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PHASE 2: GROUND INVESTIGATION REPORT

ABACUS STONE SALES LTD

LAND OFF STATION ROAD

MELTHAM

HUDDERSFIELD

Project No: 16-273

Prepared By:

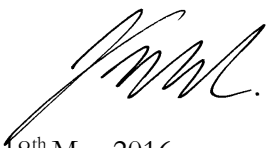
Matt Bradford



Date: 18th May 2016

Approved By:

Kevin Moir



Date: 18th May 2016

The information and/or advice contained in this Phase 2: Ground Investigation Report is based solely on, and is limited to, the boundaries of the site, the immediate area around the site, and the historical use(s) unless otherwise stated. This 'Report' has been prepared in order to collate information relating to the physical, environmental and industrial setting of the site, and to highlight, where possible, the likely problems that might be encountered when considering the future development of this site for the proposed end use. All comments, opinions, diagrams, cross sections and/or sketches contained within the report, and/or any configuration of the findings is conjectural and given for guidance only and confirmation of the anticipated ground conditions should be considered before development proceeds. Agreement for the use or copying of this report by any Third Party must be obtained in writing from Arc Environmental Limited (ARC). If a change in the proposed land use is envisaged, then a reassessment of the site should be carried out.

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APPENDICES

Appendix I	**Location Plan, Aerial Photograph, Proposed and Existing Plans**
Appendix II	**Trial Pit Location Plan, Trial Pit Record Sheets & Soakaway Calculation Sheets**
Appendix III	**Laboratory Results (Geotechnical & Ground Contamination)**
Appendix IV	**Ground Contamination Risk Assessment Data: Methodology & Notes for Off-Site Disposal**

1.0 Introduction May 2016

As requested by One17Design, on behalf of Abacus Stone Sales Ltd, and in conjunction with a Phase 1: Desk Top Study, completed by Arc Environmental (ref 15-154, July 2015) and which incorporated this part of the site, Phase 2 Ground Investigation works have been carried out by Arc Environmental Ltd. on a sloping area of land to the north of Station Road in Meltham. It is proposed to construct four residential properties with associated soft and hard landscaped areas.

The intrusive investigation works comprised the excavation of 4 no. machine excavated trial pits (labelled TP's 1 - 4). The investigation locations can be seen on the Trial Pit Location Plan, a copy of which is included in Appendix II. It should be noted that the plan should be used for orientating purposes only, as the location of the positions are approximate and the plan is not to a standard scale.

2.0 Site Details

Table 2.1

Site Name & Address:	Proposed New Residential Development, Land Off Station Road, Meltham, Huddersfield.
National Grid Reference:	410606, 411029 (approximate centre of site).
Description of Location:	The site comprises an undeveloped field, lying to the north of Station Road, to the NW of Meltham
Site Boundaries:	The site is surrounded by open fields with Station Road bounding the site to the south.
Site Shape & Development Details:	The site is irregular in shape where it is proposed to develop 4 new residential properties on the existing sloping site.
Site Surfacing:	The site surfacing comprises grass.
Above Ground Structures:	No above ground structures present.
Sub-surface Structures & Services:	Current services are not likely to be present below the development area.

N = north, S = south, etc.

3.0 Scope of Works

Table 3.1

Client:	Abacus Stone Sales Ltd.
Consultant:	One17Design.
Project type:	Proposed new residential development with associated soft and hard landscaped areas.
Site Location plan:	See Appendix I.
Layout plan (existing):	See Appendix I.
Layout plan (proposed):	See Appendix I.
Reporting:	Factual & Interpretative.
Intrusive Investigation Works:	4 no. machine excavated trial pits (TP's 1 - 4).
Laboratory Testing:	Geotechnical and Ground Contamination.
CLEA Classification:	*Residential - with home grown produce.*

The information contained in this report is limited to the boundary of the site as indicated on the Existing Site Plan shown in Appendix I. When considering the full scope of the development any features and / or issues not specifically mentioned in this report cannot be assumed to have been covered.

4.0 Investigation Rationale

This ground investigation has been designed to provide information on the general ground and groundwater conditions where access would allow, within the boundaries of the site. The rationale behind the location of each exploratory hole is summarised in Table 4.1 on the following page.

4.0 Investigation Rationale (Cont'd)

Table 4.1

Potential issue	Exploratory hole
Determine the nature of the underlying shallow ground conditions, including shallow groundwater.	TP's 1 - 4
Assessment of ground conditions for the management of surface water.	TP's 1 & 4
Determine the levels of contamination present within the initial soil deposits with a view to determining the risks posed towards the future site end-users and Controlled Waters.	TP's 1 - 4

4.1 Contamination Related Sampling & Site Protocols:-

All works associated with this ground contamination assessment and investigations have generally been completed in accordance with BS10175: British Standard Code of Practice for the Investigation of Potentially Contaminated Sites (2011) & CLR11, with the following precautions specific to this project.

4.1.1 Ground Contamination Sampling:-

Samples were recovered by a representative of ARC Environmental Ltd. during the intrusive investigation works. All samples were stored at approximately 4°C using cool boxes and ice packs prior to delivery to a UKAS/MCERTS accredited laboratory. Sampling was carried out in accordance with 'Technical Policy Statement 63: UKAS Policy on Deviating Samples'.

4.1.2 Avoiding Cross-Contamination between Sample Locations:-

To avoid cross-contamination of materials between soil horizons, the samples were recovered manually using dedicated disposable plastic gloves, replaced between each sample recovery with the equipment being cleaned between each investigation position.

5.0 Ground Conditions

For an accurate description of the ground conditions encountered at each investigation position, reference should be made to the trial pit record sheets attached in Appendix II. It should be noted that there is always the possibility of variation in the ground conditions around and between the trial pit locations.

5.1 Soil Profile:-

A summary of the soil profile for this site can be seen in Table 5.1 below.

Table 5.1 BGL = Below ground level.

Type of Strata	Depths Recorded (BGL)	Description & General Comments
TOPSOIL:	From Ground Level to c.0.20m	Turf over topsoil comprising black sandy gravelly clayey soil was encountered across the site.
RESIDUAL SOIL:	From c.0.20m to c.0.40m and c.0.60m	Natural residual soil deposits were encountered across the site comprising brown clayey gravelly SAND. The gravel comprised sandstone with cobbles noted.
SOLID GEOLOGY: (Millstone Grit))	From c.0.40m and c.0.60m to c.>1.60m	Solid deposits were encountered below the site comprising brown weathered SANDSTONE becoming less weathered with depth. This was recovered as sandy gravel with many cobbles and boulders.

5.0 Ground Conditions (Cont'd)

5.1 Soil Profile (Cont'd):-

As anticipated from the lack of historic contaminative land uses highlighted in the Phase 1: Desk Top Study, made ground was not encountered on site with topsoil encountered in all exploratory positions. There was no visual or olfactory evidence of significant or 'gross' contamination (fuel, oils or asbestos) noted at the surface or below the site during the ground investigation works.

5.2 Shallow Coal Mining Assessment:-

The Coal Mining Risk Assessment undertaken as part of the Phase 1: Desk Top Study Report concluded that risks from unrecorded shallow mining are not present at the site and mitigation measures to deal with ground instability in advance of site development are not required.

5.3 Groundwater:-

All the investigation positions remained 'dry' during the period of the investigation, with no water encountered within any of the positions. Shallow groundwater is not anticipated to be present below this site within the topsoil, residual soil or solid geology, although locally some pockets of trapped surface water may be present, particularly after periods of heavy rain, and this should be taken into account when considering the construction process for the proposed development.

As such it would be prudent to allow for the introduction of temporary groundwater control techniques (i.e. sump pumping), in order to take care of any localised ingresses of groundwater, during the construction period, especially during the wetter periods of the year and particularly given the sloping nature of the site.

6.0 Insitu Testing & Sampling

6.1 Insitu Equivalent California Bearing Ratio (CBR) Tests:-

Insitu equivalent CBR tests were carried out using a MEXE Cone Penetrometer, in accordance with the manufacturer's instructions, in order to estimate the insitu CBR values of the initial residual soil deposits, noted within the trial pits. In each case a series of tests were carried out and an average of the results noted can been seen on the graphic trial pit record sheets, adjacent to the appropriate sample level.

In summary, from the results of the tests completed, CBR values ranging from 1.2% to 1.3% were recorded. Therefore, where the initial residual soil deposits are to be used as an undisturbed subgrade, it is felt that a characteristic design CBR value of 1.0% should be taken.

6.2 Insitu Soakaway Tests:-

Insitu soakaway tests were completed at the location of TP's 1 & 4, generally in accordance with BRE 365: Soakaway Design, to assess the suitability of the sandstone deposits for utilising soakaways. The test pits were excavated to a depth of c.1.50m and c.1.60m respectively below current ground levels and were filled with water and monitored for water level versus time (at close intervals). The water was supplied from a large self driven water bowser and pumped into the test pits at a rapid rate to ensure the pits were filled within a short period of time. The pits were filled for c.1 minute and filled to levels of between c.1.20m and c.1.30m below current ground levels. The time (in seconds) was then observed for water to soakaway from 75% to 25% effective depth, and this result was used to calculate to soil infiltration rate (f) for these materials.

The soakaway calculation sheets can be seen attached in Appendix II. From the results of the soakaway tests completed, average infiltration rates ranging from between $7.29x10^{-3}ms^{-1}$ to $1.04x10^{-3}ms^{-1}$ for the sandstone deposits tested. From the results obtained it has been identified that the natural coarse soil deposits exhibit good drainage characteristics.

7.0 Laboratory Testing

All geotechnical testing was carried out in accordance with BS1377:1990: Parts 1-9 by Professional Soils Laboratory Limited (PSL) of Doncaster, South Yorkshire (UKAS accredited). Ground contamination was undertaken by Chemtech Environmental of Stanley, Co. Durham (UKAS & MCERTS accredited).

7.1 Determination of pH & SO_4:-

Representative samples (6 no.) of the topsoil and natural deposits recovered from across the site, were tested in order to determine their pH value and Soluble Sulphate (SO_4) levels. The results are shown in Table 7.1 below and are also contained in the Chemtech Analytical Report 59507, a copy of which is attached in Appendix III.

Table 7.1

Position	Strata	Depth (m)	pH value	SO_4 (mg/l)	Design SO_4 Class	ACEC Class
TP1	TS	0.15	6.4	16	DS-1	AC-2z
TP1	NS	1.00	6.7	<10	DS-1	AC-1
TP2	TS	0.15	6.1	21	DS-1	AC-2z
TP3	TS	0.15	6.4	15	DS-1	AC-2z
TP3	NS	0.90	6.9	<10	DS-1	AC-1
TP4	TS	0.15	6.1	16	DS-1	AC-2z

ACEC = Aggressive Chemical Environment for Concrete Site Classification for natural ground locations. TS=Topsoil & NS=Natural Strata.

From these results it can be seen that the samples tested range in pH from 6.1 to 6.9 and the amount of Soluble Sulphate present falls between <10mg/l to 21mg/l. The site can be given a classification of Class DS-1, in accordance with BRE Special Digest 1: 2005 (3rd Edition) and the procedures for determining Sulphate Classification for brownfield locations. When considering the pH values of the natural strata materials tested, and assuming the removal of the topsoil and potentially mobile groundwater, the assessment of the Aggressive Chemical Environment for Concrete (ACEC) for the site overall is AC-1.

7.2 Determination of Particle Size Distribution (PSD):-

Representative samples (3 no.) of the weathered sandstone deposits recovered from across the site, were tested in order to determine their particle size distribution (PSD) so they might be further classified.

The results of the tests are represented both graphically and numerically on the PSD results sheets, copies of which can be found in Appendix III and summarised in Table 7.2 below and also contained in the PSL Report no. PSL16/1965.

Table 7.2

Position	Depth (m)	Clay/Silt Fraction (%)	Sand Fraction (%)	Gravel Fraction (%)	Cobble Fraction (%)	Grading Characteristics	Brief Soil Description
TP2	0.80	6	11	41	42	Poorly	Sandy silty GRAVEL of cobbles
TP3	1.30	11	20	27	42	Poorly	Very sandy silty GRAVEL of cobbles
TP4	1.00	13	19	51	17	Poorly	Sandy silty GRAVEL of cobbles

From the results of the grading analysis, it can be seen that the samples tested are poorly graded and the laboratory results/descriptions generally correspond with the field descriptions of these materials.

7.0 Laboratory Testing (Cont'd)

7.3 Contamination Screening:-

Representative samples (4 no.) of the topsoil materials encountered within the trial pits were passed onto Chemtech Environmental Ltd of Stanley, Co. Durham so that generic soil contamination screening could be carried out. The results of all the testing can be found in the Chemtech Analytical Report 59507, a copy of which can be found in Appendix III.

Although no made ground was recorded within any of the sampling positions, for completeness representative samples of shallow soil (topsoil) were screened using a standard generic contamination suite (based on the current CLEA SGV listed analytes with historical additions) which is normally used to assess typical made ground (disturbed natural strata mixed with anthropogenic debris) of an unknown source.

No evidence of any fuel /oil type contamination, ashy deposits or anthropogenic debris were noted within the exploratory positions. However, for completeness, speciated PAH, speciated TPH and asbestos testing was also undertaken.

The contamination results have been used to carryout Level 1 Quantitative Human Health Risk Assessment for the ground contamination present and are discussed in Section 8.0. The total analysis carried out is summarised below:

- 4 no. soil samples screened for a generic (metals and non organics) soil suite which includes the following determinands; Arsenic, Cadmium, Chromium (III & VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, pH, and Total Organic Carbon (TOC).
- 4 no. soil samples screened for Speciated Polycyclic Aromatic Hydrocarbons (PAH's) – based on the current USEPA 16 PAH's + Benzo(j)fluoranthene.
- 4 no. soil samples screened for Speciated Total Petroleum Hydrocarbons (TPH's – 8 band suite).
- 4 no. samples screened for asbestos containing materials (ACM's).

The contamination results have been used to carryout a preliminary Level 1 Quantitative Human Health Risk Assessment for the ground contamination present, and are discussed in further detail in Section 8.0.

8.0 Level 1 Ground Contamination Risk Assessment

8.1 Methodology:-

Following completion of the contamination screening undertaken on various samples from this site, Level 1 quantitative ground contamination risk assessments have been undertaken, generally in accordance with CLR11: Model Procedures for the Management of Land Contamination. A detailed description of the Assessment Framework and Methodology used by ARC for these risk assessments can be found in Appendix IV.

This quantitative ground contamination risk assessment uses the current UK practice for assessing the risks from land contamination, which is based on the established *source-pathway-receptor* pollutant linkage methodology and 'suitable for use' approach (Part IIA, EPA 1990 - inserted through Section 57 EA 1995).

Based on the Conceptual Site Model (CSM) for this site (described further in the following Section 8.2), a site specific screening strategy for the site has been developed (see Section 8.3) and the risks from potential contaminants have been assessed for both Human Health and Controlled Waters. The results of the risk assessments can be found in Section 8.4 (Human Health) and 8.5 (Controlled Waters). Comments regarding off-site disposal can also be found in Appendix IV.

8.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

8.2 Conceptual Site Model (CSM):-

Following the results of the intrusive investigation works, a Conceptual Site Model (CSM) has been developed for this site. Table 8.1 below summarises the various contaminant sources, plausible migration pathways and potentially sensitive receptors identified for this site, assuming no remediation, additional protection measures and/or removal of the sources of contamination takes place.

8.2.1 Sources:-

As anticipated there was no significant visual or olfactory evidence of any contamination such as fuels or the like. Representative samples of the shallow soils (topsoil) encountered have been assessed using an appropriate soil screening suite normally used for generic made ground, in order to assess its suitability for re-use in a residential setting.

Table 8.1 * = Not included as part of Level 1 Human Health or Controlled Waters risk assessment

	Sources (S)		Pathways (P)		Receptors (R)
S1	Topsoil encountered across the site up to c.0.20m in thickness.	P1	Ingestion	R1	Human health (End users and construction workers)
		P2	Inhalation of indoor / outdoor air	R2	Groundwater within the Secondary A Aquifer and water course to the south.
		P3	Dermal contact	R3	Building materials*
		P4	Migration through existing services	R4	Adjacent sites
		P5	Direct contact with building materials		
		P6	Infiltration and surface runoff	R5	Flora and fauna*

8.2.2 Pathways:-

When considering the proposed end use (*Residential - with home grown produce*), and without considering treatment, removal or protection measures, there are some potential plausible pathways available for direct contact, dermal contact, ingestion, inhalation, wind (dust / particulate), volatilization, and vertical and lateral transportation below the site.

Within the CLEA Risk Assessment Model for Human Health, there are 3 exposure mediums considered for on site receptors, comprising ingestion of soil containing contaminants, inhalation of contaminated dust/vapours and dermal contact, with up to 10 no. exposure pathways considered, as shown below.

- *1. Ingestion of soil and indoor dust 2. Consumption of homegrown produce and attached soil 3. Dermal contact (indoor) 4. Dermal contact (outdoor) 5. Inhalation of dust (indoor) 6. Inhalation of dust (outdoor) 7. Inhalation of vapour (indoor) 8. Inhalation of vapour (outdoor) 9. Oral background intake 10. Inhalation background intake.*

Where the future site has hard cover and below new structures, the majority of these pathways will not be available.

When considering the potential pathways for leachate migration, where either hard cover and/or future surface water drainage systems are present, the potential effects of surface infiltration or contaminated surface water runoff will be greatly reduced.

8.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

8.2 Conceptual Site Model (CSM) (Cont'd):-

Similarly, when considering the construction work force, exposure pathways through direct contact, ingestion and dust inhalation will be available during part of the construction process, and therefore adequate PPE should be provided to protect the work force during this period.

8.2.3 Receptors:-

Within the CLEA Risk Assessment Model for Human Health, the potential receptors are assessed initially on site end use, followed by a delineation of age category (i.e. child or adult), with default settings for *Residential, Allotment* and *Public Open Space (Park)* end uses based on a child aged 0 to 6 years, *Public Open Space (Residential)* based on a child aged 3 to 9 and *Commercial* end uses based upon a working exposure period of up to 49 years (i.e. 16 to 65).

Key generic assumptions for *Residential* and *Public Open Space (Residential)* are based upon a typical residential property, consisting of a two-storey small terraced house, with private garden, and a *Commercial* end use based upon a typical commercial or light industrial property, consisting of a three-storey office building (pre-1970). No buildings are anticipated for *Allotment* or *Public Open Space (Park)* end uses.

Within the CLEA Risk Assessment Model for Human Health there are 6 no. generic end use categories presently in use, as follows;

1) Residential - with home grown produce, 2) Residential - without home grown produce, 3) Allotments, 4) Commercial
5) Public Open Space – Residential, 6) Public Open Space - Park

Therefore, for this Level 1 Risk Assessment, the best fit end use category for this site has been taken as:

1) Residential - with home grown produce

For Controlled Waters and assuming a worst case scenario, the primary receptors for the Level 1 Risk Assessment is groundwater (Secondary A Aquifer) and water course to the south of the site, although these are generally considered to be at a negligible level of risk.

8.3 Screening Strategy:-

From the results of the intrusive works, samples of the topsoil materials encountered across the site have been chosen for screening, using a generic soil suite, to reflect the more homogeneous nature of the potential contaminants within the general matrix of the topsoil encountered.

There was no visual, olfactory or analytical evidence of significant heavy or gross contamination, such as waste oils, fuels, etc. or the like found across the site. However, for completeness, representative samples have also been screened for speciated PAH, speciated TPH and asbestos.

8.4 Level 1 Human Health Risk Assessment (Soils):-

8.4.1 Human Health - Generic Contaminants:-

The generic and organic soil screening results have been assessed by comparing the maximum values recorded for each analyte to the critical concentration values chosen for this site. The results of the testing are contained in Appendix III, and the risk assessment has been summarised in Table 8.2 on the following page.

8.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

8.4 Level 1 Human Health Risk Assessment (Soils) (Cont'd):-

8.4.1 Human Health - Generic Contaminants (Cont'd):-

Table 8.2

Analyte	Critical Conc. (C_C)	No. of Samples Screened	Max. Conc. (C_M) Recorded	No. of Samples > C_C
Arsenic	37[1]	4	23	0
Cadmium	11[1]	4	0.4	0
Chromium III	910[1]	4	109	0
Chromium VI	6[1]	4	<1	0
Copper	2400[1]	4	30	0
Lead	200[2]	4	102	0
Mercury	40[1]	4	<0.5	0
Nickel	180[1]	4	15	0
Selenium	250[1]	4	1.1	0
Zinc	3700[1]	4	82	0
Cyanide	34[3]	4	<1	0
Speciated PAH's				
Acenaphthene	1100[1]	4	0.08	0
Acenaphthylene	920[1]	4	<0.01	0
Anthracene	11000[1]	4	0.21	0
Benzo(a)anthracene	13[1]	4	0.42	0
Benzo(a)pyrene	3[1]	4	0.43	0
Benzo(b)fluoranthene	3.7[1]	4	0.48	0
Benzo(ghi)perylene	350[1]	4	0.22	0
Benzo(k)fluoranthene	100[1]	4	0.22	0
Chrysene	27[1]	4	0.38	0
Dibenz(ah)anthracene	0.3[1]	4	0.06	0
Fluoranthene	890[1]	4	1.02	0
Fluorene	860[1]	4	0.06	0
Indeno(123cd)pyrene	41[1]	4	0.27	0
Naphthalene	13[1]	4	0.08	0
Phenanthrene	440[1]	4	0.76	0
Pyrene	2000[1]	4	0.91	0
Speciated TPH's				
TPH (C5-C7)	160[1]	4	<0.1	0
TPH (C7-C8)	530[1]	4	<0.1	0
TPH (C8-C10)	150[1]	4	0.1	0
TPH (C10-C12)	380[1]	4	4	0
TPH (C12-C16)	660[1]	4	6	0
TPH (C16-C21)	930[1]	4	17	0
TPH (C21-C35)	1700[1]	4	89	0
TPH (C35-C44)	1700[1]	4	14	0

[1] = LQM CIEH Suitable 4 Use Levels (S4UL Nov 2014 (Revised August 2015)) – *Residential with home grown produce 6.0% SOM*, [2] = C4SL Values (*Residential with home grown produce*), [3] = ATRISK^{SOIL} SSV, **Bold** = result exceeds critical concentration, Note = All units are mg/kg.

The results have identified the following:

- None of the maximum concentration (C_M) values exceed the chosen critical concentration (C_C) values for this site.
- When considering these results, the topsoil present across the site does not represent a significant risk to the future end users, and therefore can remain on site without any treatment and reused in proposed soft landscaped areas.

8.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

8.4 Level 1 Human Health Risk Assessment (Soils) (Cont'd):-

8.4.3 Human Health –Asbestos Screening:-

Four representative samples of the topsoil recovered from across the site were screened in order to determine the possible presence of asbestos fibres. The results have confirmed that no asbestos fibres were detected within the samples of made ground tested and therefore there is deemed to be no requirement to protect the future end users with regard to asbestos.

8.5 Level 1 Controlled Waters Risk Assessment (Leachate):-

The following hydrogeological and hydrological issues have been taken into consideration when assessing the risks towards controlled waters;

- A shallow continuous groundwater surface (water table) is not anticipated to be present below this site.
- Groundwater is anticipated at depth within the solid deposits (Secondary A Aquifer).
- The site is not located within a Source Protection Zone (SPZ).
- Low contamination results.

When taking into account the above site setting and based on the soil screening results the risk of significant contamination being present below the site and impacting groundwater is felt to be negligible and therefore no leachate screening was deemed necessary.

9.0 Conclusions & Recommendations

9.1 Ground Conditions:-

Turf over topsoil was encountered across the site comprising black sandy gravelly clayey soil to a depth of c.0.20m.

Natural residual soil deposits were encountered below the topsoil to a depth of between c.0.40m and c.0.60m and comprised brown clayey gravelly sand. The gravel comprised sandstone with cobbles.

Solid deposits were encountered below the site from c.0.40m and c.0.60m to a depth in excess of c.1.60m, comprising brown weathered sandstone, becoming less weathered with depth, and recovered as sandy gravel with many cobbles and boulders.

9.2 Groundwater:-

During the investigation works completed, no ingresses/strikes were noted with the exploratory hole locations remaining dry throughout the period of investigation, indicating an absence of a continuous shallow groundwater surface (water table) below the site.

However, it would be prudent to allow for the possible introduction of temporary groundwater control measures, i.e. pumping equipment, in order to take care of any surface water ingresses and pockets of trapped surface drainage within the topsoil and natural strata particularly during the wetter periods of the year and given the sloping nature of the site.

9.0 Conclusions & Recommendations (Cont'd)

9.2 Groundwater (Cont'd):-

From the results of the soakaway tests completed, average infiltration rates ranging from between $7.29x10^{-3}ms^{-1}$ to $1.04x10^{-3}ms^{-1}$ for the sandstone deposits tested. From the results obtained it has been identified that the natural coarse soil deposits exhibit good drainage characteristics.

9.3 Foundation Options:-

With regards to new foundations, it can be seen that in and around the area of the proposed development topsoil over residual soil was recorded to depths of between c.0.40m and c.0.60m below ground levels before natural weathered sandstone deposits were encountered.

Therefore, it is felt that strip or pad foundations should be acceptable for the proposed development, with foundations based wholly within the highly weathered sandstone, where a maximum allowable bearing pressure of c.150kN/m^2 is available at a depth of c.0.60m below finished ground levels when first encountered in its weathered condition i.e. resembling a "sandy gravel with cobbles". However, if required, a greater bearing pressure of 300kN/m^2 is available towards the base of the exploratory holes in the more competent sandstone deposits.

In addition, when considering the depths at which bedrock was encountered, although initially weathered an allowance should be made for plant & equipment capable of excavating and breaking out competent intact rock. In addition, care should be taken when excavating the rock to prevent significant "overbreak" from occurring i.e. rock breakage beyond the intended excavation lines.

The development is located on a sloping site and will generate large excavation works. The natural residual soil and sandstone deposits will be subject to deterioration if exposed to the elements over long periods of time or uncontrolled ingress of groundwater occurs into excavations, with potentially rapid failure of excavation walls before adequate support can be installed. It is therefore imperative that excavations are suitably supported and kept dry during the construction period. When considering the nature of the sandstone deposits recorded on site it is felt that a conservative value of 42° for the angle of internal friction would be a reasonable value to employ when battering back development related excavations. However, this should be reassessed on site during the creation of these excavations.

9.4 Ground Contamination:-

From the results of the contamination screening carried out, it can be seen that the topsoil materials can remain on site without representing a risk to the end users. Similarly the made ground does not represent a risk towards Controlled Waters and adjacent sites.

The results of the asbestos screening would generally suggest that the made ground materials present on-site are not contaminated with asbestos fibres, however the potential for unforeseen asbestos containing materials, may still exist and as such it would be prudent for the appointed groundworks contractor to undertake a visual inspection of all excavations and arisings to identify the possible presence of any suspicious materials.

When considering the contamination results, the levels of contaminants in the samples screened are not considered to represent a significant risk to controlled waters or adjacent sites, and as such no further treatment, removal, protection measures and/or DQRA is considered necessary in this regard.

9.0 Conclusions & Recommendations (Cont'd)

9.4 Ground Contamination (Cont'd):-

From the ground contamination assessment, further works in the form of remediation or a Remediation Strategy is not required for this site.

From the results of the pH and soluble sulphate testing, a current concrete design class of DS-1 and ACEC class of AC-1 is applicable to this site.
When considering the risks to any future maintenance or construction workforce, standard PPE should prove adequate protection against the levels of potential contaminants recorded during these investigation works. Similarly, the results can also be used by the Main Contractor / Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations. For further guidance reference should be made to the Health and Safety Executive (HSE) document EH40/2005 Workplace exposure limits.

If during future redevelopment works, any excavated materials are to be removed from this site as a waste and disposed of at a landfill, reference should be made to the notes on off-site disposal within Appendix IV, particularly when assessing the likely classification of these materials prior to disposal.

9.5 General Comments:-

According to the Phase 1: Desk Top Study, radon protection measures are not required for new buildings on the site. Furthermore, risks from unrecorded shallow mining are not present at the site and mitigation measures to deal with ground instability in advance of site development are not required.

When considering the risks to the construction workforce, suitable PPE should be adopted to provide protection against the levels of potential contaminants recorded during these investigation works. Similarly, the results can also be used by the Main Contractor / Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations.

For deeper excavations, drainage, service runs or the like that may pass close to or beneath any proposed new foundations, these should be undertaken with care and completed prior to the preparation of any new foundations, so as not to allow any loose or granular material to move or 'flow', thus causing settlement to occur to any new foundations based at a higher level.

It is also recommended for any new developments, adequate surface drainage should be designed and installed by a competent contractor, in order to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged.

An "observational technique" can be applied to the design and construction on this site, and where ground conditions seem to vary from that indicated from the Conceptual Site Model derived from works to date, then advice from a suitably qualified Engineering Geologist/Geotechnical Engineer should be sought.

END OF REPORT

GENERAL REFERENCES

- Phase 1: Desk Top Study, completed by Arc Environmental (ref 15-154, July 2015)

- DoE, DEFRA & EA - Contaminated Land Reports

  CLR 1: A framework for assessing the impact of contaminated land on groundwater and surface water. Report by Aspinwall & Co. Volumes 1 & 2. DoE, 1994.
  CLR 2: Guidance on preliminary site inspection of contaminated land. Report by Applied Environmental Research Centre Ltd. Volume 1. DOE, 1994.
  CLR 3: Documentary research on industrial sites. Report by RPS Group plc. DoE, 1994.
  CLR 4: Sampling strategies for contaminated land. Report by The Centre for Research into the Built Environment, The Nottingham Trent University. DoE, 1994.
  CLR 5: Information systems for land contamination. Report by Meta Generics Ltd. DoE, 1994.
  CLR 6: Prioritisation & categorisation procedure for sites which may be contaminated. Report by M J Carter Associates. DoE, 1995.
  CLR11: Model Procedures for the Management of Land Contamination. DEFRA/EA, 2004.
  Science Report Final SC050021/SR2: Human Health Toxicological Assessment of Contaminants in Soils, 2009.
  Science Report Final SC50021/SR3: Updated Technical Background to the CLEA Model, 2009.
  Science Report SC050021/SR4: CLEA software (version 1.05) handbook, 2009.

- Guidance on Comparing Soil Contamination Data with Critical Concentrations, CL:AIRE/CIEH, May 2008
- BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution (BS 1377-9:1990 is partially superseded by BS EN 1997-2: 2007)
- BS 5930: 2015: Code of practice for site investigations. British Standards Institution
- BS EN 1997-1: 2004: Eurocode 7 - Geotechnical design. Part 1: General rules. British Standards Institution
- BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design. Part 2: Ground investigation and testing British Standards Institution
- BS EN ISO 9001: 2000: Quality Management Systems - requirements. British Standards Institution
- BS EN ISO 14688-1: 2002: Geotechnical investigation and testing. Identification and classification of soil. Identification and description.
- BS EN ISO 14688-2: 2004: Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.
- BS EN ISO 14689-1: 2003: Geotechnical investigation and testing - Identification and classification of rock. Identification and description. British Standards Institution. Amended 2007 (Partially supersedes BS 5930:1999)
- BS EN ISO 22476-3: 2005: Geotechnical investigation and testing. Field testing. Standard penetration test. British Standards Institution
- BS5837: 2012: Trees in relation to design, demolition and construction - recommendations
- NHBC Standards 2007: Chapter 4.2 – Building near trees
- BRE Special Digest 1 2005: Concrete in Aggressive Ground 3rd Edition
- BS10175:2011 + A1:2013: Investigation of potentially contaminated sites – Code of practice
- Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D66, 2008 (NHBC, EA, CIEH)
- Asbestos in soil and made ground: a guide to understanding and managing risks, CIRIA C733, 2014
- Assessing Risks Posed by Hazardous Ground Gases to Buildings, CIRIA C665, 2007
- Methane and Associated Hazards to Construction - CIRIA Reports 149,150,151 & 152
- BS 8485: 2015: Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings
- BS8576:2013: Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds
- Category 4 Screening Levels (C4SL's) – DEFRA/CL:AIRE
- LQM CIEH Suitable 4 Use Levels (S4UL Nov 2014 (Revised August 2015))

APPENDIX I

Location Plan
Aerial Photograph
Existing & Proposed Site Layout Plans



Client:

ABACUS STONE SALES

Project Title:	Drawing Title:
Proposed Residential Development Land off Station Road, Meltham Huddersfield	Location Plan

rev.	date	amendments	drawn	chckd

Job Reference:	Drawing Number:	Revision:
16-273	–	–

Drawn by:	Date:	Scale at A4:
P.D	18.05.16	As Shown

Checked by:	Approved by:	
M.P.B	M.P.B	The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.
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LEGEND

	APPROXIMATE SITE BOUNDARY

rev.	date	amendments	drawn	chckd

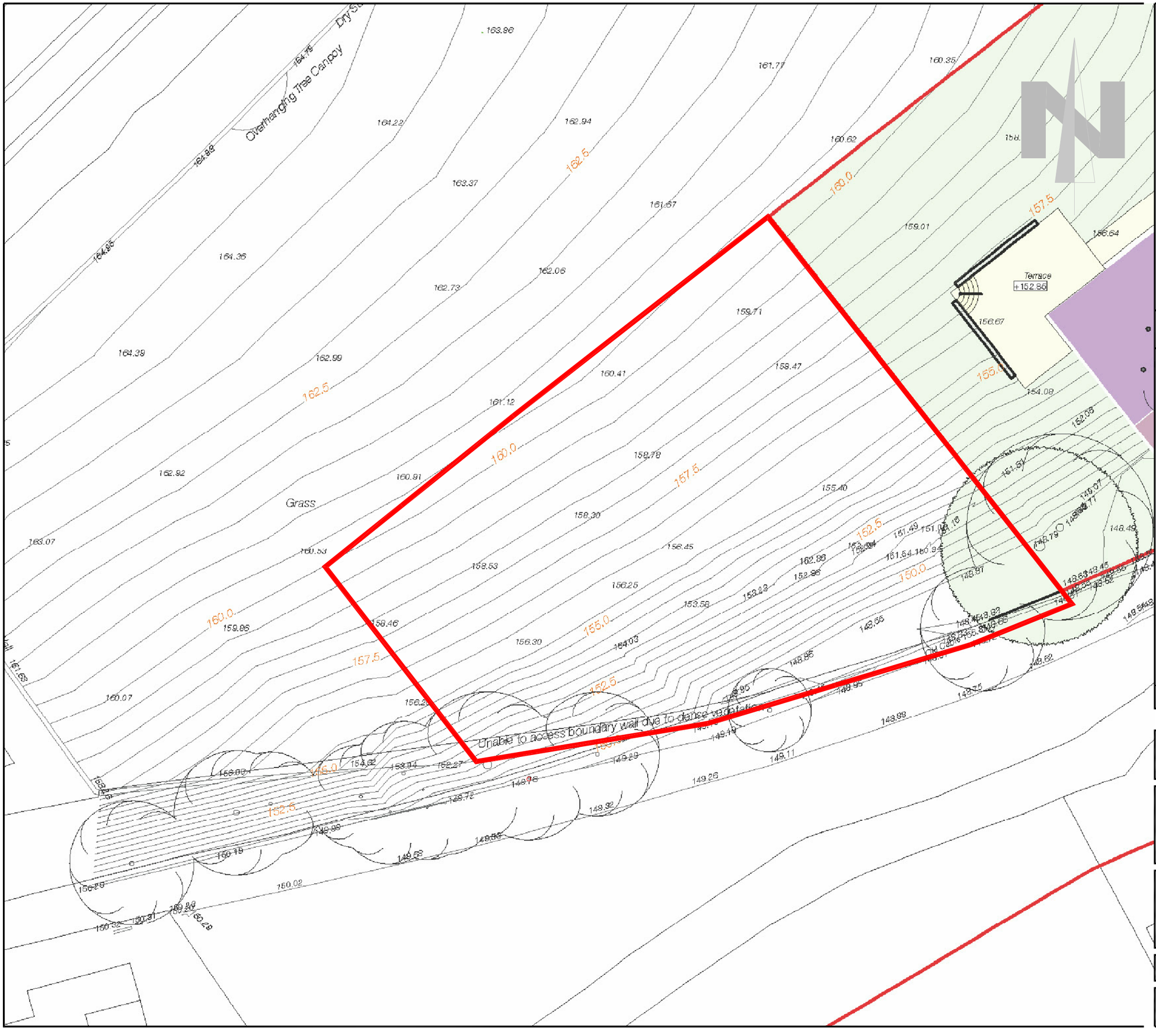
Client:
ABACUS STONE SALES LTD

Project Title:
Proposed Residential Development
Land off Station Road
Meltham, Huddersfield

Drawing Title:
Aerial Photograph

Scale at A3:	Date:	Drawn by:	Approved by:
NTS @ A3	17.05.16	P.D	M.P.B

Job Ref:	Drg no:	Rev:
16-273	–	–



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LEGEND

	APPROXIMATE SITE BOUNDARY

rev.	date	amendments	drawn	chckd

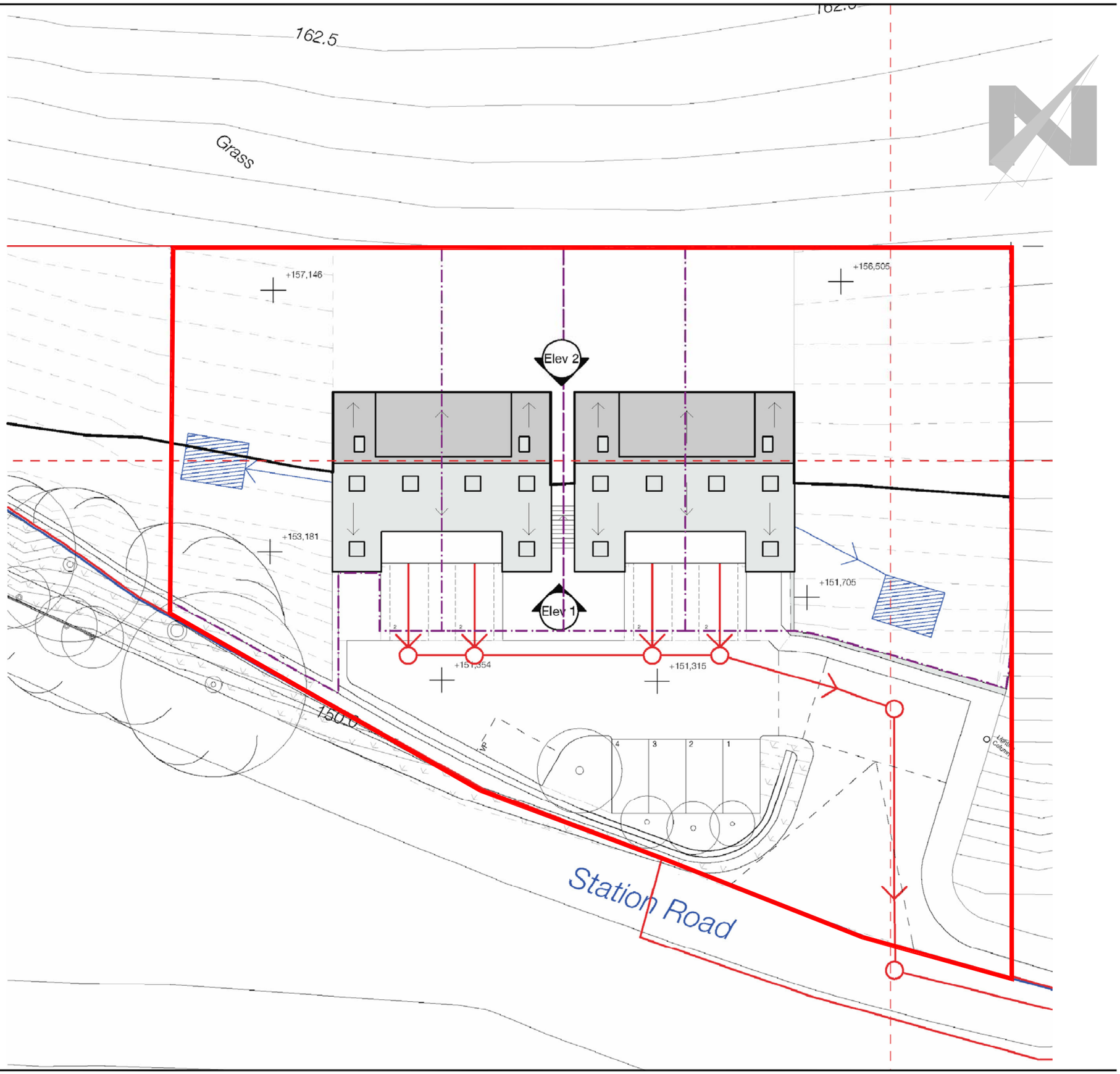
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ABACUS STONE SALES LTD

Project Title:
Proposed Residential Development
Land off Station Road
Meltham, Huddersfield

Drawing Title:
Existing Site Layout Plan

Scale at A3:	Date:	Drawn by:	Approved by:
NTS @ A3	17.05.16	P.D	M.P.B

Job Ref:	Drg no:	Rev:
16-273	–	–



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	APPROXIMATE SITE BOUNDARY

rev.	date	amendments	drawn	chckd

Client:
ABACUS STONE SALES LTD

Project Title:
Proposed Residential Development
Land off Station Road
Meltham, Huddersfield

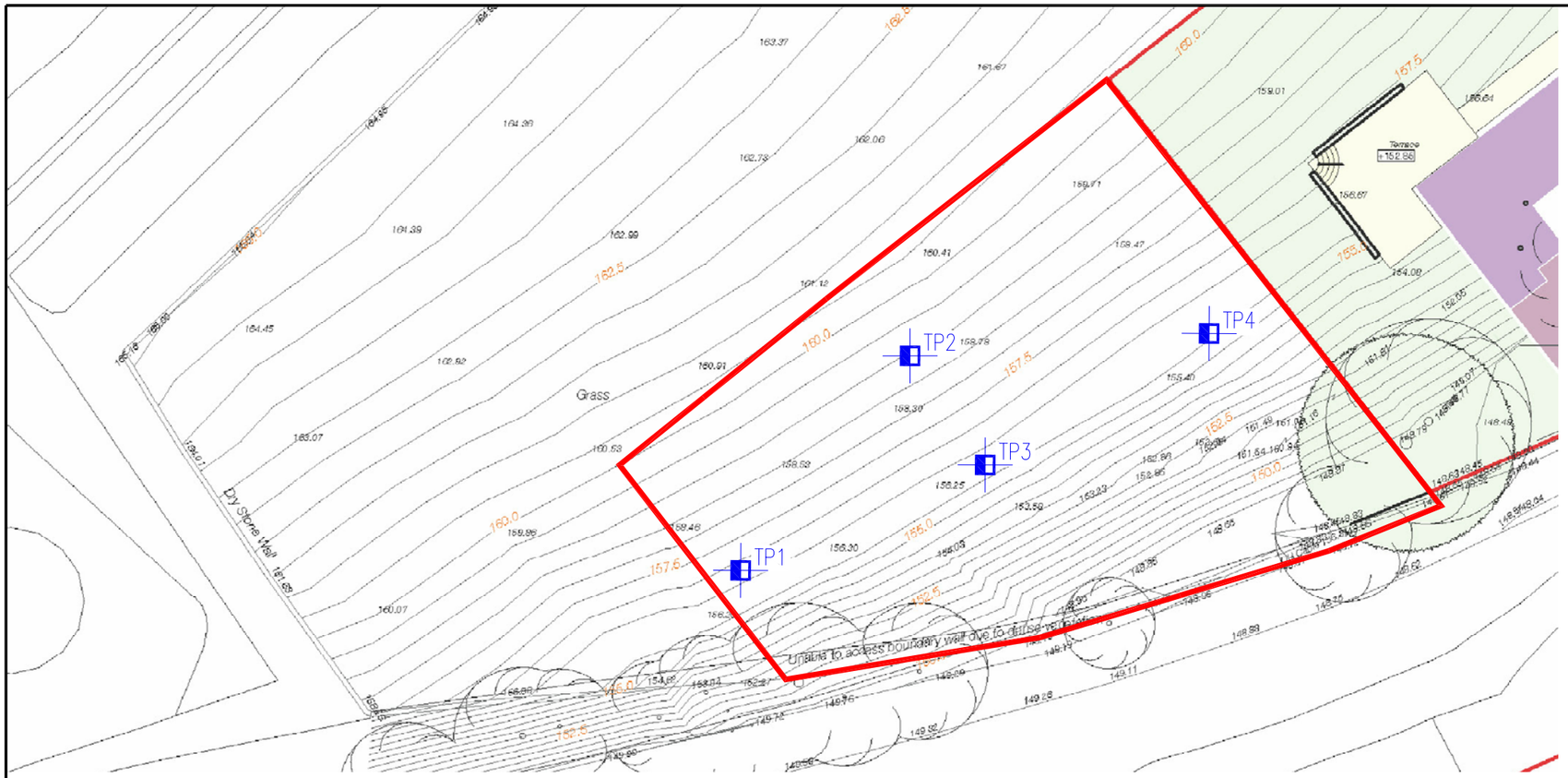
Drawing Title:
Proposed Development Layout Plan

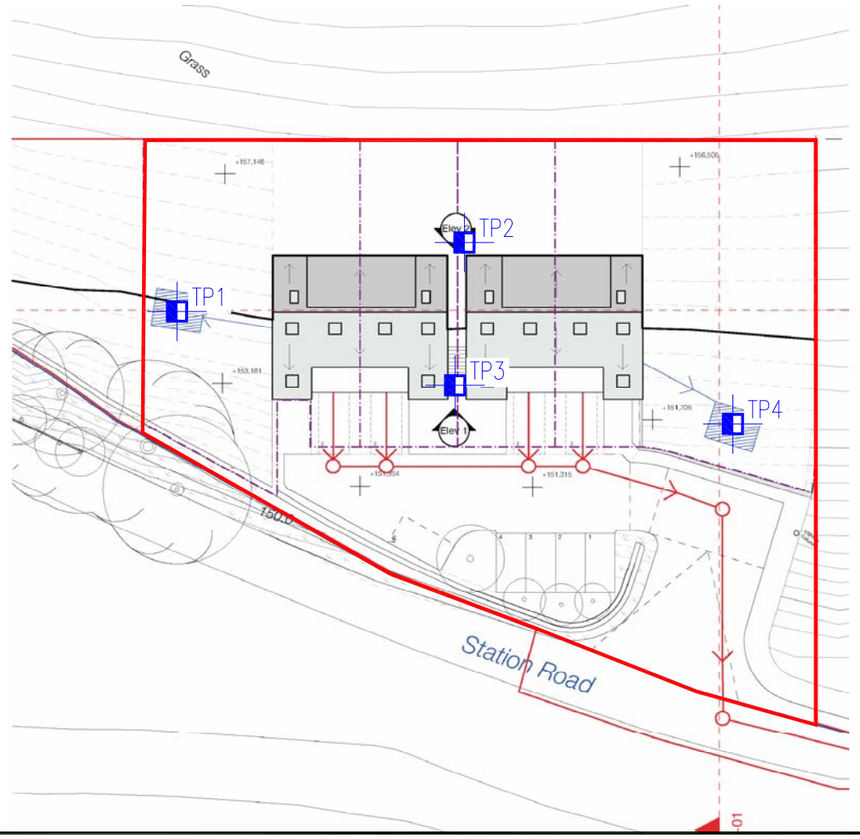
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NTS @ A3	17.05.16	P.D	M.P.B

Job Ref:	Drg no:	Rev:
16-273	–	–

APPENDIX II

Trial Pit Location Plan
Trial Pit Record Sheets
Soakaway Calculation Sheets





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LEGEND	
	APPROXIMATE SITE BOUNDARY
	MECHANICALLY EXCAVATED TRIAL PIT POSITION

rev.	date	amendments	drawn	chckd

Client:
ABACUS STONE SALES LTD

Project Title:
Proposed Residential Development
Land off Station Road
Meltham, Huddersfield

Drawing Title:
Trial Pit Location Plan

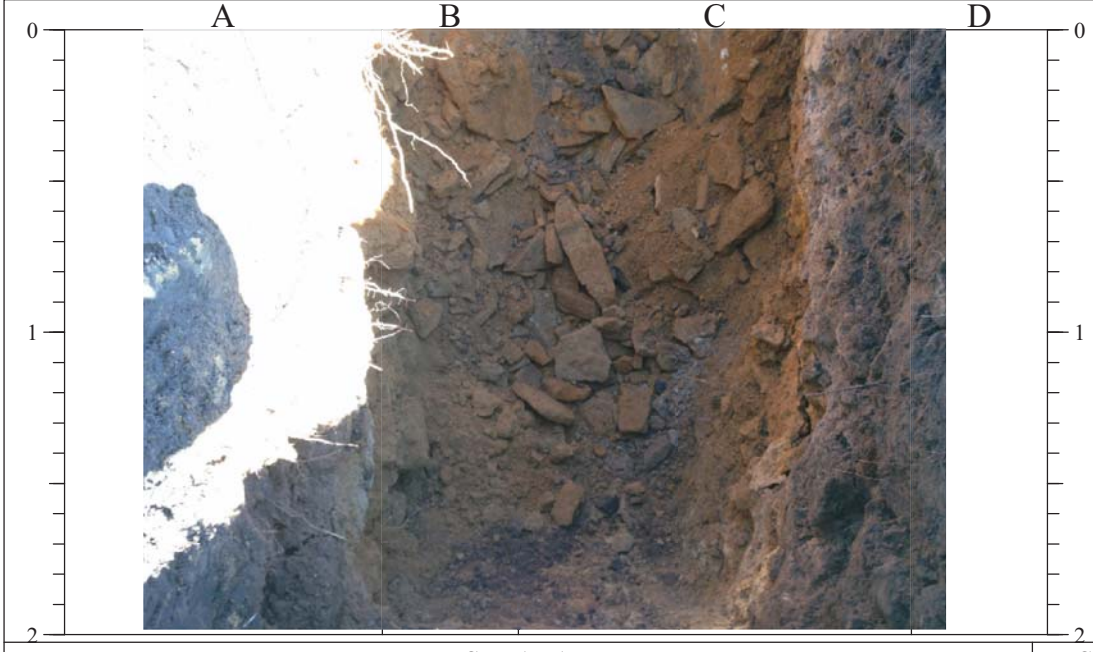
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NTS @ A3	17.05.16	P.D	M.P.B

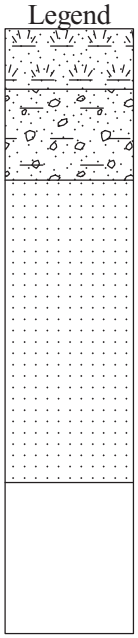
Job Ref:	Drg no:	Rev:
16-273	–	–

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St Johns Road, Meadowfield
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Telephone: 01913786380

TRIAL PIT LOG

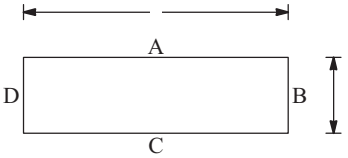
Project				TRIAL PIT No
Station Road, Meltham				TP1
Job No	Date	Ground Level (m)	Co-Ordinates ()	
16-273	28-04-16			
Contractor				Sheet
				1 of 1





STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.20		Turf and Topsoil. Black sandy gravelly clayey soil (TOPSOIL).			
0.20-0.50		Brown clayey gravelly SAND. Gravel is fine to coarse of sandstone. Cobbles (RESIDUAL SOIL).	0.15	J/D	
			0.30	CBR	1.3%
0.50-1.50		Brown weathered SANDSTONE. Recovered as sandy gravel with many cobbles and boulders up to c.500mm. Becoming less weathered with depth (MILLSTONE GRIT).	1.00	B	
1.50		Trial pit terminated at 1.50m.	1.50	B	

Shoring/Support:
Stability:





GENERAL REMARKS

WATER OBSERVATIONS: Trial pit remained open and dry on completion.

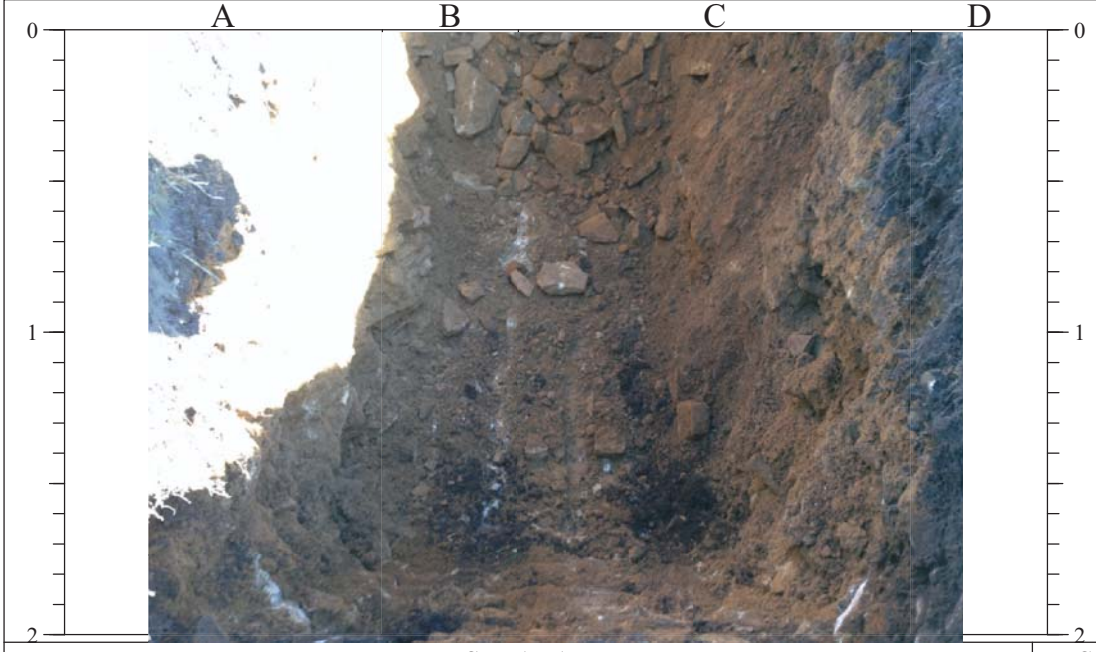
All dimensions in metres Scale 1:25	Client One17 Design	Method/ Plant Used 5 tonne 360 Excavator	Logged By MB

AGS3 UK TP LOGS 16-273.GPJ AGS3_ALL.GDT 29/4/16

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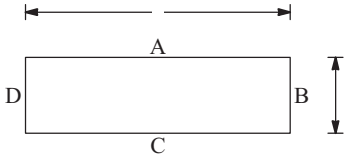
TRIAL PIT LOG

Project				TRIAL PIT No
Station Road, Meltham				TP2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
16-273	28-04-16			
Contractor				Sheet
				1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.20		Turf and Topsoil. Black sandy gravelly clayey soil (TOPSOIL).			
0.20-0.40		Brown clayey gravelly SAND. Gravel is fine to coarse of sandstone. Cobbles (RESIDUAL SOIL).	0.15	J/D	
			0.30	CBR	1.3%
0.40-1.40		Brown weathered SANDSTONE. Recovered as sandy gravel with many cobbles and boulders up to c.600mm. Becoming less weathered with depth (MILLSTONE GRIT).	0.80	B	
			1.30	B	
1.40		Trial pit terminated at 1.40m.			

Shoring/Support:
Stability:





GENERAL REMARKS

WATER OBSERVATIONS: Trial pit remained open and dry on completion.

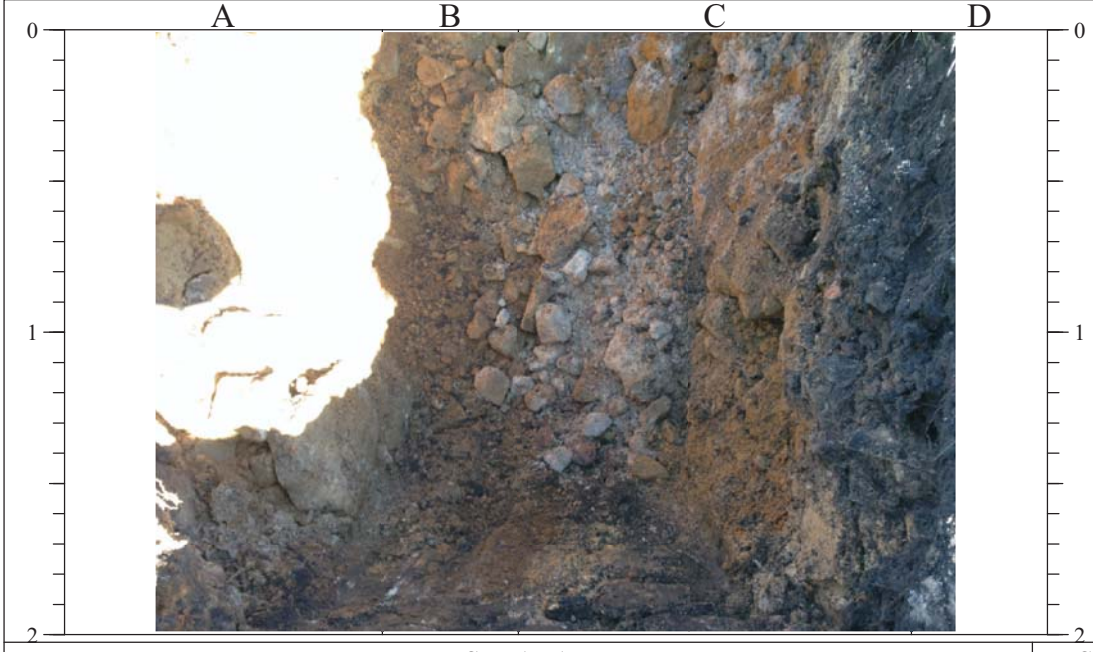
All dimensions in metres Scale 1:25	Client One17 Design	Method/ Plant Used 5 tonne 360 Excavator	Logged By MB

AGS3 UK TP LOGS 16-273.GPJ AGS3_ALL.GDT 29/4/16

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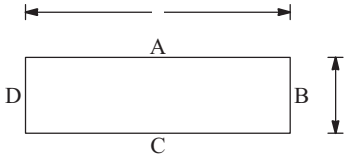
TRIAL PIT LOG

Project				TRIAL PIT No
Station Road, Meltham				TP3
Job No	Date	Ground Level (m)	Co-Ordinates ()	
16-273	28-04-16			
Contractor				Sheet
				1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.20		Turf and Topsoil. Black sandy gravelly clayey soil (TOPSOIL).			
0.20-0.60		Brown clayey gravelly SAND. Gravel is fine to coarse of sandstone. Cobbles (RESIDUAL SOIL).	0.15	J/D	
			0.40	CBR	1.2%
0.60-1.40		Brown weathered SANDSTONE. Recovered as sandy gravel with many cobbles and boulders up to c.500mm. Becoming less weathered with depth (MILLSTONE GRIT).	0.90	B	
			1.30	B	
1.40		Trial pit terminated at 1.40m.			

Shoring/Support:
Stability:





GENERAL REMARKS

WATER OBSERVATIONS: Trial pit remained open and dry on completion.

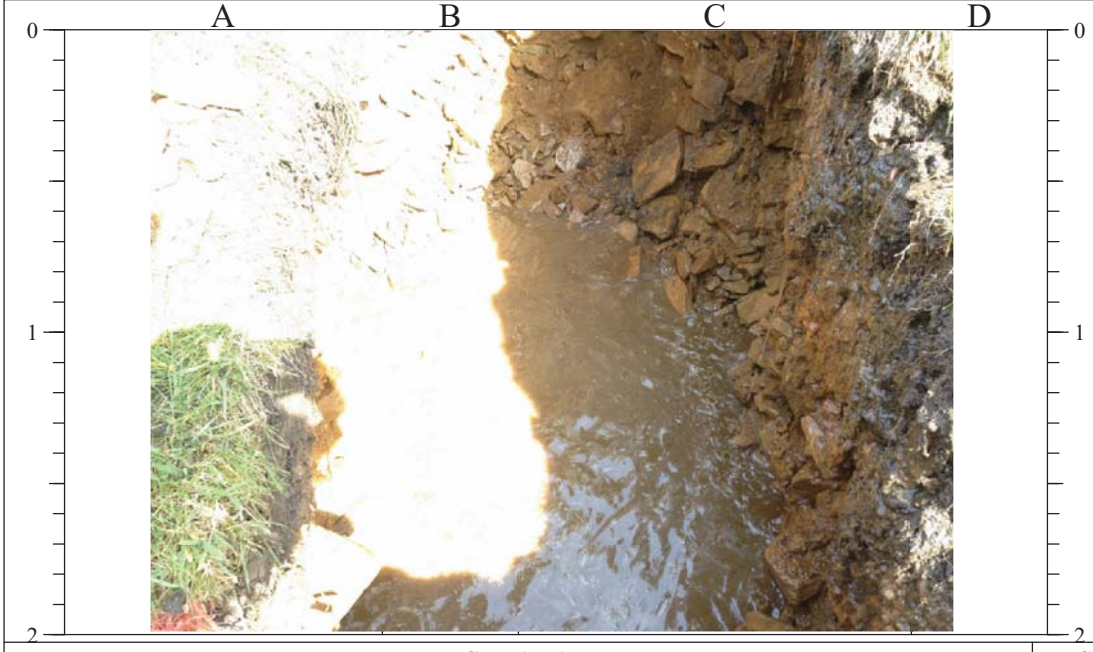
All dimensions in metres Scale 1:25	Client One17 Design	Method/ Plant Used 5 tonne 360 Excavator	Logged By MB

AGS3 UK TP LOGS 16-273.GPJ AGS3_ALL.GDT 29/4/16

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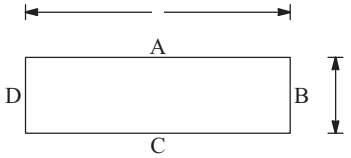
TRIAL PIT LOG

Project				TRIAL PIT No
Station Road, Meltham				TP4
Job No	Date	Ground Level (m)	Co-Ordinates ()	
16-273	28-04-16			
Contractor				Sheet
				1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.20		Turf and Topsoil. Black sandy gravelly clayey soil (TOPSOIL).			
0.20-0.40		Brown clayey gravelly SAND. Gravel is fine to coarse of sandstone. Cobbles (RESIDUAL SOIL).	0.15	J/D	
			0.30	CBR	1.2%
0.40-1.60		Brown weathered SANDSTONE. Recovered as sandy gravel with many cobbles and boulders up to c.700mm. Becoming less weathered with depth (MILLSTONE GRIT).	1.00	B	
			1.50	B	
1.60		Trial pit terminated at 1.60m.			

Shoring/Support:
Stability:





GENERAL REMARKS

WATER OBSERVATIONS: Trial pit remained open and dry on completion.

All dimensions in metres Scale 1:25	Client One17 Design	Method/ Plant Used 5 tonne 360 Excavator	Logged By MB

AGS3 UK TP LOGS 16-273.GPJ AGS3_ALL.GDT 29/4/16

16-273 Meltham - Test Pit No. TP1

Worksheet for Soakaways: Soil Infiltration Rate Calculated as BRE Digest 365: Soakaway Design

DATE: 28/04/16

Test pit dimesions	L	W	D
	2.30	0.70	1.50

Effective depth (D) from 1.30m to 1.50m = 0.20 m

75% effective depth =	1.35	m bg
50% effective depth =	1.4	m bg
25% effective depth =	1.45	m bg

V_{p75-25} = outflow volume between 75% & 25% effective depth — V_{p75-25} = 0.161 m^3

a_{p50} = 50% internal surface area of effective depth including base — a_{p50} = 2.210 m^2

OBSERVATIONS:

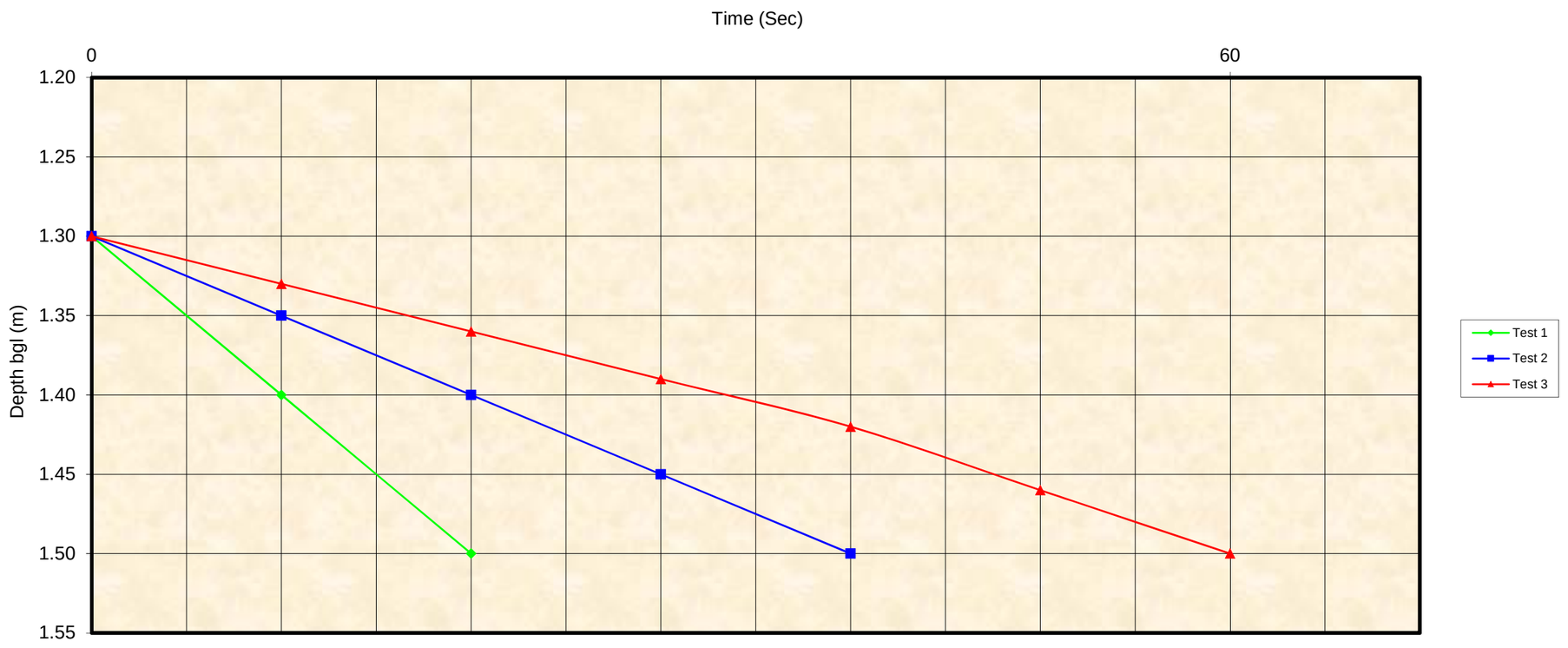
Pit filled from water bowser- Fill times c.1mins

Unable to fill pit past 1.30m depth

The pit remained stable during construction

Time (sec) dt_0	**Depth bgl (m)** Test No. 1	Test No. 2	Test No. 3
0	1.30	1.30	1.30
10	1.40	1.35	1.33
20	1.50	1.40	1.36
30		1.45	1.39
40		1.50	1.42
50			1.46
60			1.50

Fig 1: Depth v's Time - Infiltration Rates



Soil Infiltration Calculations

t_{p75-25} = time for infiltration (from fig 1) — t_{p75-25} = 10 20 30 **secs**

Soil infiltration rate (**f**) = $\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

f= 7.29E-03 3.64E-03 2.43E-03 **ms^{-1}**

Average f= 4.45E-03 ms^{-1}

16-273 Meltham - Test Pit No. TP4

Worksheet for Soakaways: Soil Infiltration Rate Calculated as BRE Digest 365: Soakaway Design

DATE: 28/04/16

Test pit dimesions	L	W	D
	2.20	0.70	1.60

Effective depth (D) from 1.20m to 1.60m = 0.40 m

75% effective depth =	1.3	m bg
50% effective depth =	1.4	m bg
25% effective depth =	1.5	m bg

V_{p75-25} = outflow volume between 75% & 25% effective depth — V_{p75-25} = 0.308 m^3

a_{p50} = 50% internal surface area of effective depth including base — a_{p50} = 2.700 m^2

OBSERVATIONS:

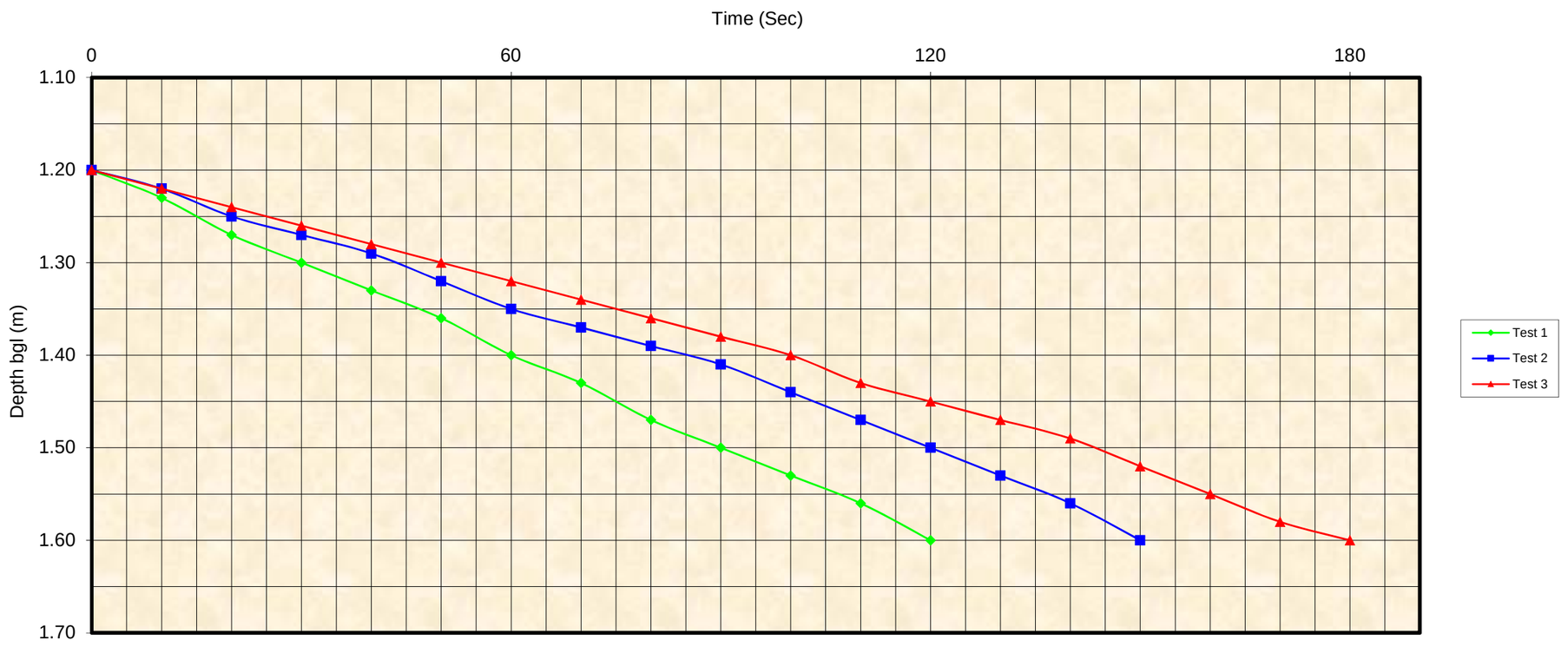
Pit filled from water bowser- Fill times c.1mins

Unable to fill pit past 1.20m depth

The pit remained stable during construction

Time (sec) dt_0	Depth bgl (m) Test No. 1	2	3
0	1.20	1.20	1.20
10	1.23	1.22	1.22
20	1.27	1.25	1.24
30	1.30	1.27	1.26
40	1.33	1.29	1.28
50	1.36	1.32	1.30
60	1.40	1.35	1.32
70	1.43	1.37	1.34
80	1.47	1.39	1.36
90	1.50	1.41	1.38
100	1.53	1.44	1.40
110	1.56	1.47	1.43
120	1.60	1.50	1.45
130		1.53	1.47
140		1.56	1.49
150		1.60	1.52
160			1.55
170			1.58
180			1.60

Fig 1: Depth v's Time - Infiltration Rates



Soil Infiltration Calculations

t_{p75-25} = time for infiltration (from fig 1) — t_{p75-25} = 60 78 110 **secs**

Soil infiltration rate (**f**) = $\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

f= 1.90E-03 1.46E-03 1.04E-03 **ms^{-1}**

Average f= 1.47E-03 ms^{-1}

APPENDIX III

Laboratory Results (Geotechnical & Ground Contamination)

LABORATORY REPORT

4043

Contract Number: PSL16/1965

Report Date: 12 May 2016

Client's Reference: 16-273

Client Name: Arc Environmental
Solum House
Unit 1 Elliott Court
St Johns Road, Meadowfield
Durham
DH7 8PN

For the attention of: Matt Bradford

Contract Title: Station Road, Meltham

Date Received: 4/5/2016
Date Commenced: 4/5/2016
Date Completed: 12/5/2016

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
D Lambe (Senior Technician)	S Royle (Senior Technician)	L Knight (Senior Technician)

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awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP2		B	0.80		Brown sandy silty GRAVEL of cobbles.
TP3		B	1.30		Brown very sandy silty GRAVEL of cobbles.
TP4		B	1.00		Brown sandy silty GRAVEL with cobbles.

UKAS TESTING
4043

PSL
Professional Soils Laboratory

Checked / Approved		Date	12/05/16	Contract No:
Station Road, Meltham				PSL16/1965
				Client Ref:
				16-273

PARTICLE SIZE DISTRIBUTION TEST

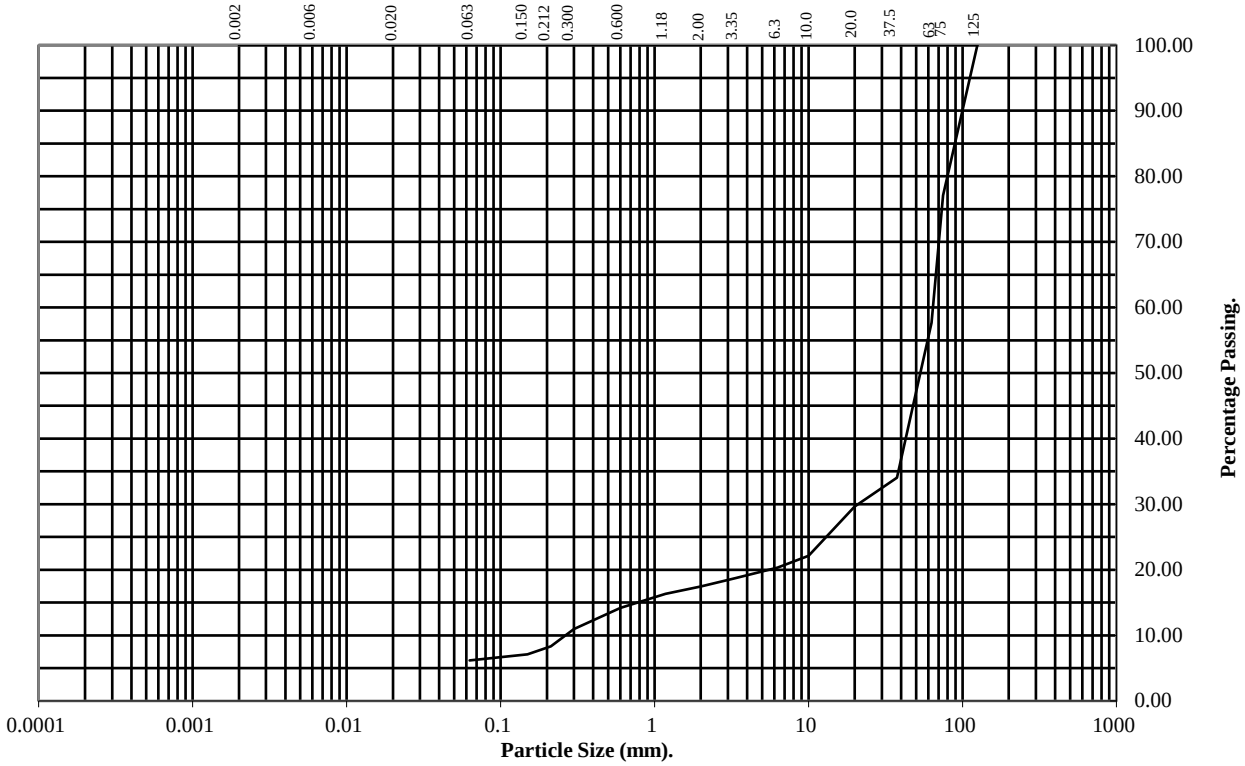
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP2** **Top Depth (m):** **0.80**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve	Percentage Passing
125	100
75	77
63	58
37.5	34
20	30
10	22
6.3	20
3.35	19
2	17
1.18	16
0.6	14
0.3	11
0.212	8
0.15	7
0.063	6

Soil Fraction	Total Percentage
Cobbles	42
Gravel	41
Sand	11
Silt/Clay	6

Remarks:

See summary of soil descriptions.

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Checked / Approved**		**Date**	**12/05/16**	**Contract No:**
		Station Road, Meltham				**PSL16/1965**
						Client Ref:
						16-273

PARTICLE SIZE DISTRIBUTION TEST

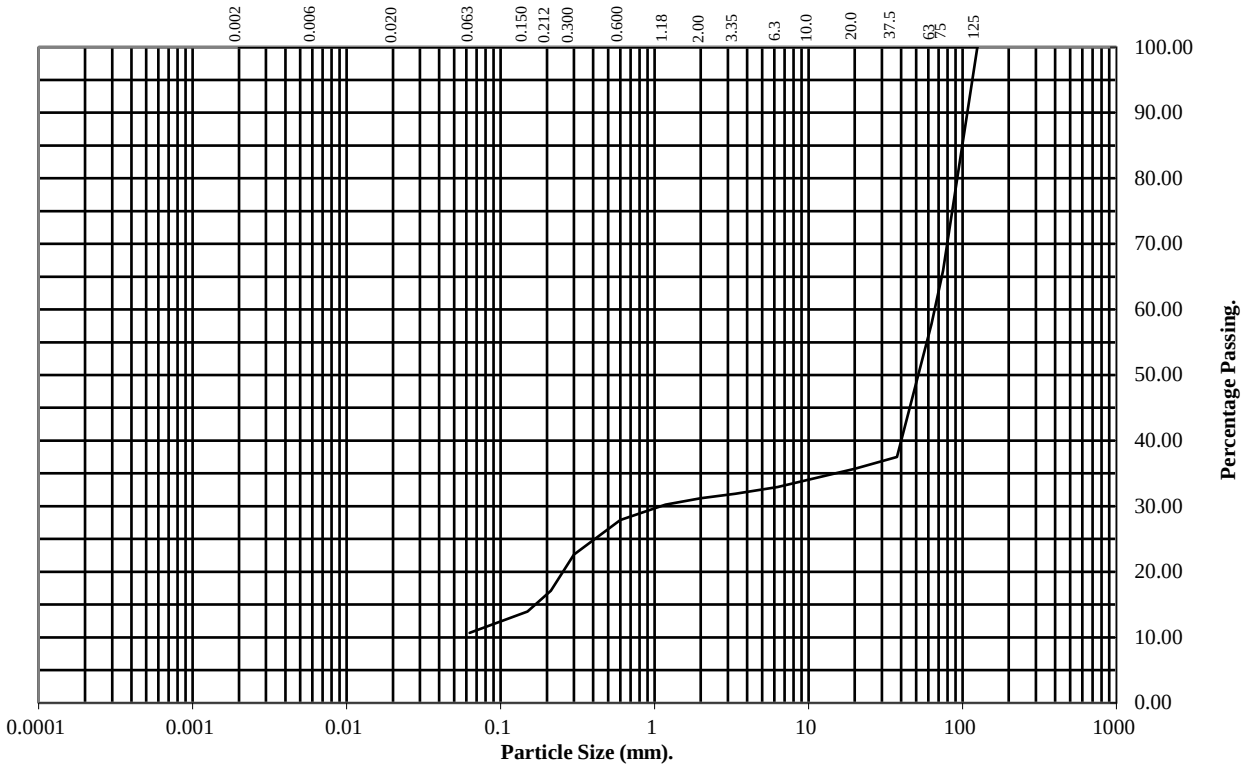
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP3** **Top Depth (m):** **1.30**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve	Percentage Passing
125	100
75	66
63	58
37.5	38
20	36
10	34
6.3	33
3.35	32
2	31
1.18	30
0.6	28
0.3	23
0.212	17
0.15	14
0.063	11

Soil Fraction	Total Percentage
Cobbles	42
Gravel	27
Sand	20
Silt/Clay	11

Remarks:

See summary of soil descriptions.

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Checked / Approved**		**Date**	**12/05/16**	**Contract No:**
		Station Road, Meltham				**PSL16/1965**
						Client Ref:
						16-273

PARTICLE SIZE DISTRIBUTION TEST

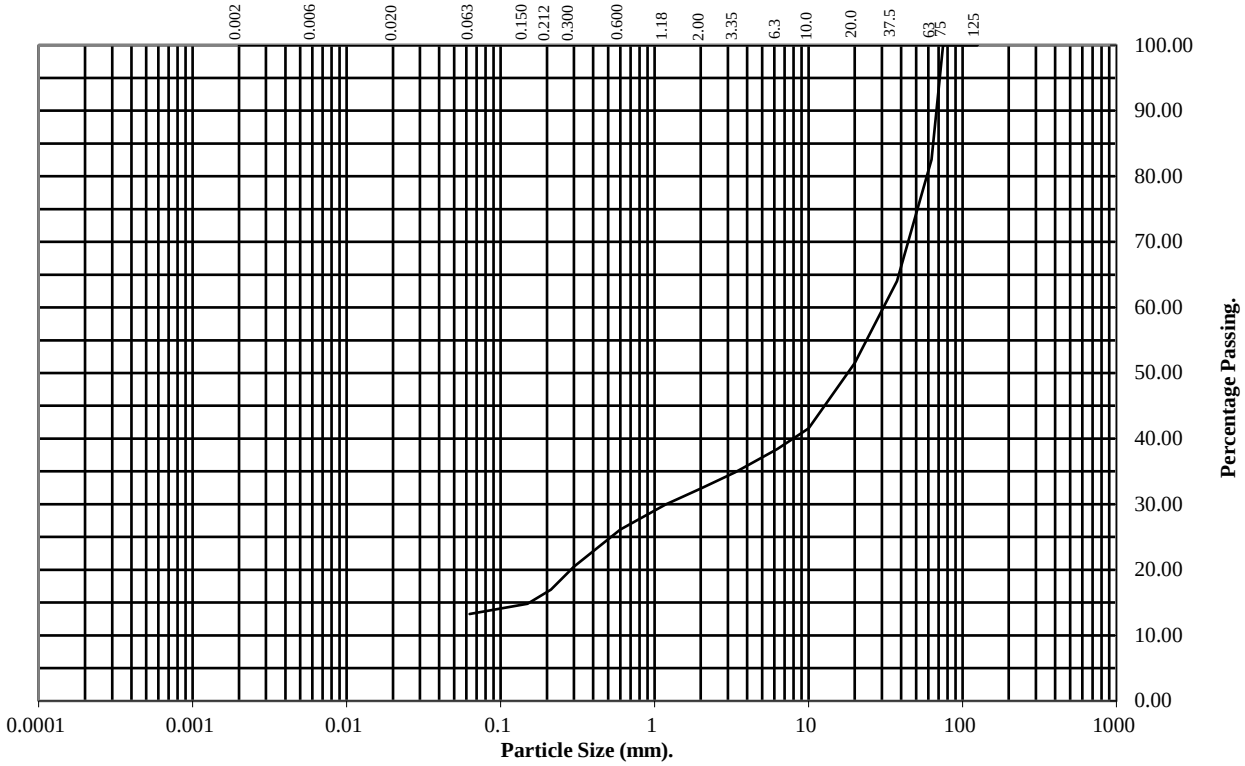
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP4** **Top Depth (m):** **1.00**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	83
37.5	64
20	52
10	42
6.3	38
3.35	35
2	32
1.18	30
0.6	26
0.3	20
0.212	17
0.15	15
0.063	13

Soil Fraction	Total Percentage
Cobbles	17
Gravel	51
Sand	19
Silt/Clay	13

Remarks:

See summary of soil descriptions.

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Checked / Approved**	**Date** 12/05/16	**Contract No:** PSL16/1965
		Station Road, Meltham		**Client Ref:** 16-273

2531

ANALYTICAL TEST REPORT

Contract no: 59507

Contract name: Station Road, Meltham

Client reference: 16-273

Clients name: ARC Environmental

Clients address: Solum House, Unit 1 Elliott Court
St Johns Road
Meadowfield
DH7 8PN

Samples received: 03 May 2016

Analysis started: 03 May 2016

Analysis completed 10 May 2016

Report issued: 10 May 2016

Notes:
Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, withour prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key:
U UKAS accredited test
M MCERTS & UKAS accredited test
$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:



James Spittle
Customer Services Team Leader

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
59507-1	TP1	0.15	Loam with Roots	-	-	21.6
59507-2	TP1	1.00	Clayey Sand with Gravel	-	-	18.7
59507-3	TP2	0.15	Loam with Roots	-	-	28.1
59507-4	TP3	0.15	Loam with Roots	-	-	20.9
59507-5	TP3	0.90	Clayey Sand with Gravel & Roots	-	-	13.1
59507-6	TP4	0.15	Loam with Gravel & Roots	-	-	19.0

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SOILS

Lab number			59507-1	59507-2	59507-3	59507-4	59507-5	59507-6
Sample id			TP1	TP1	TP2	TP3	TP3	TP4
Depth (m)			0.15	1.00	0.15	0.15	0.90	0.15
Date sampled			28/04/2016	28/04/2016	28/04/2016	28/04/2016	28/04/2016	28/04/2016
Test	**Method**	**Units**						
Arsenic (total)	CE127 M	mg/kg As	18	-	23	22	-	17
Cadmium (total)	CE127 M	mg/kg Cd	0.4	-	0.4	0.4	-	0.3
Chromium (total)	CE127 M	mg/kg Cr	109	-	97	93	-	106
Chromium (III)	-	mg/kg CrIII	109	-	97	93	-	106
Chromium (VI)	CE146	mg/kg CrVI	<1	-	<1	<1	-	<1
Copper (total)	CE127 M	mg/kg Cu	22	-	26	30	-	23
Lead (total)	CE127 M	mg/kg Pb	77	-	87	102	-	80
Mercury (total)	CE127 M	mg/kg Hg	<0.5	-	<0.5	<0.5	-	<0.5
Nickel (total)	CE127 M	mg/kg Ni	11	-	15	14	-	12
Selenium (total)	CE127 M	mg/kg Se	1.0	-	1.1	1.1	-	0.9
Zinc (total)	CE127 M	mg/kg Zn	64	-	82	69	-	53
pH	CE004 M	units	6.4	6.7	6.1	6.4	6.9	6.1
Sulphate (2:1 water soluble)	CE061 M	mg/l SO_4	16	<10	21	15	<10	16
Cyanide (free)	CE077	mg/kg CN	<1	-	<1	<1	-	<1
Total Organic Carbon (TOC)	CE072 M	% w/w C	5.08	-	5.09	5.66	-	4.80
PAH								
Acenaphthene	CE087 M	mg/kg	0.04	-	0.01	0.08	-	0.02
Acenaphthylene	CE087 M	mg/kg	<0.01	-	<0.01	<0.01	-	<0.01
Anthracene	CE087 U	mg/kg	0.06	-	0.05	0.21	-	0.03
Benzo(a)anthracene	CE087 U	mg/kg	0.19	-	0.24	0.42	-	0.19
Benzo(a)pyrene	CE087 U	mg/kg	0.23	-	0.25	0.43	-	0.24
Benzo(b)fluoranthene	CE087 M	mg/kg	0.24	-	0.28	0.48	-	0.27
Benzo(ghi)perylene	CE087 M	mg/kg	0.12	-	0.13	0.22	-	0.13
Benzo(k)fluoranthene	CE087 M	mg/kg	0.13	-	0.13	0.22	-	0.13
Chrysene	CE087 M	mg/kg	0.25	-	0.22	0.38	-	0.22
Dibenz(ah)anthracene	CE087 M	mg/kg	0.03	-	0.04	0.06	-	0.04
Fluoranthene	CE087 M	mg/kg	0.46	-	0.44	1.02	-	0.44
Fluorene	CE087 U	mg/kg	0.02	-	0.01	0.06	-	0.01
Indeno(123cd)pyrene	CE087 M	mg/kg	0.16	-	0.17	0.27	-	0.18
Naphthalene	CE087 M	mg/kg	0.06	-	0.05	0.08	-	0.07
PAH (total of USEPA 16)	CE087	mg/kg	2.71	-	2.62	5.61	-	2.59
Phenanthrene	CE087 M	mg/kg	0.28	-	0.17	0.76	-	0.19
Pyrene	CE087 M	mg/kg	0.43	-	0.43	0.91	-	0.42
Benzo(j)fluoranthene	CE087	mg/kg	0.04	-	0.04	0.07	-	0.04
PAH (total of OIL 8)	CE087	mg/kg	1.27	-	1.37	2.33	-	1.31
TPH								
TPH (C5-C7)	CE067	mg/kg	<0.1	-	<0.1	<0.1	-	<0.1
TPH (C7-C8)	CE067	mg/kg	<0.1	-	<0.1	<0.1	-	<0.1
TPH (C8-C10)	CE067	mg/kg	<0.1	-	<0.1	0.1	-	<0.1
TPH (C10-C12)	CE033	mg/kg	3	-	4	3	-	3
TPH (C12-C16)	CE033	mg/kg	4	-	6	6	-	5

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SOILS

Lab number			59507-1	59507-2	59507-3	59507-4	59507-5	59507-6
Sample id			TP1	TP1	TP2	TP3	TP3	TP4
Depth (m)			0.15	1.00	0.15	0.15	0.90	0.15
Date sampled			28/04/2016	28/04/2016	28/04/2016	28/04/2016	28/04/2016	28/04/2016
Test	**Method**	**Units**						
TPH (C16-C21)	CE033	mg/kg	10	-	17	11	-	10
TPH (C21-C35)	CE033	mg/kg	52	-	89	45	-	57
TPH (C35-C44)	CE033	mg/kg	6	-	14	4	-	5
Subcontracted analysis								
Asbestos (qualitative)	$	-	NAD	-	NAD	NAD	-	NAD

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
-	Chromium (III)	Calculation: Cr (total) - Cr (VI)	Dry		1	mg/kg CrIII
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO_4
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	Wet		1	mg/kg CN
CE072	Total Organic Carbon (TOC)	Removal of IC by acidification, Carbon Analyser	Dry	M	0.1	% w/w C
CE087	Acenaphthene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	Wet	U	0.01	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Naphthalene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	Wet		0.27	mg/kg
CE087	Benzo(j)fluoranthene	Solvent extraction, GC-MS	Wet		0.02	mg/kg
CE087	PAH (total of OIL 8)	Solvent extraction, GC-MS	Wet		0.15	mg/kg
CE067	TPH (C5-C10) speciation	Headspace GC-FID	Wet		0.1	mg/kg
CE033	TPH (C10-C40) speciation	Solvent extraction, GC-FID	Wet		1	mg/kg
$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
A	Sampling date not provided
B	Sampling time not provided (waters only)
C	Sample exceeded holding time(s)
D	Sample not received in appropriate containers
E	Headspace present in sample container
F	Sample not chemically fixed (where appropriate)
G	Sample not cooled
H	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
59507-1	TP1	0.15	N	
59507-2	TP1	1.00	N	
59507-3	TP2	0.15	N	
59507-4	TP3	0.15	N	
59507-5	TP3	0.90	N	
59507-6	TP4	0.15	N	

APPENDIX IV

Ground Contamination Risk Assessment Data: Methodology
Notes for Off-Site Disposal

Ground Contamination Risk Assessment

Assessment Framework:-

Ground contamination risk assessments are undertaken to identify potential risks from historical and recent land contamination on a given site and enable appropriate risk management actions to be undertaken in accordance with the regulatory context of the site and any future development. There are a range of technical approaches to the assessment of chemical contaminants in the UK, all of which broadly fit within a tiered/phased approach and the current UK approach is set out in the Defra and Environment Agency Publication: CLR 11: Model Procedures for the Management of Land Contamination (*Defra/EA 2004*).

ARC's approach to undertaking ground contamination risk assessments is based on the tiered/phased framework in accordance with CLR11, and for Human Health, the recently updated CLEA (Contaminated Land Exposure Assessment) framework and model for assessing potentially contaminated land in the UK. This framework and model is based primarily on the following publications and software: Science Reports SC050021/SR2 (EA 2008b Human Health toxicological assessment of contaminants in soil) and SC050021/SR3 (Updated technical background to CLEA model – replaces the previous guidance documents CLR9, CLR10 and Briefing notes 1 – 4); Science Report SC050021/SR4 (CLEA Software (version 1.06 beta) handbook) and the new CLEA software (replaces Science Report SC050021/H CLEA UK Handbook (draft) and the CLEA UK Software version 1.0 beta), along with the publication of a review of body weight and height data used within the Contaminated Land Exposure Assessment model (CLEA), Project no. SC050021/Technical Review 1.

At present, the SGV's (Soil Guidance Values) published as part of the previous CLEA UK Handbook (draft) and software (version 1.0 beta), have been withdrawn along with guidance documents CLR7 and CLR8, and replacement of the SGV values, using the updated model and software (version 1.071), is currently ongoing, and the new guidance documents for CLR7 & CLR8 have yet to be published. Currently, Defra and the EA have published TOX and SGV reports for the following select substances: Benzene, Toluene, Ethylbenzene, Xylenes, Arsenic, Cadmium, Mercury, Nickel, Selenium and Phenol. Although updated SGV values have been calculated for the aforementioned analytes, at present for the majority of the potential contaminants, relevant data is yet to be made available for the new model. According to Defra and the EA, the schedule for publication of the remaining reports will depend on various factors, and they anticipate publishing the remaining TOX and SGV reports for Cyanide, Lead, Dioxins, Dioxin-like Polychlorinated Biphenyls and Polycyclic Aromatic Hydrocarbons during the remainder of 2010.

When considering ground contamination risk assessments for Controlled Waters (groundwater and surface waters), ARC follows the EA guidance on Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination, 2006.

Methodology:-

During this transitional period, prior to the publication of all the new SGV values for the above mentioned analytes, ARC consider that the most appropriate methodology for completing a ground contamination risk assessment for soils on this site will be to utilise the recently published SGV values (Benzene, Toluene, Ethylbenzene, Xylenes, Arsenic, Cadmium, Chromium (III & VI), Mercury, Nickel, Selenium and Phenol), combined with the former CLEA model SGV's based on the CLEA UK software and other newly published and recognised GAC's (generic assessment criteria) for the remaining analytes. It is widely recognised by ground contamination risk assessment practitioners that the new CLEA model will generally result in higher SGV and GAC (generic assessment criteria) values for the standard end uses, and consequently continued use of the former CLEA model will result in a slightly more conservative assessment.

For general soil surface contamination, the new SGV value for inorganic Mercury can be compared with chemical analysis for total mercury content, as the concentrations of elemental and methylmercury compounds are likely to be very low, in accordance with Science Report SC050021 / Mercury SGV. In addition, the updated SGV values are based upon a Soil Organic Matter (SOM) content of 6%, in line with the most recent Defra and EA guidance. Once all the relevant data is available, a reassessment of the ground contamination present on this site can be carried out, if felt necessary, as this may result in a reduction in the scope of remediation works (if required). It should be noted that guidance document CLR11: Model Procedures for the Management of Land Contamination has not been withdrawn.

Ground Contamination Risk Assessment (Cont'd)

Methodology (Cont'd):-

ARC ground contamination risk assessments, in accordance with CLR11, are based on the established *source-pathway-receptor* pollutant linkage methodology and 'suitable for use' approach (Part IIA, EPA 1990 - inserted through Section 57 EA 1995), and adopts the tiered/phased approach beginning with a preliminary assessment (also referred to a desk top study). If potential pollutant linkages are identified from the preliminary assessment, for both Human Health and/or Controlled Waters, then Level 1 Quantitative Risk Assessments are appropriate guideline values. For soils these typically comprise soil guideline values (SGV's), generic assessment criteria (GAC) or site specific assessment criteria (SSAC) and for controlled waters, Environmental Quality Standards (EQS) or UK Drinking Water Standards.

Where any Level 1 criteria have been exceeded, various courses of action are available for recommendation, in order to try and 'break' the pollutant linkage by designing into the proposed development works and/or by recommending appropriate remediation works, i.e. removal of source, treatment of contaminants, installation of permanent barriers, etc. and/or by carrying out more detailed site specific quantitative risk assessment (DQRA, i.e. Level 2 or above). Completing further DQRA for any contaminants present, can take into account factors such as the introduction of physical barrier and the actual availability of plausible contaminant migration pathways, as well as site specific data such as the type, properties and characteristics (permeability, porosity, density, etc.) of the soil present on site, groundwater depth and flow, site specific exposure criteria and values, and contaminant retardation, attenuation, dilution and degradation. Similarly, when considering potential risks to off-site receptors, these are considered by assessing the potential risks to on-site receptors, as well as the potential mobility of any contaminants present within either the soils or water/groundwater below this site.

For the purpose of this report, preliminary and level 1 risk assessments consider two main categories of receptor, and these are as follows:

- On site Human Health – (CLEA Model).
- Controlled Waters – (groundwater) – (EA Remedial Targets Methodology).

When considering the risk to construction workforce, the results of the screening can be used by the Main Contractor/Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations, and when assessing the level of PPE required on site. Similarly, when considering the risks to building materials, again the results of the contamination screening can be used to determine the level of protection that may be required, and reference should be made to the utilities suppliers for their comments.

Level 1 - Human Health:-

Level 1 human health related assessments are based upon the current CLEA Model, with site values assessed against published Soil Guidance Values (SGV's), and where these values are not available against the published CIEM (Chartered Institute of Environmental Health)/LQM Generic Assessment Criteria (GAC), Atkins ATRISKsoil© SSV values and USEPA Region 9 Screening Values (2009). For statistical analysis, the site is assessed to delineate any potentially differing areas of contamination (averaging areas), based on the results of the preliminary investigation as well as the result of any visual, olfactory or analytical evidence following completion of the intrusive investigation works. Following this geographical delineation of the site, where generic or pervasive contaminants are anticipated, for each 'averaging area' under consideration, the results are assessed using the established methods of statistical analysis given in the CL:AIRE Guidance on Comparing Soil Contamination Data with a Critical Concentration (C_C), May 2008. In this case, the results of the sample population are assessed to determine whether they represent a normal or non-normal distribution and the statistical upper confidence limit is (95% percentile – $UCL_{0.95}$) is calculated and then compared with the chosen Level 1 Critical Concentration (C_C) value for the site (i.e. the appropriate SGV, GAC or SSV).

In addition, further statistical analysis is undertaken to determine whether the maximum concentration(s) recorded represent statistical outliers, i.e. potential 'hot spots', and where necessary these are removed from the sampling populations and a reassessment of the averaging areas/potential hot spot areas identified.

Ground Contamination Risk Assessment (Cont'd)

Methodology (Cont'd):-

Level 1 - Human Health (Cont'd):-

Where targeted screening is undertaken, i.e. speciated PAH's for 'ashy' type materials, screening for suspected organic contamination, etc., the maximum site values recorded (C_M) at each location have been compared to the chosen Level 1 Critical Concentration (C_C), with no requirement for statistical analysis to be undertaken on for these samples.

Level 1 – Controlled Waters:-

The Level 1 controlled waters risk assessment has been carried out (in accordance with the guidance; Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination, Environment Agency, 2006) by comparing samples of leachate, with the chosen Level 1 Critical Concentration (C_C) value, based on an appropriate water quality standard (EQS, UK Drinking Water, etc.), and which is also taken as the Level 1 Leachate Remedial Target (LTC_1).

The number of samples chosen for screening is determined by assessing the potential risk of contamination reaching a sensitive receptor, i.e. shallow groundwater, nearby surface water feature, etc., based on the results of the preliminary investigation, as well as olfactory, visual, anecdotal and analytical evidence collected during the intrusive investigation works.

Where the potential risk is considered to be low between 0% and c.25% of the samples are targeted for screening, c.25% to c.50% where the risk is considered to be moderate and c.75% to 100% where the risk is considered to be high. This is to ensure that the potential risk is adequately assessed without carrying out unnecessary testing. When considering any 'hot spots' identified, samples are specifically targeted for screening on a sample by sample and analyte by analyte basis.

Notes for Off-Site Disposal

When considering the removal of any materials from this site as a waste, to be disposed of at a landfill, it can be seen that where the uncontaminated natural strata (excluding any 'topsoil' or 'peat' materials) can be kept separate from any made ground or contaminated natural strata, then these materials can be considered as 'inert' and taken to an Inert Landfill Site.

Where made ground or contaminated natural strata is to be removed off site as a 'waste', a preliminary classification assessment, regarding off-site disposal, can be made utilising the contamination soils screening undertaken as part of the Level 1 Risk Assessment for Human Health. If there is sufficient screening to classify these materials as Non-Hazardous, then they can be disposed of at a Non-Hazardous Landfill. If insufficient preliminary screening has been undertaken to carryout the classification assessment, then further preliminary soils screening should be undertaken, where required.

If the results of the preliminary classification assessment indicate that the materials to be removed from site as a 'waste' should be classified as Hazardous Waste, then prior to disposal, full WAC screening should be completed so that these materials can be classified as either Stable Non-Reactive Hazardous Waste or Hazardous Waste, and disposed of at a suitable waste disposal facility.

If possible, removal of materials from site as a 'waste' should be kept to a minimum, however, if materials have to be removed to accommodate finished ground levels etc., it is recommended that the volume to be disposed of is calculated, as the amount of additional screening required, including any full WAC screening, will be dependant upon the volume of material to be disposed of.