 Objective of Investigation

Soils Limited was commissioned by Cleansing Service Group to undertake a Phase II Ground Investigation to supply the client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed residential development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the trial holes.

Soil samples were taken for Waste Acceptance Criteria (WAC) analysis for the Hazardous Waste Classification process.

1.2 Location

The site was located at Grange Road, Hedge End, Southampton, Hampshire SO30 2GD and had an approximate O.S Land Ranger Grid Reference of SU 500 132.

The site location plan is given in Figure 1.

1.3 Site Description

The site incorporated three single storey warehouses on predominantly flat and level ground. The site was of concrete hardstanding with mature trees located at the eastern extreme.

An aerial photograph has been included in Figure 2.

1.4 Proposed Development

At the time of reporting, June 2017, the proposed development comprised the demolition of the three existing structures and the subsequent erection of two steel framed buildings over the area of the existing buildings.

In compiling this report reliance was placed on drawing number 0711-PL03-A, dated November 2016, prepared by designAplace. Any change or deviation from the scheme outlined in the drawing could invalidate the foundation design and remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

Development plans provided by the client are presented in Appendix D.

1.5 Anticipated Geology

The 1:50,000 BGS map showed the site to be located directly upon the bedrock Earnley Sand Formation with no overlying superficial deposits. The Wittering Formation underlays the Earnley Sand Formation in this area.

1.5.1 Earnley Sand Formation

The Earnley Sand Formation is part of the Bracklesham Group and comprises glauconitic silty sands and sandy silts and can be up to 325m in thickness.

1.5.2 Wittering Formation

The Wittering Formation underlays the Earnley Sand Formation in this area, marked by a transgressive surface of glauconitic silty sands and a pebble bed. The Wittering Formation comprises greyish brown laminated clay; wavy- to lenticular-bedded sand interbedded with clay in equal proportions; and fine- to medium-grained sparsely glauconitic sand.

1.6 Limitations and Disclaimers

This Phase II Ground Investigation Report relates to the site located at Grange Road, Hedge End, Southampton, Hampshire SO30 2GD and was prepared for the sole benefit of Cleansing Service Group (The “Client”). The report was prepared solely for the brief described in Section 1.1 of this report.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data or any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. “Contaminated Land” is defined in Section 57 of the Environment Act 1995 as:

“Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused”.

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets remains with Soils Limited. License is for the sole use of the client and may not be assigned, transferred or given to a third party

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed residential development. The intended investigation, as outlined within the Soils Limited quotation (Q18703, dated 25th April 2017), was therefore to comprise the following items:

- 1-day windowless sampler boreholes and dynamic probes;
- DCP-TRL probes;
- Geotechnical laboratory testing;
- WAC testing.

2.1.1 Actual Project Works

The actual project works were undertaken on 17th May 2017 and comprised:

- 3No. windowless sampler boreholes;
- 3No. dynamic probes;
- 2No. DCP-TRL probes;
- Geotechnical laboratory testing;
- 1No. WAC test.

All windowless sampler boreholes were backfilled with gravel upon completion and hardstanding reinstated to a usable condition. All trial hole locations have been presented in Figure 3.

Following completion of site works, soil cores were logged and sub sampled so that samples could be sent to the laboratory for geotechnical testing and WAC testing.

2.2 Ground Conditions

On 17th May 2017, three windowless sampler boreholes (WS1 – WS3) were drilling, using a tracked windowless sampler rig, all to depths of 4.00m below ground level (bgl) at locations selected by Soils Limited using a development plan provided by the client.

Three dynamic probes, super heavy, (DP1 – DP3) were driven prior and adjacent to their corresponding windowless sampler borehole all to depths of 6.00m bgl. Two DCP-TRL probes were undertaken at locations selected by Soils Limited using a development plan provided by the client.

The maximum depths of trial holes have been included in

Table 2.1.

All trial holes were scanned with a Cable Avoidance Tool (C.A.T.) and GENNY prior to excavation to ensure the health and safety of the operatives.

Table 2.1 Final Depth of Trial Holes

Trial Hole	Depth (m bgl)	Trial Hole	Depth (m bgl)
WS1	4.00	DP2	6.00
WS2	4.00	DP3	6.00
WS3	4.00	DCP1	0.95
DP1	6.00	DCP2	0.95

The approximate trial hole locations are shown on Figure 3.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the trial hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots, or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion, the succession of conditions encountered in the trial holes in descending order can be summarised as:

Made Ground (MG)
Earnley Sand Formation (EA)

The ground conditions encountered in the trial holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
MG	Recent	0.00	0.38 – 0.60	0.50	Concrete over brown sandy clayey GRAVEL comprising flint, brick and concrete fragments.
EA	Eocene	0.38 – 0.60	4.00[1] – 6.00[1]	Not proven[2]	Light greenish grey mottled brown clayey fine to medium SAND.

Note: [1] Final depth of trial hole. [2] Base of strata not encountered

2.3 Ground Conditions Encountered in Trial Holes

The ground conditions encountered in trial holes have been described below in descending order. The engineering logs are presented in Appendix A.1.

2.3.1 Made Ground and Topsoil

Soils described as Made Ground were encountered in all trial holes from ground level to depths ranging between 0.38m and 0.60m bgl.

The Made Ground typically comprised concrete over brown sandy clayey GRAVEL. The gravel comprised fragments of flint, brick and concrete.

The final depths of Made Ground have been included in Table 2.3.

Table 2.3 Final Depth of Made Ground

Trial Hole	Depth (m bgl)
WS1	0.38
WS2	0.60
WS3	0.50

2.3.2 Earnley Sand Formation

Soils described as the Earnley Sand Formation were encountered below the Made Ground and was inferred to have persisted to the full investigatory depth of 6.00m bgl.

The Earnley Sand Formation typically comprised loose to medium dense light greenish grey mottled brown clayey fine to medium SAND. A band of very sandy clayey GRAVEL and gravelly CLAY was noted to immediately underlay the Made Ground to depths ranging between 1.15m and 1.45m bgl. The gravel comprised fine to coarse subangular to rounded clasts of flint.

The final depths of Earnley Sand Formation have been included in Table 2.4.

Table 2.4 Final Depth of Earnley Sand Formation

Trial Hole	Depth (m bgl)
WS1	6.00[1, 2]
WS2	6.00[1, 2]
WS3	6.00[1, 2]

Note: [1] Final depth of trial hole. [2] Inferred past base of windowless sampler trial hole.

2.4 Roots

No roots were encountered in any of the trial holes.

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within a trial pit is necessary to gain a better indication of the maximum root depth.

No trial holes could be located in proximity to the mature trees noted at the east of the site due to limited access and presence of subsurface utilities.

2.5 Groundwater

Groundwater was encountered within all trial holes, noted at ground level in WS1 and struck and depths of 3.20m and 3.00m bgl in WS2 and WS3 respectively. The level recorded in WS1 was considered to be relating to surface water pooling into the trial hole during construction as a result from conditions of torrential rain during drilling works and water runoff from the concrete hardstanding onsite.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in May (2017), when groundwater levels should be falling from their annual maximum (highest) elevation, which typically occurs around March.

Water was noted to be pooling on the hardstanding at the time of the intrusive investigation.

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made via groundwater monitoring wells.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at three locations (DP1 to DP3) adjacent and prior to the drilling of their corresponding windowless sampler borehole to depths of 6.00m bgl. The results were converted to equivalent SPT "N" values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix B.1, Table B.1.1 to Table B.1.3.

The Earnley Sand Formation recorded equivalent SPT "N" values between 0 and 12 within cohesive beds and 0 to 20 in granular beds, with typical values ranging between 12 to 17 in granular beds below 1.50m bgl. The cohesive beds, encountered in DP3 to 1.45m bgl, were classified as extremely low to medium strength with inferred undrained cohesive strengths ranging <10kPa to 60kPa. The granular beds were typically classified as medium dense below 1.50m bgl.

It should be noted that SPT 'N' values quoted within Table B.2.1, presented in Appendix B.2 and referred to within this report, are presented as corrected values in accordance with BS EN 22476 Part 3, to account for the rig efficiency, borehole depth, overburden factors etc. Further correction of the 'N' values should therefore not be necessary. Raw field data is presented in Appendix B.3.

A full interpretation of the DPSH tests are outlined in Appendix B.2, Table B.2.1.

3.2 Dynamic Cone Penetrometer Tests

The Transport Research Laboratory (TRL), Dynamic Cone Penetrometer (DCP) was undertaken at two locations (DCP1 – DCP2). The results were interpreted based on the classification outlined in Appendix B.1.

The results from DCP testing indicated CBR values of between 6% and 10% for soils encountered below the hardstanding in the top 1.00m bgl.

The DCP results are presented in Appendix B.3.

3.3 Atterberg Limit Tests

Atterberg Limit tests were performed on four samples from the more cohesive parts of the Earnley Sand Formation. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2. One of the samples was identified as non-plastic.

The cohesive soils of the Earnley Sand Formation were classified as low volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

A full interpretation of the Atterberg Limit tests is outlined in Table B.2.2, Appendix B.2 and the laboratory report in Appendix B.3.

3.4 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on six samples from the granular parts of the Earnley Sand Formation.

PSD classified the five of the six samples from the granular beds of the Earnley Sand Formation as having a volume change potential in accordance BRE Digest 240. None of the samples were classified as having volume change potential in accordance with NHBC Standards Chapter 4.2. Note that a cohesive soil is only classified as having a volume change potential if it is also plastic and an Atterberg Limit test can be conducted on the strata.

A full interpretation of the PSD tests is outlined in Table B.2.3, Appendix B.2 and the laboratory report in Appendix B.3.

3.5 Sulphate and pH Tests

Two samples were taken from the Earnley Sand Formation (WS1:2.00m bgl) for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, ‘Concrete in Aggressive Ground’.

The tests recorded water soluble sulphate between 329mg/l and 548mg/l with pH values of 7.2 to 7.5.

The significance of the sulphate and pH Test results are discussed in Section 4.4 and the laboratory report in Appendix B.3.

Section 4 Foundation Design

4.1 General

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented. Soil descriptions are based on analysis of disturbed samples taken from the trial holes.

4.1.1 Made Ground

The terms *Fill* and *Made Ground* are used to describe material, which has been placed by man either for a particular purpose e.g. to form an embankment, or to dispose of unwanted material. For the former use, the Fill and/or Made Ground may well have been selected for the purpose and placed and compacted in a controlled manner. With the latter, great variations in material type, thickness and degree of compaction invariably occur and there can be deleterious or harmful matter, as well as potentially methanogenic organic material.

The BSI Code of Practice for Foundations, BS 8004:1986, Clause 2.2.2.3.5 Made Ground and Fill, includes the caveat that *'all Topsoil should be treated as suspect, because of the likelihood of extreme variability'*.

Soils described as Made Ground were encountered in all trial holes from ground level to depths ranging between 0.38m and 0.60m bgl. The Made Ground typically comprised concrete over brown sandy clayey GRAVEL. The gravel comprised fragments of flint, brick and concrete. The depths of Made Ground have been included in Table 2.3.

A result of the inherent variability, particularly of uncontrolled Topsoil, Fill and/or Made Ground is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Topsoil and/or Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

4.1.2 Earnley Sand Formation

Soils described as Earnley Sand Formation were encountered in all trial holes directly below the Made Ground and persisted to the full investigatory depth of 6.00m bgl. The Earnley Sand Formation typically comprised loose to medium dense light greenish grey mottled brown clayey fine to medium SAND. A band of very sandy clayey GRAVEL and gravelly CLAY was noted to immediately underlay the Made Ground to depths ranging between 1.15m and 1.45m bgl. The gravel comprised fine to coarse subangular to rounded clasts of flint.

The results from the dynamic probing within the granular material gave equivalent SPT N-values ranging from 0 to 20, but were generally within the range of 12 to 17 below 1.50m bgl, which inferred that the Earnley Sand Formation was typically medium dense relative density.

The results from Atterberg Limit tests on the cohesive beds showed one sample as non-plastic and modified plasticity indexes of the remaining three samples range between 9 to 19%.

On this basis, the soils of the Earnley Sand Formation had **low volume change potential** in accordance with BRE Digest 240. Only one sample (WS3:1.00) had a volume change in accordance with NHBC Standards Chapter 4.2.

Soils of the Earnley Sand Formation are overconsolidated and are expected to display moderate bearing capacities with moderate settlement characteristics. The soils of the Earnley Sand Formation would be considered a suitable bearing stratum for the proposed development.

4.1.3 Roots

Roots were not encountered in any of the trial holes. Due to the limitations of narrow diameter boreholes, roots may be found at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

4.1.4 Groundwater

Groundwater was encountered within all trial holes, present at ground level in WS1 and struck and depths of 3.20m and 3.00m bgl in WS2 and WS3 respectively. The level recorded in WS1 was considered to be relating to surface water pooling into the trial hole during construction as a result from conditions of torrential rain during drilling works and water runoff from the concrete hardstanding onsite.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in May (2017), when groundwater levels should be falling from their annual maximum (highest) elevation, which typically occurs around March.

The site was noted to be waterlogged at the time of the intrusive investigation.

The groundwater regime has not been conclusively established, therefore the presence of water at a shallower depth should not be ruled out. Groundwater equilibrium conditions may only be conclusively established if a series of observations are made via groundwater monitoring wells.

4.2 Foundation Scheme General

At the time of reporting, June 2017, the proposed development comprised demolition of the three existing structures and the subsequent erection of two steel framed buildings over the area of the demol;ihed buildings.

In compiling this report reliance was placed on drawing number 0711-PL03-A, dated November 2016, prepared by designAplace. Any change or deviation from the scheme outlined in the drawing could invalidate the foundation design and remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

Development plans provided by the client are presented in Appendix D.

4.2.1 Guidance on Shrinkable Soils

The Building Research Establishment (BRE) Digests 240, 241 and 242 provide guidance on 'best practice' for the design and construction of foundations on shrinkable soils.

The results from Atterberg Limits Tests showed that the Earnley Sand Formation had **low volume change potential** in accordance with both BRE Digest 240 and one sample exhibited a volume change potential in accordance with NHBC Standards Chapter 4.2.

Low volume change potential must therefore be adopted where foundations pass through or are founded within the Earnley Sand Formation.

The BRE Digest 241 states: "An increasingly common, potentially damaging situation is where trees or hedges have been cut down prior to building. The subsequent long-term swelling of the zone of clay desiccated by the roots, as moisture slowly returns to the ground, can be substantial. The rate at which the ground recovers is very difficult to predict and if there is any doubt that recovery is complete then bored pile foundations with suspended beams and floors should be used".

The stated intention of the NHBC is to ensure that shrinkage and swelling of plastic soils does not adversely affect the structural integrity of foundations to such a degree that remedial works would be required to restore the serviceability of the building. It must be borne in mind that adherence to the NHBC tables and design recommendations may not, in all cases, totally prevent foundation movement and cracking of brickwork might occur.

The BRE Digest 240 suggests: *"Two courses of action are open:*

Estimate the potential for swelling or shrinkage and try to avoid large changes in the water content, for example by not planting trees near the foundations.

Accept that swelling or shrinkage will occur and take account of it. The foundations can be designed to resist resulting ground movements or the superstructure can be designed to accommodate movement without damage."

The design of foundations suitable to withstand movements is presented in BRE

Digest 241 “Low-rise buildings on shrinkable clay soils: Part 2”

4.3 Foundation Scheme

Foundations **must not** be constructed within any Made Ground/Topsoil due to the likely variability and potential for large load induced settlements both total and differential.

No roots were encountered during the intrusive investigation, which incorporated small diameter trial holes in places of hardstanding not in proximity to vegetation. If roots are encountered during the construction phase, foundations **must not be placed within any live root penetrated** or desiccated **cohesive soils or those with a volume change potential**. Should the foundation excavations reveal such materials, the excavations **must** be extended to greater depth in order to bypass these unsuitable soils. Excavations must be checked by a suitable person prior to concrete being poured.

Considering the type of development, a shallow foundation solution was considered the most suitable.

Although not strictly applicable to non-residential structures, the proposed development is likely to be both light and brittle. It is therefore considered that foundation design is undertaken using NHBC Standards Chapter 4.2.

4.3.1 Shallow Foundations into the Earnley Sand Formation

As per the client brief, designs have been provided for both tradition trench fill foundations and pad footings. Based on a 5.00m by 0.75m strip foundation and 0.60m x 0.60m pad foundation, using commercial software, Table 4.1 and Table 4.2 shows the calculated bearing values and anticipated settlement characteristics. The maximum encountered depth of Made Ground was 0.60m bgl and soil conditions were consistently soft in the top 1.00m bgl. Bearing capacities were calculated below 1.50m bgl.

Table 4.1 Allowable Bearing Capacities within the Earnley Sand Formation based on a Strip Foundation

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.50	5.00 x 0.75	90	25
2.00		100	25

Table 4.2 Allowable Bearing Capacities within the Earnley Sand Formation based on a Pad Foundation

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.50	0.60 x 0.60	150	25
1.50	1.00 x 1.00	110	25

The foundations must be taken through the soft more cohesive soils found immediately underlying the Made Ground and founded within the underlying competent granular soils of the Earnley Sand Formation which were consistently present below 1.50m bgl.

The use of reinforced trench fill foundations would simplify construction and reduce the possibility of differential settlement affecting the foundations.

For the allowable bearing value given above, settlements should not exceed the presented values, provided that excavation bases are carefully bottomed out and blinded, or concreted as soon after excavation as possible and kept dry. Foundations must not be constructed over former structures and other hard spots. The foundations design must be suitable for the conditions present at the site.

The anticipated settlement includes both elastic settlement and long-term drained settlement (in the case of cohesive soils).

Anticipated settlements may be taken as proportional to the bearing capacity adopted (for the same configuration of foundation), therefore if the bearing value is halved the anticipated settlement will halve.

4.3.2 Ground Floor Slab

Given the relatively limited thickness of Made Ground (0.25m - 0.60m bgl) ground bearing slabs could be adopted for the proposed redevelopment. It is recommended that either any Made Ground is stripped from beneath the slab or that it is proof rolled and any soft spots excavated and backfilled with a suitable granular fill that is placed in layers and compacted to a suitable specification.

4.4 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts fell into Class **DS-2** of the BRE Special Digest 1 2005, *'Concrete in Aggressive Ground'.* Table C2 of the Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-2**. The pH of the soils tested ranged between 7.2 and 7.5. The classification given was determined using the mobile groundwater case, in the view of groundwater being encountered. The laboratory results are presented in Appendix B.3.

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1 2005, *'Concrete in Aggressive Ground'* taking into account any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

4.5 Excavations

Shallow excavations in the Made Ground are likely to be marginally stable in the short term at best.

Deeper excavations taken into the Earnley Sand Formation are likely to be stable in the short term, depending on the thickness of overlying Made Ground. Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported or battered back to a safe angle of repose before excavations are entered by personnel.

Excavations beneath the groundwater table are likely to be unstable and dewatering of foundation trenches may be necessary. At the time of investigation, May 2017, groundwater was struck at 3.00m and 3.20m bgl within the trial holes and the site was noted to have been waterlogged. The groundwater regime has not been conclusively established and should be expected at shallower depths.

4.6 Pavements

The Transport Research Laboratory (TRL) Dynamic Cone Penetrometer (DCP) was undertaken at two locations on site (DCP1 – DCP2). The results from dynamic cone penetrometer tests indicated **CBR values of between 6% and 10%** for soils of the Earnley Sand Formation, after breaking out of the overlying hardstanding, encountered in the top 1.00m bgl. The high CBR values encountered were anticipated to be large gravel clasts associated with the Made Ground struck during the test.

When discounting the top 400mm to account for the Made Ground, the worst case CBR value was 6%. It is recommended that, **in-situ testing must be undertaken** immediately prior to the installation of pavements/roads. Soft spots at formation level should be dug out and replaced with a suitably compacted granular fill. Prior to construction the formation level should be proof rolled. The soils of the Earnley Sand Formation would not be frost susceptible as plasticity indexes were greater than 20% in some of the cohesive samples and all of the granular samples had a silt/clay fraction of greater than 10%.

It should be noted that the groundwater regime has not been conclusively established, therefore the presence of groundwater close to surface should not be ruled out.

Section 5 Waste Acceptance Criteria Analysis

5.1 Excavated Material

Excavated material must be classified with the Environment Agency for disposal at an appropriately licensed disposal facility. The requirements of Duty of Care and Health and Safety Guidance must be complied with.

Both Producers and Waste Management companies must ensure compliance with the Waste Acceptance Criteria (WAC) prior to landfill in hazardous, stable non-reactive cells and inert sites. These regulations govern the operation of landfill in England and Wales. Basic characterisation is the responsibility of the waste producer and compliance checking is generally the responsibility of the landfill operator. Therefore, landfill operators will be unlikely to accept waste that does not meet the Waste Acceptance Criteria for their class of site.

There is an obligation to ‘treat’ all soils destined for landfill, including non-hazardous waste. This treatment must now be documented and presented to the landfill operator or waste may be refused entry. Note that all liquids are banned from landfill.

For the purposes of legal compliance, ‘treatment’ must comprise three things (the ‘three-point test’):

1. It must be a physical, thermal, chemical or biological process.
2. It must change the characteristics of the waste.
3. It must do so in order to:
    (a) reduce its volume, or
    (b) reduce its hazardous nature, or
    (c) facilitate its handling, or enhance its recovery.

WAC testing was undertaken on one sample (WS2:0.20 – 0.60) as part of this report. The analysis results prepared by QTS Environmental Ltd are presented in 31Appendix C.1.

5.1.1 Risk Based Hazard Assessment of Waste

The analysis results of the chemical laboratory testing undertaken as part of report, prepared by QTS Environmental Ltd were used for the **Hazardous Waste Classification** process. The determination of the hazardous waste classification process is outlined in Appendix C.3.

Full results of the laboratory analysis and hazardous waste classification tool are given in Appendix C.1 with the samples classified as hazardous outlined in

Table 5.1.

Table 5.1 Risk Based Hazard Assessment of Waste

Trial Hole	Depth (m bgl)	Certificate	Description (general)	Type/Waste Code	HazWasteOnline Classification Hazardous Waste
WS2	0.20-0.80	17-59395	Brown sandy gravel with brick and concrete	17 05 04*	Non-hazardous

Notes: *Soil and stones other than those mentioned in 17 05 03

5.2 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use should be in accordance with the Environmental Permitting Regulations 2007 (EPR). Environmental Permit Exemptions (EPE) are for the re-use of non-hazardous or inert waste only; hazardous waste cannot be re-used under a permit exemption. EPE apply only to imported inert waste materials; inert material arising on site and recovered on site is not classified as waste and does not require an exemption. It is possible that materials arising on-site will be classified as inert and would not need an exemption.

Environmental Permit Exemptions are only allowed for certain activities, placing controls on the quantities that can be stored and re-used. The re-use of waste shall be within areas and levels defined in planning applications and permissions for the development. An EPE requires a site specific risk assessment for the receptor site to demonstrate that the materials are suitable for use, i.e. that they will not give rise to harm to human health or pollution of the environment.

Under the CL:AIRE voluntary code of practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site.

Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a ‘Qualified Person’ as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

Should it be necessary to import materials from another site where materials are excavated and which is not material from a quarry or produced under a WRAP protocol, then an EPE would be necessary for the imported material whether the work was managed under the CoP or the EPR.

5.3 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

List of Figures

List of Appendices

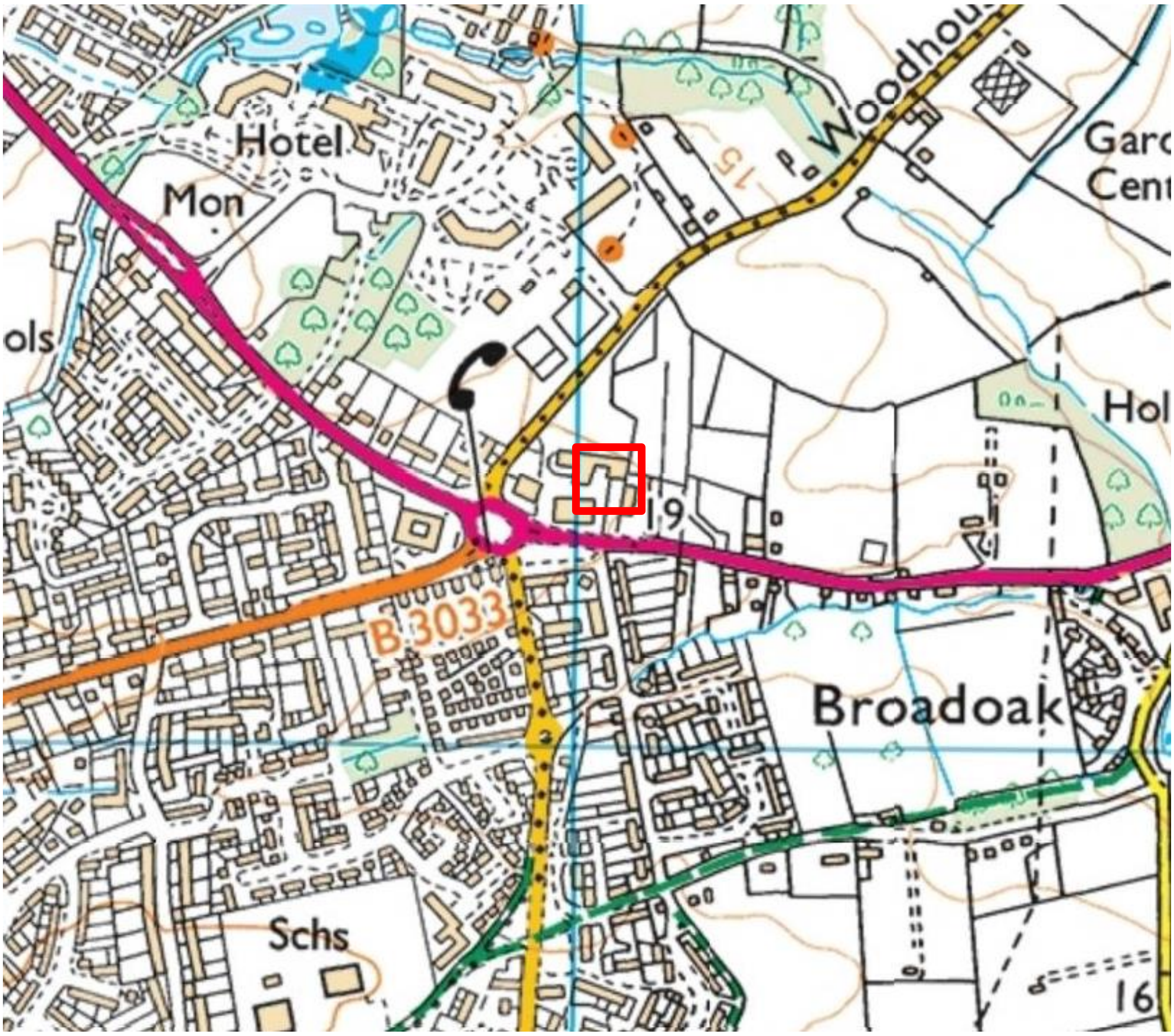


Figure 1 – Site Location Map

Job Number 16245	**Project** Grange Road, Hedge End, Southampton, Hampshire SO30 2GD
Client Cleansing Service Group	**Date** June 2017

Figure 2 – Aerial Photograph

Project
Grange Road, Hedge End,
Southampton, Hampshire SO30
2GD

Client
Cleansing Service Group

Date
June 2017

Job Number
16245

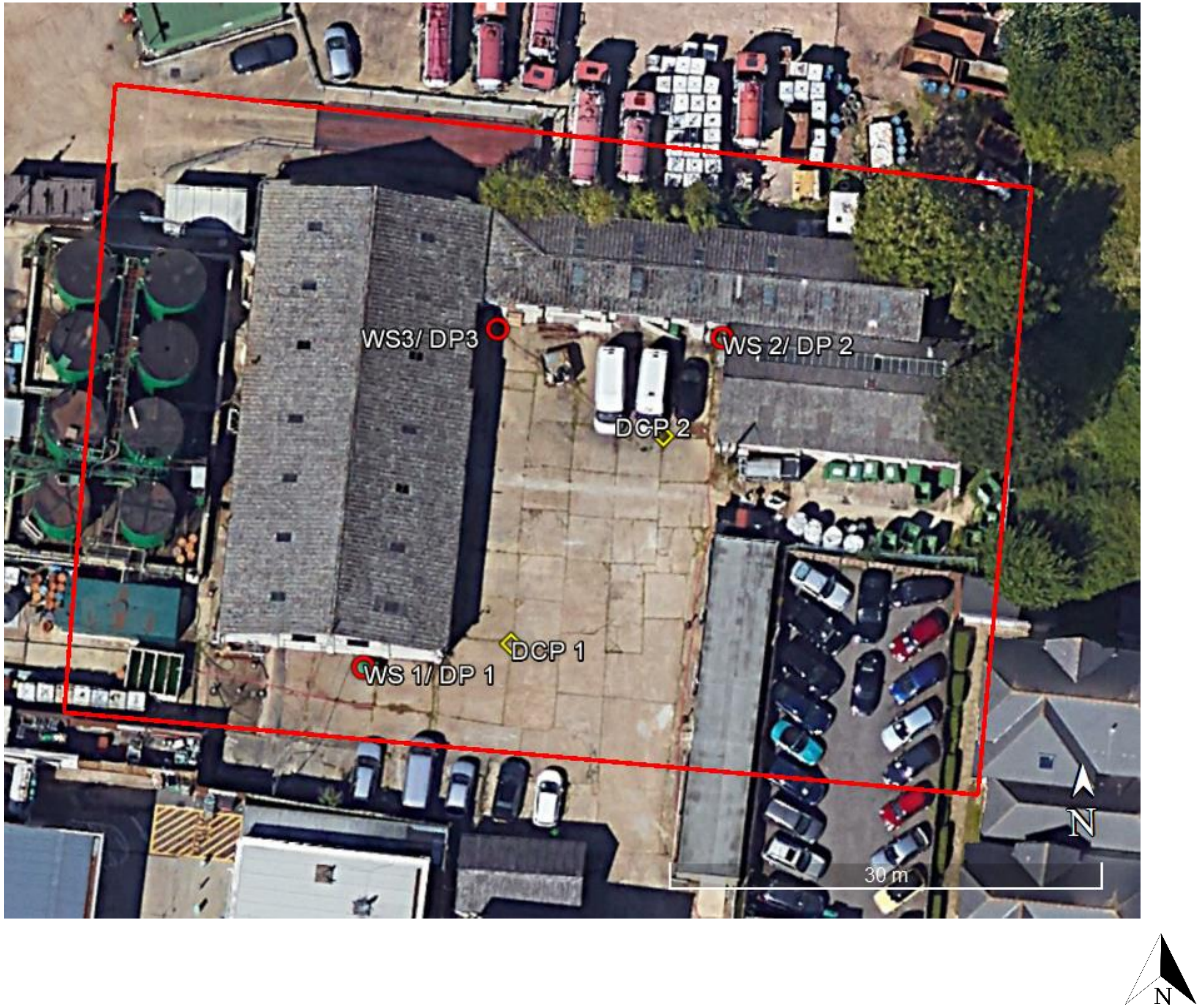


Figure 3 – Trial Hole Plan

Project
Grange Road, Hedge End,
Southampton, Hampshire SO30
2GD

Client
Cleansing Service Group

Date
June 2017

Job Number
16245

Appendix A Field Work

Appendix A.1 Engineers Logs

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	# Borehole Log		Borehole No. **WS1** Sheet 1 of 1
Project Name: Grange Road,	Project No.: 16245	Co-ords:	Hole Type WS
Location: Hedge End, Southampton SO30 2GD		Level:	Scale 1:50
Client: Cleansing Service Group Ltd		Dates: 17-05-2017	Logged By MB

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.00	B		0.25			MADE GROUND; CONCRETE (recovered as angular gravel).
		0.30	J		0.38			MADE GROUND; Brown very sandy clayey GRAVEL. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse flint, brick, concrete. (sub base).
		0.45 0.50	J B+D		0.80			Very loose greenish grey mottled brown clayey sandy GRAVEL. Gravel is sub-angular to rounded fine to coarse flint. Sand is fine. Locally stained dark grey/black & with slight hydrocarbon odour. EARNLEY SANDY FORMATION
		1.00	D		1.35			Very loose reddish brown mottled brown and light greenish brown very sandy clayey GRAVEL. Sand is fine to coarse. Gravel is sub-angular to rounded fine to coarse flint. EARNLEY SANDY FORMATION
		1.50	D		2.00			Medium dense brown mottled orangish brown clayey silty fine SAND. EARNLEY SANDY FORMATION
		2.20 2.70 3.20 3.70	D D D D		4.00			Medium dense light greenish grey mottled light orangish brown very clayey fine SAND. EARNLEY SANDY FORMATION
								End of Borehole at 4.00m

General Remarks:

No roots observed. Water at ground level.

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Borehole Log

Borehole No. **WS2**
Sheet 1 of 1

Project Name: Grange Road,	Project No.: 16245	Co-ords:	Hole Type WS
Location: Hedge End, Southampton SO30 2GD		Level:	Scale 1:50
Client: Cleansing Service Group Ltd		Dates: 17-05-2017	Logged By MB

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	B+J		0.60			MADE GROUND; CONCRETE and BRICK. (recovered as angular gravel).
		0.70	D+J		0.75			Very loose dark brown, becoming brown, clayey sandy GRAVEL. Sand is fine. Gravel is sub-angular to rounded fine to coarse flint. EARNLEY SANDY FORMATION
		0.90	D+J		1.15			Very loose reddish brown mottled brown sandy very clayey GRAVEL. Sand is fine to coarse. Gravel is sub-angular to rounded fine to coarse flint. EARNLEY SANDY FORMATION
		1.30	D7		1.70			Loose to medium dense laminated reddish brown mottled orangish brown very clayey fine to medium SAND. EARNLEY SAND FORMATION
		2.00	D8		2.60			Medium dense laminated light greenish grey mottled light brown and orangish brown clayey fine SAND. EARNLEY SAND FORMATION
		2.70	D9		3.00			Medium dense light greenish grey clayey fine SAND. EARNLEY SAND FORMATION
	▼	3.10 3.50	D10 D11		4.00			Medium dense becoming loose dark brown mottled brown clayey fine SAND. EARNLEY SAND FORMATION

End of Borehole at 4.00m

General Remarks:
No roots observed. Groundwater strike at 3.20m bgl.

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Borehole Log

Borehole No.
WS3
Sheet 1 of 1

Project Name: Grange Road,	Project No.: 16245	Co-ords:	Hole Type WS
Location: Hedge End, Southampton SO30 2GD		Level:	Scale 1:50
Client: Cleansing Service Group Ltd		Dates: 17-05-2017	Logged By MB

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 - 0.50	B+J					MADE GROUND; CONCRETE and BRICK. (recovered as angular gravel).
		0.60 - 0.85	B+J		0.50			Very soft dark brown, becoming brown, slightly sandy gravelly CLAY. Sand is fine. Gravel is sub-angular to rounded fine to coarse flint. EARNLEY SAND FORMATION
		1.00	D+J		0.85			Soft to firm reddish brown mottled orangish brown and light greenish grey fine sandy CLAY. EARNLEY SAND FORMATION
		1.60	D		1.45			Medium dense laminated light greenish grey mottled light brown and orangish brown clayey fine SAND. EARNLEY SAND FORMATION
		2.10	D					
		2.50	D		2.45			Loose light greenish grey mottled orangish brown clayey fine SAND. EARNLEY SAND FORMATION
					2.70			Loose dark brown mottled light blueish grey clayey fine SAND. EARNLEY SAND FORMATION
		3.00	D					
		3.70	D		3.40			Loose to medium dense dark orangish brown mottled light blueish grey silty fine SAND. EARNLEY SAND FORMATION
					4.00			End of Borehole at 4.00m

General Remarks:

No roots observed. Groundwater strike at 3.00m bgl.

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Classification based on SPT "N" values:

The inferred undrained strength of the cohesive soils was based on the SPT "N" blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table B.1.1. (Ref: Stroud, M. A. 1974, "The Standard Penetration Test – its application and interpretation", Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.).

Table B.1.1 SPT "N" Blow Count Cohesive Classification

Classification	Undrained Cohesive Strength C_u (kPa)
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	> 300

Note: (Ref: BS EN ISO 14688-2:2004+A1:2013 Clause 5.3.)

The relative density of granular soils was classified based of the relationship given in Table B.1.2.

The *UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing, NA 3.7 SPT test, BS EN 1997-2:2007, Annex F* states "Relative density descriptions on borehole records should also be based on uncorrected SPT N values, unless significantly disturbed, using the density classification in BS 5930:2015, Table 7.

Table B.1.2 SPT "N" Blow Count Granular Classification

Classification	SPT "N" blow count (blows/300mm)
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	Greater than 50

Note: (Ref: The Standard Penetration Test (SPT): Methods and Use, CIRIA Report 143, 1995)

Chalk samples recovered are disturbed by the sampling process. Therefore, it is difficult to assess an accurate chalk grade for in accordance with CIRIA C574 'Engineering in

Chalk'. In the absence of a standardised correlation between SPT "N" values and chalk grade for the most recent chalk classification (CIRIA C574) a broad indication of the in-situ chalk grade can be assessed using a paper by T.R.M. Wakeling from a site in Mundford, Norfolk, which compares SPT "N" values to the old Spink & Norbury chalk classification. From the Spink & Norbury classification it is possible to infer a basic CIRIA Grade (structureless or structured), as outlined in Table B.1.3.

Table B.1.3 Interpretation of SPT "N" Blow Counts in Chalk

SPT "N" Value Range	Spink & Norbury Grade	Inferred CIRIA Grade
<8	VI	Structureless (Dm)
8 – 15	V	Structureless (Dc)
15 – 20	IV	Structured chalk (C5 – A1)
20 - 25	III	Structured chalk (C5 – A1)
25 - 35	II	Structured chalk (C5 – A1)
>35	I	Structured chalk (C5 – A1)

Note:

Classification of DCP results to CBR:

The DCP consists of a cone fixed to the bottom of a 575mm vertical rod. An 8kg weight is repeatedly lifted and dropped onto an anvil at the mid-height of the rod to deliver a 'blow'. A vertical scale alongside the rod is used to measure the depth of penetration of the cone. These measurements are then converted to CBR values using the following equation derived from the DTP Interim Advice Note 73/06 – Design Guidance for Road Pavement Foundations:

$$Log_{10}(CBR) = 2.48 - 1.057 \times Log_{10}(mm/blow)$$

Appendix B.2 Interpretation

Table B.2.1 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N Blow Counts	Inferred Cohesive Strength/Granular Density
DP1	EA 0.40 – 1.00 Sandy clayey GRAVEL	0 – 3	Very loose
	EA 1.00 – 1.70 Clayey SAND	17 – 20	Medium dense
	EA[1] 1.70 – 4.70 Clayey SAND	12 – 17	Medium dense
	EA[1] 4.70 – 5.50 Clayey SAND	9 – 12	Loose to medium dense
	EA[1] 5.50 – 6.00 Clayey SAND	14 – 17	Medium dense
DP2	EA 0.60 – 1.10 Sandy clayey GRAVEL	0	Very loose
	EA 1.10 – 1.60 Clayey SAND	3 – 12	Very Loose to medium dense
	EA 1.60 – 2.30 Clayey SAND	14 – 17	Medium dense
	EA 2.30 – 3.90 Clayey SAND	12 – 14	Medium dense
	EA[1] 3.90 – 5.50 Clayey SAND	6 – 9	Loose
	EA[1] 5.50 – 6.00 Clayey SAND	14 – 17	Medium dense
DP3	EA 0.50 – 1.20 Sandy CLAY	0	Extremely low (C_U = <10kPa)
	EA 1.20 – 1.45 Sandy CLAY	6 – 12	Low to medium (C_U = 30 – 60)
	EA 1.45 – 2.30 Clayey SAND	15 – 17	Medium dense

DP	Strata	Equivalent SPT N Blow Counts	Inferred Cohesive Strength/Granular Density
	EA 2.30 – 3.60 Clayey SAND	6 – 9	Loose
	EA[1] 3.60 – 4.40 Clayey SAND	12 – 15	Medium dense
	EA[1] 4.40 – 5.40 Clayey SAND	6 – 9	Loose
	EA[1] 5.40 – 6.00 Clayey SAND	12 – 17	Medium dense

Note: [1] Ground conditions inferred past the base of windowless sampler boreholes.

Table B.2.2 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
EA	19 - 24	12 - 22	42 - 99	9 - 19	CL - CI	Low	Low[1]

Note: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2
Soils Classification based on British Soil Classification System
The most common use of the term clay is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.
(The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5)
[1] Only one sample exhibited volume change potential in accordance NHBC Standards Chapter 4.2.

Table B.2.3 Interpretation of PSD Tests

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)
			BRE	NHBC	
WS1	1.00	Brown very sandy clayey GRAVEL	Yes	No	17
WS1	1.50	Brown very clayey SAND	Yes	No	22
WS1	2.20	Brown very clayey SAND	Yes	No	24
WS2	1.30	Brown very clayey SAND	Yes	No	28
WS2	2.70	Brown clayey SAND	No	No	14
WS3	2.50	Brown clayey SAND	Yes	No	17

Note: BRE 240 states that a soil has a volume change potential when the clay fraction **exceeds 15%**. Only the silt and clay combined fraction are determined by sieving therefore the volume change potential is estimated from the percentage passing the 63µm sieve. NHBC Standards Chapter 4.2 states that a soil is shrinkable if the percentage of silt and clay passing the 63µm sieve is greater than 35% and the Plasticity Index is greater than 10%.
(The Particle Size Distribution Tests were undertaken in accordance with BS 1377: Part 2: 1990 Clause 9)

Appendix B.3 Geotechnical In-Situ and Laboratory Results

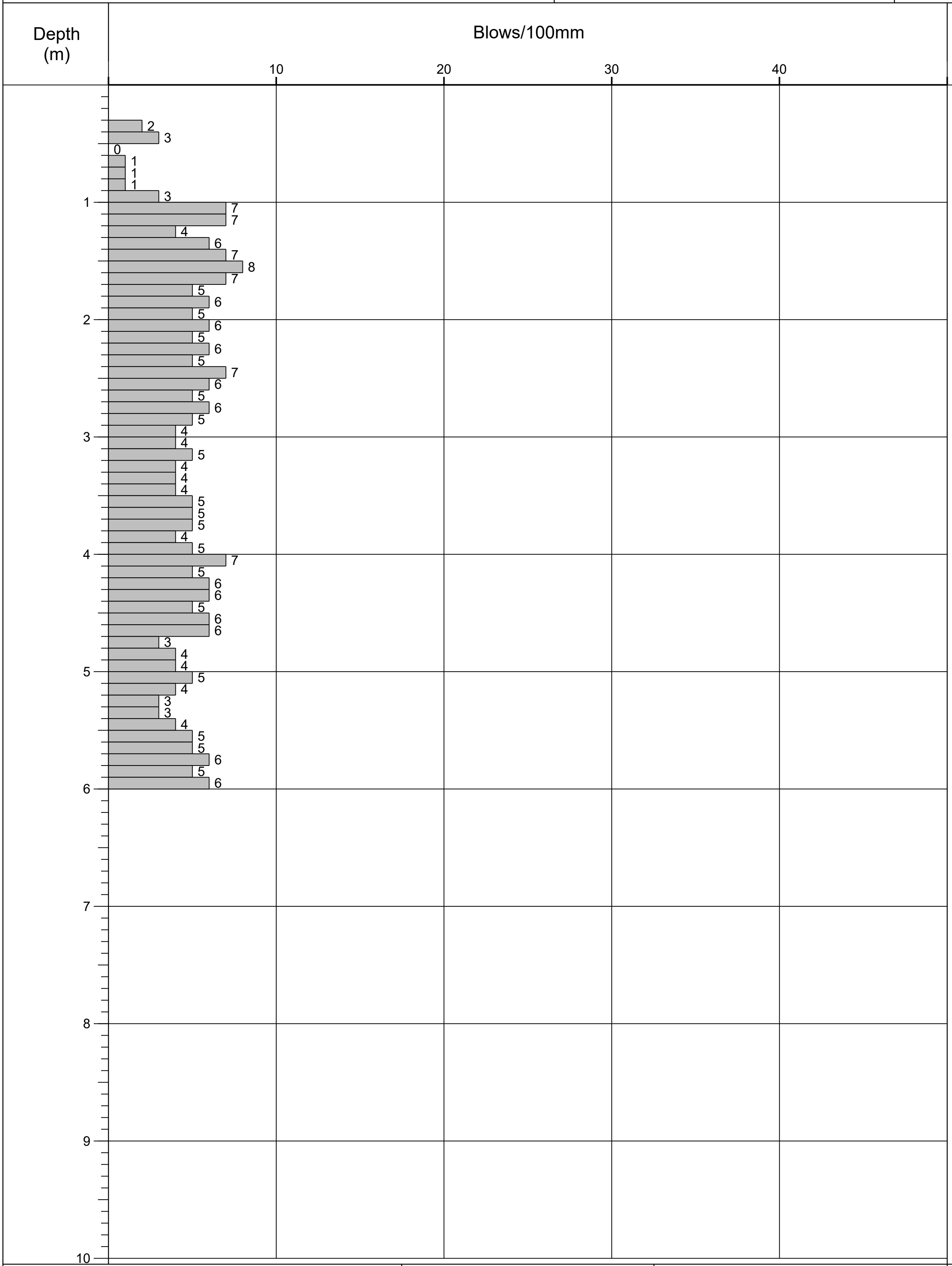
Soils Limited

Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Probe Log

Probe No.
DP1
Sheet 1 of 1

Project Name:	Grange Road,	Project No. 16245	Co-ords:	Hole Type DP
Location:	Hedge End, Southampton SO30 2GD		Level: m AOD	Scale 1:50
Client:	Cleansing Service Group Ltd		Dates: 17-05-2017	Logged By



Remarks	Fall Height mm	Cone Base Diameter	mm
	Hammer Weight kg	Final Depth	5.9m
	Probe Type	Energy Ratio (Er)	%

Soils Limited

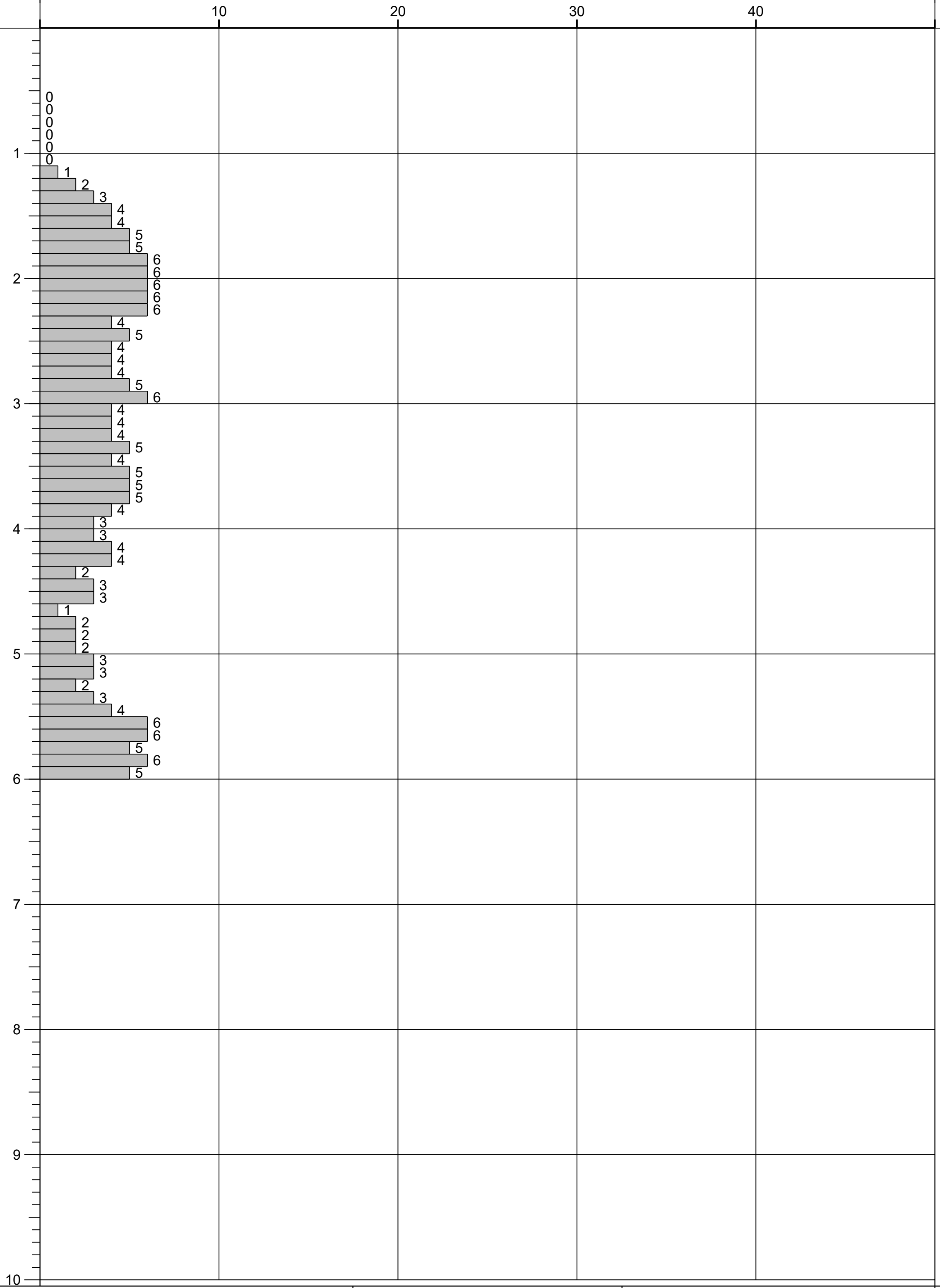
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Probe Log

Probe No.
DP2
Sheet 1 of 1

Project Name: Grange Road,	Project No. 16245	Co-ords:		Hole Type DP
Location: Hedge End, Southampton SO30 2GD		Level:	m AOD	Scale 1:50
Client: Cleansing Service Group Ltd		Dates:	17-05-2017	Logged By

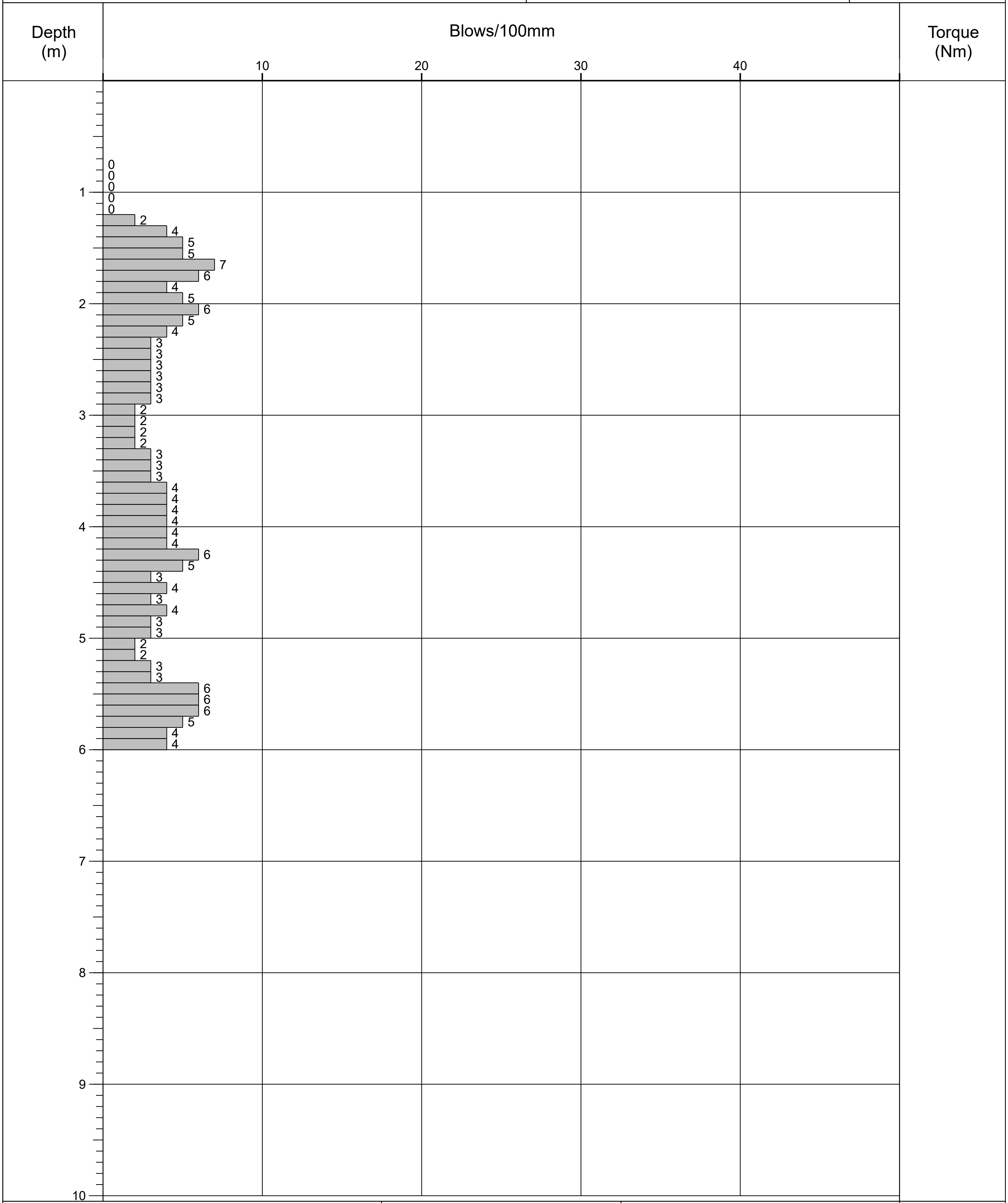
Depth (m) | Blows/100mm | Torque (Nm)



Remarks	Fall Height mm	Cone Base Diameter mm	
	Hammer Weight kg	Final Depth	5.9m
	Probe Type	Energy Ratio (Er)	%

AGS

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk		**Probe Log**	Probe No. **DP3** Sheet 1 of 1
Project Name: Grange Road,	Project No. 16245	Co-ords:	Hole Type DP
Location: Hedge End, Southampton SO30 2GD		Level: m AOD	Scale 1:50
Client: Cleansing Service Group Ltd		Dates: 17-05-2017	Logged By

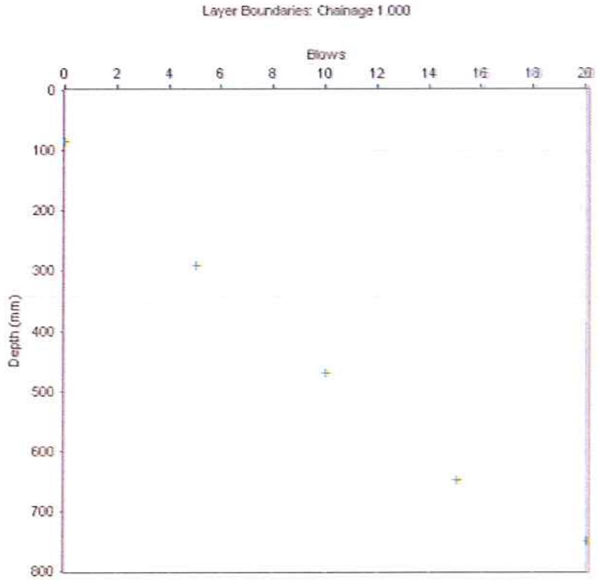


Remarks	Fall Height mm	Cone Base Diameter mm	
	Hammer Weight kg	Final Depth 5.9m	
	Probe Type	Energy Ratio (Er) %	

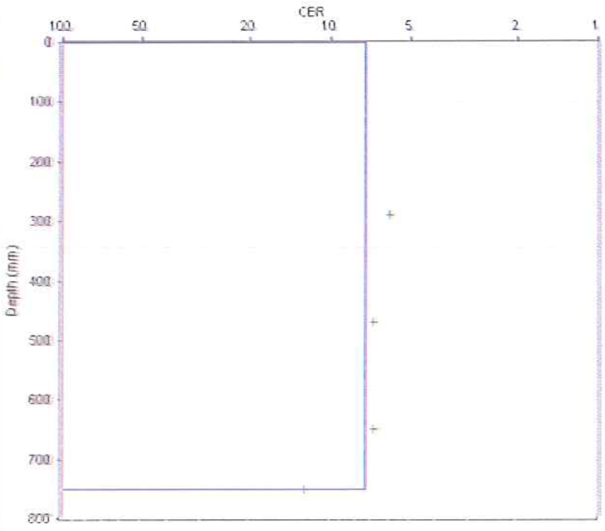
DCP Layer Strength Analysis Report

Project Name: DCPs

Chainage (km):	1.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	200	Surface Moisture:	Wet
Test Date:	17/05/2017	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	33.30	7	751	751	Base	0.02	0.61	0.61	0.61

Pavement Strength

	Layer Contribution		
Layer	SN	SNC	SNP
Surface	--	--	--
Base	0.61	0.61	0.61
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.61	0.61	0.61

CBR Relationship:

TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

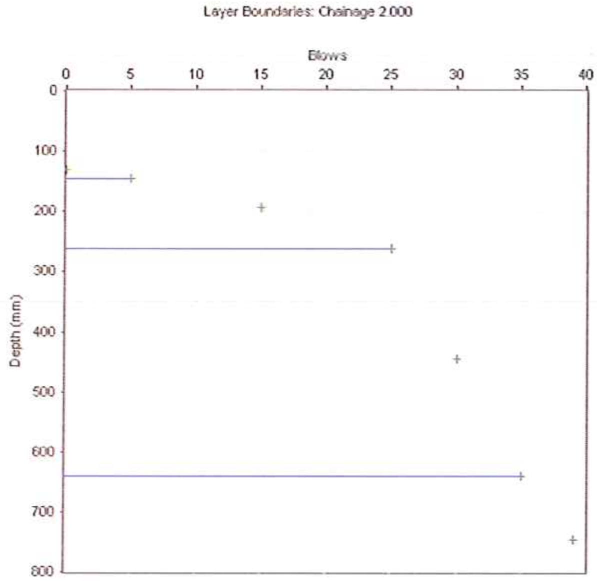
Report produced by ....

DCP Layer Strength Analysis Report

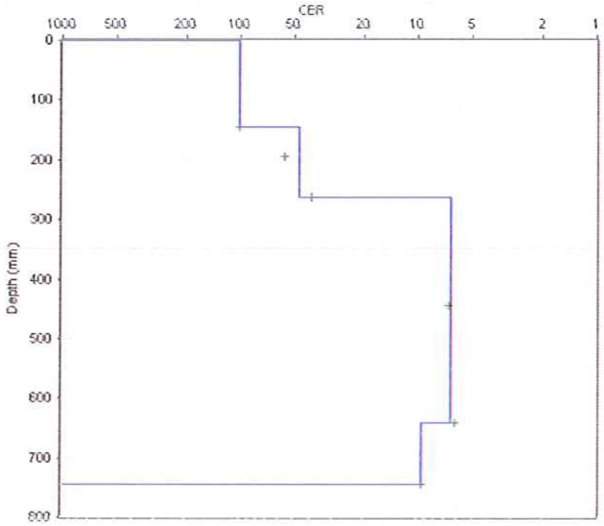
Project Name: DCPs

Chainage (km): 2.000
Direction:
Location/Offset: Carriageway
Cone Angle: 60 degrees
Zero Error (mm): 200
Test Date: 17/05/2017

Surface Type: Unpaved
Thickness (mm): 0
Base Type:
Thickness (mm):
Surface Moisture: Wet
Moisture adjustment factor: Not adjusted



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	2.80	102	145	145	Base	0.14	0.79	0.79	0.79
2	5.85	47	117	262	Base	0.10	0.45	0.45	0.45
3	37.80	6	378	640	Base	0.02	0.27	0.27	0.27
4	26.25	10	105	745	Base	0.03	0.11	0.11	0.11

Pavement Strength

	Layer Contribution		
Layer	SN	SNC	SNP
Surface	--	--	--
Base	1.62	1.62	1.62
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	1.62	1.62	1.62

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by ....

Laboratory Report

Contract Number: 35350

Client's Reference: **16245**

Report Date: **05-06-2017**

Client **Soils Limited**
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

Contract Title: **Grange Road**
For the attention of: **Tim Rudkin**

Date Received: **26-05-2017**
Date Commenced: **26-05-2017**
Date Completed: **05-06-2017**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	4
1 Point Liquid & Plastic Limit 1377 : 1990 Part 2 : 4.4 & 5.3 - * UKAS	4
PSD Wet Sieve method 1377 : 1990 Part 2 : 9.2 - * UKAS	6
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

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 Signatories:
Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)
Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative/Quality Assistant)
Vaughan Edwards (Managing Director) - Wayne Honey (Administrative/Quality Assistant)

GSTL

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX
(BS 1377 : Part 2 : 1990 Method 5)
DESCRIPTIONS

Contract Number	**35350**	
Site Name	**Grange Road**	

WS Window Sample	Sample Number	Sample Type	Depth (m)			Descriptions
WS1	1	D	1.00	-		Brown/red silty clayey fine to coarse sandy fine to coarse GRAVEL
WS1	1	D	1.50	-		Brown slightly clayey silty fine to coarse SAND
WS2	1	D	1.30	-		Brown slightly fine gravelly silty clayey fine to coarse SAND
WS3	1	D	1.00	-		Brown sandy silty CLAY
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
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				-		
				-		
				-		
				-		
				-		

Operators	Checked	04/06/2017	Sean Penn	
RO/MH	Approved	05/06/2017	Ben Sharp	

UKAS TESTING 2788

GSTL	**LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX** **(BS 1377 : Part 2 : 1990 Method 5)**	
Contract Number	**35350**	
Site Name	**Grange Road**	

WS Window Sample	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing .425mm %	Remarks
WS1	1	D	1.00	-		12	39	17	22	42	CI Intermediate Plasticity
WS1	1	D	1.50	-		19		NP		99	
WS2	1	D	1.30	-		19	32	20	12	99	CL Low Plasticity
WS3	1	D	1.00	-		24	40	19	21	90	CI Intermediate Plasticity
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
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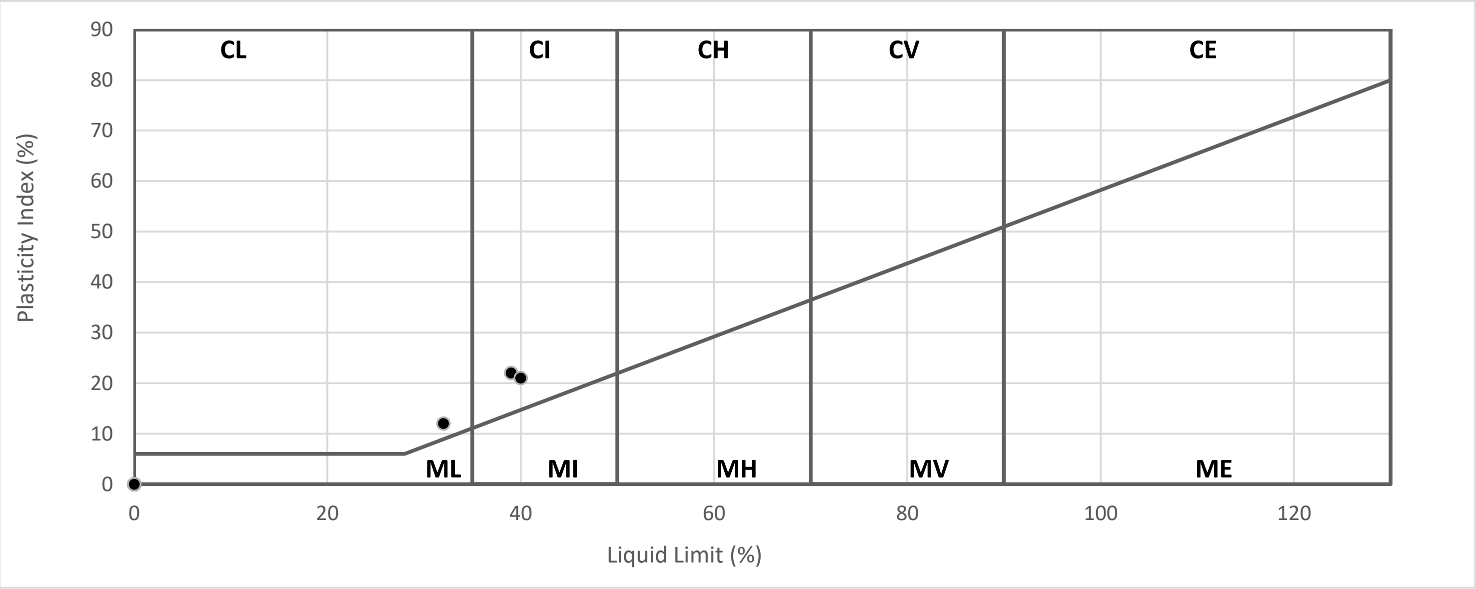
				-							
				-							
				-							
				-							
				-							
				-							
				-							

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

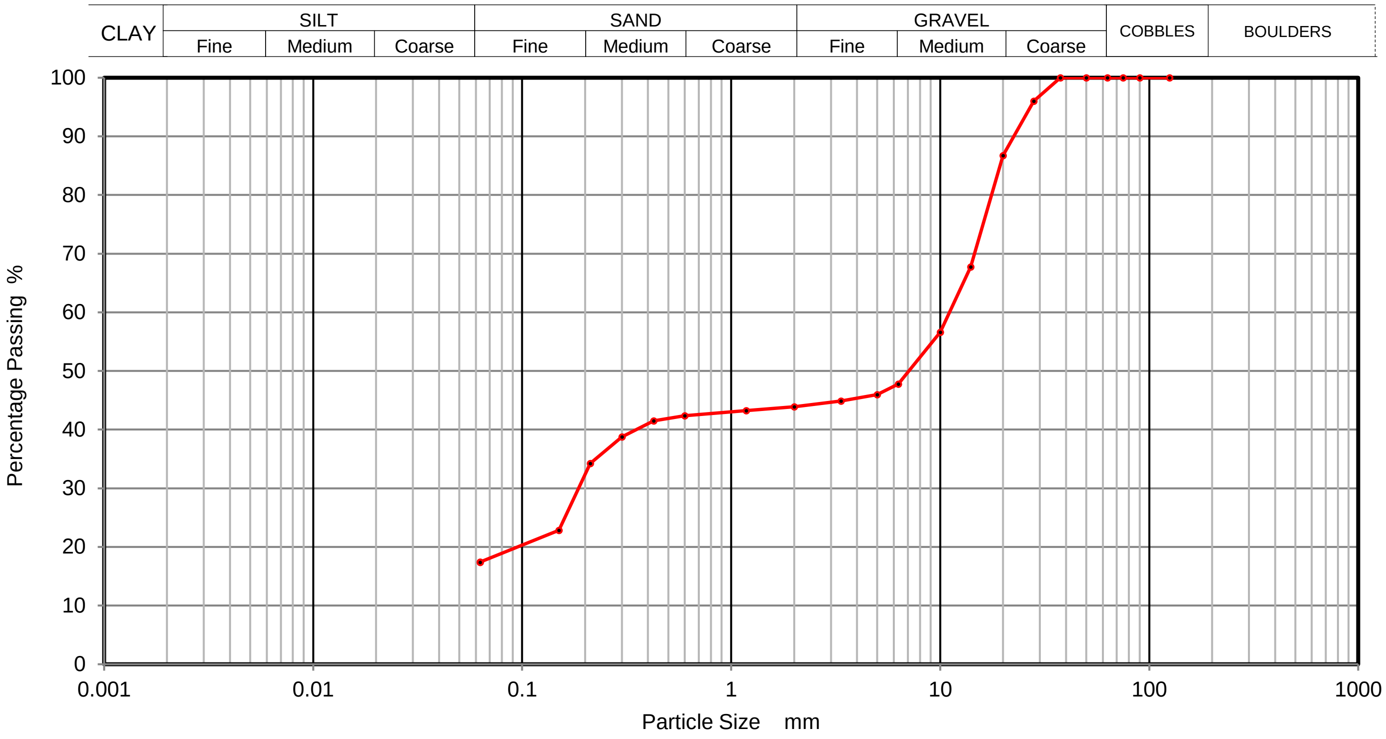
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	04/06/2017	Sean Penn	S. Pen
DB	Approved	05/06/2017	Ben Sharp	

UKAS
TESTING
2788

GSTL	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	**35350**
		Borehole/Pit No.	**WS1**
Site Name	**Grange Road**	Sample No.	**1**
Soil Description	Brown/red silty clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	**1.00**
		Depth Base	
		Sample Type	**D**



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	100		
28	96		
20	87		
14	68		
10	57		
6.3	48		
5	46		
3.35	45		
2	44		
1.18	43		
0.6	42		
0.425	42		
0.3	39		
0.212	34		
0.15	23		
0.063	17		

Sample Proportions	% dry mass
Cobbles	0
Gravel	56
Sand	27
Silt and Clay	17

Grading Analysis	
Uniformity Coefficient	

Remarks

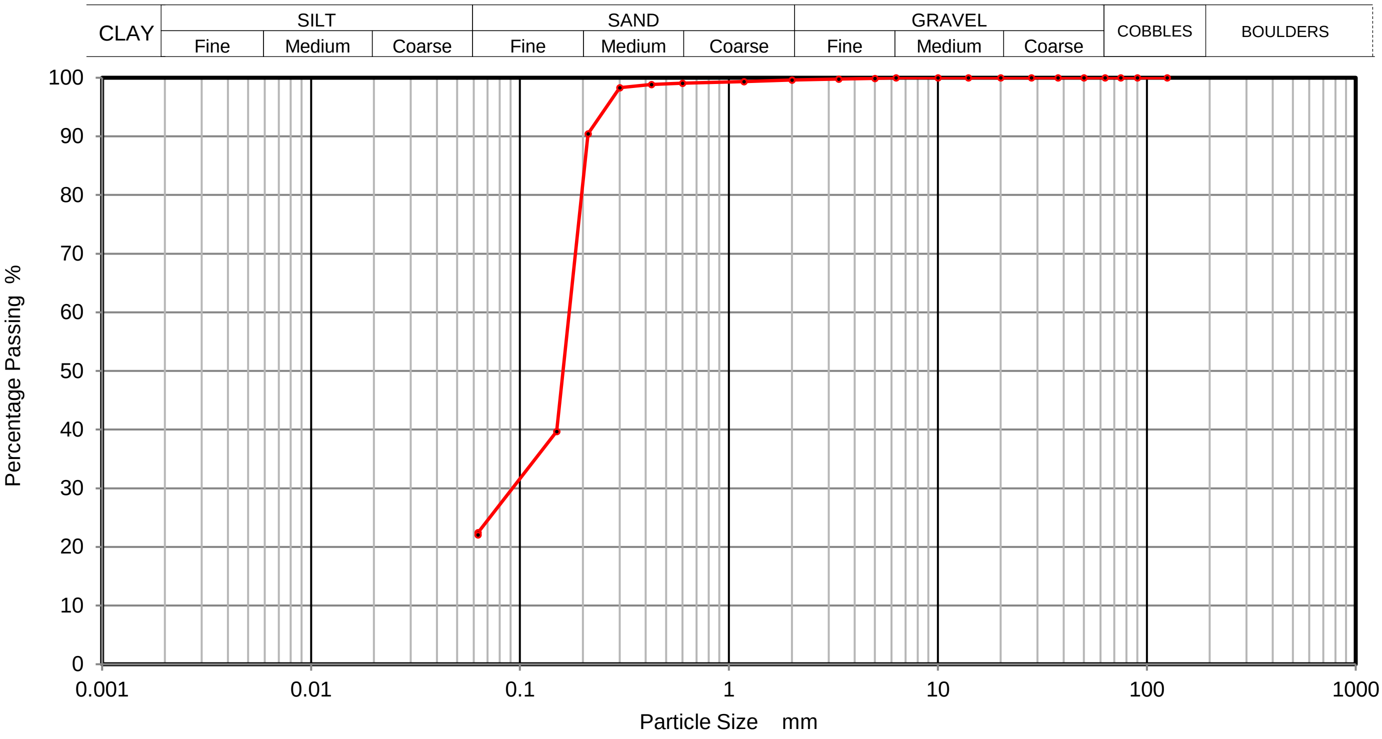
Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	04/06/2017	Sean Penn	
RO/MH	Approved	05/06/2017	Ben Sharp	

UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

		Contract Number	**35350**
		Borehole/Pit No.	**WS1**
Site Name	**Grange Road**	Sample No.	**1**
Soil Description	Brown slightly clayey silty fine to coarse SAND	Depth Top	**1.50**
		Depth Base	
		Sample Type	**D**



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99		
0.425	99		
0.3	98		
0.212	90		
0.15	40		
0.063	22		

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	78
Silt and Clay	22

Grading Analysis	
Uniformity Coefficient	

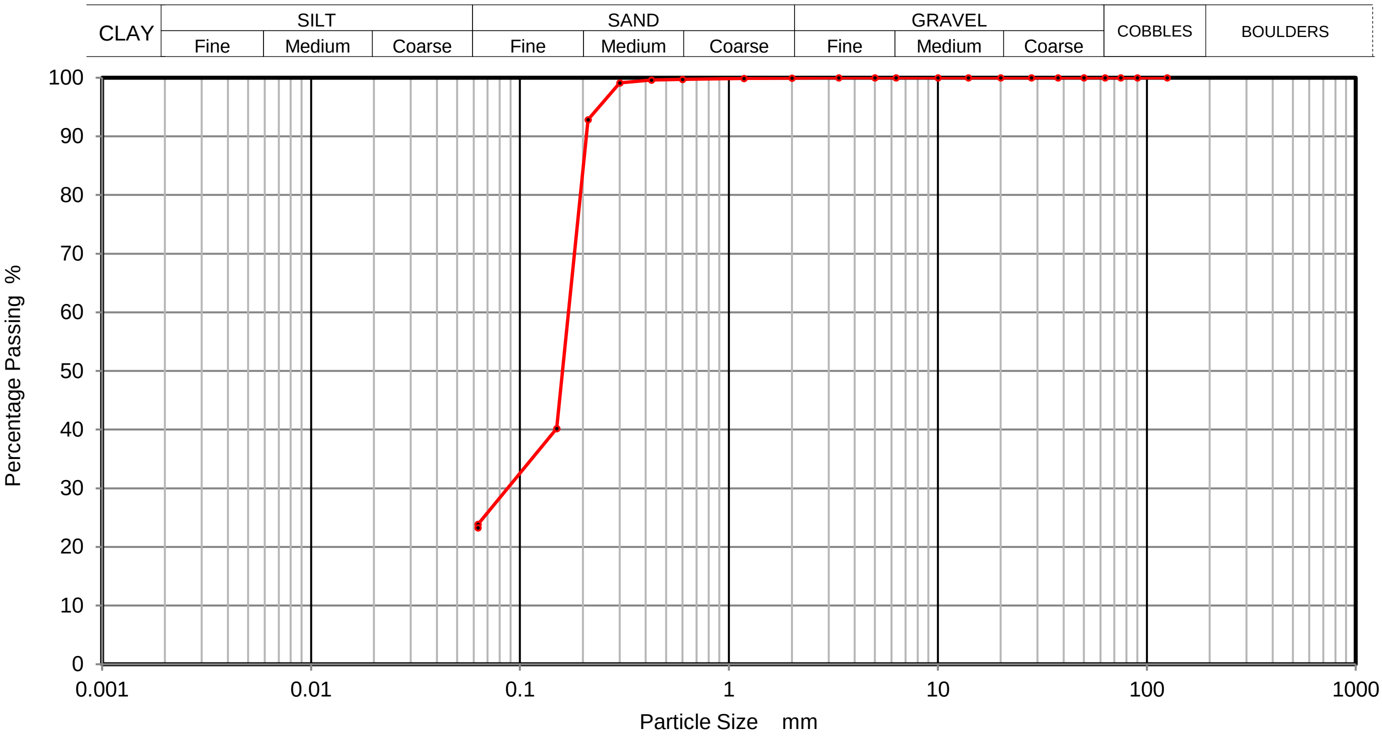
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	04/06/2017	Sean Penn	
RO/MH	Approved	05/06/2017	Ben Sharp	

UKAS TESTING 2788

GSTL	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	**35350**
		Borehole/Pit No.	**WS1**
Site Name	**Grange Road**	Sample No.	**1**
Soil Description	Brown slightly clayey silty fine to medium SAND	Depth Top	**2.20**
		Depth Base	
		Sample Type	**D**



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	93		
0.15	40		
0.063	24		

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	76
Silt and Clay	24

Grading Analysis	
Uniformity Coefficient	

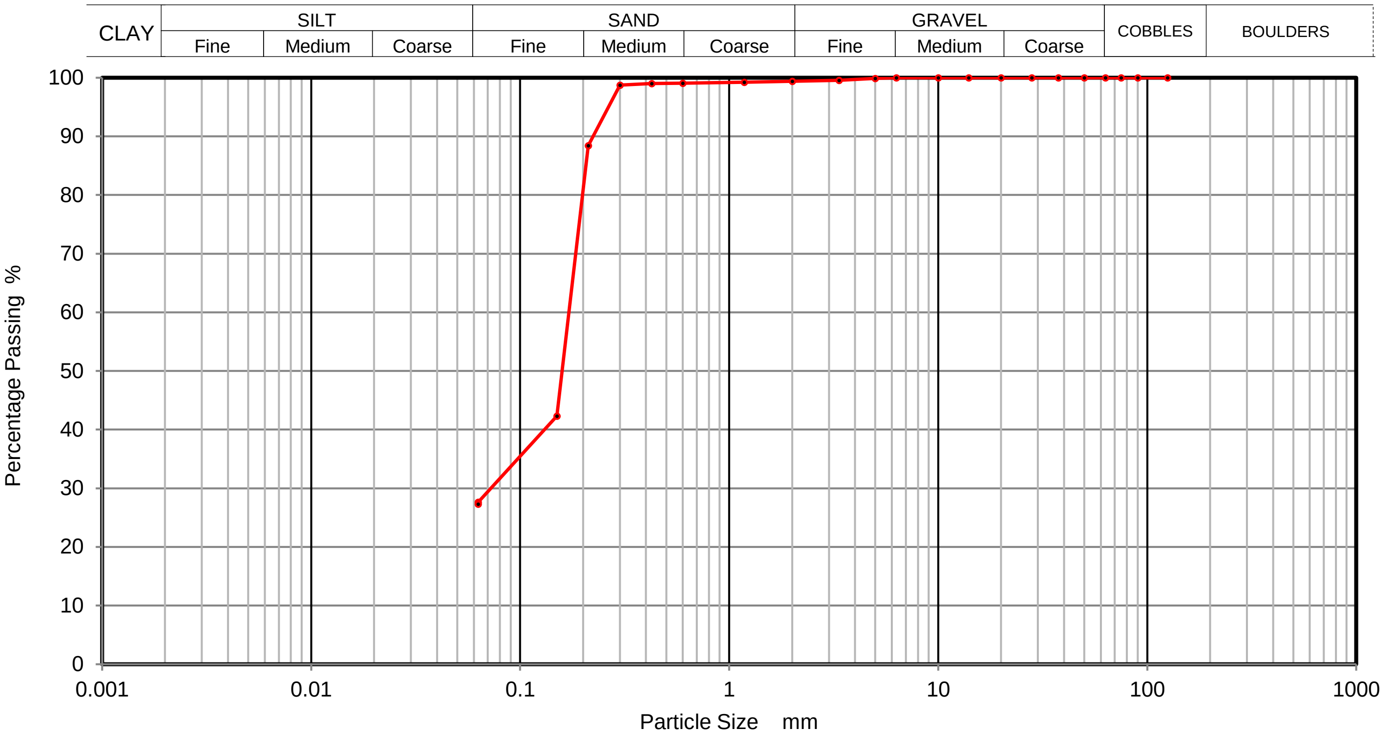
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	04/06/2017	Sean Penn	
RO/MH	Approved	05/06/2017	Ben Sharp	

UKAS TESTING 2788

GSTL	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	**35350**
		Borehole/Pit No.	**WS2**
Site Name	**Grange Road**	Sample No.	**1**
Soil Description	Brown slightly fine gravelly silty clayey fine to coarse SAND	Depth Top	**1.30**
		Depth Base	
		Sample Type	**D**



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	99		
0.212	88		
0.15	42		
0.063	28		

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	71
Silt and Clay	28

Grading Analysis	
Uniformity Coefficient	

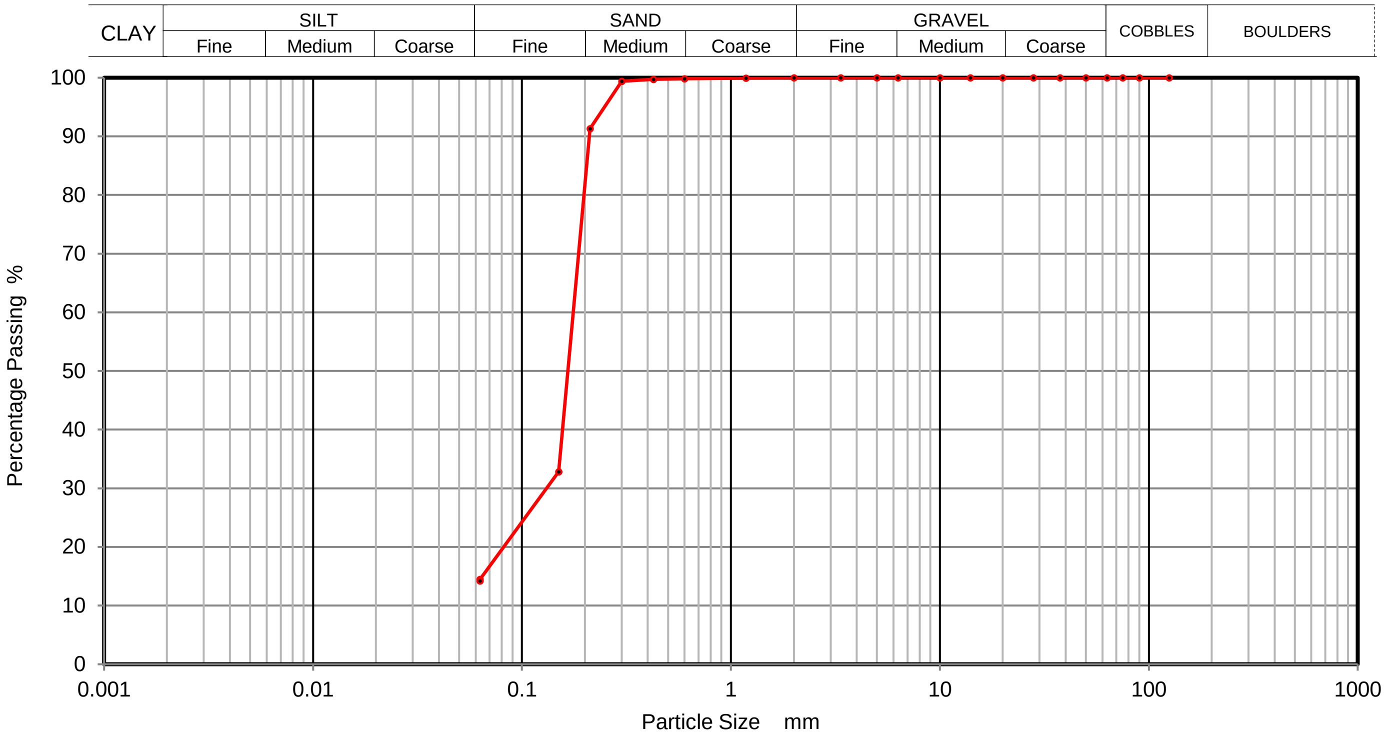
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	04/06/2017	Sean Penn	
RO/MH	Approved	05/06/2017	Ben Sharp	

UKAS TESTING 2788

GSTL	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	**35350**
		Borehole/Pit No.	**WS2**
Site Name	**Grange Road**	Sample No.	**1**
Soil Description	Brown silty fine to medium SAND	Depth Top	**2.70**
		Depth Base	
		Sample Type	**D**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	91		
0.15	33		
0.063	14		

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	86
Silt and Clay	14

Grading Analysis	
Uniformity Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

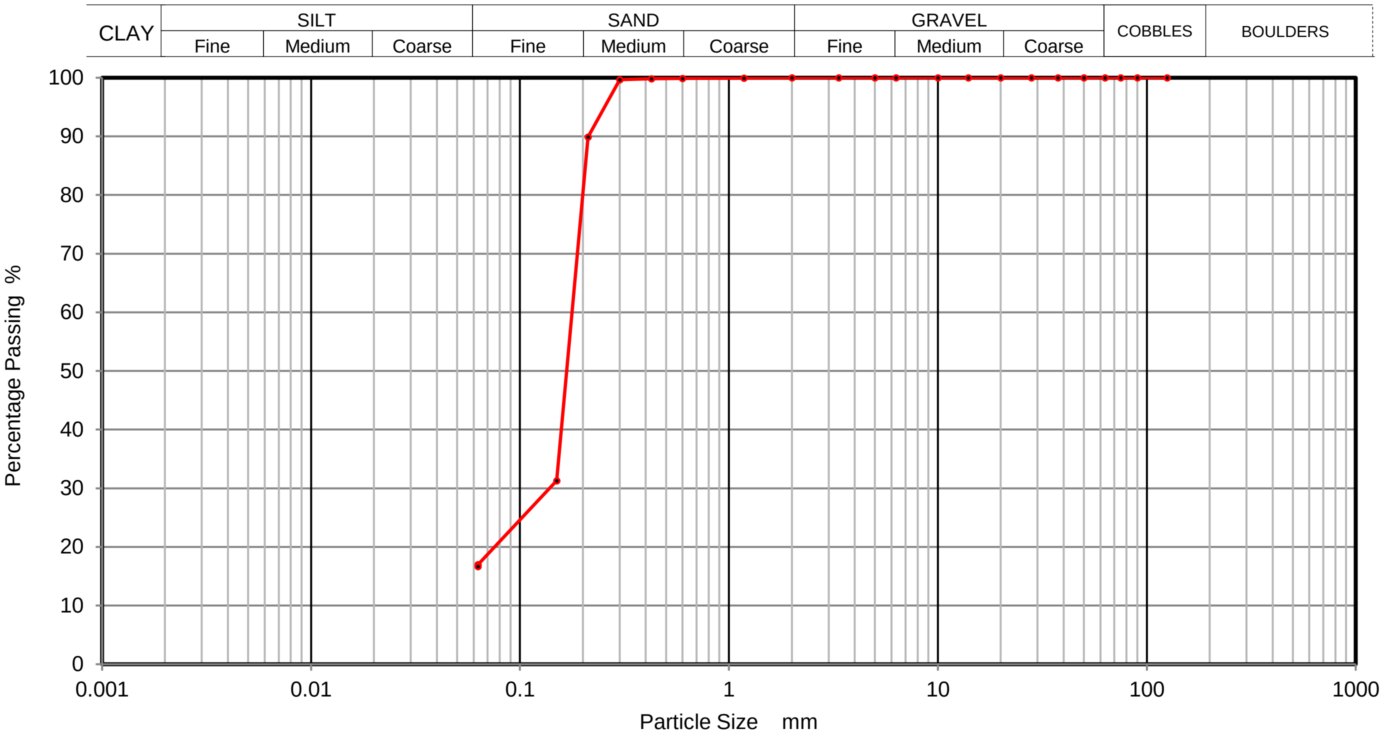
Operators	Checked	04/06/2017	Sean Penn	
RO/MH	Approved	05/06/2017	Ben Sharp	

UKAS
TESTING
2788

GSTL

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Site Name	**Grange Road**	Contract Number	**35350**
		Borehole/Pit No.	**WS3**
		Sample No.	**1**
Soil Description	Brown slightly clayey silty fine to medium SAND	Depth Top	**2.50**
		Depth Base	
		Sample Type	**D**



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	90		
0.15	31		
0.063	17		

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	83
Silt and Clay	17

Grading Analysis	
Uniformity Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	04/06/2017	Sean Penn	
RO/MH	Approved	05/06/2017	Ben Sharp	

UKAS TESTING 2788

Tim Rudkin
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 17-60250

Site Reference: Grange Road

Project / Job Ref: 16245

Order No: 16103

Sample Receipt Date: 16/06/2017

Sample Scheduled Date: 16/06/2017

Report Issue Number: 1

Reporting Date: 21/06/2017

Authorised by:

Russell Jarvis
Associate Director of Client Services

Authorised by:

Dave Ashworth
Deputy Quality Manager

QTSE is the trading name of DETS Ltd, company registration number 03705645

Soil Analysis Certificate

QTS Environmental Report No: 17-60250	**Date Sampled**	None Supplied	None Supplied			
Soils Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: Grange Road	**TP / BH No**	WS2	WS3			
Project / Job Ref: 16245	**Additional Refs**	None Supplied	None Supplied			
Order No: 16103	**Depth (m)**	0.90	1.60			
Reporting Date: 21/06/2017	**QTSE Sample No**	274089	274090			

Determinand	**Unit**	**RL**	**Accreditation**					
pH	pH Units	N/a	**MCERTS**	7.2	7.5			
Total Sulphate as SO$_4$	mg/kg	< 200	NONE	329	548			
Total Sulphate as SO$_4$	%	< 0.02	NONE	0.03	0.05			
W/S Sulphate as SO$_4$ (2:1)	mg/l	< 10	**MCERTS**	50	< 10			
W/S Sulphate as SO$_4$ (2:1)	g/l	< 0.01	**MCERTS**	0.05	< 0.01			
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02			
Ammonium as NH$_4$	mg/kg	< 0.5	NONE	2.3	2.5			
Ammonium as NH$_4$	mg/l	< 0.05	NONE	0.23	0.25			
W/S Chloride (2:1)	mg/kg	< 1	**MCERTS**	5	7			
W/S Chloride (2:1)	mg/l	< 0.5	**MCERTS**	2.3	3.3			
Water Soluble Nitrate (2:1) as NO$_3$	mg/kg	< 3	**MCERTS**	20	4			
Water Soluble Nitrate (2:1) as NO$_3$	mg/l	< 1.5	**MCERTS**	10	2			
W/S Magnesium	mg/l	< 0.1	NONE	0.6	0.3			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis $^{(S)}$

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 17-60250	
Soils Ltd	
Site Reference: Grange Road	
Project / Job Ref: 16245	
Order No: 16103	
Reporting Date: 21/06/2017	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 274089	WS2	None Supplied	0.90	10.8	Red sandy clay with stones
^ 274090	WS3	None Supplied	1.60	13.1	Green sandy clay

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

Insufficient Sample $^{I/S}$

Unsuitable Sample $^{U/S}$

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

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 17-60250
Soils Ltd
Site Reference: Grange Road
Project / Job Ref: 16245
Order No: 16103
Reporting Date: 21/06/2017

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

D **Dried**
AR **As Received**

Appendix C Chemical Laboratory Testing

Appendix C.1 Chemical Laboratory Results

Tim Rudkin
Soils Ltd
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KT20 5SR

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Rose Lane Industrial Estate
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t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 17-59395

Site Reference:	Grange Road
Project / Job Ref:	16245
Order No:	16103
Sample Receipt Date:	24/05/2017
Sample Scheduled Date:	24/05/2017
Report Issue Number:	1
Reporting Date:	31/05/2017

Authorised by:

Russell Jarvis
Associate Director of Client Services

Authorised by:

Dave Ashworth
Deputy Quality Manager

QTSE is the trading name of DETS Ltd, company registration number 03705645

Soil Analysis Certificate

QTS Environmental Report No: 17-59395	**Date Sampled**	None Supplied				
Soils Ltd	**Time Sampled**	None Supplied				
Site Reference: Grange Road	**TP / BH No**	WS2				
Project / Job Ref: 16245	**Additional Refs**	None Supplied				
Order No: 16103	**Depth (m)**	0.20 - 0.60				
Reporting Date: 31/05/2017	**QTSE Sample No**	270550				

Determinand	**Unit**	**RL**	**Accreditation**					
Asbestos Screen (S)	N/a	N/a	**ISO17025**	Not Detected				
pH	pH Units	N/a	**MCERTS**	10.2				
Total Cyanide	mg/kg	< 2	NONE	< 2				
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	**MCERTS**	158				
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	**MCERTS**	0.16				
Sulphide	mg/kg	< 5	NONE	< 5				
Organic Matter	%	< 0.1	**MCERTS**	1.1				
Total Organic Carbon (TOC)	%	< 0.1	**MCERTS**	0.6				
Antimony (Sb)	mg/kg	< 1	NONE	7.4				
Arsenic (As)	mg/kg	< 2	**MCERTS**	6				
Beryllium (Be)	mg/kg	< 0.5	NONE	< 0.5				
W/S Boron	mg/kg	< 1	NONE	< 1				
Cadmium (Cd)	mg/kg	< 0.2	**MCERTS**	0.4				
Chromium (Cr)	mg/kg	< 2	**MCERTS**	17				
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2				
Copper (Cu)	mg/kg	< 4	**MCERTS**	21				
Lead (Pb)	mg/kg	< 3	**MCERTS**	244				
Mercury (Hg)	mg/kg	< 1	NONE	< 1				
Nickel (Ni)	mg/kg	< 3	**MCERTS**	10				
Selenium (Se)	mg/kg	< 3	NONE	< 3				
Vanadium (V)	mg/kg	< 2	NONE	22				
Zinc (Zn)	mg/kg	< 3	**MCERTS**	189				
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Asbestos Analyst: Javeed Malik

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported “Loose Fibres - PT” with type(s).

Subcontracted analysis (S)

Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 17-59395	**Date Sampled**	None Supplied				
Soils Ltd	**Time Sampled**	None Supplied				
Site Reference: Grange Road	**TP / BH No**	WS2				
Project / Job Ref: 16245	**Additional Refs**	None Supplied				
Order No: 16103	**Depth (m)**	0.20 - 0.60				
Reporting Date: 31/05/2017	**QTSE Sample No**	270550				

Determinand	**Unit**	**RL**	**Accreditation**					
Naphthalene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Acenaphthylene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Acenaphthene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Fluorene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Phenanthrene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Anthracene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Fluoranthene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Pyrene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Benzo(a)anthracene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Chrysene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Benzo(b)fluoranthene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Benzo(k)fluoranthene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Benzo(a)pyrene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Dibenz(a,h)anthracene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Benzo(ghi)perylene	mg/kg	< 0.1	**MCERTS**	< 0.1				
Total EPA-16 PAHs	mg/kg	< 1.6	**MCERTS**	< 1.6				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3

QTS Environmental Report No: 17-59395	**Date Sampled**	None Supplied
Soils Ltd	**Time Sampled**	None Supplied
Site Reference: Grange Road	**TP / BH No**	WS2
Project / Job Ref: 16245	**Additional Refs**	None Supplied
Order No: 16103	**Depth (m)**	0.20 - 0.60
Reporting Date: 31/05/2017	**QTSE Sample No**	270550

				Landfill Waste Acceptance Criteria Limits		
Determinand	**Unit**	**MDL**		**Inert Waste Landfill**	**Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
TOC^{MU}	%	< 0.1	0.6	3%	5%	6%
Loss on Ignition	%	< 0.01	2.60	--	--	10%
BTEX^{MU}	mg/kg	< 0.05	< 0.05	6	--	--
Sum of PCBs	mg/kg	< 0.1	< 0.1	1	--	--
Mineral Oil^{MU}	mg/kg	< 10	< 10	500	--	--
Total PAH^{MU}	mg/kg	< 1.7	< 1.7	100	--	--
pH^{MU}	pH Units	N/a	10.2	--	>6	--
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	2.1	--	To be evaluated	To be evaluated

Eluate Analysis	**2:1** **mg/l**	**8:1** **mg/l**		**Cumulative 10:1 mg/kg**	**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)**		
Arsenic^{U}	< 0.01	< 0.01		< 0.2	0.5	2	25
Barium^{U}	< 0.02	0.02		0.2	20	100	300
Cadmium^{U}	< 0.0005	< 0.0005		< 0.02	0.04	1	5
Chromium^{U}	0.053	0.014		< 0.20	0.5	10	70
Copper^{U}	0.02	< 0.01		< 0.5	2	50	100
Mercury^{U}	< 0.005	< 0.005		< 0.01	0.01	0.2	2
Molybdenum^{U}	0.004	0.001		< 0.1	0.5	10	30
Nickel^{U}	< 0.007	< 0.007		< 0.2	0.4	10	40
Lead^{U}	< 0.005	< 0.005		< 0.2	0.5	10	50
Antimony^{U}	0.012	0.008		0.08	**0.06**	0.7	5
Selenium^{U}	< 0.005	< 0.005		< 0.1	0.1	0.5	7
Zinc^{U}	0.008	< 0.005		< 0.2	4	50	200
Chloride^{U}	16	4		54	800	15000	25000
Fluoride^{U}	< 0.5	< 0.5		< 1	10	150	500
Sulphate^{U}	47	15		186	1000	20000	50000
TDS	120	75		803	4000	60000	100000
Phenol Index	< 0.01	< 0.01		< 0.5	1	-	-
DOC	9.2	6.3		66	500	800	1000

Leach Test Information	
Sample Mass (kg)	0.20
Dry Matter (%)	89.7
Moisture (%)	11.6
Stage 1	
Volume Eluate L2 (litres)	0.33
Filtered Eluate VE1 (litres)	0.21

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and QTS Environmental cannot be held responsible for any discrepencies with current legislation
M Denotes MCERTS accredited test
U Denotes ISO17025 accredited test

Soil Analysis Certificate - Sample Descriptions

QTS Environmental Report No: 17-59395
Soils Ltd
Site Reference: Grange Road
Project / Job Ref: 16245
Order No: 16103
Reporting Date: 31/05/2017

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 270550	WS2	None Supplied	0.20 - 0.60	10.3	Brown sandy gravel with brick and concrete

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

Insufficient Sample $^{I/S}$

Unsuitable Sample $^{U/S}$

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

Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 17-59395
Soils Ltd
Site Reference: Grange Road
Project / Job Ref: 16245
Order No: 16103
Reporting Date: 31/05/2017

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

D **Dried**
AR **As Received**

Appendix C.2 General Assessment Criteria

HUMAN HEALTH RISK ASSESSMENT

1.1 Introduction

Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC).

GAC are conservative values adopted to ensure that they are applicable to the majority of possible contaminated site. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC derived by a third party or the Environment Agency/ DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC to ensure that they are used appropriately. Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific values for relevant soil contaminants based on the site specific conditions.

1.2 General Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'.

1.2.1 Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

- EA Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
- EA Science Report SC050021/SR3: Updated technical background to the CLEA model.
- EA CLEA Bulletin (2009).
- CLEA software version 1.04 (2009)
- Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

1. do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.
2. do not cover risks to the environment, such as groundwater, ecosystems or buildings.
3. do not provide a definitive test for telling when human health risks are significant.
4. are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.

1.3 Soil Guideline Values (2009)

The EA are publishing a series of SGV reports for a selection of common contaminants relevant to the assessment of land contamination.

SGV's are generic assessment criteria based on CLEA standard land-uses and can be used to simplify the assessment of human health risks from long-term exposure to chemical contamination in soil. They do not cover short-term exposure (i.e. construction and maintenance workers), acute exposure or other risks such as fire, suffocation or explosion, as might arise from an accumulation of gases such as methane and carbon dioxide, or either odour or aesthetic issues.

SGV's represent 'trigger values', indicators that soil concentrations above the SGV level may pose a possibility of *significant harm* to human health. The converse, where soil concentrations are less that the SGV, is that the long-term human health risks are considered to be tolerable or minimal.

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

1.4 Ongoing development of CLEA based guidance

The EA is involved in a programme of publishing SGV's and related toxicity data (the TOX reports). As at July 2009 ten SGV's and matching TOX reports had been published. Soil Assessment Criteria (SAC's) may be derived using toxicity data from the updated TOX reports, where these are published, or from the original TOX reports. SGV reports also take account of recent updates for plant uptake and other factors.

- GAC's developed by CLEA guidance and given in this report will need to be assessed against updated TOX reports and SGV's when these are published.
- SGV reports may give values that differ from the GAC's used in this report.
- These variations may materially alter the remediation requirement for the site, requiring either an increase or decrease in the extent, type and cost of remediation.

1.5 Phytotoxicity

CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

ICRCL 70/90: *Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing*.

1.6 Other Generic Assessment Criteria

If an SGV is not available for a substance identified in the soil then the range of Generic Assessment Criteria published from a collaborative research by Land Quality Management Limited (LQM) and the Chartered Institute of Environmental Health (CIEH) are used for example. In the case of Lead, Category 4 screening levels (C4SLs) have replaced the AtRisk Soil SSV.

1.6.1 EIC/AGS/CL: AIRE

The report represents the collaborative effort of risk assessors from 26 EIC and AGS member companies to produce generic assessment criteria (GAC) for soils for human health risk assessment. The project involved the collation and review of physico-chemical data, toxicological data and information on background exposure for 44 contaminants sometimes encountered on land affected by contamination in the UK and the derivation of GAC for 351 of these using the CLEA model (v1.06). The GAC are intended to complement soil guideline values (SGV) produced by the Environment Agency of England and Wales and the 2nd edition GAC produced by LQM and CIEH (Nathanail et al, 2009). All three sets of assessment criteria have been derived in general accordance with the Environment Agency of England and Wales Contaminated Land Exposure Assessment (CLEA) guidance and thus the combined efforts of these three groups have resulted in a useful set of screening criteria for the assessment of risks to human health from soil contamination for more than 120 potentially contaminative substances.

1.6.2 CL: AIRE Category 4 screening levels (C4SLs) (2014)

A new statutory DEFRA guidance recently (i.e. August 2014) published some GACs with a more pragmatic (but still strongly precautionary) approach in their derivation called the Category 4 screening levels (C4SLs). These values provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land. They are intended as generic screening values, (ii) they describe a level of risk that whilst above ‘minimal’ is still ‘low’ and (iii) they provide a ‘higher simple test’ for deciding that land is suitable for use and definitely not contaminated. These values were derived for four generic land uses: residential, commercial, allotments, and public open space.

1.6.3 LQM/CIEH Suitable 4 Use Level (S4UL) (2015)

The new S4UL’s ((Nathanail *et al*, 2015), was developed for around 85 substances and are intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants. The S4ULs were:

- based on Health Criteria Values, updated to reflect changes since 2009
- derived for the standard CLEA land uses and the two public open space scenarios developed by Defra SP1010
- developed for ca 85 substances (those previously covered by the LQM/CIEH GAC and the SGV substances);
- Compliant with SR2 and the long standing principle of ‘suitable for use’ and reflecting changes to exposure parameters produced by Defra SP1010.

For derivation of these Generic Assessment Criteria reference must be made to: Nathanial, P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A., Ogden, R., Scott, D. *The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (3rd edition)*. **Land Quality Press**. 2015.

1.7 Standard Land-use Scenarios

The standard land-use scenarios used to develop conceptual exposure models are presented in the following sections:

1.7.1 Residential

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil and indoor dust ingestion, consumption of home-grown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
- Building type is a two-storey small terraced house.

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home grown vegetables will not occur.

1.7.2 Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

1.7.3 Commercial/Industrial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

1.7.4 Public Open Space within Residential Area

The generic scenario refers to any grassed area 0.05 ha and that is close to Housing.

- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil
- Predominantly used by children for playing and may be used for activities such as a football kick about
- Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply
- older children as the critical receptor on basis that they will use site most frequently (Age class 4-9)
- ingestion rate 75 mg.day^{-1}

1.7.5 *Public Open Space Park*

This generic scenario refers to any public park that is more than 0.5ha in area:

- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% cover)
- Female child age classes 1-6
- Soil ingestion rate of 50 mg.day^{-1}
- Occupancy period outdoors = 2 hours.day^{-1}
- Exposure frequency of 170 days.year-1 for age classes 2-18 and 85
- days.year^{-1} for age class 1
- Outdoor exposure pathways only (no tracking back).

1.8 Detailed Quantitative Risk Assessments (DQRA)

Where the adoption of an SGV/GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a DQRA may be undertaking to develop site specific values for relevant soil contaminants.

- Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation.
- Developing more accurate parameters using site data.

1.9 Current Criteria

Table 1 presents the current Generic Assessment Criteria and reference should be made to the original publications if needed**.**

1.10 Statistical Tests

DEFRA R&D Publication CLR 7 (DOE 1994) and CL: AIRE Category 4 screening levels (C4SLs) (2014) addressed the statistical treatment of test results and their comparison to Soil Guideline Values.

Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

The DEFRA discussion paper Assessing risks from land contamination – a proportionate approach (‘the way forward’) (CLAN06/2006) aimed to increase understanding of the role that statistics can play in quantifying the uncertainty attached to the estimates of the mean concentration of contaminants in soil. In direct response CLAIRE/CIEH published a joint report, *Guidance in comparing soil contamination data with a critical concentration* (CLAIRE/CIEH 2008). A software implementation of the statistical techniques given in the report was published by ESI International (2008).

Treatment of Hot-Spots

- A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.
- Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

Land Use				Residential With or Without Plant Uptake						Allotments			Commercial			Public Open Space (POS)								
				With home-grown produce			Without home-grown produce									Residential			Park					
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
Type	Contaminants	Species	Year																			Name	Authority	Date
	Antimony		2010						550						7500							EIC/AGS/ CL:AIRE	EIC/AGS/ CL:AIRE	2010
Metals	Arsenic		2014			37			40			49			640			79			168	C4SL	DEFRA	2014
			2015			37			40			40			640			79			170	S4UL	LQM/CIEH	2015
	Beryllium		2015			1.7			1.7			35			12			2.2			63	S4UL	LQM/CIEH	2015
	Boron		2015			290			11000			45			240000			21000			46000	S4UL	LQM/CIEH	2015
	Cadmium		2015			11			85			1.9			190			120			532	S4UL	LQM/CIEH	2015
			2014			26			149			4.9			410			220			880	C4SL	DEFRA	2014
	Chromium	III	2015			910			910			18000			8600			1500			33000	S4UL	LQM/CIEH	2015
		VI	2014			21			21			170			49			23			250	C4SL	DEFRA	2014
		VI	2015			6			6			1.8			33			7.7			220	S4UL	LQM/CIEH	2015
	Copper		2015			2400			7100			520			68000			12000			44000	S4UL	LQM/CIEH	2015
	Lead					200			310			80			2330			630			1300	C4SL	DEFRA	2014
	Mercury	Elemental	2012			1.0			1.0			26			26							SGV	DEFRA	2012
			2015			1.2			1.2			21			58			16			30	S4UL	LQM/CIEH	2015
		Inorganic	2012			170			170			80			36000							SGV	DEFRA	2012
			2015			40			56			19			1100			120			240	S4UL	LQM/CIEH	2015
		Methyl	2012			11			11			8			410							SGV	DEFRA	2012
			2015			11			15			6			320			40			68	S4UL	LQM/CIEH	2015
	Nickel		2012			130			130			230			1800							SGV	DEFRA	2012
			2015			130			180			53			980			230			800	S4UL	LQM/CIEH	2015
	Selenium		2012			350			350			120			13000							SGV	DEFRA	2012
			2015			250			430			88			12000			1100			1800	S4UL	LQM/CIEH	2015
	Vanadium		2015			410			1200			91			9000			2000			5000	S4UL	LQM/CIEH	2015
	Zinc		2015			3700			40000			620			730000			81000			170000	S4UL	LQM/CIEH	2015
BTEX & MTBE	Benzene		2012			0.33			0.33			0.07			95							SGV	DEFRA	2012
			2014			0.87			3.3			0.18			98			140			230	C4SL	DEFRA	2014
			2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	S4UL	LQM/CIEH	2015
	Toluene		2012			610			610			120			4400							SGV	DEFRA	2012
			2015	130	290	660	880	1900	3900	22	51	120	65000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015
	Ethylbenzene		2012			350			350			90			2800							SGV	DEFRA	2012
			2015	47	110	260	83	190	440	16	39	91	4700	13000	27000	24000	24000	25000	17000	22000	27000	S4UL	LQM/CIEH	2015
	Xylenes	o-xylene	2012			250			250			160			2600							SGV	DEFRA	2012
			2015	60	140	330	88	210	480	28	67	160	6600	15000	33000	41000	42000	43000	17000	24000	33000	S4UL	LQM/CIEH	2015
		m-xylene	2012			240			240			180			3500							SGV	DEFRA	2012
			2015	59	140	320	82	190	450	31	74	170	6200	14000	31000	41000	42000	43000	17000	24000	32000	S4UL	LQM/CIEH	2015
		p-xylene	2012			230			230			160			3200							SGV	DEFRA	2012
			2015	56	130	310	79	180	310	29	69	160	5900	14000	30000	41000	42000	43000	17000	23000	31000	S4UL	LQM/CIEH	2015
Petroleum Hydrocarbons Fractions	Aliphatic >C5 - C6		2015	42	78	160	42	78	160	730	1700	3900	3200	5900	12000	570000	590000	600000	95000	130000	180000	S4UL	LQM/CIEH	2015
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	7800	17000	40000	600000	610000	620000	150000	220000	320000	S4UL	LQM/CIEH	2015
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	2000	4800	11000	13000	13000	13000	14000	18000	21000	S4UL	LQM/CIEH	2015
	Aliphatic >C10 - C12		2015	130	330	760	130	330	770	2200	4400	7300	9700	23000	47000	13000	13000	13000	21000	23000	24000	S4UL	LQM/CIEH	2015
	Aliphatic >C12 - C16		2015	1100	2400	4300	1100	2400	4400	11000	13000	13000	59000	82000	90000	13000	13000	13000	25000	25000	26000	S4UL	LQM/CIEH	2015
	Aliphatic >C16 - C35		2015	65000	92000	110000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aliphatic >C35 - C44		2015	65000	92000	140000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aromatic >C5 - C7		2015	70	140	300	370	690	1400	13	27	57	26000	46000	86000	56000	56000	56000	76000	84000	92000	S4UL	LQM/CIEH	2015
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	56000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	3500	8100	17000	5000	5000	5000	7200	8500	9300	S4UL	LQM/CIEH	2015
	Aromatic >C10 - C12		2015	74	180	380	250	590	1200	13	31	74	16000	28000	34000	5000	5000	5000	9200	9700	10000	S4UL	LQM/CIEH	2015
	Aromatic >C12 - C16		2015	140	330	660	1800	2300	2500	23	57	130	36000	37000	38000	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015
	Aromatic >C16 - C21		2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015

Land Use			Residential With or Without Plant Uptake						Allotments			Commercial			Public Open Space (POS)								
			With home-grown produce			Without home-grown produce									Residential			Park					
		SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	Name	Authority	Date
Type	Contaminants Species	Year																					
	Aromatic >C21 - C35	2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aromatic >C34 - C44	2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aliphatic + Aromatic >C44 - C70		1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
Polycyclic Aromatic Hydrocarbons (PAH's) (mg/kg)	Acenaphthene	2015	210	510	1100	*3000*	*4700*	*6000*	34	85	200	*84000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Acenaphthylene	2015	170	420	920	*2900*	*4600*	*6000*	28	69	160	*83000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Anthracene	2015	2400	5400	11000	*31000*	*35000*	*37000*	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015
	Benzo(a)anthracene	2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015
	Benzo(a)pyrene	2014			5			5.3			5.7			76			10			21	C4SL	DEFRA	2014
		2015	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015
	Benzo(b)fluoranthene	2015	2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015
	Benzo(ghi)perylene	2015	320	340	250	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	S4UL	LQM/CIEH	2015
	Benzo(k)fluoranthene	2015	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	S4UL	LQM/CIEH	2015
	Chrysene	2015	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	S4UL	LQM/CIEH	2015
	Dibenz(a,h)anthracene	2015	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	S4UL	LQM/CIEH	2015
	Fluoranthene	2015	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015
	Fluorene	2015	170	400	860	*2800*	*3800*	*4500*	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015
	Indeno(1,2,3-cd)pyrene	2015	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015
	Naphthalene	2015	2.3	5.6	13	2.3	5.6	13	4.1	10	24	*190*	*460*	*1100*	4900	4900	4900	*1200*	*1900*	*3000*	S4UL	LQM/CIEH	2015
	Phenanthrene	2015	95	220	440	*1300*	*1500*	*1500*	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015
	Pyrene	2015	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	4700	15000	15000	15000	S4UL	LQM/CIEH	2015
	Coal Tar(Bap as surrogate matter)	2015	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015
Chloroalkanes & alkenes	1,2 Dichloroethane	2015	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015
	1,1,1 Trichloroethane	2015	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	*140000*	*57000*	*76000*	*100000*	S4UL	LQM/CIEH	2015
	1,1,2,2 Tetrachloroethane	2015	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015
	1,1,1,2 Tetrachloroethane	2015	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015
	Tetrachloroethene	2015	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	*810*	*1100*	1500	S4UL	LQM/CIEH	2015
	Tetrachloromethane (Carbon Tetrachloride)	2015	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015
	Trichloroethene	2015	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015
	Trichloromethane	2015	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015
	Vinyl Chloride (cloroethene)	2015	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015
Explosives	2,4,6 Trinitrotoluene	2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)	2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)	2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	*23000*	*23000*	*24000*	S4UL	LQM/CIEH	2015
Pesticides	Aldrin	2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015
	Dieldrin	2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015
	Atrazine	2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015
	Dichlorvos	2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015
	Alpha - Endosulfan	2015	7.4	18	41	*160*	*280*	*410*	1.2	2.9	6.8	*5600*	*7400*	*8400*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Beta - Endosulfan	2015	7	17	39	*190*	*320*	*440*	1.1	2.7	6.4	*6300*	*7800*	*8700*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Alpha -Hexachlorocyclohexanes	2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015
	Beta -Hexachlorocyclohexanes	2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015
	Gamma -Hexachlorocyclohexanes	2015	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	S4UL	LQM/CIEH	2015
Chlorobenzenes	Chlorobenzene	2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	*1300*	*2000*	*2900*	S4UL	LQM/CIEH	2015
	1,2-Dichlorobenzene	2015	23	55	130	24	57	130	94	230	540	*2000*	*4800*	*11000*	90000	95000	98000	*24000*	*36000*	*51000*	S4UL	LQM/CIEH	2015
	1,3-Dichlorobenzene	2015	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	S4UL	LQM/CIEH	2015
	1,4-Dichlorobenzene	2015	61	150	350	61	150	350	15	37	88	*4400*	*10000*	*25000*	17000	17000	1700	*36000*	*36000*	*36000*	S4UL	LQM/CIEH	2015
	1,2,3,-Trichlorobenzene	2015	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	*770*	*1100*	*1600*	S4UL	LQM/CIEH	2015
	1,2,4,-Trichlorobenzene	2015	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	*1700*	*2600*	*4000*	S4UL	LQM/CIEH	2015
	1,3,5,-Trichlorobenzene	2015	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	*380*	*580*	*860*	S4UL	LQM/CIEH	2015

Land Use				Residential With or Without Plant Uptake						Allotments			Commercial			Public Open Space (POS)								
				With home-grown produce			Without home-grown produce									Residential			Park					
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	Name	Authority	Date
Type	Contaminants	Species	Year																					
	1,2,3,4,-Tetrachlorobenzene		2015	15	36	78	24	56	120	4.4	11	26	1700	3080	4400	830	830	830	*1500*	*1600*	*1600*	S4UL	LQM/CIEH	2015
	1,2,3,5,- Tetrachlobenzene		2015	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	*49*	*120*	*240*	78	79	79	*110*	*120*	*130*	S4UL	LQM/CIEH	2015
	1,2,4, 5,- Tetrachlobenzene		2015	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	*42*	*72*	*96*	13	13	13	25	26	26	S4UL	LQM/CIEH	2015
	Pentachlrobenzene		2015	5.8	12	22	19	30	38	1.2	3.1	7	*640*	*770*	*830*	100	100	100	190	190	190	S4UL	LQM/CIEH	2015
	Hexachlorobenzene		2015	*1.8*	*3.3*	4.9	*4.1*	*5.7*	*6.7*	0.47	1.1	2.5	*110*	120	120	16	16	16	30	30	30	S4UL	LQM/CIEH	2015
Phenols & Chlorophenols																								
	Phenols		2012			420			420			280			*3200*							SGV	DEFRA	2012
			2015	120	200	380	440	690	1200	23	42	83	*440*	*690*	*1300*	*440*	*690*	*1300*	*440*	*690*	*1300*	S4UL	LQM/CIEH	2015
	Chlorophenols (4 Congeners)		2015	0.87	2	4.5	94	150	210	0.13	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	S4UL	LQM/CIEH	2015
	Pentachlorophenols		2015	0.22	0.52	1.2	27	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	S4UL	LQM/CIEH	2015
Others	Carbon Disulphide		2015	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	S4UL	LQM/CIEH	2015
	Hexachloro-1,3-Butadiene		2015	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	S4UL	LQM/CIEH	2015
	Sum of PCDDs, PCDFs and dioxin-like PCB's.		2012			8			8			8			240							SGV	DEFRA	2012

NOTE

Priority	Guideline (mg kg $^{-1}$)
1	Site Specific Assessment Criteria (SSAC) (Soils Limited)
2	2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014)
3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)
4	2015: Suitable 4 Use Level (S4UL) (Nathanail *et al*, 2015)
	For Generic Risk Assessment, the values in Bold have priority

Appendix C.3 Determination of Hazardous Waste Classification

Software such as the HazWasteOnline produced Hazardous Waste Classification Tool, enables soils ‘total’ chemical testing data to be used to identify the classification of waste soils in accordance with Environment Agency guidance. The HazWasteOnline Hazardous Waste Classification Tool was designed primarily for the classification of soil wastes as identified by the European Waste Catalogue (EWC) Chapter 17 - Construction and demolition wastes (including contaminated soils).

The classification of waste as either hazardous or non-hazardous must be conducted in accordance with the 2003 Environment Agency publication Interpretation of the Definition and Classification of Hazardous Waste (Technical Guidance WM2). This establishes the regulatory framework and allows classification of wastes based on their various risk phrases. Additional guidance provided by the 2007 Environment Agency publication ‘How to Find Out if Waste Oil and Wastes that Contain Oil Are Hazardous’ (HWR08) provides further clarification on the classification methodology for hydrocarbon contamination.

As part of the Hazardous Waste Classification process, contaminant compounds are selected based on historical and contemporary land-use. The inclusion of such data on the input form enables the correct waste classification to be determined. For example, in cases of land associated with former gasworks, the classification of coal-tar contaminated soils can be partially determined using total PAH concentrations as opposed to TPH concentrations as coal-tar may be deemed a “substance”. Hazardous (HWR08) provides further clarification on the classification methodology for hydrocarbon contamination.

Appendix D Information Provided by the Client

NOTES

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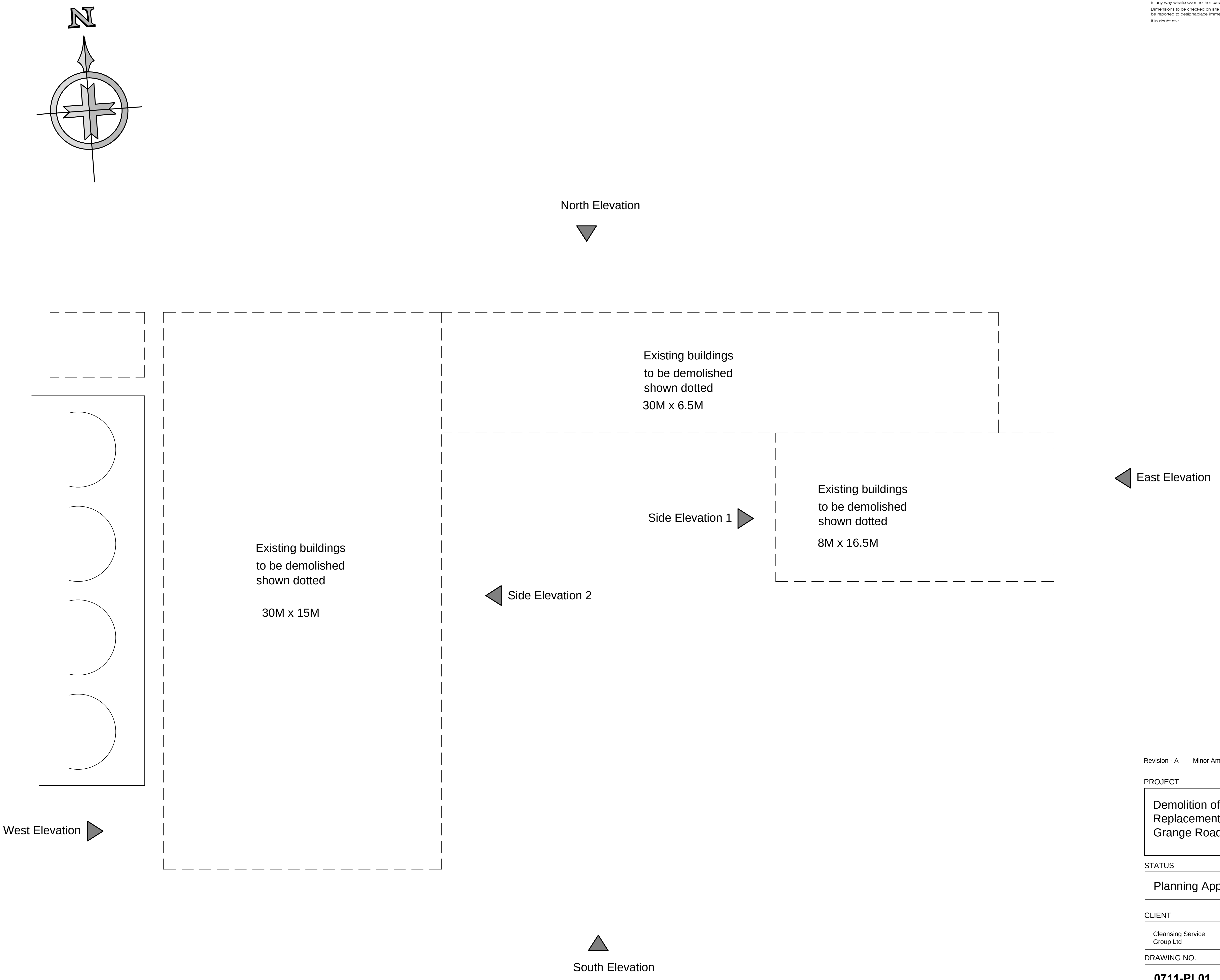
Dimensions to be checked on site prior to commencing any work. Any discrepancies should be reported to designaplace immediately.

If in doubt ask.



Revision - A Minor Amendment 09-11-16 MA

PROJECT

Demolition of existing 3 Buildings and
Replacement with 2 New Buildings.
Grange Road, Hedge End. SO30 2GD

STATUS

Planning Application

CLIENT	TITLE
Cleansing Service Group Ltd	Part of Site Plan - Existing

DRAWING NO.	REVISION
0711-PL01	**A**

SCALES	DATE	DRAWN
1/200 @A3	Nov 16	MA

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Architectural Design + Planning
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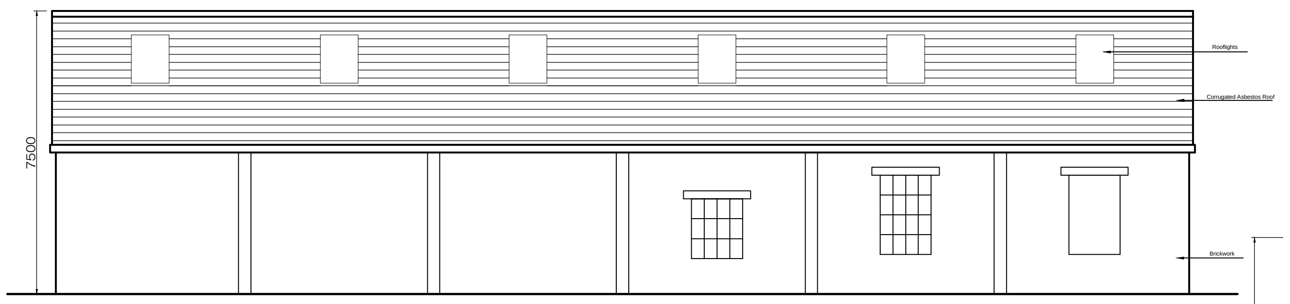
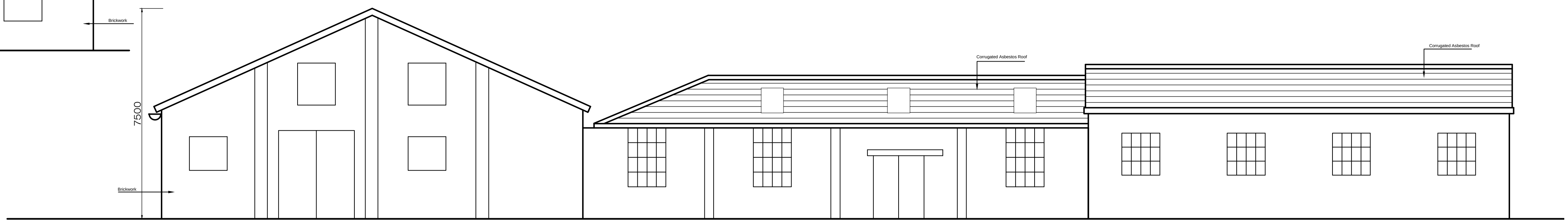
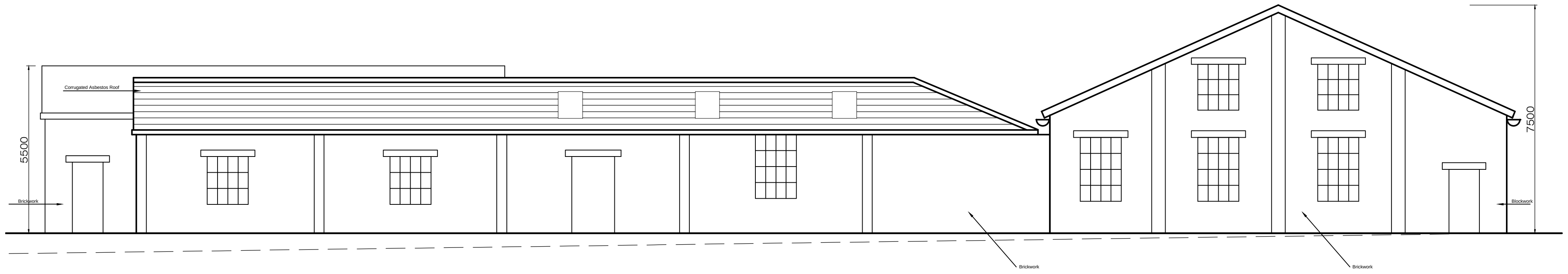


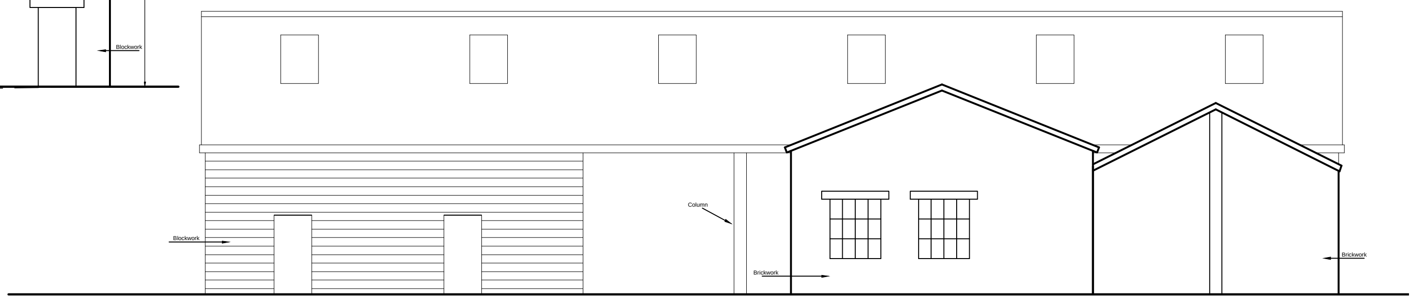
WEST ELEVATION



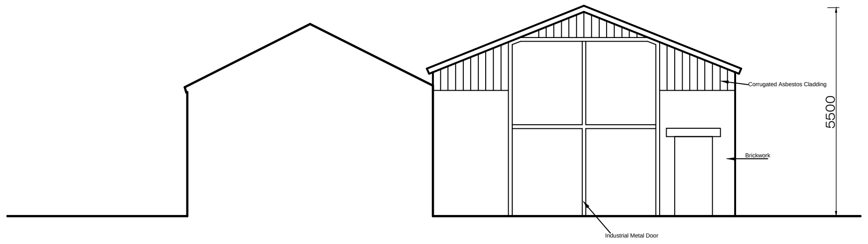
SOUTH ELEVATION



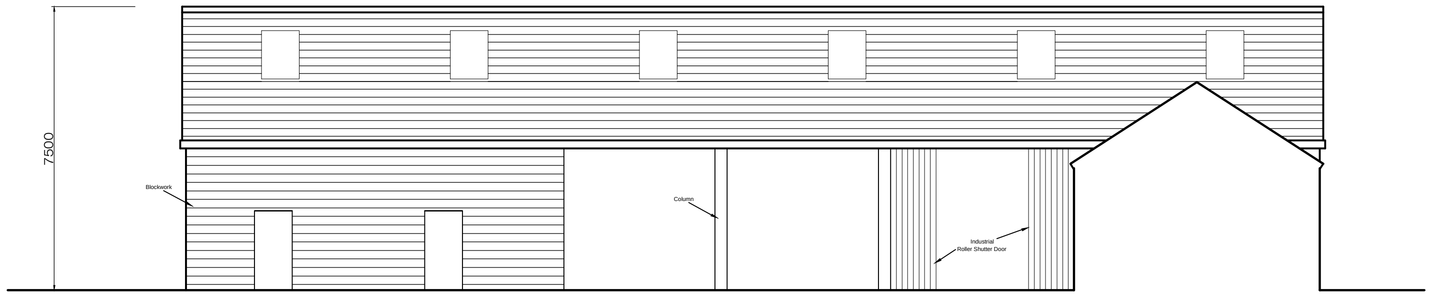
NORTH ELEVATION



EAST ELEVATION



SIDE ELEVATION - 1



SIDE ELEVATION - 2

Revision - A	Minor Amendment	09-11-16	MA

PROJECT

Demolition of existing 3 Buildings and
Replacement with 2 New Buildings.
Grange Road, Hedge End. SO30 2GD

STATUS

Planning Application

CLIENT
Cleansing Service
Group Ltd

TITLE
Part of Site Plan - Existing Elevations

DRAWING NO.
0711-PL02

REVISION
A

SCALES
1/200 @A3

DATE
Nov 16

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MA

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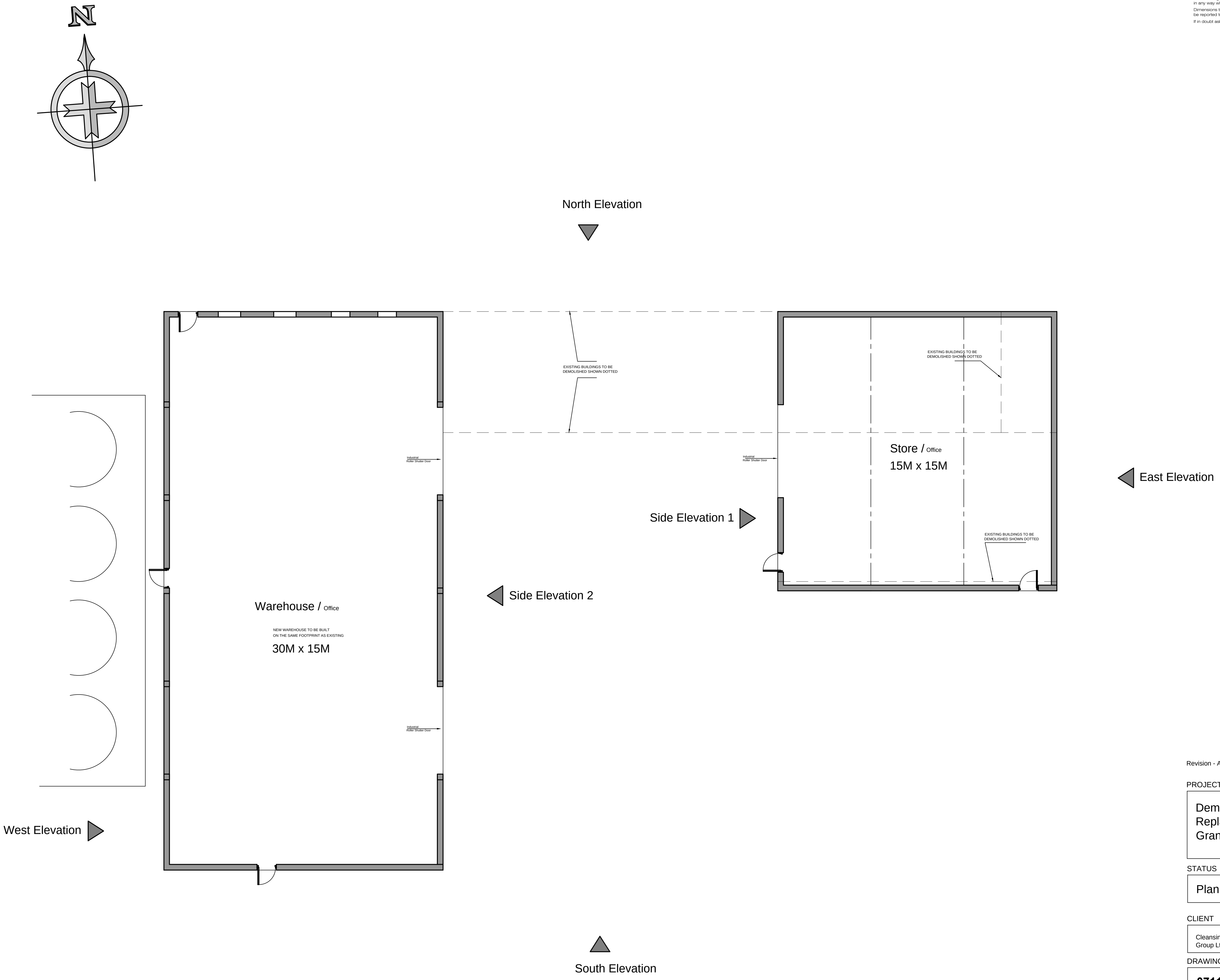

Revision - A	Minor Amendment	09-11-16	MA

PROJECT

Demolition of existing 3 Buildings and
Replacement with 2 New Buildings.
Grange Road, Hedge End. SO30 2GD

STATUS

Planning Application

CLIENT	TITLE
Cleansing Service Group Ltd	Part of Site Plan - Proposed

DRAWING NO.	REVISION
0711-PL03	**A**

SCALES	DATE	DRAWN
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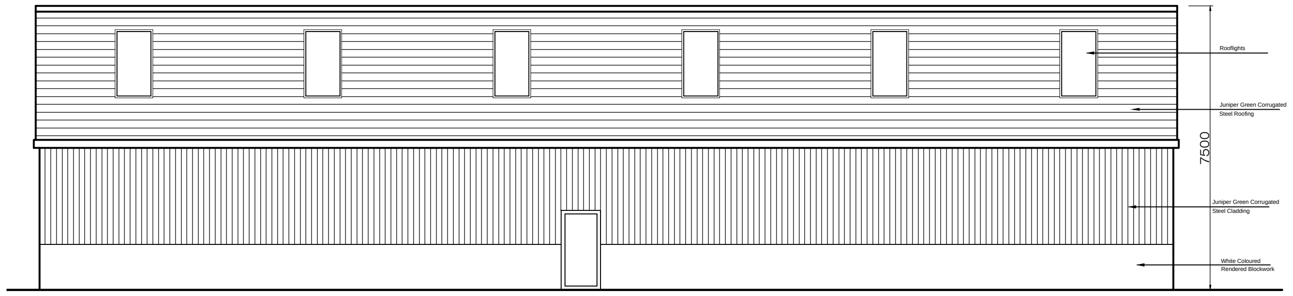
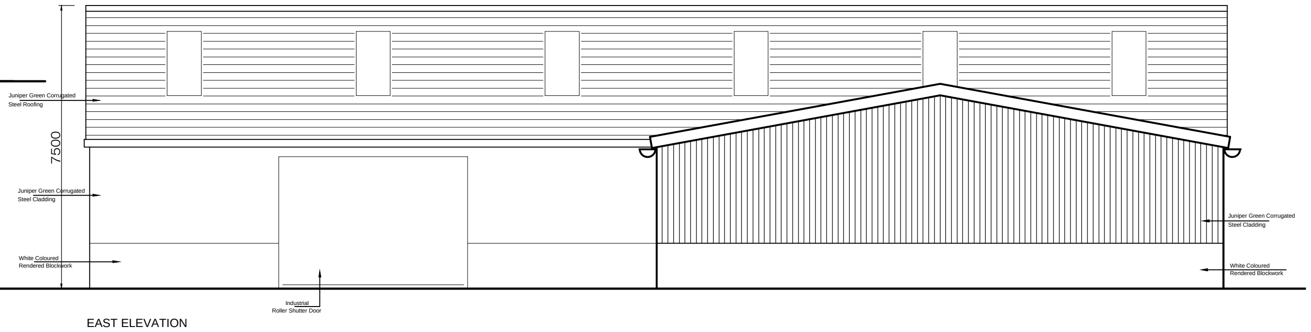


WEST ELEVATION

SOUTH ELEVATION

NORTH ELEVATION



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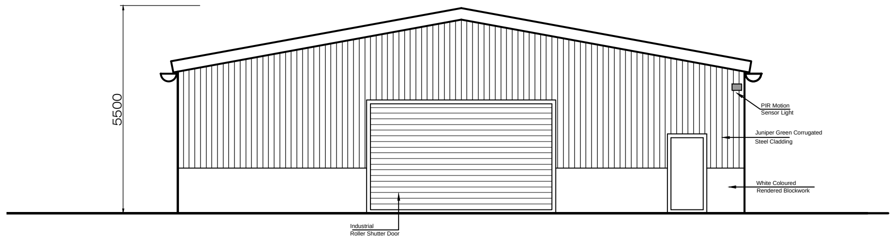
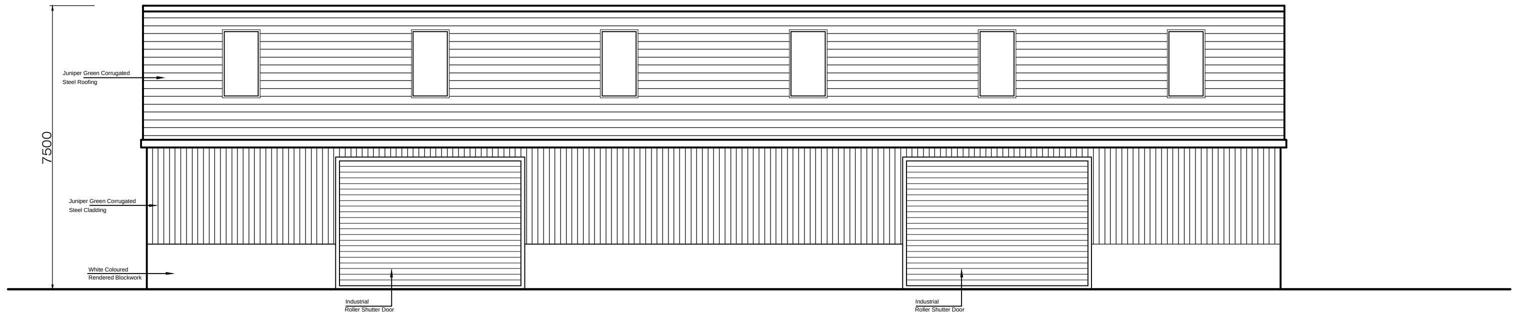


SIDE ELEVATION - 1



SIDE ELEVATION - 2

Revision - A Minor Amendment 09-11-16 MA

PROJECT

Demolition of existing 3 Buildings and
Replacement with 2 New Buildings.
Grange Road, Hedge End. SO30 2GD

STATUS

Planning Application

CLIENT	TITLE
Cleansing Service Group Ltd	Part of Site Plan - Proposed Elevations

DRAWING NO.	REVISION
0711-PL04	**A**

SCALES	DATE	DRAWN
1/200 @A3	Nov 16	MA

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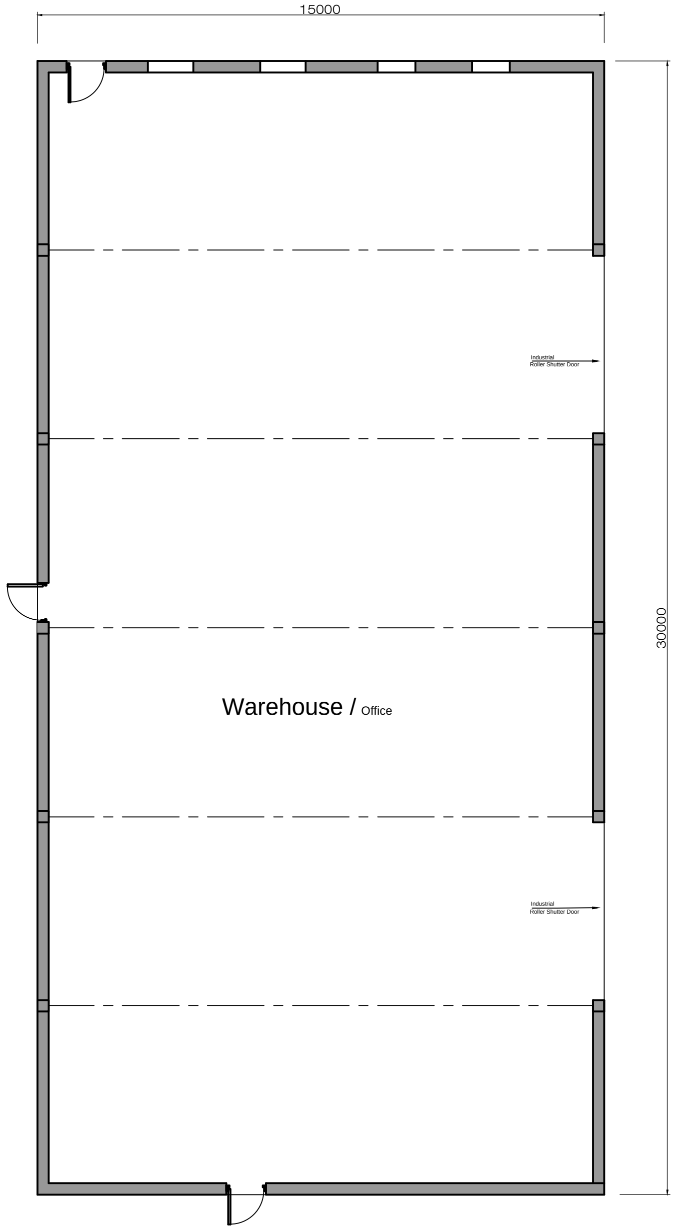
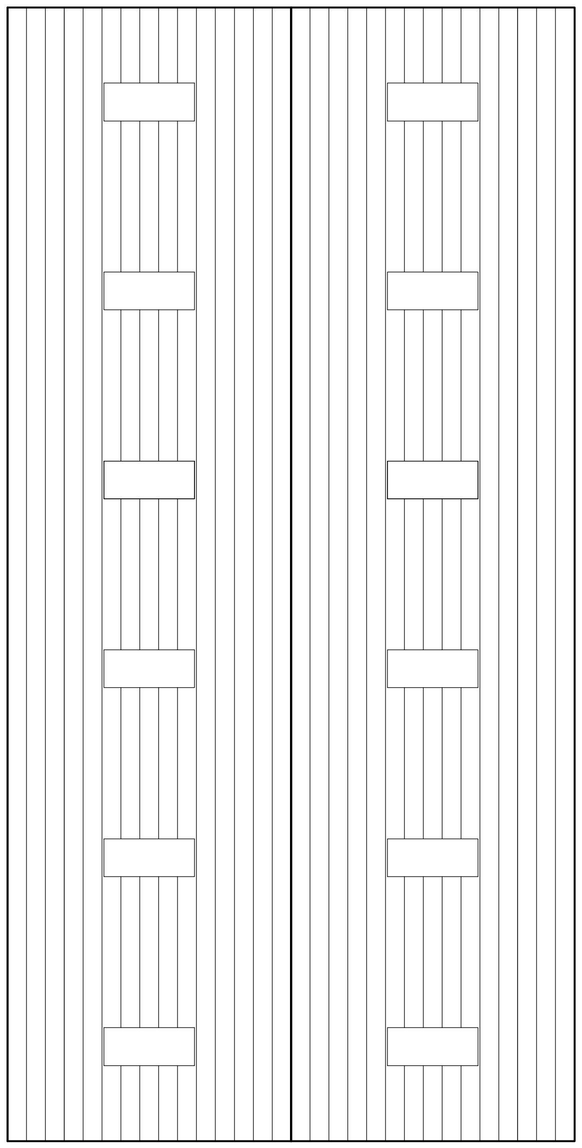


FLOOR PLAN



ROOF PLAN

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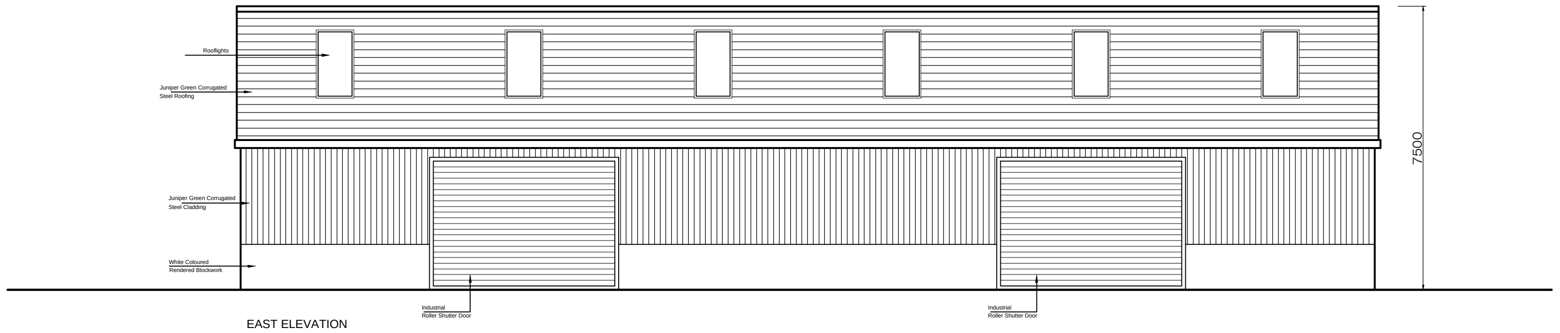

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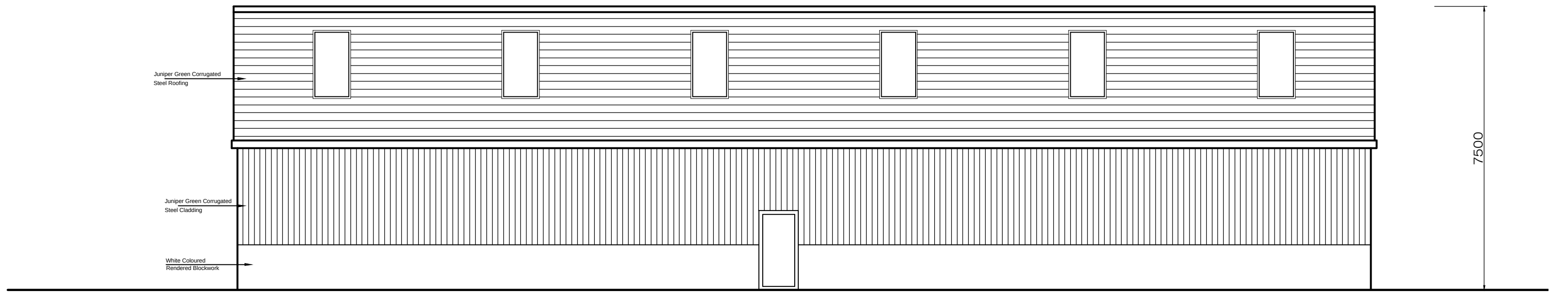
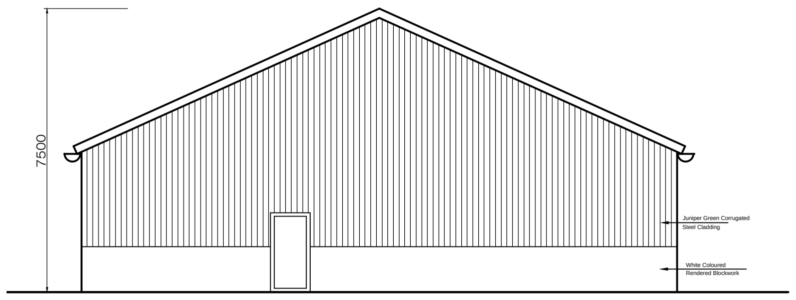
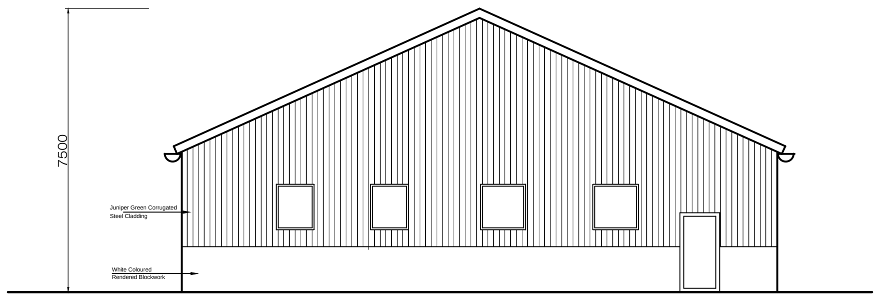


WEST ELEVATION



SOUTH ELEVATION



NORTH ELEVATION

Revision - A Minor Amendment 09-11-16 MA

PROJECT

Demolition of existing 3 Buildings and
Replacement with 2 New Buildings.
Grange Road, Hedge End. SO30 2GD

STATUS

Planning Application

CLIENT
Cleansing Service
Group Ltd

TITLE
Warehouse - Plans / Elevations
(Proposed)

DRAWING NO.
0711-PL05

REVISION
A

SCALES
1/200 @A3

DATE
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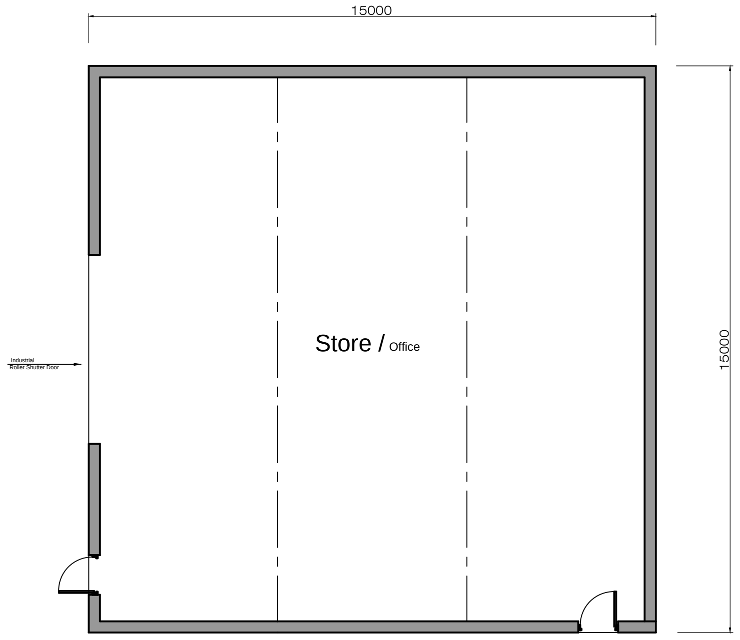
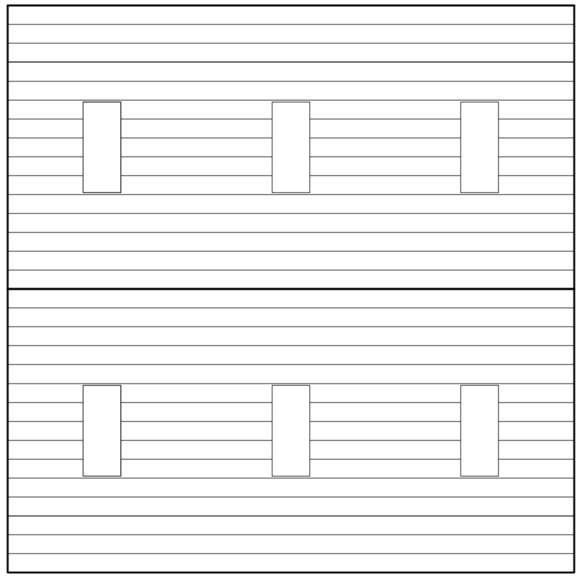
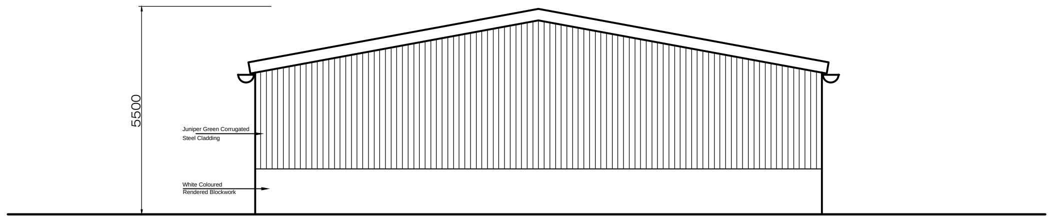


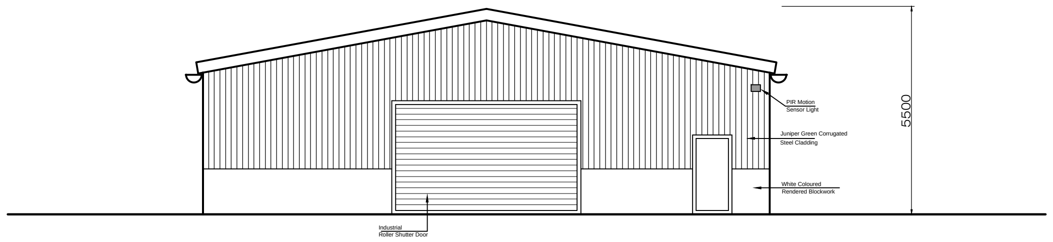
FLOOR PLAN



ROOF PLAN



EAST ELEVATION



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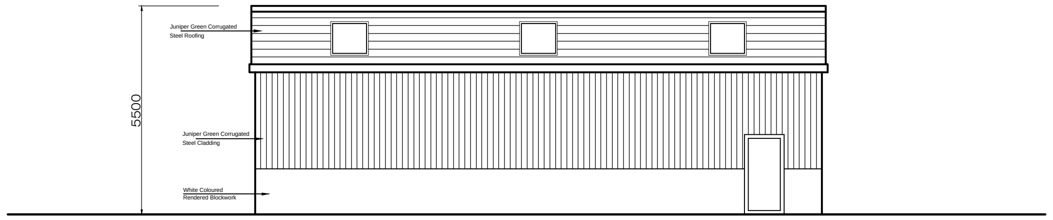

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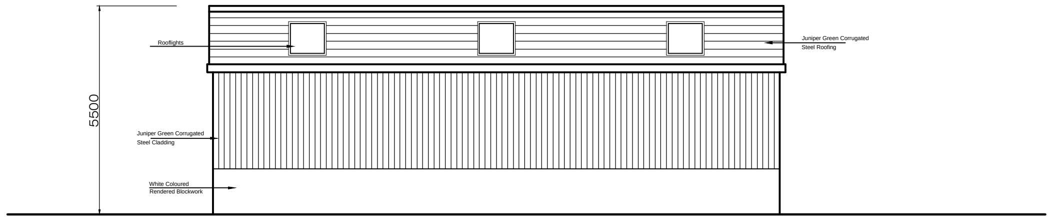

NORTH ELEVATION

Revision - A Minor Amendment 09-11-16 MA

PROJECT

Demolition of existing 3 Buildings and
Replacement with 2 New Buildings.
Grange Road, Hedge End. SO30 2GD

STATUS

Planning Application

CLIENT	TITLE
Cleansing Service Group Ltd	Store - Plans / Elevations (Proposed)

DRAWING NO.	REVISION
0711-PL06	**A**

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