Solum House
Unit 1 Elliott Court
St Johns Road
Meadowfield
Durham
DH7 8PN

Tel: (0191) 378 6380
Fax: (0191) 378 0494

Email: admin@arc-environmental.com
www.arc-environmental.com

GROUND INVESTIGATION REPORT

MAUGHAN REYNOLDS PARTNERSHIP

PROPOSED EXTENSION OF WINDSOR CARE HOME

AT THE FORMER GREENFIELDS SCHOOL

VICTORIA ROAD EAST

HEBBURN

TYNE AND WEAR

Project No: 13-422

Prepared By:
Terry McMenam

Date: 10/03/2014

Approved By:
Darren McGrath

Date: 10/03/2014

The information and or advice contained in this 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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1.0 Introduction March 2014

Arc Environmental Limited was instructed by Maughan Reynolds Partnership of Gateshead, Tyne & Wear, on behalf of their client Windsor Care Home, to undertake a program of Ground Investigation Works on the site of the former Greenfields School in Hebburn, Tyne & Wear. The site is located to the north of Victoria Road East in the small Town of Hebburn, Tyne & Wear where proposals have been made to extend the adjacent Windsor Care Home which bounds the site to the west.

The intrusive investigation works undertaken by Arc Environmental Limited comprised the sinking of 9 no. windowless sampling boreholes (labelled BH's 1 – 5 & BH's A – D) accompanied by the installation of 3 no. combined ground gas and groundwater monitoring wells, installed at the location of BH's 1, 3 & 5. The investigation works completed on site were generally undertaken in accordance with the results of a Phase 1: Desk Top Study Report which was produced for the site by Geo Environmental Engineering, reference; 2012-443, dated February 2013. The borehole positions can be seen on the borehole location plan attached in Appendix II. This plan should be used for orientating purposes only, as the positions shown are approximate and the plan is not to scale.

2.0 Site Details

Table 2.1

Site Name & Address:	Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear.
National OS Grid Reference:	432033, 564936.
Description of Location:	The site is located to the north of Victoria Road East, and to the east of the existing Windsor Care Home development within the small Town of Hebburn.
Site Shape & Development Details:	The site is irregular in shape. Proposals have been made to extend the existing Windsor Care Home development which is situated to the west. At this stage, only the western part of the site (adjoining land) is earmarked for new development works (new structures). The eastern part of the site is reserved for a new application, comprising a second Care Home development.

3.0 Scope of Works

Table 3.1

Client:	Windsor Care Home.
Consulting Engineers:	Maughan Reynolds Partnership.
Project Type:	Proposed Care Home extension.
Site Location Plans:	See Appendix I.
Layout Plan (Existing):	See Appendix I.
Layout Plan (Proposed):	See Appendix I.
Intrusive Investigation Works:	9 no. windowless sampling boreholes (labelled BH's 1 – 5 & BH's A - D), Installation of 3 no. combined ground gas and groundwater monitoring wells, installed at the location of BH's 1, 3 & 5.
Laboratory Testing:	Geotechnical & Generic Ground Contamination.
CLEA Classification:	*Residential.*
Reporting:	Factual & Interpretative.
Previous Investigations:	A Phase 1: Desk Top Study Report has been produced for this site by Geo Environmental Engineering, reference; 2012-443, dated February 2013. The Phase 1: Desk Top Study Report involves the collation and review of information already available for the site, such as geological plans, mining records, historical plans, etc. and forms the basis of a preliminary risk assessment.

3.0 Scope of Works (Cont'd)

The information contained in this report is limited to the area of the site as indicated on the existing and proposed site plans shown in Appendix I, and to those areas accessible during the ground investigation. The depths of strata on the record sheets are recorded from current ground level. 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 Rational

The purpose of this ground investigation is to provide information on the general ground and groundwater conditions below the site area, in order to help aid with the design of foundations for the proposed Care Home extension and to highlight any possible ground contamination issues which may be of concern. The rationale behind the location of each exploratory position is summarised in Table 4.1 below.

Table 4.1

Potential issue	Position
Geotechnical considerations – targeting the proposed Care Home building extension	BH's 1 – 5
Determine the gas regime and groundwater conditions below the area of the proposed building extension	BH's 1, 3 & 5
General site wide contamination assessment	BH's 1 – 5 & BH's A – D

5.0 Ground Conditions

For an accurate description of the ground conditions encountered at each borehole locations, reference should be made to the borehole 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 borehole locations.

5.1 Soil Profile:-

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

Table 5.1

Type of strata	Depths recorded (BGL)	Description & general comments
MADE GROUND: (Variable)	From 0.00m up to c.0.20m to c.4.00m	At the borehole locations the site surfacing comprised a mixture of block paving, dolostone, tarmac, brick rubble and grass. The underlying made ground deposits consisted of black sandy, ash debris, black shale, stone and sandy, gravelly clay deposits containing anthropogenic debris. The deepest zone of made ground was recorded at the location of BH2 which extended to a depth of c.4.00m. At the location of BHD the borehole was terminated within made ground deposits at a depth of c.1.00m.
DRIFT GEOLOGY: (Glacial Till)	From c.0.20m to c.4.00m up to c.5.00m (base of BH's 1 – 5)	The natural deposits comprised firm and stiff, sandy, gravelly CLAYS containing occasional cobbles.

5.0 Ground Conditions (Cont'd)

5.1 Soil Profile (Cont'd):-

There was no visual evidence of significant ground contamination (i.e. fuel-derived contaminants, etc.) present within the soils recorded at the borehole locations. In addition, there was no evidence of asbestos fibres or asbestos containing materials (ACM's) within the general matrix of the made ground deposits encountered. However, fragments of ash were recorded within the made ground deposits as well, as rubble type debris at a number of the borehole locations.

5.2 Groundwater:-

All of the boreholes remained dry during the period of investigation.

Whilst the boreholes remained dry during the exploratory period, it would be deemed prudent to allow for the introduction of temporary groundwater control techniques (i.e. pumping equipment), in order to take care of any localised ingresses of groundwater which may occur within open excavations during the construction period, especially during the wetter periods of the year. Combined ground gas & groundwater monitoring wells were installed at the locations of BH's 1, 3 & 5 in order to undertake out a program of ground gas and groundwater monitoring. The results are discussed in detail in Section 6.1 below and continues on the following page.

6.0 Insitu Testing

6.1 Insitu Gas & Groundwater Monitoring:-

Combined ground gas & groundwater monitoring wells were installed at the location of BH's 1, 3 & 5 primarily to determine the ground gas regime for the site. In addition, water levels were also observed during each visit. A standard 50mm diameter HDPE standpipe, with gravel and/or geo-wrap surround, bentonite seal, gas valve cap and security cover, was installed to depths of c.5.00m below current ground levels, and the ground gas and water levels were allowed to reach equilibrium, prior to the first monitoring visit. Monitoring was undertaken using a Gas Data GFM 430 soil gas analyser, with integral flow meter, and a Geotechnical Instruments electronic dip-meter. The response zones were designed to target ground gas migration from nearby historic infilled areas which include; clay pits and a reservoir. In accordance with CIRIA Report C665, November 2007, the current NHBC Document; Guidance on evaluation of development proposals on site where methane and carbon dioxide are present, Report Edition No. 04, March 2007, BS8485:2007: Code of practice for the characterization and remediation from ground gas affected developments and the recent BS8576:2013 Guidance on Investigations for Ground Gas, Permanent Gases and Volatile Organic Compounds (VOC's) it is felt that an adequate risk assessment for this site can be undertaken based on the following limiting factors:

- The proposed development (residential care home – flats 'best fit') is considered as a **moderate** sensitivity
- The risk associated with the gas generation potential of sources for this particular site is considered as **moderate.** The assessment has been based on the results of the Geo Environmental Engineering, reference; 2012-443, dated February 2013, as well as the ground conditions identified within the boreholes during the fieldworks

In accordance with the aforementioned documents it was deemed appropriate to undertake 9 no. monitoring visits undertaken over a period of 6 months for this development site.

6.0 Insitu Testing (Cont'd)

6.1 Insitu Gas & Groundwater Monitoring (Cont'd):-

A summary of the results for the visits undertaken, compared with the 'inert' background gas levels are presented in Table 6.1 below and copies of the monitoring certificates are attached in Appendix V. For the purposes of the proposed redevelopment the site is characterised based on the limiting borehole gas volume flow for methane and carbon dioxide known as the Gas Screening Value (GSV) which in turn determines the level of protection required. The gas monitoring undertaken has identified nominal concentrations of Carbon Dioxide (CO_2) ranging from 0.1%v/v up to 2.9%v/v. No levels of Methane (CH4) were recorded and flow rates were consistently recorded at <0.1l/hr.

In accordance with CIRIA Report C665, the risk to the proposed development from ground gases has been assessed by converting the results in Table 6.1 to a GSV, calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates (after Wilson & Card). Due to the lack of CH_4 recorded, there is no GSV value for Methane. In order to complete the risk assessment the maximum GSV for the CO_2 levels recorded has been determined by multiplying the maximum concentration recorded (2.9%v/v) by the maximum flow rate (0.1l/hr). The GSV can be calculated as follows;

Carbon Dioxide GSV Carbon Dioxide GSV = 0.029 x 0.1 = 0.0029l/hr

The GSV value of 0.0029l/hr places the site within the Characteristic Situation 1 (CS1) classification. Based on the insitu gas monitoring results obtained, the site is not considered to be at risk from hazardous ground gases and therefore the proposed building will not require any dedicated protection measures.

Table 6.1

Position	Date	Atmospheric Pressure (mbar)	Water (m bgl)	CH_4 (%v/v)	LEL (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	Flow Rate (l/hr)
Background		**~**	**~**	**0**	**0**	**0**	**21.0**	**0**
BH1	18/10/2013	1007	0.74	0.0	0.0	2.9	18.3	<0.1
BH3			1.00	0.0	0.0	1.8	18.1	<0.1
BH5			2.17	0.0	0.0	1.5	18.3	<0.1
BH1	24/10/2013	1004	0.70	0.0	0.0	0.1	19.6	<0.1
BH3			1.05	0.0	0.0	0.2	19.7	<0.1
BH5			1.75	0.0	0.0	0.1	20.1	<0.1
BH1	29/10/2013	994	0.75	0.0	0.0	0.1	19.6	<0.1
BH3			0.90	0.0	0.0	0.1	19.6	<0.1
BH5			1.55	0.0	0.0	0.1	19.6	<0.1
BH1	04/11/2013	982	0.80	0.0	0.0	0.1	19.9	<0.1
BH3			0.95	0.0	0.0	0.2	20.0	<0.1
BH5			1.55	0.0	0.0	0.1	19.9	<0.1
BH1	21/11/2013	999	0.78	0.0	0.0	0.2	19.8	<0.1
BH3			0.85	0.0	0.0	0.1	19.7	<0.1
BH5			1.70	0.0	0.0	0.1	19.9	<0.1
BH1	20/12/2013	1001	0.80	0.0	0.0	0.1	19.9	<0.1
BH3			0.85	0.0	0.0	0.1	19.5	<0.1
BH5			1.70	0.0	0.0	0.1	19.7	<0.1
BH1	09/01/2014	991	0.75	0.0	0.0	0.1	19.8	<0.1
BH3			1.00	0.0	0.0	0.2	19.7	<0.1
BH5			1.70	0.0	0.0	0.1	19.9	<0.1

6.0 Insitu Testing (Cont'd)

6.1 Insitu Gas & Groundwater Monitoring (Cont'd):-

Table 6.1 (Cont'd)

Position	Date	Atmospheric Pressure (mbar)	Water (m bgl)	CH_4 (%v/v)	LEL (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	Flow Rate (l/hr)
Background		**~**	**~**	**0**	**0**	**0**	**21.0**	**0**
BH1	29/01/2014	990	0.70	0.0	0.0	0.1	19.6	<0.1
BH3			1.10	0.0	0.0	0.1	19.6	<0.1
BH5			1.80	0.0	0.0	0.1	19.7	<0.1
BH1	27/02/2014	992	0.75	0.0	0.0	0.1	19.1	<0.1
BH3			0.60	0.0	0.0	0.1	19.1	<0.1
BH5			0.98	0.0	0.0	0.1	19.0	<0.1

When considering the results of the groundwater monitoring completed, it can be seen that water levels ranging from between c.0.60m to c.2.17m have been recorded. The water levels observed are likely to be attributable to trapped pockets of water, rather than representing a continuous shallow ground water surface (water table) below the site, particularly as the boreholes remained dry during the initial investigation works. Nevertheless, as previously recommended, it would be considered prudent to allow for the introduction of temporary groundwater control measures and dewatering techniques i.e. pumping equipment, in order to take care of any water ingresses that may occur, which could be significant on this site, particularly during the wetter periods of the year and where deeper excavations are envisaged, i.e. drainage, etc.

6.2 Insitu Hand Shear Vane Tests:-

Insitu hand vane tests were carried out using a portable insitu hand vane tester on the natural clay deposits encountered within the boreholes. The insitu hand vane tester takes direct readings of shear strength, three vane sizes allow for the direct determination of undrained shear strength of extremely low to high strength clays. The peak vane value is determined by a calibrated scale ring built into the head assembly. The cross handle is used both to push the vane to the desired test depth and apply the shearing torque. The results are summarised in Table 6.2 below and can also be found adjacent to the appropriate sample level, on the graphic borehole record sheets attached in Appendix II.

Table 6.2

Type of strata	Range of shear strength values
Natural clay	60kN/m² up to 120kN/m²

120kN/m² is the upper limit of the testing equipment

Insitu hand vane test results completed on the natural clay deposits were noted to range from 60kN/m^2 up to 120kN/m^2 which are indicative of medium and high strength strata.

6.3 Insitu Standard Penetration Tests:-

Insitu standard penetration tests (SPT's) were carried out within the boreholes, with the use of a normal split spoon sampler in order to determine the relative density and strength of the made ground deposits tested. The results are shown as uncorrected 'N' values on the graphic borehole record sheets, adjacent to the appropriate sample level and can be seen attached in Appendix II. The results are summarised in Table 6.3 on the following page.

6.0 Insitu Testing (Cont'd)

6.3 Insitu Standard Penetration Tests (Cont'd):-

Table 6.3

Type of strata	Range of SPT 'N' values	Results details
Made ground	6 up to 9	The results are indicative of loose strata

7.0 Laboratory Testing

All geotechnical testing was carried out in accordance with BS1377:1990: Parts 1-9 unless otherwise stated, at a UKAS accredited laboratory. The geotechnical testing was completed by Professional Soils Laboratory of Doncaster and Chemtech Environmental Limited of Consett, Co. Durham, whereas the contamination screening was solely completed by Chemtech Environmental Limited.

7.1 Determination of pH & SO_4:-

Nine representative samples of the made ground and natural deposits encountered within the boreholes were tested in order to determine their acidic (pH) and soluble sulphate (SO_4) levels. The results are shown in Table 7.1 below and are also contained in the Chemtech Environmental Limited Analytical Report no. 49076, a copy of which can be seen in Appendix III.

Table 7.1

Position	Depth (m)	pH	SO_4(mg/l)	Design SO_4 class	ACEC class	Type of strata
BH1	0.30-0.70	7.7	25	DS-1	AC-1	Made ground
BH1	2.00-3.00	8.1	83	DS-1	AC-1	Natural clay
BH2	0.20-0.70	7.7	36	DS-1	AC-1	Made ground
BH2	0.70-1.00	8.0	45	DS-1	AC-1	Made ground
BH3	1.00-2.00	8.1	76	DS-1	AC-1	Natural clay
BH4	0.20-1.00	7.8	29	DS-1	AC-1	Made ground
BH5	1.00-2.00	8.1	31	DS-1	AC-1	Natural clay
BHB	0.00-0.20	8.2	412	DS-1	AC-1	Made ground
BHC	0.30-0.90	7.3	43	DS-1	AC-1	Made ground

The pH values obtained range from 7.3 to 8.2 and the amount of soluble sulphate present falls below the negligible threshold value of 500mg/l. Therefore, in accordance with BRE Special Digest 1: 2005 (3rd Edition) the site should be given a classification of Class DS-1. When considering the nature of the deposits tested and assuming mobile groundwater, the assessment of the Aggressive Chemical Environment for Concrete (ACEC) for the site overall, is AC-1.

7.2 Determination of Liquid & Plastic Limits:-

Four representative samples of the natural clay deposits encountered within the boreholes were tested in order to determine their liquid and plastic limits, so these materials could be classified. The results can be seen in Table 7.2 on the following page and are also contained in the PSL Analytical Report, ref no: PSL13/3459 a copy of which can be seen attached in Appendix III.

7.0 Laboratory Testing (Cont'd)

7.2 Determination of Liquid & Plastic Limits (Cont'd):-

Table 7.2

Position	Depth(m)	M/C (%)	LL	PL	PI	Class	% Passing 425µm Sieve
BH1	1.00-2.00	20	47	20	27	CI	77
BH3	1.00-2.00	20	45	20	25	CI	85
BH4	2.00-3.00	18	48	21	27	CI	78
BH5	0.30-1.00	36	86	30	56	CV	100

From the results it can be seen that the samples tested are inorganic in nature, and when plotted on the plasticity chart fall within the intermediate and very high plasticity ranges and from the resulting plasticity indices have a moderate and high volume change potential, when taking into account the amount passing the 425µm sieve. Therefore, it can be seen that some of the natural clay deposits tested may undergo significant changes in volume, if large changes in their natural moisture content were to occur due to seasonal variations or the like, and if new foundations were to be based within these materials, they would need to be taken down to a minimum depth of 1.00m below finished ground levels. The minimum foundation depth will need to be increased due to the thickness of made ground noted over the site, at the location of BH2 in particular, and if the proposed development is within close proximity to existing or envisaged vegetation, even if trees are to be removed, in order to ensure no additional future shrinkage and swelling of these materials occurs. Reference should be made to BS5837: 2012, "Trees in Relation to Design Demolition & Construction".

7.3 Contamination Screening:-

Representative samples of the made ground were passed onto Chemtech Environmental of Consett, Co. Durham, so that generic and targeted soil and leachate contamination screening could be carried out. The results of all the testing can be found in the Chemtech Environmental Limited Analytical Report no. 49076 a copy of which can be seen in Appendix III. In total 6 no. samples of soil were screened using a standard generic contamination suite (based on the current CLEA SGV listed analytes with historical additions), which is used to assess typical made ground (disturbed natural strata mixed with anthropogenic debris), of an unknown source. Although there was no significant evidence of any fuel /oil type contamination noted within the borehole positions carried out, fragments of ash were noted within the made ground at several locations. Therefore, for completeness representative samples were targeted for Speciated Polycyclic Aromatic Hydrocarbons (PAH's). Furthermore, based on the recent demolition of the existing Greenfields School structure selected samples were also chosen for asbestos fibre analysis. Following the results of the generic and targeted soil screening, 3 no. soil samples were subjected to leachate screening, to allow an assessment to be made of the mobility of the contaminants and the potential impact on controlled waters and off-site migration. The generic and targeted contamination results (soil, water and leachate) have been used to carryout Level 1 Quantitative Human Health and Controlled Waters Risk Assessments for the contamination present and are discussed in Section 8.0 on the following page. The total analysis carried out is summarised below:

Soils:-

- 6 no. samples chosen for generic soils suite which includes the following determinands; Arsenic, Cadmium, Chromium III & VI, Copper, Lead, Mercury, Nickel, Selenium, Zinc, pH, Soluble Sulphate, Cyanide, and Total Organic Carbon (TOC))
- 2 no. soil samples targeted for Speciated PAH's (USEPA 16)
- 3 no. soil samples chosen for asbestos screening

7.0 Laboratory Testing (Cont'd)

7.3 Contamination Screening (Cont'd):-

Leachate:-

- 3 no. soil samples chosen for a generic leachate suite which includes the following determinands; (suite comprises; Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc, pH, Sulphate and Cyanide
- 2 no. soil samples chosen for leachable Speciated PAH's (USEPA 16)

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 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 Sections 8.4 (Human Health) and 8.5 (Controlled Waters). Comments regarding off-site disposal can also be found in Appendix IV. Following the results of the intrusive investigation works, a Conceptual Site Model (CSM) has been developed for this site, and is represented graphically in Appendix IV. In addition, Table 8.1 in Section 8.2 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 Conceptual Site Model (CSM):-

Table 8.1

	Sources (S)
S1	Made ground associated with former on site activities – **The levels of contaminants on site area such that they represent a risk to the proposed end users**
S2	Hazardous ground gas production from adjacent infilled features – **no protection measures are required based on the program of gas monitoring undertaken**

	Pathways (P)
P1	Ingestion
P2	Inhalation of indoor / outdoor air
P3	Dermal contact
P4	Migration through existing services
P5	Direct contact with building materials
P6	Surface run off and leachate migration

	Receptors (R)
R1	Human health (End users and construction workforce)
R2	Groundwater at depth within the solid geology (Secondary A Aquifer)
R3	Building materials*
R4	Adjacent sites
R5	Flora and fauna*

* = Not included in the Human Health & Controlled Waters Risk Assessment

8.0 Level 1 Ground Contamination Risk Assessment

8.2.1 Sources:-

The site is effectively covered by a layer of made ground deposits ranging in thickness from between c.0.20m to c.4.00m which represents the primary potential source of ground contamination for this site. The majority of the made ground contains some anthropogenic debris mixed with disturbed natural strata and these materials have been assessed using the standard generic soil suites. The site has been considered as a single averaging area for these analytes. There was no significant visual, olfactory evidence of significant heavy or gross contamination, such as waste oils, fuels, etc. However, fragments of ash and rubble type debris was occasionally noted at several boreholes locations within the general matrix of the made ground deposits and as a result for completeness screening for Speciated PAH's and Asbestos was also undertaken.

8.2.2 Pathways:-

When considering the proposed end use (*Residential*), without considering treatment, removal or protection measures, there are some potential plausible pathways available for inhalation, wind (dust / particulate) and volatilization within the proposed structure. 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 show 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 and areas of hardstanding, a number of these pathways may 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. 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* and *Allotment* end uses based on a child aged 0 to 6 years, whilst *Commercial* end uses are based upon an adult with a working life of 49 years. Key generic assumptions for *Residential* and *Commercial* end use are also based upon a typical residential property, consisting of a two-storey small terraced house, with private garden, and a typical commercial or light industrial property, consisting of a three-storey office building (pre-1970), respectively. No building is anticipated for *Allotment* end uses. Within the recently published CLEA Risk Assessment Model for Human Health (Science Reports SC50021/SR2 & SC050021/SR3) there are 3 no. generic end use categories presently in use, as follows;

1) Residential, 2) Allotments, 3) Commercial

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

1) Residential

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

8.2.3 Receptors (Cont'd):-

With regard to nearby sensitive receptors the following have been considered;

- The underlying solid geology (Carboniferous Coal Measures) which is recorded as a Secondary A Aquifer

8.3 Screening Strategy:-

As detailed in Section 8.0, sub-section 8.4 (Contamination Screening) samples have been chosen for a wide range of determinands in order to assess the risks posed to the future site end users and nearby sensitive receptors.

8.4 Level 1 Risk Assessment (Soils):-

8.4.1 Human Health – Generic Soils Suite:-

The results for the generic soil suite screening results have been subjected to statistical analysis utilising the contaminated land statistical analysis sheets developed by CL:AIRE, and a copy of the calculation sheets and the statistical methodology can be found in Appendix IV. The results of the analysis and risk assessment have been summarised in Table 8.2 below and have identified the following.

Table 8.2

Analyte	Critical Conc. (C_C) mg/kg	No. of Samples Screened	Max. Conc. (C_M) recorded	Statistical Upper Confidence Limit ($UCL_{0.95}$) mg/kg	Has $UCL_{0.95}$ exceeded C_C	No. of Samples > C_C	Is C_M an outlier (statistical hot spot)
Arsenic	**32(1)**	**6**	**51**	**40.70**	**NO**	**2**	**NO**
Cadmium	10(1)	6	1.1	0.81	NO	0	NO
Chromium III	3,000(2)	6	42	39.31	NO	0	NO
Chromium VI	4.3(2)	6	<1	0.5	NO	0	NO
Copper	2,330(2)	6	403	379.95	NO	0	NO
Lead	**450(4)**	**6**	**1,244**	**1,181.91**	**NO**	**1**	**NO**
Mercury	170(1)	6	1.8	1.69	NO	0	NO
Nickel	130(1)	6	70	54.56	NO	0	NO
Selenium	350(1)	6	2.9	2.42	NO	0	NO
Zinc	3,750(2)	6	705	451.43	NO	0	NO
Cyanide	34(3)	6	<2	1	NO	0	NO

(1) = CLEA SGV (Residential – Version 1.06), (2) = LQM CIEH Generic Assessment Criteria Values, 2nd Edition – Residential (2009), (3) = ATRISK^{SOIL} SSV (Residential – 2011), (4) = CLEA SGV (Residential – Version 1.0 beta)

- The maximum concentration (C_M) values for Arsenic and Lead exceed the critical concentration values (C_C) for this site
- The statistical upper confidence limit $UCL_{0.95}$ value for Arsenic and Lead exceed the chosen C_C values for the site
- The maximum concentration (C_M) values and upper confidence limit ($UCL_{0.95}$) values for the remaining analytes screened fall below the C_C values for this site

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

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

8.4.1 Human Health – Generic Soils Suite (Cont'd):-

- When considering the contamination screening results, in particular the levels of Arsenic and Lead, the made ground below the site represents a potential risk to the proposed end users where exposure pathways will be available (areas of soft landscaping) post completion of the proposed development and as a result protection measures, or further assessment will be required in order to break the linkage in the source-pathway-receptor model

8.4.2 Human Health – Targeted Soil Screening (PAH's):-

The targeted soil screening results for PAH's have been summarised in Table 8.3 below and have identified the following.

Table 8.3

Analyte	Critical Conc. (C_C) mg/kg	No. of Samples Screened	Max. Conc. (C_M) recorded	No. of Samples > C_C
Naphthalene	3.7(1)	2	<0.1	0
Acenaphthylene	400(1)	2	0.3	0
Acenaphthene	480(1)	2	0.2	0
Fluorene	380(1)	2	0.4	0
Phenanthrene	200(1)	2	8.0	0
Anthracene	4900(1)	2	1.3	0
Fluoranthene	460(1)	2	14.6	0
Pyrene	1000(1)	2	11.3	0
Benzo(a)anthracene	**4.7(1)**	**2**	**6.1**	**1 (BH1 at 0.30m-0.70m)**
Chrysene	8.0(1)	2	6.8	0
Benzo(b)fluoranthene	**6.5(1)**	**2**	**8.8**	**1 (BH1 at 0.30m-0.70m)**
Benzo(k)fluoranthene	9.6(1)	2	3.4	0
Benzo(a)pyrene	**0.94 (1)**	**2**	**6.3**	**1 (BH1 at 0.30m-0.70m)**
Indeno(123cd)pyrene	**3.9(1)**	**2**	**4.1**	**1 (BH1 at 0.30m-0.70m)**
Dibenz(ah)anthracene	0.86(1)	2	0.8	0
Benzo(ghi)perylene	46(1)	2	3.5	0

(1) = LQM CIEH Generic Assessment Criteria (Residential – 2nd Edition, 2009, based on 2.5% SOM). * = Site Value (C_M) less than analytical detection limit.

- The maximum concentration (C_M) values for a number of the Speciated PAH's exceed the critical concentration values (C_C) applied to the site, at the location of BH1. The problematic PAH's are highlighted in bold text above
- When considering these results, due to the levels of PAH's the made ground below the site represents a potential risk to the proposed end users where exposure pathways will be available (areas of soft landscaping) post completion of the proposed development and as a result protection measures, or further assessment will be required in order to break the linkage to the source-pathway-receptor model

8.4.3 Human Health – Asbestos Screening:-

Due to the presence of the made ground some of which was rubble like in nature, it was deemed prudent to undertake screening on selected samples recovered within the boreholes to determine whether any unidentified asbestos fibres were present, as none were recorded during the creation of the boreholes. The results of the asbestos screening are summarised in Table 8.4 on the following page.

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

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

8.4.3 Human Health – Asbestos Screening (Cont'd):-

Table 8.4

Position	Depth (m)	Chrysotile (white)	Amosite (brown)	Crocidolite (blue)	Anthophyllite	Actinolite	Tremolite
BH1	0.30-0.70	ND	ND	ND	ND	ND	ND
BH2	0.70-1.00	ND	ND	ND	ND	ND	ND
BHB	**0.00-0.20**	**Detected**	**ND**	**ND**	**ND**	**ND**	**ND**

ND = None detected

- Chrysotile asbestos was recorded at the location of BHB at a depth of 0.00m-0.20m within the made ground which represents a potential risk to the proposed end users where exposure pathways will be available (areas of soft landscaping) post completion of the proposed development and as a result protection measures, or further assessment will be required in order to break the linkage to the source-pathway-receptor model

8.5 Level 1 Controlled Waters Risk Assessment:-

Based on the results of the soil screening carried out on various samples chosen, appropriate leachate screening has been carried out and the results have been used to complete a Level 1 Risk Assessment for the potential impact on controlled waters. Where available, the results have been assessed against most appropriate Environmental Quality Standards (EQS) for priority substances and other certain pollutants, with the remaining analytes being assessed against current UK Drinking Water Standards (DWS). A summary of the results for this Level 1 Risk Assessment can be seen in Table 8.5 below and continued on the following page.

Table 8.5

LEVEL 1		Site Data		
Analyte	Critical Conc. (C_C) (µg/l)	Max. Conc. (C_M) (µg/l)	Has max. C_C Value Been Exceeded	Number of samples >C_C
Arsenic	50(1)	13.30	NO	0
Boron	2000(1)	60	NO	0
Cadmium	5(1)	<0.07	NO	0
Chromium	5-250(1)	1.7	NO	0
Copper	1-28(1)	15.4	NO	0
Lead	4-250(1)	9.2	NO	0
Mercury	1(1)	0.035	NO	0
Nickel	50-200(1)	1.0	NO	0
Selenium	10(2)	0.78	NO	0
Zinc	8-500(2)	20	NO	0
Cyanide	50(2)	<20	NO	0
Naphthalene	10(1)	<0.1	NO	0
Acenaphthylene	0.1(3)	<0.1	NO	0
Acenaphthene	0.1(3)	<0.1	NO	0
Fluorene	0.1(3)	<0.1	NO	0
Phenanthrene	0.1(3)	<0.1	NO	0
Anthracene	0.1(3)	<0.1	NO	0
Fluoranthene	0.1(3)	<0.1	NO	0
Pyrene	0.1(3)	<0.1	NO	0

(1) = UK EQS Freshwater, (2) = UK Drinking Water Standard (DWS), (3) = UK Drinking Water Standard for PAH's. (4) = Analytical Detection Limit

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

8.5 Level 1 Controlled Waters Risk Assessment (Cont'd):-

Table 8.5 (Cont'd)

LEVEL 1	Critical Conc. (C_C) (µg/l)	Site Data		
Analyte		Max. Conc. (C_M) (µg/l)	Has max. C_C Value Been Exceeded	Number of samples >C_C
Benzo(a)anthracene	0.1[3]	<0.1	NO	0
Chrysene	0.1[3]	<0.1	NO	0
Benzo(b)fluoranthene	0.1[3]	<0.1	NO	0
Benzo(k)fluoranthene	0.1[3]	<0.1	NO	0
Benzo(j)fluoranthene	0.1[3]	<0.1	NO	0
Benzo(a)pyrene	0.1[1]	<0.1	NO	0
Indeno(123cd)pyrene	0.1[3]	<0.1	NO	0
Dibenz(ah)anthracene	0.1[3]	<0.1	NO	0
Benzo(ghi)perylene	0.1[3]	<0.1	NO	0

[1] = UK EQS Freshwater, [2] = UK Drinking Water Standard (DWS), [3] = UK Drinking Water Standard for PAH's. [4] = Analytical Detection Limit

- None of the maximum concentrations for any of the generic analytes exceed the critical concentration values for the soils tested and as a result, the risks posed to controlled waters from the contaminants recorded within the made ground deposits on this site is felt to be negligible

8.6 Off-Site Disposal:-

At this stage based on the contamination screening results obtained, it is possible that the made ground deposits will be classified as Hazardous for off-site disposal purposes due to the levels of Asbestos. However, this is an approximation only as definitive waste disposal classifications should be confirmed with individual landfill operators, in accordance with their site licences. Therefore the test results contained within Appendix III should be presented to, and discussions held with, appropriate licensed operators for confirmation of disposal classification and potential the costs involved with the removal of excess waste soils.

9.0 Conclusions & Recommendations

9.1 Ground Conditions:-

In total 9 no. windowless sampling boreholes have been sunk on this site by Arc Environmental Limited. The boreholes were labelled BH's 1 – 5 & BH's A – D and were accompanied by the installation of 3 no. combined ground gas and groundwater monitoring wells, installed at the location of BH's 1, 3 & 5.

Made ground deposits were recorded at all of the borehole locations. The made ground deposits present on site are a likely to be present as a result of former on site activities. Made ground deposits were noted to extend below the site to depths ranging from between c.0.20m to c.4.00m. The site surfacing at the borehole locations comprised a mixture of block paving, dolostone, tarmac, brick rubble and grass, below which a combination of black sandy ash debris, black shale, stone and sandy, gravelly clay deposits containing anthropogenic debris. The deepest zone of made ground was recorded at the location of BH2 which extended to a depth of c.4.00m and this is likely to be attributable to an infilled clay pit which is recorded on published OS plans.

At the location of BHD the borehole was terminated within made ground deposits at a depth of c.1.00m.

9.0 Conclusions & Recommendations (Cont'd)

9.1 Ground Conditions (Cont'd):-

Natural clays were recorded below the made ground deposits and these were noted to extend to depths of at least c.5.00m below existing site levels – c.5.00m represents the terminal depths of BH's 1 – 5, which targeted the proposed building extension.

9.2 Groundwater:-

During the sinking of boreholes no water ingresses were experienced. However, during the program of periodic ground gas and groundwater monitoring undertaken, relatively shallow water levels were observed within the monitoring wells. It would therefore be deemed prudent to allow for the introduction of temporary groundwater control techniques (i.e. pumping equipment), in order to take care of any localised ingresses of groundwater which may occur within open excavations during the construction period, especially during the wetter periods of the year. It should also be noted that instability within such excavations is also likely to occur as a result of water inflow, especially where loose made ground deposits are exposed.

9.3 Foundation Options:-

Based on the ground conditions identified within the boreholes, BH's 1 – 5 in particular, the natural firm and stiff (medium and high strength) sandy, gravelly clay deposits encountered below the site area would be a suitable foundation bearing medium for the proposed extension to the adjacent Windsor Nursing Home, where a maximum allowable bearing pressure of 150kN/m^2 will be available. However, a deep area of made ground was recorded at the location of BH2 to a depth of c.4.00m below existing site levels. As a result foundation excavations will need to be deepened within this part of the site, or alternative options considered to ensure all foundations are based within the natural firm and stiff sandy gravelly clay deposits. Other parts of the site may be underlain by similar thickness of made ground arising as a result of the sites former activity.

Since variations in the upper ground conditions have been identified below the site area within the boreholes it is recommended that all foundation excavations are inspected by a suitably qualified Geotechnical Engineer in order to confirm the correct founding strata has been reached.

9.4 Ground Contamination:-

Due to levels of Arsenic, Lead, various PAH's and the presence of Chrysotile (asbestos) the made ground below the site represents a potential risk to the proposed end users where exposure pathways will be available (areas of soft landscaping) post completion of the proposed development. Therefore protection measures, or further assessment will be required in order to break the linkage in the source-pathway-receptor model. A suitable method of protection for this site would be to introduce a 'clean cover' in all areas of soft landscaping. Where the made ground lies below buildings and hardcover there will be no requirement for protection.

Prior to undertaking any remedial measures a Remediation Strategy will need to be produced which details the remedial measures required in order to bring the risks currently posed by ground contamination to acceptable levels. The contents of this document will need to be agreed with the Local Authority prior to commencement.

Based on the insitu gas monitoring results obtained, the site is not considered to be at risk from hazardous ground gases and therefore the proposed building extension will not require any dedicated protection measures.

9.0 Conclusions & Recommendations (Cont'd)

9.4 Ground Contamination (Cont'd):-

Based on laboratory test results, the design sulphate class for concrete in contact with the made ground and the natural deposits is assessed to be DS-1 and the Aggressive Chemical Environment for Concrete (ACEC) is classified as AC-1. All buried concrete should be designed in accordance with BRE Special Digest 1:2005 (3rd Edition).

Recourse to the relevant utility suppliers should be made for their advice / comments regarding any service material precautions necessary.

When considering the risks to the construction workforce, adequate PPE will be required to provide protection against the levels of 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.

In addition, when considering the presence of Asbestos below the site, precautions will need to be taken with regards to protect the health of construction workers and members of the public during any groundwork preparation. These will include, suitable PPE (typically dust masks, disposal overalls, etc.), the dampening down of the made ground during any excavations to prevent wind blown particles/fibres from becoming airborne (especially during dry periods), and excavations left open for a long period of time being suitably covered to prevent wind blown particles/fibres escaping from open excavations, so as to provide protection for workers and the general public.

Based on the contamination screening results obtained, it is likely that the made ground deposits will be classified as Hazardous for off-site disposal purposes. However, this is an approximation only as definitive waste disposal classifications should be provided by individual landfill operators, in accordance with their site licences. Therefore the test results contained within Appendix III should be presented to, and discussions held with, appropriate licensed operators for confirmation of disposal classification and potential the costs involved with the removal of excess waste soils.

9.5 General Comments:-

For future site works, adequate lateral trench support will be required for excavations, in order to prevent trench wall collapse or over excavations, as well as to create a safe working environment below a depth of 1.20m, and any excavations on this site should remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time. Reference to CIRIA 97 'Trenching Practice' would be beneficial to establish a suitable means of support or battering of excavation sides during construction.

It is also recommended that adequate surface drainage is 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.

In addition, for deeper excavations, drainage, service runs or the like that may pass close to or beneath any existing or 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 or adjacent old foundation based at a higher level.

9.0 Conclusions & Recommendations (Cont'd)

9.5 General Comments (Cont'd):-

An "observational technique" can be applied to the design and construction of any new foundations 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

APPENDIX I

Location Plan

Aerial Photograph

Existing Site Layout Plan

Proposed Development Layout Plan

Client:

MAUGHAN REYNOLDS PARTNERSHIP

Project Title:	Drawing Title:
Proposed Extension at Windsor Nursing Home, Victoria Road Hebburn, NE31 1YQ	Location Plan

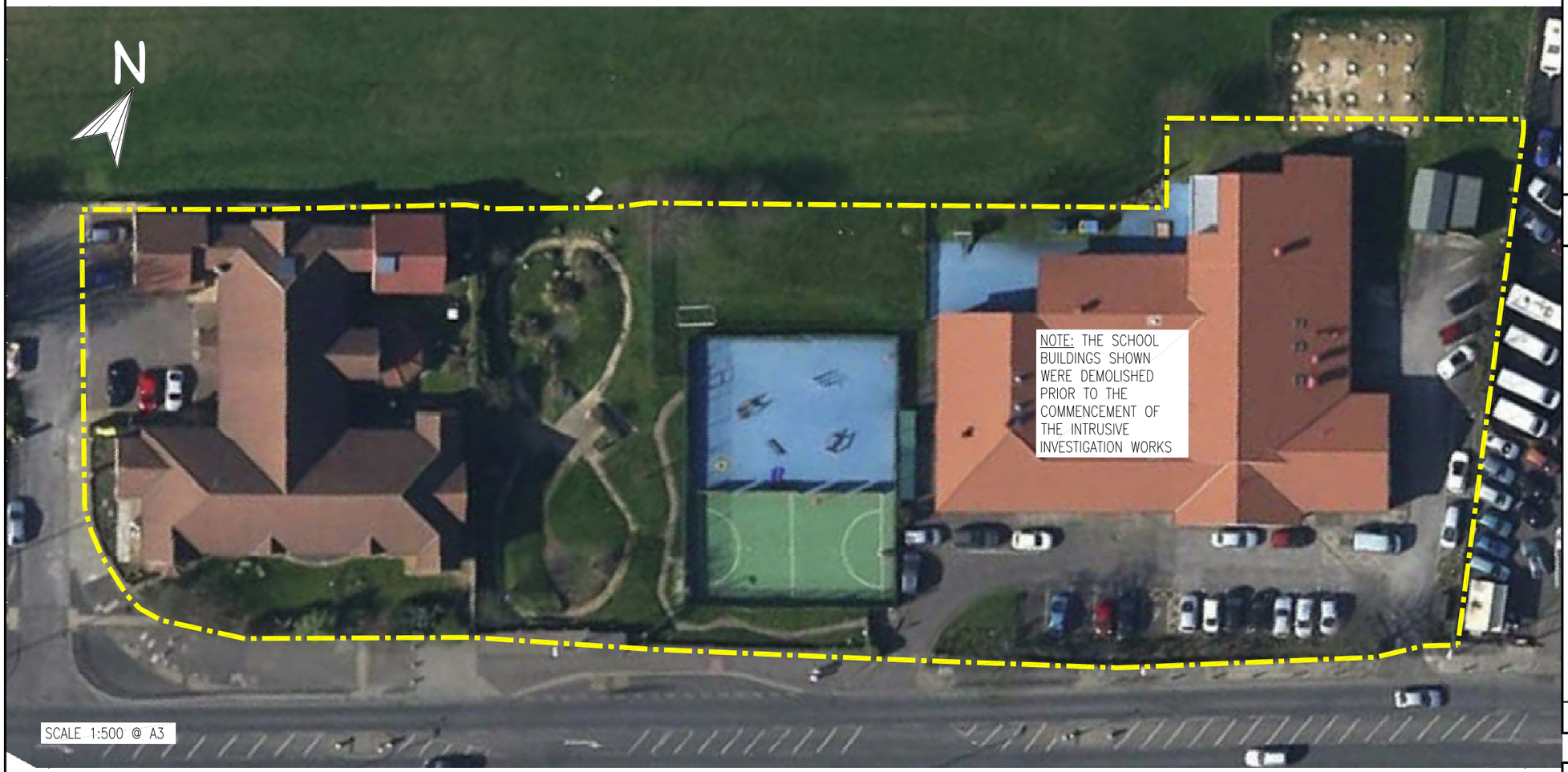
Job Reference:	Drawing Number:	Revision:
13-422	–	–

Drawn by:	Date:	Scale at A4:
P.D	24.02.14	As Shown

Checked by:	Approved by:	
T.M	T.M	The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.
		© Copyright Reserved

rev.	date	amendments	drawn	chckd

ARC ENVIRONMENTAL LTD
Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham
DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com



ARC ENVIRONMENTAL LTD
Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

LEGEND	
	INDICATIVE SITE BOUNDARY

rev.	date	amendments	drawn	chckd

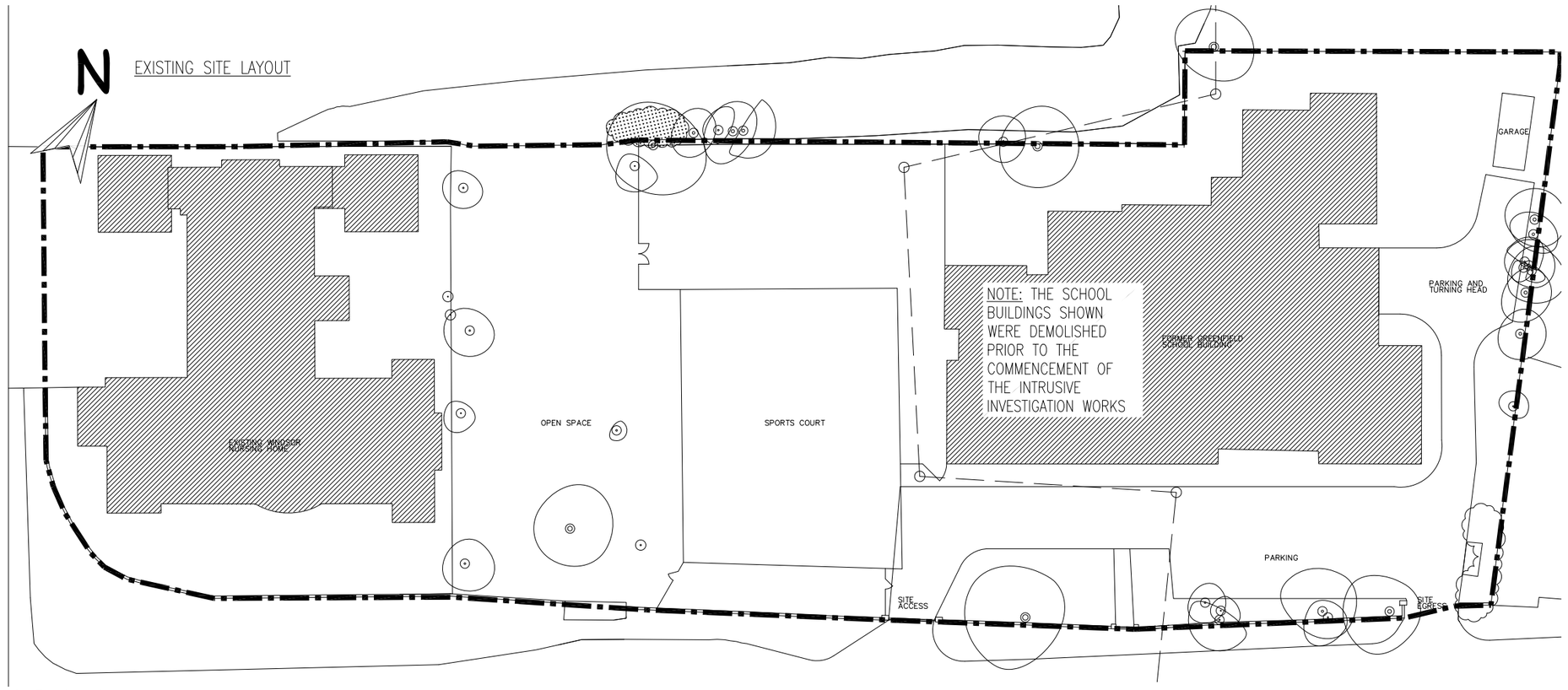
Client:
MAUGHAN REYNOLDS PARTNERSHIP

Project Title:
Proposed Extension at Windsor Nursing Home
Victoria Road
Hebburn, NE31 1YQ

Drawing Title:
Aerial Photograph

Scale at A3:	Date:	Drawn by:	Approved by:
1:500 @ A3	24.02.14	P.D	T.M

Job Ref:	Drg no:	Rev:
13-422	–	–



SCALE 1:500 @ A3

ARC ENVIRONMENTAL LTD
Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

LEGEND

	INDICATIVE SITE BOUNDARY

rev.	date	amendments	drawn	chckd

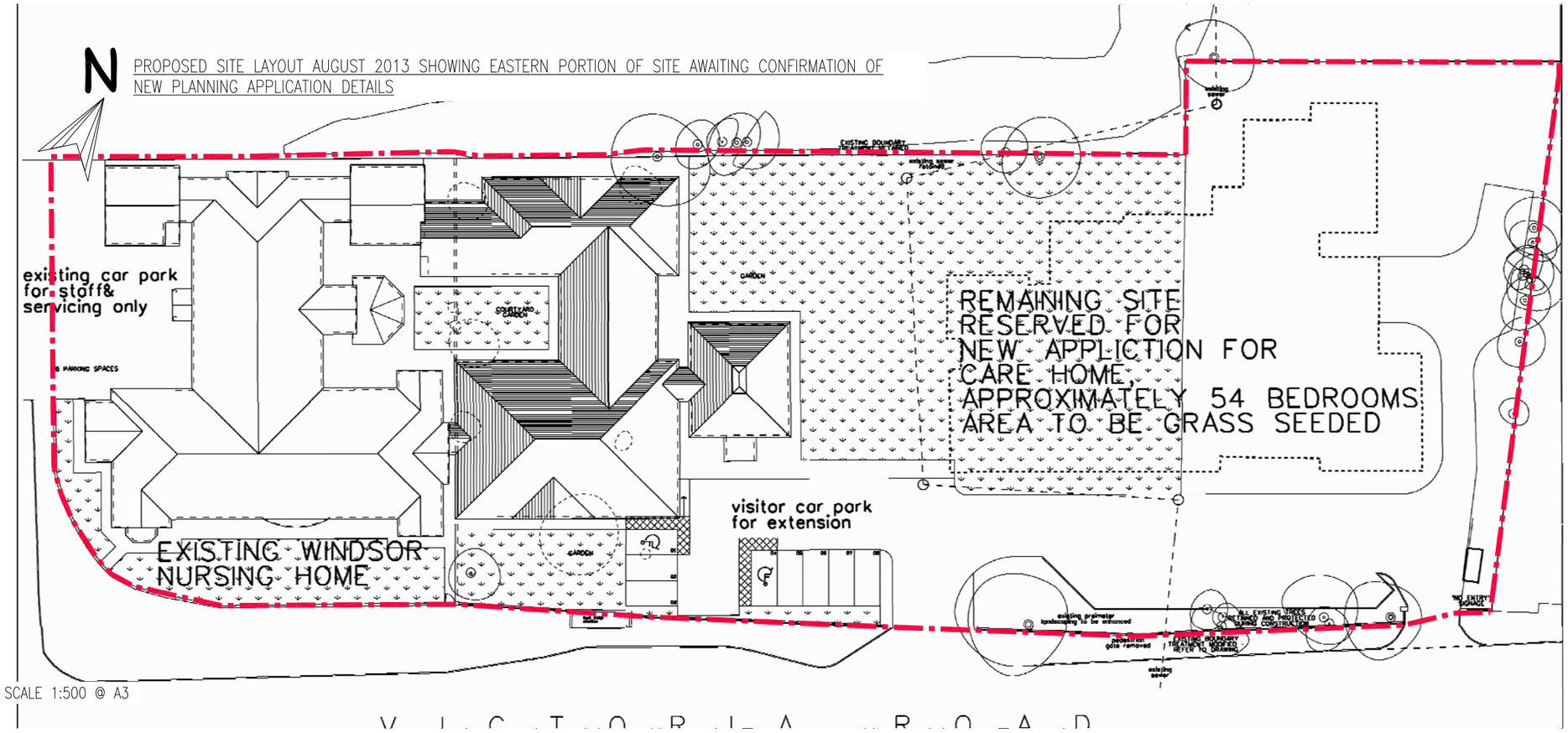
Client:
MAUGHAN REYNOLDS PARTNERSHIP

Project Title:
Proposed Extension at Windsor Nursing Home
Victoria Road
Hebburn, NE31 1YQ

Drawing Title:
Existing Site Layout Plan

Scale at A3:	Date:	Drawn by:	Approved by:
1:500 @ A3	24.02.14	P.D	T.M

Job Ref:	Drg no:	Rev:
13-422	–	–



ARC ENVIRONMENTAL LTD
Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

LEGEND

	INDICATIVE SITE BOUNDARY

rev.	date	amendments	drawn	chckd

Client:
MAUGHAN REYNOLDS PARTNERSHIP

Project Title:
Proposed Extension at Windsor Nursing Home
Victoria Road
Hebburn, NE31 1YQ

Drawing Title:
Proposed Development Layout Plan

Scale at A3:	Date:	Drawn by:	Approved by:
1:500 @ A3	24.02.14	P.D	T.M

Job Ref:	Drg no:	Rev:
13-422	–	–

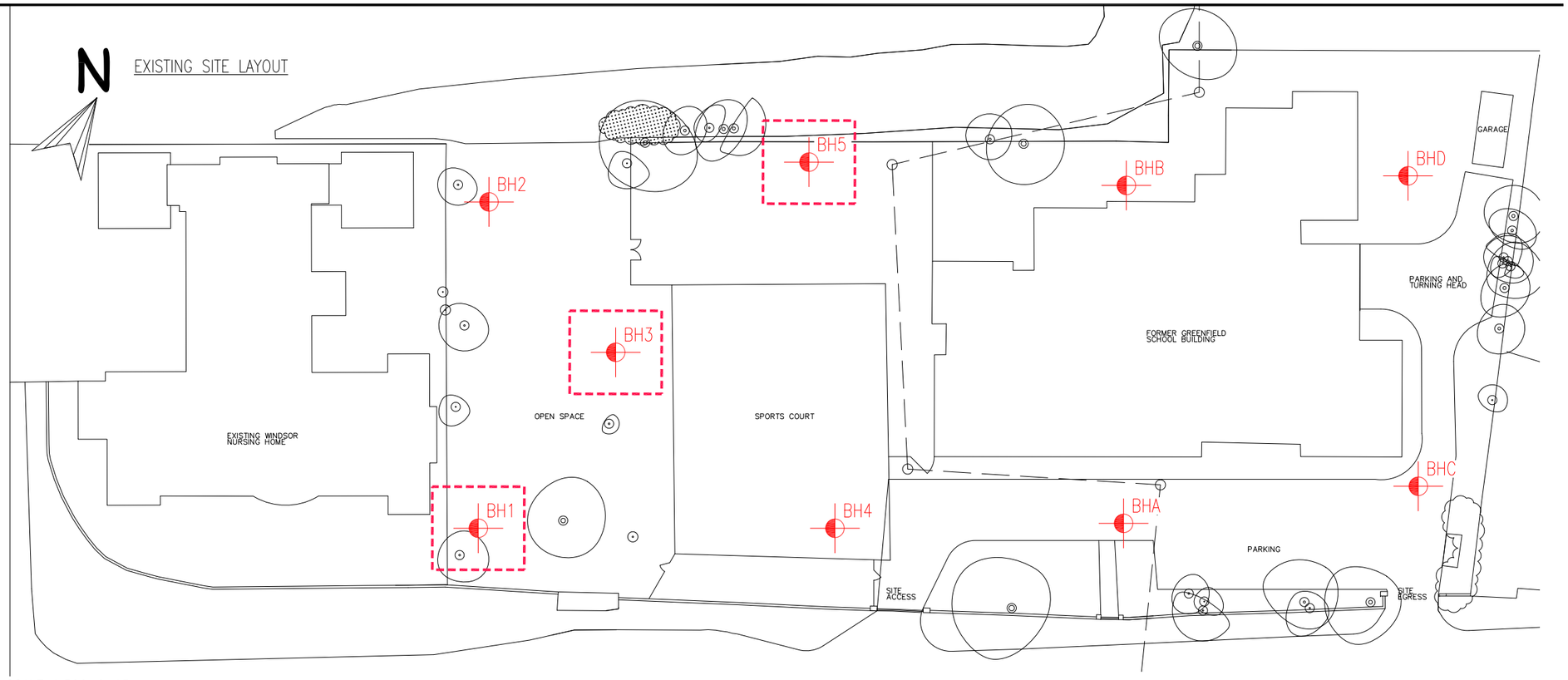
APPENDIX II

Borehole Location Plan

Borehole Record Sheets

N

EXISTING SITE LAYOUT



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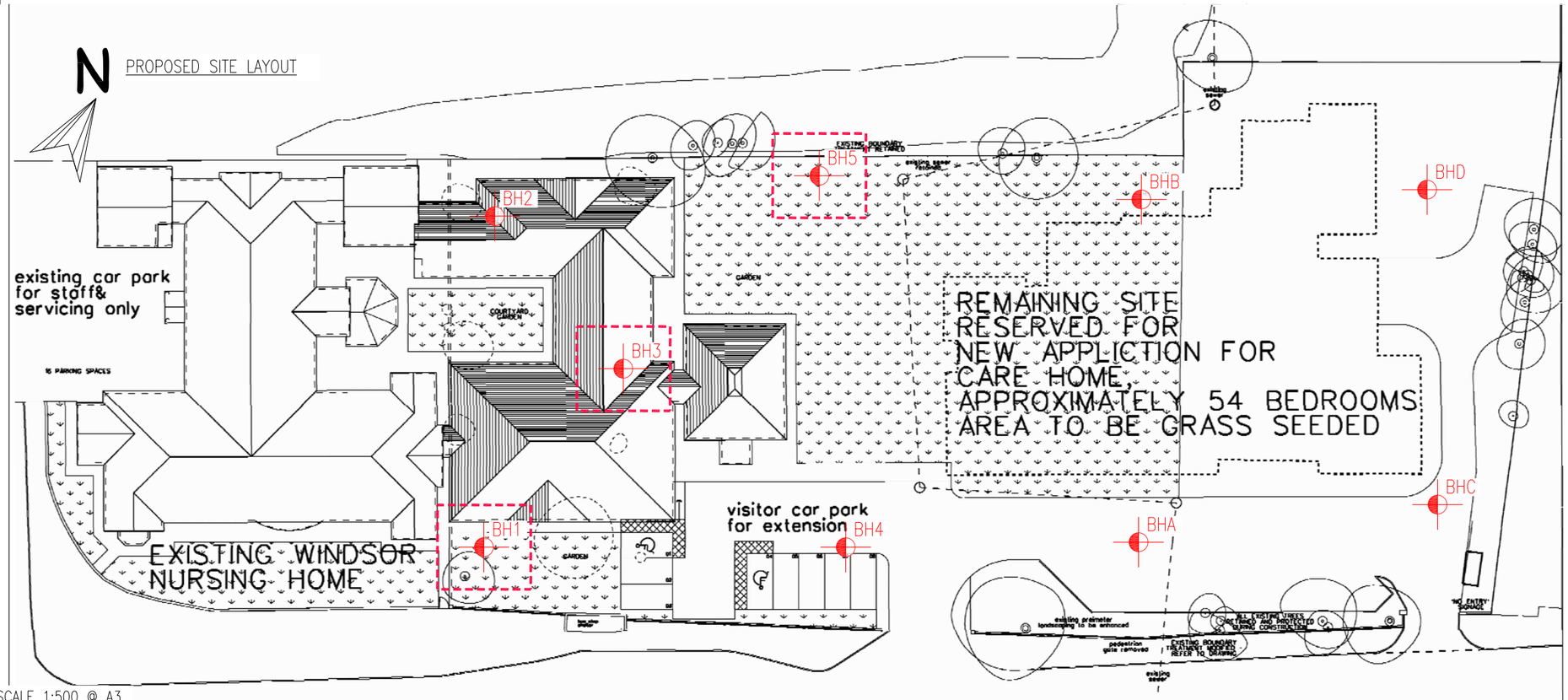
PROPOSED SITE LAYOUT



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V I C T O R I A R O A D

ARC ENVIRONMENTAL LTD
Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

KEY	
⊕	WINDOWLESS SAMPLING BOREHOLE POSITION
▭	GAS AND GROUNDWATER MONITORING WELL INSTALLED AT THIS POSITION

rev.	date	amendments	drawn	chckd

Client:
MAUGHAN REYNOLDS PARTNERSHIP

Project Title:
Proposed Extension at Windsor Nursing Home
Victoria Road
Hebburn, NE31 1YQ

Drawing Title:
Borehole Location Plan

Scale at A3:	Date:	Drawn by:	Approved by:
1:500 @ A3	02.10.13	P.D	T.M

Job Ref:	Drg no:	Rev:
13-422	–	–

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BH1**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	B					0.10	Block paving (MADE GROUND).		
						0.30	Brick rubble (MADE GROUND).		
0.30-0.70	B/J					(0.40)	Black sandy ash (MADE GROUND).		
						0.70			
0.70-1.00	B						Stiff (high strength) dark brown sandy gravelly CLAY. Occasional cobbles noted (GLACIAL TILL).		
1.00	V	80kN/m^2							
1.00-2.00	B/J								
2.00	V	110kN/m^2							
2.00-3.00	B/J					(4.30)			
3.00	V	120kN/m^2							
3.00-4.00	B								
4.00	V	80kN/m^2							
4.00-5.00	B								
						5.00			
5.00	V	60kN/m^2					Borehole complete at 5.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

AGS3 UK BH 13-422 BH LOGS.GPJ AGS3_ALL.GDT 12/3/14

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BH2**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.20	B					0.20	Dolostone (MADE GROUND).		
0.20-0.70	B/J					(0.50) 0.70	Black sandy ash with fragments of brick (MADE GROUND).		
0.70-1.00	B/J						Loose black and grey shale (MADE GROUND).		
1.00-1.45	SPT	N=9							
1.00-2.00	B								
2.00-2.45	SPT	N=7				(2.80)			
2.00-3.00	B								
3.00-3.45	SPT	N=6							
3.00-3.50	B					3.50			
3.50-4.00	B					(0.50) 4.00	Firm dark brown sandy gravelly clay containing occasional fragments of brick (MADE GROUND).		
4.00	V	70kN/m^2					Firm (medium strength) dark brown sandy gravelly CLAY (GLACIAL TILL).		
4.00-5.00	B					(1.00) 5.00			
5.00	V	70kN/m^2					Borehole complete at 5.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

AGS3 UK BH 13-422 BH LOGS.GPJ AGS3_ALL.GDT 12/3/14

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BH3**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.20	B					0.05	Tarmac (MADE GROUND).		
0.20-1.00	B					0.20	Dolostone subbase (MADE GROUND).		
							Firm and stiff (medium and high strength) dark brown sandy gravelly CLAY. Occasional cobbles noted (GLACIAL TILL).		
1.00	V	70kN/m^2							
1.00-2.00	B/J								
2.00	V	120kN/m^2							
2.00-3.00	B					(4.80)			
3.00	V	94kN/m^2							
3.00-4.00	B								
4.00	V	70kN/m^2							
4.00-5.00	B								
						5.00			
5.00	V	70kN/m^2					Borehole complete at 5.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

AGS3 UK BH 13-422 BH LOGS.GPJ AGS3_ALL.GDT 12/3/14

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BH4**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.20	B					0.20	Grass overlying dark brown sandy gravelly soil (MADE GROUND).		
0.20-1.20	B/J					(1.00)	Firm dark brown sandy gravelly clay containing occasional fragments of brick (MADE GROUND).		
1.00-1.45	SPT	N=8				1.20			
1.20-2.00	B						Stiff (high strength) dark brown sandy gravelly CLAY. Occasional cobbles noted (GLACIAL TILL).		
2.00	V	110kN/m^2							
2.00-3.00	B								
3.00	V	100kN/m^2				(3.80)			
3.00-4.00	B								
4.00	V	100kN/m^2							
4.00-5.00	B								
						5.00			
5.00	V	80kN/m^2					Borehole complete at 5.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

AGS3 UK BH 13-422 BH LOGS.GPJ AGS3_ALL.GDT 12/3/14

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BH5**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	B					(0.30) 0.30	Grass overlying dark brown sandy gravelly soil (MADE GROUND).		
0.30-1.00	B						Stiff (high strength) dark brown sandy gravelly CLAY. Occasional cobbles noted (GLACIAL TILL).		
1.00	V	90kN/m^2							
1.00-2.00	D/J								
2.00	V	110kN/m^2							
2.00-3.00	B					(4.70)			
3.00	V	100kN/m^2							
3.00-4.00	B								
4.00	V	90kN/m^2							
4.00-5.00	B								
						5.00			
5.00	V	90kN/m^2					Borehole complete at 5.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BHA**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	B					0.05	Tarmac (MADE GROUND).		
						0.30	Dolostone subbase (MADE GROUND).		
0.30-1.00	B					(0.70)	Stiff (high strength) dark brown sandy gravelly CLAY (GLACIAL TILL).		
						1.00			
1.00	V	120kN/m^2					Borehole complete at 1.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

AGS3 UK BH 13-422 BH LOGS.GPJ AGS3_ALL.GDT 12/3/14

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BHB**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.20	B/J					0.20	Brick rubble (MADE GROUND).		
0.20-1.00	B					(0.80) 1.00	Stiff dark brown sandy gravelly CLAY (GLACIAL TILL).		
							Borehole complete at 1.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

AGS3 UK BH 13-422 BH LOGS.GPJ AGS3_ALL.GDT 12/3/14

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BHC**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	B					0.05	Tarmac (MADE GROUND).		
						0.30	Dolostone subbase (MADE GROUND).		
0.30-0.90	B/J					(0.60)	Firm dark brown sandy gravelly clay containing occasional fragments of brick (MADE GROUND).		
						0.90			
0.90-1.00	B					1.00	Firm (medium strength) medium very sandy CLAY (GLACIAL TILL).		
1.00	V	80kN/m^2					Borehole complete at 1.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

AGS3 UK BH 13-422 BH LOGS.GPJ AGS3_ALL.GDT 12/3/14

ARC Environmental Ltd.
Solum House, Unit 1 Elliott Court
St Johns Road, Meadowfield, DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project				BOREHOLE No
Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear				**BHD**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
13-422	11-09-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.20	B					0.20	Dark brown sandy gravelly soil (MADE GROUND).		
0.20-1.00	B					(0.80) 1.00	Firm dark brown sandy gravelly clay containing occasional fragments of brick (MADE GROUND).		
							Borehole complete at 1.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY during the investigation period.

All dimensions in metres Scale 1:37.5	Client Maughan Reynolds Partnership	Method/ Plant Used Windowless Sampling	Logged By DO

AGS3 UK BH 13-422 BH LOGS.GPJ AGS3_ALL.GDT 12/3/14

APPENDIX III

Laboratory Results

PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL13/3459

Client's Reference: Report Date: 24 September 2013

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

For the attention of: Terry McMenam

Contract Title: Former Greenfields School, Hebburn

Date Received: 20/9/2013
Date Commenced: 20/9/2013
Date Completed: 24/9/2013

Notes: Observations 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	A Watkins	M Beastall
(Director)	(Director)	(Laboratory Manager)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH1		B	1.00-2.00	Brown gravelly sandy CLAY.
BH3		B	1.00-2.00	Brown slightly gravelly sandy CLAY.
BH4		B	2.00-3.00	Brown gravelly sandy CLAY.
BH5		B	0.30-1.00	Brown CLAY.

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	24/09/13		24/09/13		24/09/13

FORMER GREENFIELDS SCHOOL, HEBBURN.

Contract No: PSL13/3459

Client Ref: 13-422

SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

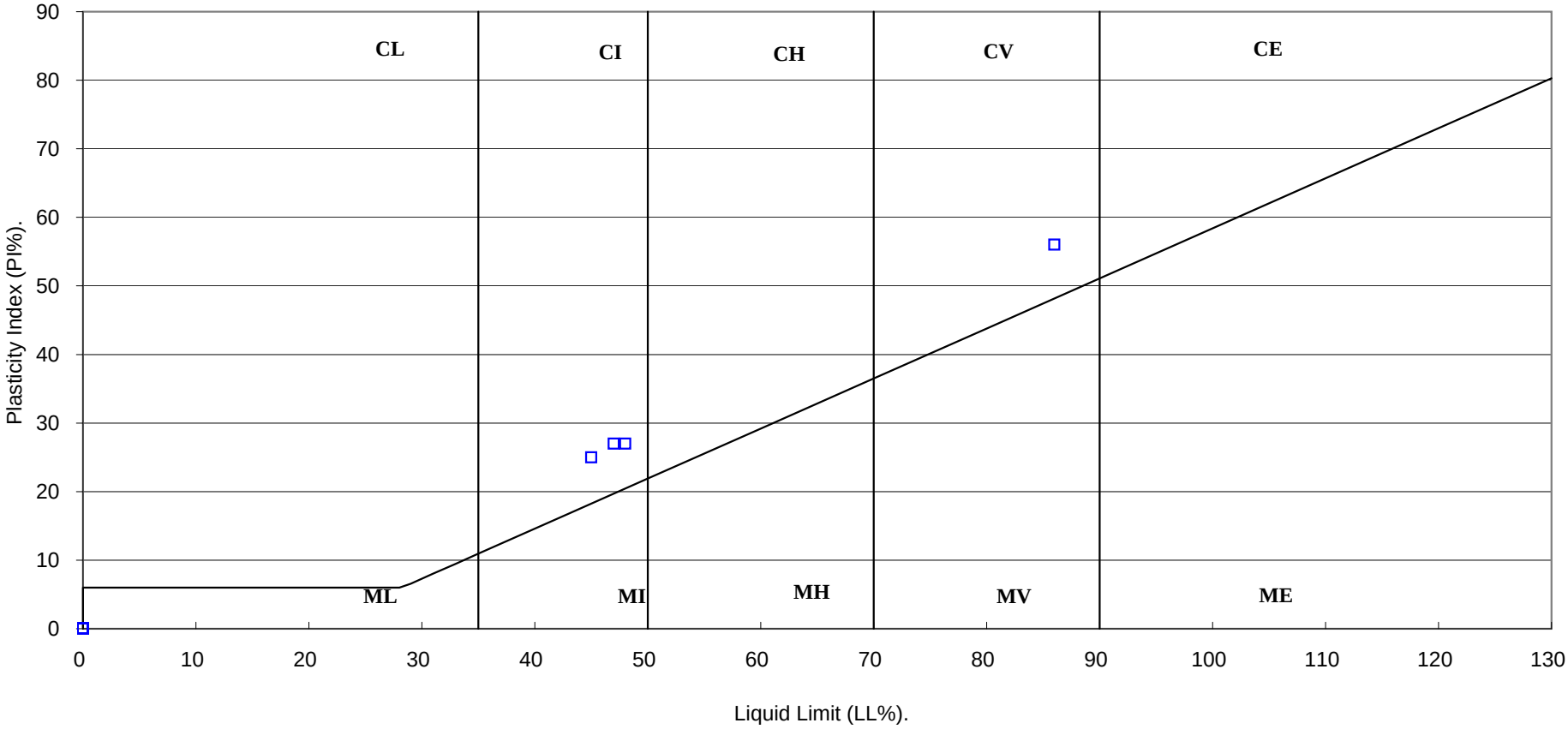
Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH1		B	1.00-2.00	20				47	20	27	77	Intermediate plasticity CI.
BH3		B	1.00-2.00	20				45	20	25	85	Intermediate plasticity CI.
BH4		B	2.00-3.00	18				48	21	27	78	Intermediate plasticity CI.
BH5		B	0.30-1.00	36				86	30	56	100	Very high plasticity CV.

SYMBOLS : NP : Non Plastic

PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		24/09/13		24/09/13		24/09/13
	FORMER GREENFIELDS SCHOOL, HEBBURN.				Contract No:	PSL13/3459
					Client Ref:	13-422

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



	Compiled by	Date	Checked by	Date	Approved by	Date
Professional Soils Laboratory		24/09/13		24/09/13		24/09/13
	FORMER GREENFIELDS SCHOOL, HEBBURN.				Contract No:	PSL13/3459
					Client Ref:	13-422

2531

ANALYTICAL TEST REPORT

Contract no: 49076

Contract name: Former Greenfields School, Hebburn

Client reference: 13-422

Clients name: ARC Environmental

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

Samples received: 18 September 2013

Analysis started: 19 September 2013

Analysis completed 25 September 2013

Report issued: 26 September 2013

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:

Karan Campbell
Director

John Campbell
Director

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 exclusive of stones.

Lab ref	Sample id	Depth (m)	Soil description passing 2mm sieve	Description of material retained on 2mm sieve	% Retained on 2mm sieve	Moisture (%)
49076-1	BH 1	0.30-0.70	Sandy Clay	Slag & Gravel	35.1	24.1
49076-2	BH 1	2.00-3.00	Clay	Stones & Gravel	23.5	13.9
49076-3	BH 2	0.20-0.70	Sandy Clay	Slag & Gravel	44.6	18.8
49076-4	BH 2	0.70-1.00	Sandy Loamy Clay	Shale	88.2	5.6
49076-5	BH 3	1.00-2.00	Clay	Gravel	19.5	14.2
49076-6	BH 4	0.20-1.20	Clay	Brick & Gravel	35.1	21.1
49076-7	BH 5	1.00-2.00	Clay	N/A	<1	13.9
49076-8	BH B	0.00-0.20	Sandy Clay	Stones & Gravel	50.7	12.3
49076-9	BH C	0.30-0.90	Clay	N/A	<1	20.5

Chemtech Environmental Limited

SOILS

Lab number			49076-1	49076-2	49076-3	49076-4	49076-5	49076-6
Sample id			BH 1	BH 1	BH 2	BH 2	BH 3	BH 4
Depth (m)			0.30-0.70	2.00-3.00	0.20-0.70	0.70-1.00	1.00-2.00	0.20-1.20
Date sampled			11/09/2013	11/09/2013	11/09/2013	11/09/2013	11/09/2013	11/09/2013
Test	**Method**	**Units**						
Arsenic (total)	CE054 M	mg/kg As	51	-	49	8.3	-	17
Cadmium (total)	CE054 M	mg/kg Cd	1.1	-	0.8	<0.2	-	0.5
Chromium (total)	CE054 M	mg/kg Cr	40	-	36	30	-	42
Chromium (III)	-	mg/kg CrIII	40	-	36	30	-	42
Chromium (VI)	CE050	mg/kg CrVI	<1	-	<1	<1	-	<1
Copper (total)	CE054 M	mg/kg Cu	403	-	149	46	-	58
Lead (total)	CE054 M	mg/kg Pb	1244	-	443	26	-	270
Mercury (total)	CE054	mg/kg Hg	1.8	-	0.7	<0.5	-	<0.5
Nickel (total)	CE054 M	mg/kg Ni	70	-	45	45	-	34
Selenium (total)	CE054 M	mg/kg Se	2.6	-	2.9	1.4	-	1.6
Zinc (total)	CE054 M	mg/kg Zn	705	-	347	73	-	208
pH	CE004 M	units	7.7	8.1	7.7	8.0	8.1	7.8
Sulphate (2:1 water soluble)	CE049 U	mg/l SO_4	25	83	36	45	76	29
Cyanide (free)	CE077	mg/kg CN	<2	-	<2	<2	-	<2
Organic matter content (OMC)	CE005 M	% w/w	7.10	-	8.43	4.10	-	2.82
Estimate of TOC (calculated from OMC)	CE005 M	% w/w C	4.12	-	4.89	2.38	-	1.64
PAH								
Acenaphthene	CE087	mg/kg	0.2	-	<0.1	-	-	-
Acenaphthylene	CE087	mg/kg	0.3	-	<0.1	-	-	-
Anthracene	CE087	mg/kg	1.3	-	<0.1	-	-	-
Benzo(a)anthracene	CE087	mg/kg	6.1	-	0.6	-	-	-
Benzo(a)pyrene	CE087	mg/kg	6.3	-	0.6	-	-	-
Benzo(b)fluoranthene	CE087	mg/kg	8.8	-	1.0	-	-	-
Benzo(ghi)perylene	CE087	mg/kg	3.5	-	0.4	-	-	-
Benzo(k)fluoranthene	CE087	mg/kg	3.4	-	0.3	-	-	-
Chrysene	CE087	mg/kg	6.8	-	0.6	-	-	-
Dibenz(ah)anthracene	CE087	mg/kg	0.8	-	<0.1	-	-	-
Fluoranthene	CE087	mg/kg	14.6	-	1.4	-	-	-
Fluorene	CE087	mg/kg	0.4	-	<0.1	-	-	-
Indeno(123cd)pyrene	CE087	mg/kg	4.1	-	0.5	-	-	-
Naphthalene	CE087	mg/kg	<0.1	-	<0.1	-	-	-
Phenanthrene	CE087	mg/kg	8.0	-	0.8	-	-	-
Pyrene	CE087	mg/kg	11.3	-	1.0	-	-	-
PAH (total of USEPA 16)	CE087	mg/kg	76	-	6.4	-	-	-
Benzo(j)fluoranthene	CE087	mg/kg	2.9	-	0.2	-	-	-
PAH (total of OIL 8)	CE087	mg/kg	39	-	<5	-	-	-
Subcontracted analysis								
Asbestos	$	-	NAD	-	-	NAD	-	-

Chemtech Environmental Limited

SOILS

Lab number			49076-7	49076-8	49076-9
Sample id			BH 5	BH B	BH C
Depth (m)			1.00-2.00	0.00-0.20	0.30-0.90
Date sampled			11/09/2013	11/09/2013	11/09/2013
Test	**Method**	**Units**			
Arsenic (total)	CE054 M	mg/kg As	-	4.0	11
Cadmium (total)	CE054 M	mg/kg Cd	-	0.3	<0.2
Chromium (total)	CE054 M	mg/kg Cr	-	27	32
Chromium (III)	-	mg/kg CrIII	-	27	32
Chromium (VI)	CE050	mg/kg CrVI	-	<1	<1
Copper (total)	CE054 M	mg/kg Cu	-	14	32
Lead (total)	CE054 M	mg/kg Pb	-	20	89
Mercury (total)	CE054	mg/kg Hg	-	<0.5	<0.5
Nickel (total)	CE054 M	mg/kg Ni	-	24	21
Selenium (total)	CE054 M	mg/kg Se	-	0.9	1.2
Zinc (total)	CE054 M	mg/kg Zn	-	62	72
pH	CE004 M	units	8.1	8.2	7.3
Sulphate (2:1 water soluble)	CE049 U	mg/l SO_4	31	412	43
Cyanide (free)	CE077	mg/kg CN	-	<2	<2
Organic matter content (OMC)	CE005 M	% w/w	-	0.94	3.32
Estimate of TOC (calculated from OMC)	CE005 M	% w/w C	-	0.54	1.93
PAH					
Acenaphthene	CE087	mg/kg	-	-	-
Acenaphthylene	CE087	mg/kg	-	-	-
Anthracene	CE087	mg/kg	-	-	-
Benzo(a)anthracene	CE087	mg/kg	-	-	-
Benzo(a)pyrene	CE087	mg/kg	-	-	-
Benzo(b)fluoranthene	CE087	mg/kg	-	-	-
Benzo(ghi)perylene	CE087	mg/kg	-	-	-
Benzo(k)fluoranthene	CE087	mg/kg	-	-	-
Chrysene	CE087	mg/kg	-	-	-
Dibenz(ah)anthracene	CE087	mg/kg	-	-	-
Fluoranthene	CE087	mg/kg	-	-	-
Fluorene	CE087	mg/kg	-	-	-
Indeno(123cd)pyrene	CE087	mg/kg	-	-	-
Naphthalene	CE087	mg/kg	-	-	-
Phenanthrene	CE087	mg/kg	-	-	-
Pyrene	CE087	mg/kg	-	-	-
PAH (total of USEPA 16)	CE087	mg/kg	-	-	-
Benzo(j)fluoranthene	CE087	mg/kg	-	-	-
PAH (total of OIL 8)	CE087	mg/kg	-	-	-
Subcontracted analysis					
Asbestos	$	-	-	Chrysotile	-

Chemtech Environmental Limited

LEACHATES

Lab number			49076-1L	49076-3L	49076-9L
Sample id			BH 1	BH 2	BH C
Depth (m)			0.30-0.70	0.20-0.70	0.30-0.90
Test	**Method**	**Units**			
Arsenic (dissolved)	CE128	µg/l As	13.30	3.11	1.87
Boron (dissolved)	CE128	µg/l B	14	15	60
Cadmium (dissolved)	CE128	µg/l Cd	<0.07	<0.07	<0.07
Chromium (dissolved)	CE128	µg/l Cr	0.2	0.3	1.7
Copper (dissolved)	CE128	µg/l Cu	15.4	3.2	3.9
Lead (dissolved)	CE128	µg/l Pb	9.2	1.1	3.9
Mercury (dissolved)	CE128	µg/l Hg	0.035	<0.008	0.014
Nickel (dissolved)	CE128	µg/l Ni	1.0	<0.5	1.0
Selenium (dissolved)	CE128	µg/l Se	0.78	0.51	0.39
Zinc (dissolved)	CE128	µg/l Zn	20	4	9
pH	CE004	units	7.8	7.7	7.1
Sulphate	CE049 [U]	mg/l SO_4	<10	<10	<10
Cyanide (free)	CE077	µg/l CN	<20	<20	<20
PAHs					
Acenaphthene	CE087	µg/l	<0.1	<0.1	-
Acenaphthylene	CE087	µg/l	<0.1	<0.1	-
Anthracene	CE087	µg/l	<0.1	<0.1	-
Benzo(a)anthracene	CE087	µg/l	<0.1	<0.1	-
Benzo(a)pyrene	CE087	µg/l	<0.1	<0.1	-
Benzo(b)fluoranthene	CE087	µg/l	<0.1	<0.1	-
Benzo(ghi)perylene	CE087	µg/l	<0.1	<0.1	-
Benzo(k)fluoranthene	CE087	µg/l	<0.1	<0.1	-
Chrysene	CE087	µg/l	<0.1	<0.1	-
Dibenz(ah)anthracene	CE087	µg/l	<0.1	<0.1	-
Fluoranthene	CE087	µg/l	<0.1	<0.1	-
Fluorene	CE087	µg/l	<0.1	<0.1	-
Indeno(123cd)pyrene	CE087	µg/l	<0.1	<0.1	-
Naphthalene	CE087	µg/l	<0.1	<0.1	-
Phenanthrene	CE087	µg/l	<0.1	<0.1	-
Pyrene	CE087	µg/l	<0.1	<0.1	-
PAH (total of USEPA 16)	CE087	µg/l	<0.1	<0.1	-
Benzo(j)fluoranthene	CE087	µg/l	<0.1	<0.1	-
PAH (total of OIL 8)	CE087	µg/l	<0.1	<0.1	-

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE054	Arsenic (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg As
CE054	Cadmium (total)	Aqua regia digest, ICP-OES	Dry	M	0.2	mg/kg Cd
CE054	Chromium (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg Cr
-	Chromium (III)	Calculation: Cr (total) - Cr (VI)	Dry		1	mg/kg CrIII
CE050	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE054	Copper (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg Cu
CE054	Lead (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg Pb
CE054	Mercury (total)	Aqua regia digest, ICP-OES	Dry		0.5	mg/kg Hg
CE054	Nickel (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg Ni
CE054	Selenium (total)	Aqua regia digest, ICP-OES	Dry	M	0.3	mg/kg Se
CE054	Zinc (total)	Aqua regia digest, ICP-OES	Dry	M	3	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE049	Sulphate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	10	mg/l SO_4
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	Wet		2	mg/kg CN
CE005	Organic matter content (OMC)	Based on BS 1377, Colorimetry	Dry	M	0.01	% w/w
CE005	Estimate of TOC (calculated from OMC)	TOC calculated from Organic Matter Content	Dry	M	0.01	% w/w C
CE087	PAH (speciated)	Solvent extraction, GC-MS	Wet		0.1	mg/kg
CE087	PAH (total)	Solvent extraction, GC-MS	Wet		5	mg/kg
$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

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METHOD DETAILS

METHOD	LEACHATES	METHOD SUMMARY	STATUS	LOD	UNITS
CE128	Arsenic (dissolved)	ICP-MS		0.06	µg/l As
CE128	Boron (dissolved)	ICP-MS		6	µg/l B
CE128	Cadmium (dissolved)	ICP-MS		0.07	µg/l Cd
CE128	Chromium (dissolved)	ICP-MS		0.2	µg/l Cr
CE128	Copper (dissolved)	ICP-MS		0.4	µg/l Cu
CE128	Lead (dissolved)	ICP-MS		0.2	µg/l Pb
CE128	Mercury (dissolved)	ICP-MS		0.008	µg/l Hg
CE128	Nickel (dissolved)	ICP-MS		0.5	µg/l Ni
CE128	Selenium (dissolved)	ICP-MS		0.07	µg/l Se
CE128	Zinc (dissolved)	ICP-MS		1	µg/l Zn
CE004	pH	Based on BS 1377, pH Meter		-	units
CE049	Sulphate	Ion Chromatography	U	10	mg/l SO_4
CE077	Cyanide (free)	Distillation, Colorimetry		20	µg/l CN
CE087	PAH (speciated)	Solvent extraction, GC-MS		0.1	µg/l
CE087	PAH (total)	Solvent extraction, GC-MS		0.1	µg/l

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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)
49076-1	BH 1	0.30-0.70	N	
49076-2	BH 1	2.00-3.00	N	
49076-3	BH 2	0.20-0.70	N	
49076-4	BH 2	0.70-1.00	N	
49076-5	BH 3	1.00-2.00	N	
49076-6	BH 4	0.20-1.20	N	
49076-7	BH 5	1.00-2.00	N	
49076-8	BH B	0.00-0.20	N	
49076-9	BH C	0.30-0.90	N	

APPENDIX IV

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

CLEA Risk Assessment Data:

Screening Results Summary Sheet - Soils
CL:AIRE Statistical Analysis Sheet

Conceptual Site Model (CSM)

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 1.06), 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 – (surface water & 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).

Ground Contamination Risk Assessment (Cont'd)

Methodology (Cont'd):-

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. Prior to disposal of these 'inert' materials, full WAC screening may need to be undertaken, with the number of samples to be screened dependant upon the volume of material to be disposed of.

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.

Client/client ref:
Project ref: 13-422
Site ref: Former Greenfields School, Hebburn
Data description: Contamination Screening Results
Contaminant(s): Generic Soils - Residential

	Arsenic (total) (mg/kg)	Cadmium (total) (mg/kg)	Chromium (III) (mg/kg)	Chromium (VI) (mg/kg)	Copper (total) (mg/kg)	Lead (total) (mg/kg)	Mercury (total) (mg/kg)	Nickel (total) (mg/kg)	Selenium (total) (mg/kg)	Zinc (total) (mg/kg)	Cyanide (free) (mg/kg)
Critical concentration, C_c	**32**	**10**	**3000**	**4.3**	**2330**	**450**	**170**	**130**	**350**	**3750**	**34**
Notes	SGV	SGV	LQM - 2009	LQM - 2009	LQM - 2009	SGV	SGV	SGV	SGV	LQM - 2009	ATRISK(SOIL) SSV - 2011
Sample size, n	6	6	6	6	6	6	6	6	6	6	6
Sample mean, $\overline{x}$	23.383333	0.4833333	34.5	0.5	117	348.66667	0.5833333	39.833333	1.7666667	244.5	1
Standard deviation, s	21.053305	0.4020779	5.8566202	0	147.76738	468.24595	0.6226288	17.904376	0.8016649	251.54463	0
Number of non-detects	0	**2**	0	**6**	0	0	**4**	0	0	0	**6**
Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	No	No	No	No	No	No	No	No	No	No	No
Distribution	Normal	Normal	Normal	Single value	Non-normal	Non-normal	Non-normal	Normal	Normal	Normal	Single value
Statistical approach	Auto: One-sample	Auto: One-sample	Auto: One-sample	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: One-sample	Auto: One-sample	Auto: One-sample	Auto: Chebychev

Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				**Evidence level required:**		**95%**	Use Log-Normal distribution to test for outliers			
t statistic, t_0 (or k_0)	-1.002523654	-57.97626603	-1240.299286	N/A	-36.68414928	-0.530095268	-666.5036434	-12.33566195	-1064.028052	-34.13583646	N/A
Upper confidence limit (on true mean concentration, μ)	40.702626	0.8140987	39.31789	0.5	379.95399	1181.9164	1.6913095	54.56219	2.4261484	451.43069	1
Evidence level	**82%**	**100%**	**100%**	**100%**	**100%**	**22%**	**100%**	**100%**	**100%**	**100%**	**100%**
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
Result	**μ ≈≥ Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ ≥ Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**
Select dataset	◉ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y

Back to data | **Go to outlier test** | **Go to normality test** | **Show individual summary**

ARC ENVIRONMENTAL LTD
Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

rev.	date	amendments	drawn	chckd

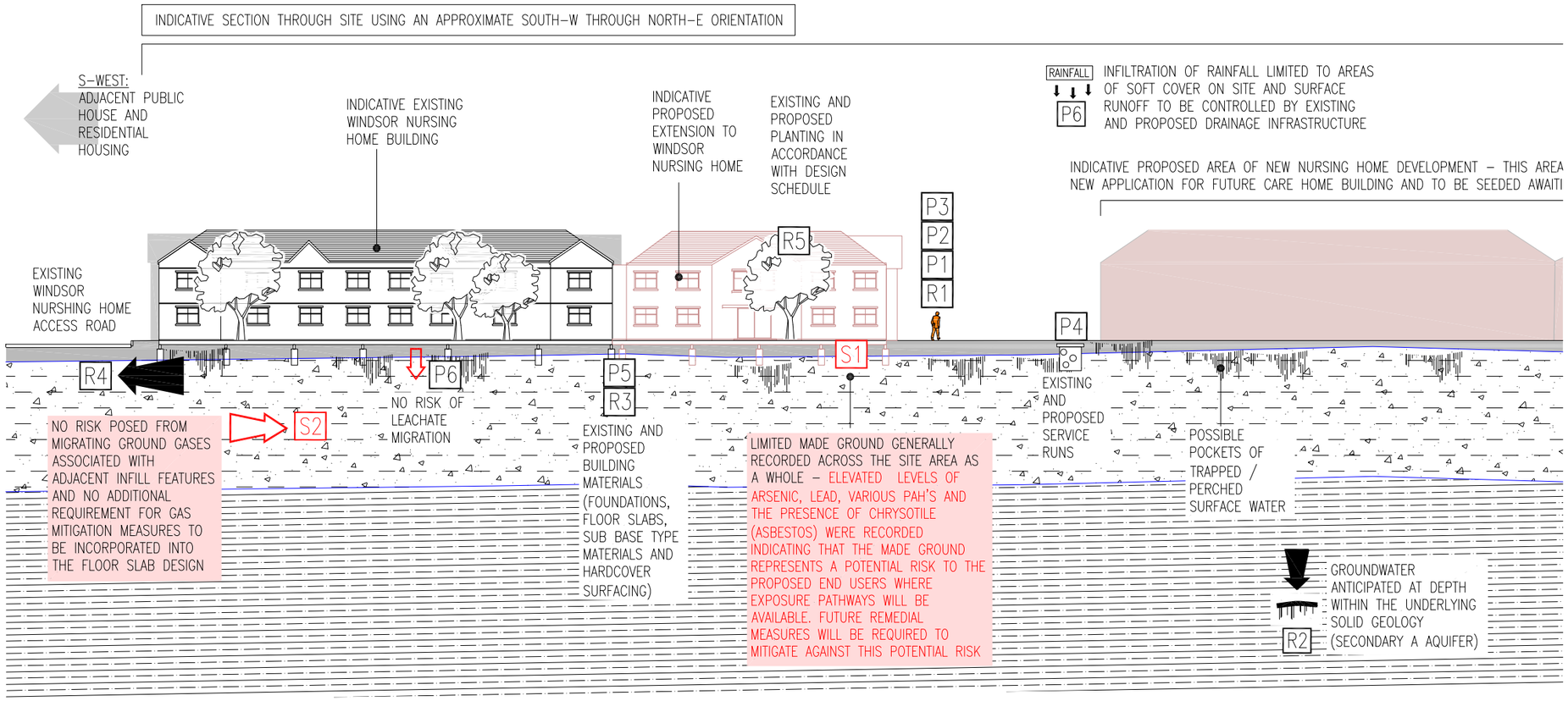
Client:
MAUGHAN REYNOLDS PARTNERSHIP

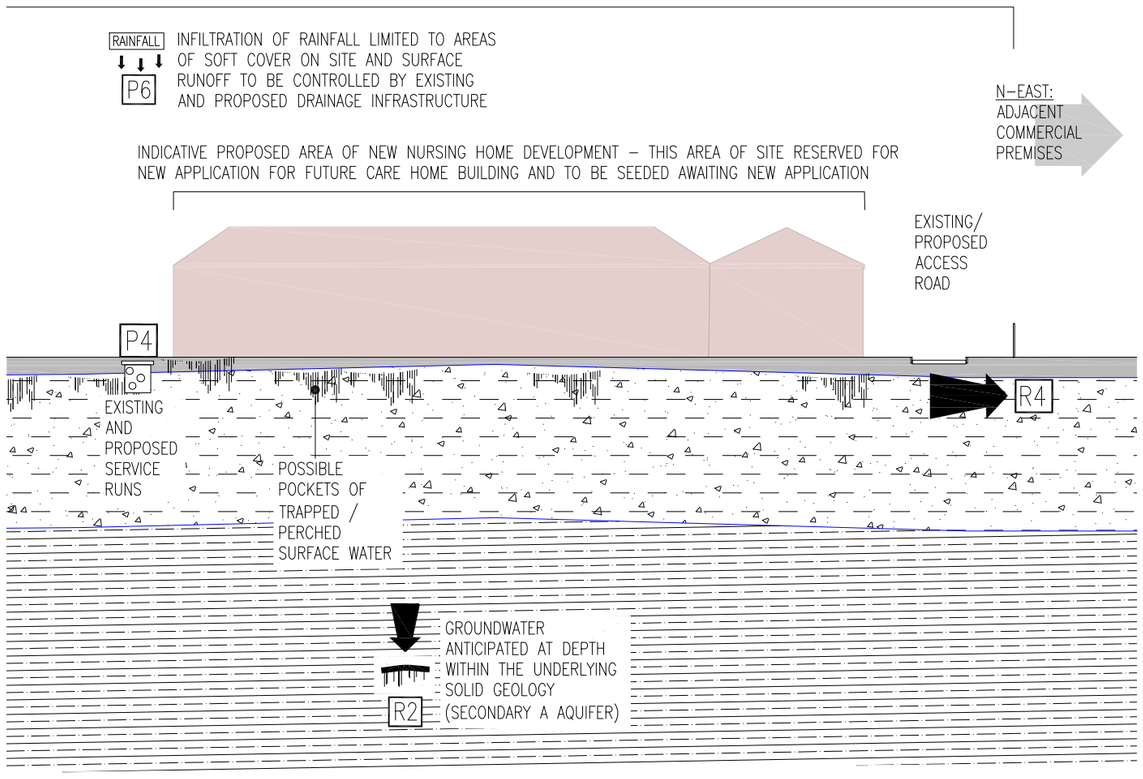
Project Title:
Proposed Extension at Windsor Nursing Home
Victoria Road
Hebburn, NE31 1YQ

Drawing Title:
CL:AIRE Statistical Analysis Sheet (Ver. 1)

Scale at A3:	Date:	Drawn by:	Approved by:
N/A	24.02.14	P.D	T.M

Job Ref:	Drg no:	Rev:
13-422	–	–





CRITICAL POLLUTANT LINKAGES

SOURCE **S**	1. MADE GROUND ASSOCIATED WITH FORMER ON SITE ACTIVITIES – THE LEVELS OF CONTAMINANTS ON SITE AREA SUCH THAT THEY REPRESENT A RISK TO THE PROPOSED END USERS 2. HAZARDOUS GROUND GAS PRODUCTION FROM ADJACENT INFILLED FEATURES – NO PROTECTION MEASURES ARE REQUIRED BASED ON THE PROGRAM OF GAS MONITORING UNDERTAKEN
PATHWAY **P**	1. INGESTION 2. INHALATION OF INDOOR / OUTDOOR AIR 3. DERMAL CONTACT 4. MIGRATION THROUGH EXISTING SERVICES 5. DIRECT CONTACT WITH BUILDING MATERIALS 6. SURFACE RUN OFF AND LEACHATE MIGRATION
RECEPTOR **R**	1. HUMAN HEALTH (END USERS AND CONSTRUCTION WORKFORCE) 2. GROUNDWATER AT DEPTH WITHIN THE SOLID GEOLOGY (SECONDARY A AQUIFER) 3. BUILDING MATERIALS* 4. ADJACENT SITES 5. FLORA AND FAUNA* * = Not included in the Human Health & Controlled Waters Risk Assessment

ARC ENVIRONMENTAL LTD
Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

STRATA DETAILS

MADE GROUND:
FROM 0.00M UP TO C.0.20M TO C.4.00M. AT THE BOREHOLE LOCATIONS THE SITE SURFACING COMPRISED A MIXTURE OF BLOCK PAVING, DOLOSTONE, TARMAC, BRICK RUBBLE AND GRASS. THE UNDERLYING MADE GROUND DEPOSITS CONSISTED BLACK SANDY ASH DEBRIS, BLACK SHALE, STONE AND SANDY, GRAVELLY CLAY DEPOSITS CONTAINING ANTHROPOGENIC DEBRIS. THE DEEPEST ZONE OF MADE GROUND WAS RECORDED AT THE LOCATION OF BH4 WHICH EXTENDED TO A DEPTH OF C.4.00M. AT THE LOCATION OF BHD THE BOREHOLE WAS TERMINATED WITHIN MADE GROUND DEPOSITS AT A DEPTH OF C.1.00M.

DRIFT DEPOSITS (GLACIAL TILL):
FROM C.0.20M TO C.4.00M UP TO C.5.00M (BASE OF BH'S 1 – 5),
THE NATURAL DEPOSITS COMPRISED FIRM AND STIFF, SANDY, GRAVELLY CLAYS CONTAINING OCCASIONAL Cobbles.

rev.	date	amendments	drawn	chckd

Client:
MR RICHARD ROBSON

Project Title:
Proposed Extension at Windsor Nursing Home
Victoria Road
Hebburn, NE31 1YQ

Drawing Title:
Conceptual Site Model

Scale at A3:	Date:	Drawn by:	Approved by:
NTS @ A3	24.02.14	P.D	T.M

Job Ref:	Drg no:	Rev:
13–422	–	–

APPENDIX V

Gas Monitoring Certificates

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 18/10/2013

Visit by: Geoff Heron **Time:** 11.35am

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	1007	0.0	0.0	0.0	0.0	2.9	2.9	18.3	18.3				0.74
BH3	<0.1	1007	0.0	0.0	0.0	0.0	1.8	1.8	18.1	18.1				1.00
BH5	<0.1	1007	0.0	0.0	0.0	0.0	1.5	1.5	18.3	18.3				2.17

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 24/10/2013

Visit by: Geoff Heron **Time:** 12.35pm

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	1004	0.0	0.0	0.0	0.0	0.1	0.1	19.6	19.6				0.70
BH3	<0.1	1004	0.0	0.0	0.0	0.0	0.2	0.2	19.7	19.7				1.05
BH5	<0.1	1004	0.0	0.0	0.0	0.0	0.1	0.1	20.1	20.1				1.75

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 29/10/2013

Visit by: Geoff Heron **Time:** 1.50pm

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	994	0.0	0.0	0.0	0.0	0.1	0.1	19.6	19.6				0.75
BH3	<0.1	994	0.0	0.0	0.0	0.0	0.1	0.1	19.6	19.6				0.90
BH5	<0.1	994	0.0	0.0	0.0	0.0	0.1	0.1	19.9	19.9				1.55

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 04/11/2013

Visit by: Geoff Heron **Time:** 2.40pm

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	982	0.0	0.0	0.0	0.0	0.1	0.1	19.9	19.9				0.80
BH3	<0.1	982	0.0	0.0	0.0	0.0	0.2	0.2	20.0	20.0				0.95
BH5	<0.1	982	0.0	0.0	0.0	0.0	0.1	0.1	19.9	19.9				1.55

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 21/11/2013

Visit by: Geoff Heron **Time:** 11.20am

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	999	0.0	0.0	0.0	0.0	0.2	0.2	19.8	19.8				0.78
BH3	<0.1	999	0.0	0.0	0.0	0.0	0.1	0.1	19.7	19.7				0.85
BH5	<0.1	999	0.0	0.0	0.0	0.0	0.1	0.1	19.9	19.9				1.70

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 20/12/2013

Visit by: Geoff Heron **Time:** 1.00pm

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	1001	0.0	0.0	0.0	0.0	0.1	0.1	19.9	19.9				0.80
BH3	<0.1	1001	0.0	0.0	0.0	0.0	0.1	0.1	19.5	19.5				0.85
BH5	<0.1	1001	0.0	0.0	0.0	0.0	0.1	0.1	19.7	19.7				1.70

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 09/01/2014

Visit by: Geoff Heron **Time:** 11.30am

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	991	0.0	0.0	0.0	0.0	0.1	0.1	19.8	19.8				0.75
BH3	<0.1	991	0.0	0.0	0.0	0.0	0.2	0.2	19.7	19.7				1.00
BH5	<0.1	991	0.0	0.0	0.0	0.0	0.1	0.1	19.9	19.9				1.70

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 29/01/2014

Visit by: Geoff Heron **Time:** 2.10pm

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	990	0.0	0.0	0.0	0.0	0.1	0.1	19.6	19.6				0.70
BH3	<0.1	990	0.0	0.0	0.0	0.0	0.1	0.1	19.6	19.6				1.10
BH5	<0.1	990	0.0	0.0	0.0	0.0	0.1	0.1	19.7	19.7				1.80

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable

Arc Environmental Ground Gas Monitoring Certificate

Equip: GFM430 Series

Site: Former Greenfields School, Victoria Road East, Hebburn, Tyne & Wear

Ref: 13-422 **Date:** 27/02/2014

Visit by: Geoff Heron **Time:** 8.55am

Signature:

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (PPM)			Depth to Water (m bgl)
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
BH1	<0.1	992	0.0	0.0	0.0	0.0	0.1	0.1	19.1	19.1				0.75
BH3	<0.1	992	0.0	0.0	0.0	0.0	0.1	0.1	19.1	19.1				0.60
BH5	<0.1	992	0.0	0.0	0.0	0.0	0.1	0.1	19.0	19.0				0.98

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table.
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes.
N/A = Not applicable