Proposed St Ambrose High School

Ground Investigation Report

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EXECUTIVE SUMMARY

URS Corporation Ltd (URS) was commissioned by North Lanarkshire Council to undertake a ground investigation at the site of the Townhead Road football pitches, Coatbridge which is earmarked for the potential construction of the new St. Ambrose High School.

The sequence of strata as revealed by the recent ground investigations generally confirm the findings of the previous exploratory works and published geological information, and may be summarised as follows:

Stratum	Depth to Underside of Strata (mbgl)	Thickness (m)
Topsoil	0.05 – 0.70	0.05 – 0.70
Made Ground	0.60 – 8.45	0.45 – 8.30
Peat	3.50 – 9.60	0.30 – 5.50
Lower Lacustrine Deposits	7.00 – 13.80	0.40 – 3.65
Glacial Till	7.40 – 14.70	0.30 – 8.60
Rockhead	Encountered from between 7.40mbgl and 14.70mbgl.	

The proposed school site is underlain by the Pyotshaw/Main, Splint, Virgin and Virtuewell Coal Seams which are all recorded to be worked, predominantly by total extraction methods, beneath the site. Where worked, the seams were worked to outcrop.

It is considered that the Pyotshaw/Main, Splint, Virgin and Virtuewell Coal seams all underlie the site at shallow depth and pose a potential mineral instability constraint to surface development.

During the course of investigations, evidence of at least two mineshafts either within or immediately adjacent to the site has been found. A third possible mine shaft may be located approximately 20m to the east of the south-eastern corner of the site.

Methane concentrations were recorded to a maximum of 68.7%, and carbon dioxide concentrations recorded to a maximum of 30.2%. Measurements of flow indicated that gas emission rates were zero. Unfortunately these gas results are considered to be conflicting in nature due to significantly elevated levels of gas with zero flow recorded which is at odds with data obtained in 2006 when some positive flows were recorded. Current assessments undertaken using the Wilson and Card methodology (CIRIA C665), based on worst-case conditions indicate Characteristic Situation 4 for the site. Typical protection measures recommended for CS-4 for a development of this nature would include proprietary gas resistant membranes and positively pressurised underfloor sub-space with monitoring facilities. For preliminary design purposes, it is considered prudent to assume worst-case conditions and it is recommended that incorporation of gas protection measures applicable for CS-4 should be allowed for in future cost plans.

It is further recommended that due to the differing readings obtained to date and the high concentrations of gas recorded, further gas monitoring be undertaken in order to allow a robust

assessment to be undertaken. Following guidance from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' it is recommended that a further 12No. monitoring visits be undertaken over a period of six months. Actual gas-protection requirements may not require such high levels of protection. However, requirements will be re-assessed and modified as additional monitoring data becomes available. It should also be noted that if the gas regime indicates significantly high positive rates of flow there might also be a requirement to install a passive gas-venting trench along the northern boundary of the site to mitigate against any potential off-site migration of hazardous gases.

A contamination assessment in which contaminant concentrations were screened against the URS GAC screening criteria most applicable to the proposed school development (residential without water uptake end use) was undertaken.

The chemical analysis of representative soil samples has identified concentrations of some contaminants elevated above their respective GAC in terms of human health and water environment risk assessment.

Risk to Human Health

In terms of future users of the site risk to human health receptors associated with the planned development of the site are considered to be low.

The contaminants recorded within the shallow soils (<1mbgl) were only marginally elevated above their respective assessment criteria, which are derived for a residential land use scenario based upon standard receptor parameters (child of 0-6 years exposed for 365 days per year). Use of this land use scenario is considered to be over conservative given the proposed development as a school. Comparison of the recorded concentrations against their respective GACs for a commercial/industrial land use demonstrates all values to be less than assessment criteria thresholds. Therefore, despite the fact that similar concentrations of the following contaminants may exist at shallow depths in areas of the waste mass not analysed, the exceedances of isolated levels of metal and organics contaminants are not considered to represent a potential significant risk of significant harm to human health receptors in the context of the proposed development,

If materials and shallow groundwater are encountered at depth during future construction, enabling or maintenance works cognisance should be made to the spatial distribution of contaminants recorded. Given the nature and concentrations of contaminants recorded in the natural soils it is considered that standard levels of PPE will be acceptable for use by maintenance workers.

Risk to the Water Environment

In summary the risk to the water environment associated with the planned development of the site are considered to be low.

Impacts generated by the made ground recorded across the site are likely to be retained in the shallow/perched groundwater table due to the presence of significant thicknesses of low permeability clay, which have been encountered beneath the site. Direct pathways for leaching and subsequent vertical and horizontal migration of contaminants from the made ground materials to nearby surface water or through to moderately permeable regional groundwater receptors in the deep underlying bedrock is therefore considered to be unlikely.

Furthermore given the age of the waste i.e. landfill closure in 1972, it is unlikely that low levels of residual contaminants that have been recorded in the shallow/perched groundwater table will persist.

Risk to the Built Environment

Contamination risks to the built environment are considered to be low.

Water supply pipes being laid directly in the existing made ground or natural soils on the site should be wrapped iron. Where an increase in the thickness of pipe bedding is possible, backfilling the trench with a clean inert material would allow a standard MDPE plastic pipe to be used.

Based on the guidance within the BRE Special Digest, the site has been classified as a Design Sulphate Class DS-3 and an Aggressive Chemical Environment for Concrete (ACEC) Class AC-4 for all materials across the site.

The proposed development has not been finalised although it is understood to comprise a school building of two-storeys, although this may increase, with associated car parking, playground and football pitches. The foundation loadings have not been specified, however, the following general guidance is provided with respect to a typical school development.

Piled foundations may be used to transfer the building loads to a suitable bearing stratum at depth. It is considered that the glacial till deposits may provide a suitable bearing stratum for piled foundations. It is considered that a safe bearing capacity of 150kN/m^2 to 200kN/m^2 will be available in stiff glacial till with settlements of less than 25mm. Where imposed building loads are expected to exceed 150kN/m^2 to 200kN/m^2, rockhead would be considered to be a suitable bearing stratum.

Consideration should be given to settlement of any ground bearing floor slabs, areas of hardstanding and service connections and their interaction with 'hard', piled foundation elements.

If the general surface level of the site is raised consideration should be given to negative skin friction effects arising form the long term consolidation of the weak, compressible soils under the weight of the new fill and the settlement of associated hardstanding areas and services.

Due to the variable nature of the made ground deposits encountered it is recommended that a preliminary design CBR value of <2% be adopted for road pavement design.

Given the presence of a significant thickness of buried peat, it is recommended that early dialogue with the Local Roads Department be entered into to ensure an acceptable design for adoption.

It is considered that the introduction of piled foundations has the potential to introduce contaminant migration pathways specifically in relation to migration of soil gas. Assessment of this pathway and the need for inclusion of appropriate mitigation measures in the building design will be undertaken following the collection of representative future gas monitoring data.

Cognisance should also be made to the spatial distribution of contaminants recorded in this investigation so as to limit cutting operations in areas of the site where fill materials may not be suitable for reuse.

To assess the suitability of site-won material for reuse it will be necessary to agree a suitable method of assessment with the environmental services department of the council for classification purposes.

In terms of general waste disposal, if material is required to be removed from site then, dependant upon the nature of the soil, it should be handled and disposed of at a suitable facility in accordance with the Environmental Protection Act 1990 and subsequent amendments and other relevant legislation.

Considerations for the Site Remaining in its Current Use

Based on the results of the investigation in terms of risks to human health receptors and risks to the water environment with the exception of risks arising from ground gas generation there are not considered to be any significant risks which would warrant remedial action.

It has been recommended a further assessment of the gas regime is undertaken. Should the gas regime indicate significantly high positive rates of flow the requirement to install a passive gas-venting trench along the northern boundary of the site to mitigate against any potential off-site migration of hazardous gases might still remain.

The presence of mine shafts can pose a risk to public safety due to the potential for collapse. It is recommended that the recorded mine shafts be dealt with in line with North Lanarkshire Council's policy on other known shafts. The risk from mineral stability as a result of shallow mineworkings is considered to be relatively low. However, it is recommended that ground maintenance staff be made aware of the recorded mineshafts and potentially minerally unstable areas and they be vigilant for signs of surface instability. Evidence may comprise areas of localised collapsed ground, surface cracking or ominous depressions.

1. INTRODUCTION

1.1. Background

URS Corporation Ltd (URS) was commissioned by North Lanarkshire Council to undertake a ground investigation at the site of the Townhead Road football pitches, Coatbridge which is earmarked for the potential construction of the new St. Ambrose High School.

The location of the site is shown on the Site Location Plan URS Drawing No. 49339729/0001 included in Appendix A.

URS has previously undertaken a Stage 1 Desk Study in 2005 on the site as well as a Preliminary Ground Investigation Report in 2006 for North Lanarkshire Council.

1.2. Objectives of the Ground Investigation

The objectives of the ground investigation were to provide geotechnical information on which to inform the foundation design and earthwork strategy for the proposed use of the site and its associated infrastructure and to determine the geotechnical and environmental risk associated with the proposed development, as well as the risk of mineral instability. The information is intended to assist in the planning process and cost budgeting. It is not intended to cover all aspects required for detailed design of the development as this will be undertaken by a Construction Contractor appointed by North Lanarkshire Council.

1.3. Objectives of the Report

The objectives of the Ground Investigation Report are to provide:

- A review of existing ground investigation information;
- An outline of the ground investigation works carried out across the site;
- A summary of factual data recorded during the ground investigation;
- An interpretation on ground conditions present across the site;
- Comment on engineering properties of the underlying soils with respect to foundation and earthworks design with regard to the proposed development;
- Comment on the potential for contaminated materials across the site and remediation measures;
- Comment on the potential for elevated ground gases across the site and required gas protection measures;
- Comment on the mineral stability of the site.

1.4. Scope of Works

The following provides a summary of the ground investigation works undertaken by Raeburn Drilling and Geotechnical Ltd under the supervision of URS during the period 9th June to July 2008:

- 26No. Cable percussive boreholes;
- 10No. Cable percussive boreholes with rotary follow on;
- 10No. Rotary boreholes;
- 105No. Machine excavated trial pits;
- 20No. Cone Penetration Tests;
- In-situ testing;
- Geotechnical testing and chemical analysis of soil samples;
- Gas and water monitoring and sampling from borehole installations.

10No. rotary follow on and 30No. cone penetration tests were originally proposed to be undertaken in the vicinity of the proposed school building footprint but these were put in abeyance at the request of North Lanarkshire Council as the final design and footprint of the building had not been decided.

1.5. Limitations of the Report

URS has prepared this report for the use of North Lanarkshire Council in accordance with the Agreement under which URS services were performed. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by URS. This Report may not be relied upon by any other party without the prior and express written agreement of URS.

Unless otherwise stated in this Report, the assessments made assume that the site and facilities will continue to be used for their current purpose without significant change. The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested. Information obtained from third parties has not been independently verified by URS, unless otherwise stated in the Report.

Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the services. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in using this Report.

2. PREVIOUS REPORTS

2.1. Desk Study Report by URS Corp Ltd, 2005

URS were commissioned by North Lanarkshire Council to produce a desk study report to assess the viability of two sites for the relocation of St Ambrose High School.

The desk study included an examination of historical records, geological records and mining records in order to assess the mineral stability of the site, the potential risk for contamination and the viability of the site in relation to the proposed development.

2.2. Preliminary Ground Investigation by URS Corp Ltd, 2006

URS were commissioned by North Lanarkshire Council to produce a feasibility study of the Townhead Road site (denoted Site 2 within the Desk Study Report). The boundary of the site investigated varied slightly to that investigated in 2008.

The Preliminary Ground Investigation was to determine overall ground conditions in relation to foundation design, earthworks, mineral stability and soil and groundwater contamination.

The above were reviewed to produce background information for the present investigation.

3. THE SITE

3.1. Location and Topography

The site is located to the northwest of Coatbridge and is bounded by Townhead Road to the north, a Community Centre and Pavilion to the east, Drumpellier Park to the south and a Golf Course to the west.

The National Grid Reference for the approximated centre of the site is NS 716 659. The site occupies approximately 13.50ha in plan area.

A site location plan is included in Appendix A.

3.2. Historical Development

The following account of the historical development of the site is based upon a review of the URS Desk Study (2005) and Preliminary Ground Investigation (2006).

The history of the site can be generalised as follows:

- Until the 1930's the site was located in an area of industry associated with coal mining;
- The area then underwent a period of urbanisation, with the site being utilised as a landfill.
- From the late 1970's the site and its surrounding surroundings underwent very little change and is used as recreational sports pitches.

North Lanarkshire Council records indicate that the Townhead Landfill site came into operation in 1945 and closed in 1972. During the period of operation an estimated half million tonnes of domestic refuse from Coatbridge was deposited at the site. In addition to this, 77,000gallons of wet sewage and unspecified residue from Gartsherrie Steel Works were disposed of annually for an indeterminate period.

3.3. General Geology

The following has been compiled from a review of readily available published geological information and the Preliminary Ground Investigation Report for the site.

The superficial deposits beneath the site are recorded to comprise peat, glaciolacustrine clays, silts and sands and glacial till increasing in thickness from less than 10m in the south of the site to 20m in the north of the site. The bedrock strata beneath these superficial deposits are recorded to comprise the Middle Coal Measures with the Virgin and Splint Coals subcroping along the southern boundary of the site and the Virtuewell Coal subcroping along the northern boundary. The strata are recorded to dip to the south or southwest at between 5° and 10°. An east-west trending fault is recorded to be present in the western portion of the site. A shaft in the northeastern corner of the site records the

Splint Coal at 21.9m below ground level, the Virtuewell Coal at 73.2m below ground level and the Kiltongue Coal at 102.4m below ground level. The geological sequence for the area suggests that the Airdrie Blackband Ironstone or Coal may also be expected to subcrop beneath the site.

The sequence of strata established by the preliminary ground investigation carried out by Raeburn Drilling and Geotechnical Ltd for URS in 2006 shows the site to be underlain by topsoil, made ground, peat, lower lacustrine deposits, and glacial till. The findings of the investigation are summarised as follows:

Stratum	Depth to Underside of Strata (mbgl)	Thickness (m)
Topsoil	0.1 – 0.4	0.1 – 0.4
Made Ground	0.8 – 4.9	0.8 – 4.7
Peat	4 – 8.3	2.6 – 3.4
Lower Lacustrine Deposits	8.8 – 10	1.6 – 1.7
Glacial Till	Encountered from 8.8mbgl to 10mbgl	
Bedrock	Encountered from 10.8mbgl to 23.2mbgl	

3.4. Mining

The site is underlain by several coal seams at shallow depth, with areas of recorded workings in multiple seams. The stratigraphy, gleaned from various mine abandonment plans is summarised below:

Seam Name	Average seam thickness (m)	Average thickness of Intervening Strata (m)
Pyotshaw Coal	1.45	
		0.17
Main Coal	1.17	
		18.8 – 27.5
Splint Coal	0.79 (2.24 main roadway height)	
		2.5
Virgin Coal	0.71 (1.47 main roadway height)	
		36
Virtuewell Coal	0.91 (1.5 main roadway height)	
		33
Kiltongue Coal	1.52	

From the preliminary information, it was apparent that the Splint Coal had been worked and underlay the north-western and southern areas of the site with a rock cover:seam thickness of less than 10. The northern fringe of the site was also likely to be affected by shallow workings in the Virtuewell Coal. The extreme southern margin was also considered to be underlain by shallow workings in the Pyotshaw/Main Coal. Evidence of workings in the Virgin Coal were apparent in the south-west of the site only and the possibility of workings in this seam beneath other areas of the site could not be discounted.

Mine Entries

One mine shaft was recorded within the 2006 site boundary, in the north east of the site. A second shaft was recorded approximately 20m beyond the site boundary, to the south-east.

As in all areas affected by historical mining, the presence of unrecorded mine entries on site could not be fully discounted.

3.5. Hydrogeology

The 1:625 000 Groundwater Vulnerability Map of Scotland (1995) indicates that the bedrock strata beneath the site is moderately permeable fractured or potential fractured rocks that do not have a high primary permeability, or other formations of variable permeability.

3.6. Hydrology

Several drains are located to the southwest of the site in Drumpellier Country Park. Lochend Loch is situated approximately 500m to the west of the site whilst Woodend Loch is located approximately 800m to the northwest of the site. Monklands Canal lies approximately 350m to the south of the site trending east west with an east west trending drain a further 10m to the south.

4. PRELIMINARY CONCEPTUAL SITE MODEL

4.1. General

Part II A of The Environment Protection Act 1990 was adopted as statue in England and Wales on 1 April 2000 and was enacted in Scotland on 14 July 2000. This legislation defines the new regime for identifying, assessing and, where appropriate, remediating land that is deemed to be 'contaminated' on the basis that it does, or could, adversely impact health or the environment.

In line with this new legislation, the interpretation of the data compiled in connection with this report has been undertaken using risk-based principles adopting the contaminant source-pathway-receptor principle. For the purpose of this assessment these terms are defined as follows:

For ground contamination to present a significant risk, all three of the following components must be present:

- **Source** – substance(s) in the soil, groundwater or present as a discrete phase which may release contaminant species to the environment;
- **Pathway** – a route by which receptors can become exposed to contaminants. Examples include vapour inhalation, soil ingestion and groundwater migration;
- **Receptor** – a target that is at risk of harm following exposure to a contaminant. Examples include human occupants/users of site, controlled waters, property and ecosystems.

The absence of one or more of these components would prohibit a viable pollutant linkage being established.

Defining a conceptual site model (CSM) of risk associated with a site requires identification of all potential sources, pathways and receptors and any plausible combinations of these three components. Potential pollutant linkages are then qualitatively assessed to identify plausible scenarios.

A preliminary CSM has been developed using the information obtained from the previous desk studies, adopting the Source-Pathway-Receptor principal to examine potential pollutant linkages. This CSM can then be utilised in the design of any subsequent intrusive ground investigation. The key potential sources, pathways and receptors identified at the site are described in the following paragraphs (Sections 4.2 to 4.5). A visual representation of the CSM is contained within Appendix K.

All comments that are made are based on the assumption that the site continues in its present usage for recreation and sports pitches.

4.2. Potential Sources

4.2.1. On-Site Sources

Potential contamination sources associated with the known and suspected historical activities undertaken on the site may be present on or beneath the surface.

These may include

- Contaminated materials associated with the historical Local Authority Recorded Landfill beneath the site;
- Contaminated materials associated with historical mine shafts located to the northeastern area of the site;
- Unknown fill materials and underlying organic-rich peat strata, which may give rise to ground gas generation.

4.2.2. Off-Site Sources

A number of potential off-site sources of contamination have been identified and include:

- Existing railway line beyond the southern site boundary;
- Alexander Hospital located 150m to the east;
- Former railway line on northern site boundary;
- Historical mineral railway to the eastern site boundary.

Potential secondary sources may include impacted soils associated with the above sources, and contaminants present in groundwater migrating onto the site.

4.2.3. Summary Table of Potential Contamination Sources

The potential contamination sources described previously are summarised in Table 4.1:

Table 4.1 – Potential Contamination Sources

No	Source	Nature
S1	Residual contamination in subsurface soils and fill, associated with the historical use of the site: • 1a. In soil/fill material beneath site; • 1b. In soil/fill material in adjacent ground.	High pH; Hydrocarbons (TPH, PAH); Toxic metals; Asbestos; Inorganic contaminants (e.g. sulphate).
S2	Free phase or dissolved contaminants in groundwater beneath site: • 2a. Originating from soils and fill materials at the site; • 2b Originating from other sources in adjacent ground.	High pH; Hydrocarbons (TPH, PAH); Toxic metals; Inorganic contaminants (e.g. sulphate).
S3	Gaseous or vapour phase contaminants: • 3a. Emanating from any of the above sources; • 3b. Emanating from other natural sources within or adjacent to the site.	Methane; Carbon monoxide; Carbon dioxide; Hydrogen sulphide.

4.3. Receptors

A number of potential receptors may be at risk from the potential contaminants identified in Section 4.2. These include:

- Human health receptors (e.g. site occupants);
- Shallow groundwater in superficial deposits;
- Deeper groundwater in bedrock;
- Nearby surface waters;
- Ecological receptors;
- Construction materials;
- Nearby building structures.

Potential receptors of the identified contamination sources are summarised below in Table 4.2:

Table 4.2 – Potential Receptors

No.	Receptor
R1	Human Health related: • 1a. Members of public accessing the site; • 1b. Site Workers carrying out future intrusive works; • 1c. Future users.
R2	The Water Environment: • 2a. Groundwater in superficial deposits beneath site; • 2b. Groundwater in bedrock beneath site; • 2c. Groundwater in superficial deposits or bedrock adjacent to the site, down hydraulic flow; • 2d. Nearby surface waters (Lochend Loch and Monklands Canal).
R3	Other environmental targets: • 3a. Buildings / Construction materials / property on site and nearby land; • 3b. Pets, wildlife and nearby natural ecosystems.

4.4. Pathways

For a risk to be considered significant, a pathway must exist by which identified contaminants can move from a source to a potential receptor. Several potential pathways for contaminant migration have been identified at the site including:

- Dermal contact, ingestion and inhalation (e.g. during any future drilling or construction works on site);
- Leaching and migration of contaminants to shallow groundwater or surface water;
- Lateral and vertical migration of contaminants in shallow groundwater to deeper groundwater or surface water;
- Generation and migration or accumulation of ground gases, resulting in, for instance, asphyxia or explosion;
- Root uptake from soil, and uptake by aquatic fauna via ingestion and/or bioaccumulation in local watercourses;
- Direct contact with construction materials.

The possible pathways by which the identified contamination could impact on receptors are listed in Table 4.3 below (with the associated targets from Table 4.2 listed in the column on the right).

Table 4.3 – Potential Pathways

P1	**Via physical exposure pathways, mainly affecting human health targets:**	
	- Outdoor inhalation of dust.	**R1a, R1b**
	- Dermal contact with contaminated soil, dust or groundwater.	**R1a, R1b**
	- Ingestion or inhalation of contaminated soil, dust or groundwater.	**R1a, R1b**
P2	**Via mobilisation of subsurface contaminants into surface water run-off or groundwater, mainly affecting controlled waters:**	
	- Leaching and lateral migration of contaminants via shallow deposits and service runs.	**R2a - R2d, R3a, R3b**
	- Surface water by migration of contaminants via groundwater.	**R2d, R3b**
	- Groundwater within the underlying natural superficial deposits by leaching and migration of contaminants via shallow deposits.	**R2b, R2c**
P3	**Via vapour or gas migration through subsurface soils or via underground structures.**	**R1b, R3a, R3b**
P4	**Via direct uptake of contaminants from soil and water.**	**R3b**

4.5. Pollutant Linkages

A number of potential pollutant linkages have been identified in association with the contamination sources identified in the CSM.

No evidence for any intact human health related pollutant linkages has been identified from the information obtained during the desk study.

However, additional pollutant linkages may be in existence or there may be the potential for such linkages to be created by changes in land use, any future intrusive works or by other changes in site conditions.

5. RECENT GROUND INVESTIGATION WORKS

5.1. General

Ground investigation works were undertaken during the period June to August 2008 by Raeburn Drilling and Geotechnical Ltd under the direction of URS.

The ground investigation comprised machine excavated trial pits, cable tool percussion boreholes and rotary boreholes and was carried out in accordance with BS 5930:1999 'Code of Practice for Site Investigation', and BS 10175:2001 'Investigation of Potentially Contaminated Sites – Code of Practice'. The soil descriptions given on the record sheets comply with BS 5930:1999 and are based on an examination of the soil samples together with the results of the in-situ and laboratory testing.

The investigations were undertaken in three 'packages' to investigate the following areas:

- Ground conditions relating to geotechnical, contamination and gas emissions in the centre of the site for the proposed school building;
- Ground conditions relating to geotechnical, contamination and gas emissions in the periphery of the site for the hard-standing, sports pitches and landscaping areas associated with the school; and
- Mineral stability.

The locations of the exploratory holes are shown on the Ground investigation Location Plans, Drawing Nos.49339729/007, 49339729/008, and 49329729/006, included as Appendices B, C and D respectively.

5.2. Trial Pits

The purpose of the trial pits was to allow a visual examination of the underlying shallow soils and to take representative disturbed samples for laboratory testing and chemical analysis.

A series of 105No. trial pits (denoted TP201 to TP255, and TP301 to TP350) were excavated using a mechanical excavator to depths of between 2mbgl and 4.3mbgl.

A Geotechnical Engineer from URS logged the trial pits. Detailed trial pit logs are included in Appendix E.

5.3. Cable Tool Percussion Boreholes

In order to obtain information on the soil profile at greater depth, 26No. 150mm diameter cable tool percussion boreholes (denoted BH201 to BH213, and BH301 to BH313) were sunk to depths of between 7.05mbgl and 15.5mbgl.

Representative rock and soil samples were recovered at regular intervals for subsequent laboratory testing. Records of the cable percussion boreholes are included in the Contractor's Factual Reports included in Appendices F and G.

5.4. Rotary Boreholes

Ten boreholes were sunk by rotary openhole methods (denoted BH101 to BH110) to rockhead at depths ranging from 9.4mbgl to 17.3mbgl with continuation by rotary coring extending to a maximum depth of 47.3mbgl. The rock cores recovered during the drilling works were transported to the Contractor's premises for logging by their Engineer.

Records of the rotary boreholes are included in Appendix H.

5.5. Cone Penetration Testing

In order to obtain information on the soil profile at depth 21No. cone penetration tests denoted C301 to C320 were sunk to depths of between 3.27m and 14.99m by Lankelma, a sub-contractor to Raeburn. All tests measured the cone resistance, local side friction and pore water pressure with depth.

The purpose of the Cone Penetration Tests (CPTs) was to determine the soil profile and identify the soils present beneath the site and to provide engineering parameters for the soils to inform foundation design. The data from the CPTs was to supplement the information from the boreholes and trial pits.

The estimation of soil types based on the cone restriction and friction ratio were made by Lankelma and are presented on there CPT logs, included within Appendix G.

5.6. In-Situ Testing

5.6.1. Standard Penetration Tests

Standard Penetration Tests (SPTs) were undertaken at regular intervals in the cable tool percussion in both granular and cohesive soils. The tests were carried out in accordance with BS1377: 1990 Part 9, Methods of Test for Soils for Engineering Purposes – In Situ Tests.

The results are reported as SPT N-values on the borehole record sheets, which are included in Appendices F and G.

5.7. Gas and Groundwater Installations

To allow monitoring of gas and groundwater levels beneath the site, standpipes were installed to depths of between 3mbgl and 12.6mbgl within cable tool percussion boreholes. Details of the standpipe installations are presented in the borehole logs within Appendix F.

Post-fieldwork, ground and gas monitoring was undertaken by Raeburn staff. The installations were monitored on four occasions during the period between 1 August and

22 August 2008. The following parameters were recorded using a GA2000 infrared gas analyser:

- Levels of methane, carbon dioxide, oxygen, hydrogen sulphide and carbon monoxide;
- Gas flow rate;
- Atmospheric pressure.

Groundwater levels were measured using an electrical dipmeter.

The borehole installation monitoring records are included in Appendices F and G.

5.8. Laboratory Testing

5.8.1. Geotechnical Testing

A laboratory testing schedule was prepared for soil samples recovered during the ground investigation works. All of the tests were performed in accordance with BS 1377:1990 'Soils for Civil Engineering Purposes'.

The following tests were undertaken:

- Natural Moisture Content;
- Atterberg Limit Tests;
- Particle Size Distribution Tests (sieve and sedimentation);
- Organic Matter Content;
- Unconsolidated undrained triaxial testing;
- Oedometer testing;
- Compaction testing;
- pH and Sulphate.

The results of the geotechnical testing carried out on soil samples are included in Appendices F and G.

5.8.2. Chemical Analysis

A schedule of chemical testing was prepared by URS in order to provide an indication of and contamination present at the site. The following contaminants were tested for:

- Arsenic;
- Cadmium;
- Cyanide;
- Sulphate;

- Chromium;
- Copper;
- Nickel;
- Zinc;
- Lead;
- Mercury;
- Selenium;
- Hexavalent Chromium;
- Boron;
- Sulphide;
- Sulphur;
- pH;
- PAHs;
- Phenols;
- Thiocyanate;
- TPHs;
- VOCs.

The results of the chemical analysis carried out on soil samples are included in Appendices F and G.

Groundwater samples recovered from ten boreholes at the site and were analysed for the following suite of chemical determinants:

- Arsenic;
- Cadmium;
- Chromium;
- Copper;
- Nickel;
- Zinc;
- Lead;
- Mercury;
- Selenium;
- Hexavalent Chromium;
- Boron;
- Cyanide;
- Sulphate;
- Sulphide;
- Sulphur;
- pH;
- PAHs;
- Phenols;
- Thiocyanate;
- TPHs;
- Ammonical Nitrogen;
- Nitrate/nitrite;
- Chloride;
- Manganese;
- Dissolved Organic Carbon.

The results of the chemical analysis carried out on the groundwater samples are included in Appendices F and G.

6. GROUND CONDITIONS

6.1. General

The sequence of strata established by the ground investigation carried out by Raeburn shows the site to be underlain by topsoil, made ground, peat, Lower Lacustrine Deposits and Glacial Till. The findings of the investigation are summarised below:

Stratum	Depth to Underside of Strata (mbgl)	Thickness (m)
Topsoil	0.05 – 0.7	0.05 – 0.7
Made Ground	0.6 – 8.45	0.45 – 8.3
Peat	3.5 – 9.6	0.3 – 5.5
Lower Lacustrine Deposits	7 – 13.8	0.4 – 3.65
Glacial Till	7.4 – 14.7	0.3 – 8.6
Rockhead	Encountered from between 7.4mbgl and 14.7mbgl.	

6.2. Topsoil

Localised pockets of natural topsoil recorded as clayey sand and gravel with many rootlets were encountered in trial pits and boreholes, concentrating around the northern region of the site. The deposits were found to range in thickness between 0.05m and 0.7m.

6.3. Made Ground

Deposits of made ground were recorded throughout the site within all trial pits. Made ground was encountered at depths of between ground surface and 0.7mbgl and ranging in thickness from 0.45m and 8.3m. The made ground deposits were generally recorded to comprise a topsoil and turf surface with clayey gravelly sand and gravels containing ash and various other debris beneath.

Standard penetration tests performed within the made ground gave SPT “N” values between 0 and 18, which are indicative of soils which are very loose to medium dense. However, due to the varying nature of made ground deposits, these results may not be indicative of the density of the strata as a whole.

Fourteen particle size distribution tests undertaken on the made ground gave the following range of particle distribution:

- Cobbles 0% to 96%
- Gravel 4% to 65.2%
- Sand 0% to 46.8%

- Silt 0% to 10.1%
- Clay 0% to 10.1%

Four dry density / moisture content relationship tests (compaction test) undertaken on the made ground recorded the following:

Exploratory Hole	Depth (mbgl)	Method of Compaction	Maximum Dry Density (Mg/m^3)	Optimum Moisture Content (%)
BH301	2.8	2.5kg	1.87	13.4
BH302	1.6	4.5kg	1.37	20
BH302	2.7	2.5kg	1.2	25.9
BH303	0.7	2.5kg	1.38	22.2

Twenty-four pH and sulphate content (as SO_4) tests undertaken on samples of made ground gave sulphate content values of between 0.01g/l and 3.59g/l with corresponding pH values of between 5.8 and 8. The majority of the values are indicative of acidic conditions.

6.4. Peat

Deposits of very fibrous peat with plant material were encountered depths ranging from 1.15mbgl to 6mbgl and concentrated within the central areas of the site. The deposits were found to range in thickness between 0.3m and 5.5m.

At these locations the peat was noted to range from H2 to H3 on the Von Post Humification Scale, this is indicative of a peat which is almost entirely undecomposed to very slightly decomposed with no amorphous material present. Details of the Von Post scale are provided in Appendix I.

Twenty natural moisture content tests undertaken on the sand gave moisture content values of between 71% and 634%, with an average value of 448%.

Standard penetration tests performed within the peat gave SPT “N” values between 1 and 10, which are indicative of very soft to firm soils.

The cone penetration tests confirmed the peat to generally consist of very soft organic material with clay. The measured cone end resistance (qc) generally varied between 0MPa and 0.5MPa.

Eight loss on ignition tests (LOI) were undertaken on peat deposits in place of organic matter content tests. This was due to the organic matter content of the samples being found to be outwith the working range of the scheduled test method. The LOI tests returned values of 81% and 97.2%. These values are indicative of a peat with high organic content.

Eight pH and sulphate content (as SO_4) tests undertaken on samples of peat gave sulphate content values of between 0.03g/l and 1.7g/l with corresponding pH values of between 3.8 and 5.8. The majority of the values are indicative of acidic conditions.

6.5. Lower Lacustrine Deposits

Lower Lacustrine deposits generally recorded as a soft to firm sandy gravelly silt were encountered at depths ranging from 6.4mbgl to 8.9mbgl with thicknesses between 0.4m and 3.65m.

Fourteen natural moisture content tests undertaken on the sand gave moisture content values of between 12% and 46%, with an average value of 27%.

Standard penetration tests performed within the Lower Lacustrine deposits gave SPT "N" values between 1 and 24, which are indicative of very soft to stiff soils.

The cone penetration tests confirmed the peat to generally consist of very soft clay with soft/loose silts and loose sands. The measured cone end resistance (qc) generally varied between 0MPa and 1MPa.

The table below provides a guide for the relationship between cone resistance and shear strength of cohesive soils[1].

Cone Resistance (q_c) MPa	Description	Equivalent S_u value from q_c (kPa)
0 – 0.4	Very soft	0 – 20
0.4 – 0.8	Soft	20 – 40
0.8 – 1.5	Firm	40 - 75
1.5 – 3.0	Stiff	75 - 150
>3.0	Very Stiff	>150

Atterberg limit tests undertaken on four samples of the Lower Lacustrine deposits gave the following results:

Exploratory Hole	Depth (mbgl)	Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index
BH203	9.5	46	40	19	CI
BH204	9.9	35	36	18	CI
BH205	12	12	33	15	CL
BH208	10.4	35	39	22	CI

[1] Interpretation of Static Cone Penetration Tests; Llankelma

When plotted on a plasticity chart the above results indicate that the Lower Lacustrine deposits comprise a clay of low to intermediate plasticity.

Eight particle size distribution tests undertaken on the Lower Lacustrine deposits gave the following range of particle distribution:

- Cobbles 0%
- Gravel 0% to 16.6%
- Sand 5.1% to 55.9%
- Silt 25.3% to 63.1%
- Clay 14.5% to 37.1%

A single sample of the Lower Lacustrine deposits was tested for one-dimensional consolidation. At the in-situ depth the following results were achieved:

Exploratory Hole	Pressure Range (kPa)	M_v m^2/MN	C_v (t90) m^2/year	C_v(t50) m^2/year	Void Ratio (e)
BH203	160 - 320	0.03	5.13	N/A	0.566

After loading of the strata, a pressure range increase of 100kPa was applied. This pressure range yielded the following results:

Exploratory Hole	Pressure Range (kPa)	M_v m^2/MN	C_v (t90) m^2/year	C_v(t50) m^2/year	Void Ratio (e)
BH203	320 - 640	0.021	11.7	4.93	0.556

Two pH and sulphate content (as SO_4) tests undertaken on samples of Lower Lacustrine deposits gave sulphate content values of 0.04g/l and 0.08g/l with corresponding pH values of 7.1 and 7.2. These values are indicative of neutral to slightly alkaline conditions.

6.6. Glacial Till

Glacial till deposits generally recorded as a stiff sandy gravelly clay were encountered at depths ranging from 0.6mbgl to 13.8mbgl and thickness between 0.3m and 8.6m.

Standard penetration tests performed within the Glacial Till gave SPT “N” values between 10 and >50, which are indicative of soils which are firm to very stiff.

The cone penetration tests confirmed the glacial till to generally consist of stiff to very stiff clay with bands of dense to very dense silt, sand and gravel. The measured cone end resistance (qc) generally varied between 2MPa and 6MPa.

Fifteen natural moisture content tests undertaken on the sand gave moisture content values of between 8.4% and 39%, with an average value of 19%.

Atterberg limit tests undertaken on 16No. samples of the Glacial Till deposits gave the following results:

Exploratory Hole	Depth (mbgl)	Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index
TP201	2.1	33	51	25	CH
TP206	3.7	25	36	19	CI
TP232	2.9	27	45	24	CI
TP302	3	22	37	20	CI
TP316	3	22	44	22	CI
TP341	4	39	48	23	CI
TP348	2.2	26	41	23	CI
BH202	11.4	11	27	13	CL
BH206	9.5	26	35	20	CL
BH207	7.9	22	30	15	CL
BH210	7.6	11	24	12	CL
BH213	7.9	17	NP	NP	NP
BH301	4.45	10	26	13	CL
BH302	6.95	28	45	20	CI
BH306	6.6	8.4	29	18	CL
BH310	10.1	15	33	18	CL

When plotted on a plasticity chart the above results indicate that the Glacial Till comprise a clay of low to intermediate plasticity, with the exception of one sample from TP201 which was of high plasticity.

Five particle size distribution tests undertaken on the Glacial Till gave the following range of particle distribution:

- Cobbles 0%
- Gravel 2.8% to 60.4%
- Sand 18.2% to 51.4%
- Silt 7.9% to 49.9%
- Clay 7.9% to 43%

A single dry density / moisture content relationship tests (compaction test) undertaken on the Glacial Till recorded the following:

Exploratory Hole	Depth (mbgl)	Method of Compaction	Maximum Dry Density (Mg/m^3)	Optimum Moisture Content (%)
BH301	3.5	4.5kg	2.08	8.4

Four Glacial Till samples were submitted for unconsolidated undrained multistage triaxial compression testing, these returned shear strength parameters with c_u values of between 38kPa and 71kPa, which is generally indicative of a firm material, with corresponding phi values ranging from 5.2° and 15.1°.

Three samples of Glacial Till were tested for one-dimensional consolidation. At the in-situ depth the following results were achieved:

Exploratory Hole	Pressure Range (kPa)	M_v m^2/MN	C_v (t90) m^2/year	C_v(t50) M^2/year	Void Ratio (e)
BH202	200 – 400	0.162	11.5	2.49	0.315
BH206	160 – 320	0.126	4.56	3.06	0.517
BH213	140 – 280	0.088	5.79	15.82	0.433

After loading of the strata, a pressure range increase of 100kPa was applied. This pressure range yielded the following results:

Exploratory Hole	Pressure Range (kPa)	M_v m^2/MN	C_v (t90) m^2/year	C_v(t50) m^2/year	Void Ratio (e)
BH202	400 – 800	0.074	8.82	5	0.296
BH206	320 – 640	0.075	3.68	3.14	0.481
BH213	280 – 560	0.056	7.29	18.45	0.411

Eight pH and sulphate content (as SO_4) tests undertaken on samples of Glacial Till gave sulphate content values of between 0.03g/l and 0.12g/l with corresponding pH values of between 3.6 and 7.7. The majority of the values are indicative of alkaline conditions.

6.7. Bedrock

The solid bedrock stratum was encountered from between 7.4mbgl and 14.7mbgl and comprised sandstone, mudstone and coal with evidence of worked horizons. Within the sandstone core recovery was between 33% and 100% with variable RQD values throughout the rock cores ranging from 12% and 100%. The core recovery within the mudstone ranged between 50% and 100% with variable RQD values throughout the rock cores ranging from 0% to 73%. Evidence of mined horizons was also encountered in the form of broken or collapsed strata.

A summary of the findings of the mineral seams in the boreholes is presented in the table below:

Borehole	Rock head (mbgl)	Pyotshaw & Main Coal (mbgl)	Splint Coal (mbgl)	Virgin Coal (mbgl)	unnamed coal (mbgl)	Virtuewell Coal (mbgl)
RBH101	13.0	-			-	37.1 coal
RBH102	15.8	-	18.3 waste	22.9 coal	-	-
RBH103	14.3	-	-	-	35.9 Coal	-
RBH104	17.1	-	-	-		26.3 waste & coal
RBH105	15.6	-			23.05 coal	-
RBH106	15.5	-	-	16.3 coal	42.1 coal	-
RBH107	14.9	-	-	-	-	23.7 coal
RBH108	14.4	-	-	-	37.2 coal	-
RBH109	15.9	-	-	18.4 waste	44.8 coal	-
RBH110	9.1	-	13.7 waste	17.2 waste	-	-

Note. Coal seam depths are to pavement.

- denotes seam not encountered, borehole not located where seam present or terminated depth before depth of seam.

6.8. Groundwater

Groundwater was encountered in 13No. of the soil boreholes with water strikes at depths ranging between 2.9mbgl to 14.2mbgl.

Groundwater was encountered in 44No. of the trial pits indicated to be a moderate to fast seepage at depths ranging between 1.9mbgl to 4mbgl.

Groundwater monitoring carried out over four visits in all 26No. borehole installations (BH201 to BH213 and BH301 to BH313) indicated the groundwater levels to vary between 2.21mbgl and 8.13mbgl were encountered.

6.9. Gas

Monitoring of the borehole installations for soil gas was carried out on four occasions between 1 August and 22 August 2008.

Soil gas can be generated from natural soils or wastes containing biodegradable organic matter. The primary gases of concern are methane and carbon dioxide. Methane is lighter than air and is both a flammable and asphyxiating gas that can accumulate within buildings and explode on ignition when the concentrations of the gas in air fall within explosive concentrations (5%-15% by volume in air). Carbon dioxide is denser than air and is a non-flammable, asphyxiating and toxic gas.

Soil gas emissions can accumulate within manholes and service pits resulting in a possible risk to maintenance personnel.

The results of the gas monitoring at the site are summarised below:

Borehole	Methane %v/v	Carbon Dioxide %v/v	Oxygen %v/v	Atmospheric Pressure (mb)	Flow (l/h)	Response Zone
R201	0	0.8 - 1.7	16.8 – 18.1	983 - 1003	0	Made Ground
R202	65.3 - 68.7	20 - 30.2	0.		0	Peat
R203	0	1.5 - 1.9	18.2 – 18.8		0	Made Ground
R204	0	1.9 - 2.5	17.4 – 18.2		0	Peat
R205	2.9 - 3.7	2.9- 4.8	13.1 – 13.9		0	Made Ground
R206	0	1.7 – 2.3	17.8 - 18.4		0	Made Ground
R207	0	0.6 - 0.8	20.1 - 20.4		0	Silts/Clays
R208	8.3 - 10.2	6.9 - 9.6	6.7 – 8.9		0	Peat
R209	0	2.5 – 3.7	16.1 - 16.7		0	Made Ground
R210	0	0 - 0.1	20.1 – 20.6		0	Peat
S211	0	9.8 - 12.3	7.8 – 10.2		0	Made Ground
S212	N/A	N/A	N/A		0	Peat
S213	0	0	20.7 – 20.8		0	Made Ground
S301	0	2.9 - 3.9	15.7 – 16.1		0	Made Ground
S302	62.1 – 66.2	20.5 - 23.3	0 – 0.7		0	Peat
S303	0.3	17.7 - 18.4	1.1 – 1.3		0	Made Ground
S304	7.9 - 9.1	3.9 - 5.1	16.3 – 16.9		0	Peat
S305	28.9 - 34.8	18.7 – 20	9.7 – 10.5		0	Silts/Clays
S306	0	0.1 - 0.4	20.4 – 20.7		0	Made Ground
S307	0	11.7 - 13.7	6.1 – 7.5		0	Made Ground
S308	38.9 – 47.4	20.7 - 23.2	4.2 – 5.8		0	Peat
S309	15.3 – 16.8	20.5 - 21.7	4.5 - 4.8		0	Peat
S310	0	0 – 0.6	20.1 - 20.7		0	Made Ground
S311	0	14.7 - 16.8	2.3 – 3.3		0	Made Ground
S312	0	0.5 - 0.8	19.5 – 19.9		0	Peat
S313	0	12.9	3		0	Made Ground

Analysis of the gas results has determined conflicting readings in terms of measured gas concentrations and measured flow readings. In the presence of high levels of CH_4 and CO_2 that have mainly been recorded in the natural organic peat materials, it would be expected to record a degree of positive or negative flow depending on the ground conditions. As can be seen in the above table, levels of flow have been recorded by Raeburn Drilling to be 0l/h at every monitoring location on each of the 4 monitoring rounds. Although this is possible, it is considered to be unlikely given the high degree of variability in the nature of the overlying fill materials. It would be more likely to record a range of positive and/or negative flows across the variable range of atmospheric conditions stated. Furthermore, previous monitoring of shallow gas wells installed in the fill materials overlying the natural peat was undertaken by URS on 4 occasions in 2006 when significant positive flow readings of up to 2.4l/h were recorded. The results of this monitoring are included in GLRP0795-44768522/Nov2006/Preliminary Ground Investigation report.

If an assessment was undertaken using the Wilson and Card methodology (CIRIA C665), based on worst-case conditions, i.e. using the maximum recorded methane

concentration of 68.7% v/v and the maximum flow readings recorded up to 2.4l/h in 2006 the Characteristic Situation for the site would be CS-4. The typical scope of protection measures for CS-4 for a development of this nature would include proprietary gas resistant membranes and positively pressurised underfloor sub-space with monitoring facilities.

Therefore due to the differing readings obtained to date and high concentrations of gas recorded on site, it is recommended that further gas monitoring be undertaken in order to allow a robust assessment of the risks posed to the built environment from gas emissions to be undertaken. Following guidance from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' it is recommended that a further 12No. monitoring visits be undertaken over a period of six months.

However, for preliminary design purposes, it is considered prudent to assume worst-case conditions and incorporation of gas protection measures as discussed above should be allowed for in the cost plan. Actual gas-protection requirements may end-up requiring less onerous measures. This will be re-assessed and modified as additional monitoring data becomes available.

7. MINERAL STABILITY ASSESSMENT

7.1. Geology

Data on mineral extraction beneath the site has been obtained from an examination of 1:10,000 scale geological sheets, available mine abandonment plans, reports from the Coal Authority and the findings of previous and current rotary boreholes.

7.2. Review of Mine Abandonment Plans

Relevant mine abandonment plans were obtained from The Coal Authority and reviewed to obtain greater detail of the workings present below the site. Due to the age and poor condition of some of the mine abandonment plans, parts of the plans were illegible.

Areas of recorded workings within the Pyotshaw & Main, Splint, Virgin and Virtuewell beneath the site have been digitised and are presented on URS Drawing Nos. 49339729/0016, 0015, 0014 and 0013 respectively (Appendix L). Records of extensive workings are recorded in the Kiltongue Coal, but this is at sufficient depth that development constraints from workings in this seam can be discounted.

Plan 5507 Drumpellier Mineral Field (Espieside), 1910 (Main, Splint and Virgin Coal Workings)

The Main Coal is recorded to be worked to outcrop beneath the extreme southern area of the site. The workings appear to be partial extraction ('Stoop and Room'). An area denoted 'Old Workings' was recorded to the south, towards the Railway line and Monklands Canal. The abandonment plan indicates the Main Coal is actually the combination of the Pyotshaw and Main Coals, which have coalesced in this area and are only separated by 0.17m of fireclay with a combined thickness of approximately 2.8m.

The Splint Coal is also recorded to be worked to outcrop beneath the southern area of the site. The workings appear to be complete extraction ('Shortwall). The coal seam is indicated at 1.09m thick although in places, an additional 1.44m of roof strata were also removed (usually to improve roof stability). Similar to the Main Coal, an area denoted 'Old Workings' was recorded to the south, towards the Railway line and Monklands Canal.

The Virgin Coal is recorded to be worked from a small area just to the south of the site. The coal seam is indicated at 0.71m thick although in places, an additional 0.76m of roof strata were also removed

Plan S.3862/1 Espieside Colliery, 1889 (Splint, Virtuewell, Kiltongue and Main Coal Workings)

The Splint Coal is recorded to be worked beneath the north-west and south-east portions of the site. No depths of workings are indicated, nor is the method of working clear with only extents of workings shown. The workings in the north-west were worked to outcrop. The workings in the south-east were accessed from Espieside No.3 Pit in the vicinity of the south-eastern corner of the site.

The Virtuewell Coal is recorded to be worked beneath the majority of the site. Again, no depths of workings are indicated, nor is the method of working clear with only extents of workings shown. The workings in the north were worked to outcrop, close to Townhead Road. The workings were accessed from Espieside No.4 Pit located close to the north-eastern corner of the site.

A localised area of workings in the Main Coal is recorded to the west of the site and was accessed via two adits.

Plan S.3862/2 Espieside Colliery, 1889 (Virgin and Drumgray Coal Workings)

The Virgin Coal is recorded to be worked beneath the south-eastern portion of the site by a combination of partial and total extraction methods. The workings were accessed via No.3 Pit and were worked to outcrop. The workings were disrupted by an east west trending fault, which with the seam to the south downthrown by around 10m.

Information from the relevant abandonment plans is summarised below:

Plan 1279A/6 Gartsherrie (Virtuewell Coal Workings)

The Virtuewell Coal is recorded to have been extracted beneath the majority of the site. The seam was accessed via the Espieside Colliery Pits Nos. 3 and 4, located to the south-east and close to the north-east portions of the site. The seam is recorded at 36m and 71m bgl in Pit Nos. 3 and 4 respectively. The majority of the workings appear to have been wrought be total extraction methods although large pillars ('stoops') of coal are recorded in a line between the two shafts. These were likely to have been left intact as support to the roof above a main underground roadway. An east-west trending fault interrupted the workings beneath the southern part of the site having downthrown the strata to the south by some 13m. The seam was also worked to outcrop, which was encountered close to the line of the current Townhead Road.

Plan 4665/1 Espieside Colliery, 1903 (Virtuewell Coal Workings)

The Virtuewell Coal Is recorded to be worked beneath almost all the site. The workings appear to be total extraction with pillars of coal left intact around No.3 and No.4 Pits. Again, the workings are disrupted by an east-west trending fault interrupted the workings beneath the southern part of the site. The Virtuewell Coal is recorded at 75m bgl in No.3 Pit. The western limit of the workings is delineated by 'Want' on the plan, which indicates the seam pinched out in this area or became too thin to be worked economically.

7.3. Mineral Ground Investigations

The findings of rotary borehole investigations into the coal seams, which underlie the site at shallow depth as recorded by previous (2006) and recent investigations, may be summarised as follows:

Borehole	Rock head (mbgl)	Pyotshaw & Main Coal (mbgl)	Splint Coal (mbgl)	Virgin Coal (mbgl)	unnamed coal (mbgl)	Virtuewell Coal (mbgl)
2006 Investigations						
R1	23.2	-	29.6 borehole collapsed	-	-	-
R2	12.0	-	-	-	-	
R3	13.6	-	20.7 void	24.1 coal	-	
R4	10.8	-			-	25.3 coal
2008 Investigations						
RBH101	13.0	-			-	37.1 coal
RBH102	15.8	-	18.3 waste	22.9 coal	-	-
RBH103	14.3	-	-	-	35.9 Coal	-
RBH104	17.1	-	-	-		26.3 waste & coal
RBH105	15.6	-			23.05 coal	-
RBH106	15.5	-	-	16.3 coal	42.1 coal	-
RBH107	14.9	-	-	-	-	23.7 coal
RBH108	14.4	-	-	-	37.2 coal	-
RBH109	15.9	-	-	18.4 waste	44.8 coal	-
RBH110	9.1	-	13.7 waste	17.2 waste	-	-

Note. Coal seam depths are to pavement.

- denotes seam not encountered, borehole not located where seam present or terminated depth before depth of seam.

It should be noted that none of the boreholes encountered evidence of workings in coal seams in areas outwith recorded workings. However, mine abandonment plans indicated old workings to the south of the site in the Main and Splint Coal seams and, as in all areas of historical mineworkings, the presence of unrecorded workings cannot by discounted.

7.4. Assessment of Potentially Minerally Unstable Areas

The recent investigations have been reviewed in conjunction with a fresh review of all available borehole information and mine abandonment plans, to allow an assessment of the potentially minerally unstable areas beneath the site. The interpreted locations of the coal outcrops beneath the site and extents of recorded workings are presented on URS Drawing Nos. 49339729/00013, 0014, 0015 and 0016, included in Appendix L.

The information has revealed that the Pyotshaw/Main, Splint, Virgin and Virtuewell Coal seams dip to the south at a shallow angle of about 8°. Faulting disrupts the seams and the Virtuewell is know to thin or pinch out to the west.

The majority of the workings appear to be 'shortwall' total extraction workings. However, some areas of coal have been worked by an older method of working known as 'Stoop and Room' extraction where 'stoops' or pillars of coal were left in place as support for the mining operations and the 'rooms' from where the coal has been removed remain open often long after abandonment.

The shortwall mining method involves total extraction of the coal seam from a series of panels accessed via a network of roadways. The collapse of roof strata is allowed to occur as working progresses along a worked panel and surface ground movements generally occur at the time of working. The risk of significant ground movements due to residual consolidation of the workings is considered to be low. However there is a potential instability risk associated with the possible collapse of the roadways remaining open. There is a possibility that mine roadways remain at least partially open. Rotary borehole findings confirm the condition of the mineworkings as generally collapsed with 'wastes' and 'packed wastes' recorded and only minor evidence of significant open voids. Ground movements may be expected local to ongoing roof collapse above roadways.

Collapse in shallow 'Stoop and Room' workings typically occurs when the roof strata over the extracted 'rooms' fail under tension. Collapse then proceeds upwards ("void migration"), exacerbated by jointing, until it is arrested either by competent strata (typically a competent sandstone unit), or until failure is suppressed by bulking of the collapsed strata (choking). If the failure is sufficiently shallow the void reaches ground surface, before choking, in the form of subsidence or a "crown hole". The ground conditions encountered over shallow stoop and room workings can therefore comprise areas of broken rock due to ongoing roof strata collapse and deterioration. In the shallow Scottish coalfields where stoop and room mining was employed, subsidence accountable to pillar failure, as opposed to roof failure, is virtually unknown.

Mechanisms which bring about collapse of roof strata overlying former mineworkings are complicated and varied and are mainly related to rock strength in conjunction with

frequency and pervasiveness of discontinuities. Additionally, hydrostatic pressures and fluctuating groundwater can contribute to the degradation of the mine environment with time, due to loading/unloading effects and changes from anaerobic to aerobic conditions promoting weathering and mineral breakdown of the rocks. Old mine workings may stand for 100 to 200 years, but it is recognised that ultimately collapse will occur. The prediction of when this will occur is not possible. Progressive collapse can take place many years after mine abandonment and take a similar time before it is expressed at the ground surface.

Where multiple seams are present and worked, there can be interaction between these and the height of void migration will be cumulative. Also, at shallow depths, close to the subcrop, there is a greater likelihood of collapse occurring in the rooms as the overlying roof strata tends to be weathered and hence more jointed and a weaker rock mass.

The theoretical height to which a void may migrate, before being arrested by the self bulking process, can be deduced using a variety of geometric forms of collapse, including conical, wedge and rectangular with the highest void estimated assuming the conical collapse mechanism. The typical range of bulking factors for Carboniferous strata is 30% to 50%, with the lower the bulking factor assumed giving the greatest void size estimated. The conical collapse mechanism, with a bulking factor of 30%, produces a general ratio of rock cover:seam thickness of 10:1 to be required before a migrating void will choke. As a general rule the maximum height of collapse is often taken as 5 to 10 times the seam thickness. Where a road is to be adopted by the local Highways Authority, a ratio of 10 is usually required. Where particularly sensitive structures or piled foundations are adopted, more conservative criteria, typically a ratio of 15 may be adopted. However, such rules should be viewed with caution and only give an indication of the likely heights of void migration. Where undisturbed beds of competent strata, such as strong sandstones, are present above the working the migration of voids may be arrested and may reduce the cover ratio required to provide surface stability but in addition cumulative seam action may increase the depth of instability. It has also been suggested that if the thickness of these competent strata is greater than 1.75 times the appropriate span width then the void migration will be arrested. This hypothesis is however unsubstantiated.

The lateral extent of a worked seam which could potentially induce instability beneath a structure or formation is also related to the nature and condition of the overlying strata and superficial deposits. Typically, an angle of draw of 0 to 20° to the vertical is employed in rock, whilst the angle of draw in superficial deposits would be normally determined by the long-term angle of friction of the material.

From the review of the available information, the approximate extent of potential mineral instability beneath the proposed school site has been determined. It is considered that the Pyotshaw/Main, Splint, Virgin and Virtuewell Coal seams all underlie the site at shallow depth and pose a potential mineral instability constraint to surface development. The approximate areas affected by each of these coal seams are shown on URS Drawing Nos. 49339729/00013, 0014, 0015 and 0016, included in Appendix L. The areas affected are delineated between the seam outcrop location and the location of the required rock cover:seam thickness ratio. Two areas have been estimated:

- The area where the rock cover:seam thickness ratio is less than **10**; and
- The area where the rock cover:seam thickness ratio is less than **15**.

Additionally, URS Drawing Nos. 49339729/0018 and 0019 (Appendix L) show the composite areas for all the coal seams where the rock cover:seam thickness ratios are estimated to 10 and 15 respectively. This reveals a central portion of the site where the rock cover:seam thickness ratio is greater than 15 and a piled structure could be located without the requirement for mineral consolidation works. However, this should be confirmed by a probe drilling exercise.

Although no direct evidence of unrecorded workings has been found, the presence of unrecorded workings cannot be fully discounted and the potentially minerally unstable areas should include areas outwith recorded workings.

It is envisaged that mitigation measures to ensure surface stability will comprise consolidation of the workings using grout pressure injection techniques. Areas outwith recorded workings, but within potentially unstable areas should be probe drilled during these works to confirm the extent of workings.

During any future grouting works, the Principal Contractor should take cognisance of the possible effects on the groundwater regime and the mineral stability beneath neighbouring areas and consider appropriate mitigate measures.

7.5. Mine Entries

During the course of investigations, evidence of at least two mineshafts either within or immediately adjacent to the site has been found.

An Air Pit is recorded on one abandonment plan (S.5507) which locates it on or just within the south-eastern corner of the site. There is no information on the shaft dimensions, condition nor depth, however it is linked to the Espieside No.3 Pit to the south at a depth estimated to be 24m bgl.

Espieside No.4 Pit shaft is recorded in the vicinity of the north-east corner of the site in an area of grass between Townhead Road and a blaes car park. The shaft is recorded to be at least 51m deep, where it intercepted the Kiltongue Coal. No information on the shaft dimensions nor condition upon abandonment was available.

The locations of these two shafts determined from mine abandonment plans and a Coal Authority Mining Report are shown on URS Drawing Nos. 49339729/0006 through to 0016.

The shafts will require to be located with probe drilling on a 1m spaced grid to approximately 3m below rockhead being the most effective method, given the significant thickness of made ground in the area.

The Espieside No.3 Pit shaft is located approximately 60m to the south-east of the south-eastern corner of the site.

A fourth potential shaft has been determined from a mine abandonment plan (S.3862, 1 of 2) as small unspecified rectangle is located on the edge of workings recorded in the Splint Coal seam. The rectangle is similar to those used to identify pit shafts on other areas of the plan. The potential shaft is located approximately 20m to the east of the south-eastern corner of the site and is shown on URS Drawing No. 49339729/0015 (Appendix L).

The presence of mine shafts is a risk to surface stability and likely to preclude any built development and adoptable roads immediately above or around these features. As a general rule a development exclusion zone equivalent to the depth to rockhead from the edge of the shaft is applied. However, this should be confirmed with the appropriate authorities.

As in all areas of former mining, the possibility of unrecorded mine entries cannot be discounted. It is recommended that during re-development works, any exposed formation or excavation be carefully inspected for any evidence of a mine shaft or well. Evidence may comprise areas of localised deep made ground, surface cracking or ominous depressions.

Remedial measures for mine entries are likely to comprise a combination of reinforced concrete cap and/or pressure grouting of the backfill material for mineshafts and a combination of excavation and controlled backfill and pressure grouting for mine adits.

If the site is not developed as a school and remains in its current use as recreational playing fields it is recommended that the recorded mine shafts be dealt with in line with other known shafts in the North Lanarkshire Council area.

8. CONTAMINATION ASSESSMENT

8.1. Assessment Methodology

To provide an initial assessment of the potential significant contaminant concentrations detected in soil and groundwater samples collected from the site, URS have undertaken an initial screening assessment of the reported analytical data against Generic Assessment Criteria (GAC) that have been derived to be protective of human health and the water environment. This screening approach is consistent with the Stage 2 Risk Assessment approach contained within the CRL11 guidance[2] for the investigation of potentially contaminated land.

URS has assessed the site in the context of a proposed residential without water uptake end use (i.e. post-development).

GACs are intended to provide a conservative means of initial assessment. Where contaminant concentrations are less than the appropriate GAC, it is considered unlikely that the contaminant will pose a potentially unacceptable risk to human health or the water environment. Where a contaminant concentration exceeds the GAC, it does not automatically follow that an unacceptable risk exists, but that further assessment may be necessary to quantify the risk taking into account site-specific input parameters.

URS uses the modified Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) approach within a UL context for the assessment of risks posed to human health from petroleum hydrocarbons (as recommended by the Environment Agency in Science Report P5-080/TR3, dated February 2005). This method uses a combination of indicator compounds (such as benzene) and 13 petroleum hydrocarbon fractions (e.g. aliphatic EC16-21, aromatic EC12-35 etc).

For the assessment of risks to the water environment, GACs were derived form Freshwater EQS assessment criteria. There is a published range of EQS' for freshwater for various contaminants based on water hardness. Where there is an exceedences of the lower range EQS, a conservative value using a typical hardness value of 100mg $CaCO^3$/l for Scottish waters has been used to make an assessment. In certain instances a further breakdown of these values are available as follows:

- EQS1 – derived to protect the most sensitive aquatic life; and
- ESS2 – derived to protect less sensitive aquatic life.

Where there are no EQS' the Water Supply (Water Quality)(Scotland) Regulations 2001 (DWS) have been used as a conservative approach.

[2] Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR11); Environment Agency, 2004

8.2. Soils

A non-targeted sampling strategy was adopted for testing as the final development layout has not been determined. A total of 46No. soil samples from made ground (landfill waste) and natural deposits were analysed for a variety of chemical parameters. A detailed table of results is contained within Appendix J.

It is assumed that the spatial distribution of contaminants concentrations recorded in the waste mass will not follow a normal distribution and hotspots of contamination therefore are unlikely to exist. This is due to the heterogeneity of the material, which is inherent to landfill waste. If an exceedance of a particular contaminant were recorded at 4.0mbgl for example, there would be no reason to believe that the same contaminant concentration could not exist at a shallower depth in a different location in the same mass of material. Therefore, in order to classify the made ground (fill) material, representative samples were selected for chemical analysis using spatial sampling across the full range of recorded depth profiles. Where exceedances of a particular contaminant have been recorded above GACs the significance of these is discussed further in Section 8.5.

The test results indicated exceedences of the URS GACs as follows:

Made ground (27No. Samples)

Contaminant	URS GAC (mg/kg)	Concentration (mg/kg)	Position	Depth (mbgl)
Arsenic	20	36	TP203	1.3
		27	TP231	3.1
		21	TP235	0.5
		71	TP328	2.2
		24	TP337	0.5
		36	BH210	4
Lead	450	500	TP210	1.8
		580	TP235	0.5
		510	TP238	4.1
		460	TP303	2
		680	TP328	2.2
		630	TP337	0.5
		710	TP340	1.5
		3600	BH210	4

Contaminant	URS GAC (mg/kg)	Concentration (mg/kg)	Position	Depth (mbgl)
Nickel	75	120	TP203	1.3
		110	TP210	1.8
		130	TP235	0.5
		120	TP238	4.1
		100	TP246	1.5
		120	TP255	0.5
		84	TP302	1
		110	TP303	2
		100	TP307	1
		100	TP311	1
		120	TP328	2.2
		130	TP337	0.5
		130	TP340	1.5
		160	BH210	4
Total Cyanide	50	240	TP307	1
Benzo(a)pyrene	1.1	1.7	TP203	1.3
		2.8	TP231	3.1
		9.4	TP302	1
		3.5	TP303	2
		1.4	TP311	1
		2	TP316	1
		1.2	TP319	0.5
		1.8	TP337	0.5
Dibenzo(ah)anthracene	1.10	2	TP302	1

Asbestos screens performed on 13No. made ground samples did not reveal the presence of asbestos.

Natural Deposits (19No. Samples)

Contaminant	URS GAC (mg/kg)	Concentration (mg/kg)	Position	Depth (mbgl)
Arsenic	20	24	BH308	2
		49	BH312	5
Chromium	200	440	BH312	5
Lead	450	6600	BH308	2
		910	BH312	5
Nickel	75	130	TP219	4
		180	BH308	2
		660	BH312	5
Aromatics >EC21-EC35	1700	1900	TP307	2.2
Trichloroethene	0.138	0.14	TP225	3.5

Although it can be seen that there are some isolated impacts from contamination on the natural drift deposits underlying the fill materials, the relative depth of these samples (greater than 1m bgl) means that the human health dermal and oral pathways are unlikely to be complete. As such the impacted soil greater than 1m bgl is not deemed to pose a risk to human health due to the incomplete exposure pathway in terms of the proposed future end use.

Leachate Testing (18No. Samples)

Analysis of the leachate test data indicates that all chemical determinants were below the respective GAC, with the exception of the following.

Contaminant	URS GAC (µg/kg)	Concentration (µg/kg)	Position	Depth (mbgl)
Cadmium	5	460	BH206	3.0
Sulphate	250000	540000	TP238	4.1
Phenols	30	8800 3400 2500 2700 3400 3000	TP201 TP210 TP212 TP235 TP319 TP348	0.9 1.8 0.4 0.5 0.5 2

8.3. Groundwater

Ten water samples were analysed for a variety of chemical parameters. Samples were retrieved across a variety of response zones, i.e. from made ground and natural screened zones. A detailed table of results is contained within Appendix J.

The test results indicated exceedences of the GAC as follows:

Contaminant	URS GAC (µg/kg)	Concentration (µg/kg)	Position	Response Zone
Manganese (dissolved)	50	1700 1600 7800 1700 2400 3600 4800 2400 1800 220	BH201 BH202 BH205 BH207 BH210 BH211 BH302 BH305 BH308 BH311	Made Ground Peat Made Ground Silt/clay Peat Made Ground Peat Silt/clay Peat Made Ground
Nitrite as NO2	30	270 510	BH308 BH311	Peat Made Ground
Ammonical Nitrogen	1000	4500 4400 4500 46003100 3000 2831 20592 8108	BH201 BH202 BH205 BH207 BH210 BH211 BH302 BH305 BH308	Made Ground Peat Made Ground Silt/clay Peat Made Ground Peat Silt/clay Peat
Aliphatics >C21-C35	10	740	BH205	Made Ground
Aromatics >EC21-EC35	10	360 350	BH202 BH205	Peat Made Ground
Fluoranthene	0.2	0.28 0.37 0.46	BH202 BH205 BH211	Peat Made Ground Made Ground
Benz(a)anthracene	0.092	0.17 0.2 0.21	BH202 BH205 BH211	Peat Made Ground Made Ground
Benzo(a)pyrene	0.02	0.05 0.27 0.29 0.04 0.25 0.04	BH201 BH202 BH205 BH207 BH211 BH311	Made Ground Peat Made Ground Silt/clay Made Ground Made Ground

8.4. Tier 1 Qualitative Assessment

8.4.1. Risk to Human Health

Elevated levels of metals and hydrocarbons recorded in soils were present at depths greater than 1mbgl. At these depths these contaminants do not represent any significant risk, as they are not available to human receptors. However, elevated levels of arsenic, lead, nickel and benzo(a)pyrene were encountered at 0.5mbgl. At this depth it is possible that human receptors could come into contact with contaminants and pose a potential risk to human health as at this depth the pathway of soil/dust ingestion and dermal contact may be present. However, the concentrations of the contaminants recorded within 1mbgl were only marginally elevated above their respective GAC. These were for arsenic above the GAC of 20mg/kg in TP235 (0.5m) 21mg/kg and TP337 (0.5m) 24mg/kg; for lead above 450mg/kg in TP235 (0.5m) 580mg/kg and TP337 (0.5m) 630mg/kg; for nickel above 75mg/kg in TP235 (0.5m) 130mg/kg, TP255 (0.5m) 120mg/kg and TP337 (0.5m) 100mg/kg and benzo(a)pyrene above 1.1mg/kg in TP319 (0.5m) 1.2mg/kg and TP337 (0.5m) 1.8mg/kg. Additionally, the GACs are derived for a residential land use scenario based upon standard receptor parameters (child of 0-6 years exposed for 365 days per year), which is considered as being overly conservative given the proposed land use as a school. Comparing the recorded concentrations to their respective GACs for a commercial/industrial land use demonstrates all values to be less than assessment criteria thresholds. Therefore, despite the fact that similar concentrations of the following contaminants may exist at shallow depths in areas of the waste mass not analysed, the exceedances of the arsenic, lead, nickel and benzo(a)pyrene GACs in isolated samples are not considered to represent a potential significant risk of significant harm to human health receptors in the context of the proposed development,.

The risk to human health from groundwater is considered to be low as direct contact with groundwater is unlikely given groundwater was not encountered at shallow depths during the site investigation.

If materials are encountered at depth during future construction, enabling or maintenance works cognisance should be made to the spatial distribution of contaminants recorded in this investigation and mitigation measures should be employed to protect human health receptors. Given the nature and concentrations of contaminants recorded in the natural soils it is considered that standard levels of PPE will be acceptable for use by maintenance workers.

Considering the above the risk to human health associated with the planned development of the site are therefore considered to be low.

8.4.2. Risks Associated with Ground Gas

Analysis of the gas results has determined conflicting readings in terms of measured gas concentrations and measured flow readings. Levels of flow have been recorded to be 0l/h at every location throughout each monitoring round, which is considered to be unlikely given the high degree of variability of the overlying fill materials.

On this basis it is not possible to undertake a qualitative assessment of the risk posed by ground gases at the present time. However, it is recommended that further gas monitoring be undertaken in order to allow a robust assessment of the risks posed to the built environment from gas emissions to be undertaken. Following guidance from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' it is recommended that a further 12No. monitoring visits be undertaken over a period of six months.

8.4.3. Risk to the Water Environment

The contaminants which have been recorded above EQS Freshwater are manganese, nitrite, ammoniacal nitrogen, fluoranthene, benz(a)anthracene, benzo(a)pyrene and TPH. Analysis of the leachate test data indicates that all chemical determinants were below the respective GAC, with the exception of a single cadmium concentration and several phenol and sulphate concentrations. This would indicate that although there are elevated concentrations of other contaminants present within shallow groundwater the only remaining mobile contaminants and therefore the only complete linkages identified during the investigation beneath the site are cadmium, sulphate and phenol.

Concentrations of inorganic contaminants manganese and ammoniacal nitrogen were elevated above assessment criteria at the majority of monitoring locations across the site.

Ammonium and Manganese are key indicator parameters of leachate generated by the breakdown of organic components of landfill waste, which is present at the site. Concentrations of these substances within the former landfill area on site are as expected by comparison with typical domestic waste leachate, and in a formerly unlined site without a low permeability engineered cap to minimise infiltration, it is likely that they would have leached into the groundwater on-site more rapidly than other less mobile substances. Given the age of the waste and the fact that the landfill closed in 1972 it is unlikely that these contaminants will persist and it would be expected to see a reduction in concentrations over time as they are flushed away through capillary action.

Considering the hydrological setting of the site, i.e. Lochend Loch approximately 500m to the west and Woodend approximately 800m to the northwest of the site it is unlikely that Ammonium and Manganese represent a significant risk to surface water receptors given the potential for dilution/attenuation across these distances and the fact that concentrations are likely to reduce over time. As discussed above there were also exceedances of nitrite, fluoranthene, benz(a)anthracene, benzo(a)pyrene and TPH fractions in the shallow fill deposits with some marginal impacts observed at isolated locations in the underlying natural drift deposits. However, cohesive silt and clay deposits have been encountered across the site at depth underlying the fill horizon and at ground level at the northern and southern extremities of the site. As such impacts generated by the made ground recorded across the site are likely to be retained in the shallow/perched groundwater table. Therefore, a direct pathway for leaching and subsequent vertical migration of contaminants from the made ground materials through to moderately permeable regional groundwater receptors in the deep underlying bedrock is considered to be unlikely.

Furthermore, it is also considered unlikely that contaminants would migrate laterally and pose unacceptable risks to nearby surface watercourses due to the presence of significant thickness of low permeability glacial till underlying the site, which is likely to act as a barrier to lateral movement of shallow/perched groundwater. Following redevelopment it is also considered that the building, car park and any other areas of "hard" landscaping would form an impermeable barrier thus restricting infiltration to ground.

The risks to Water Environment once the site has been developed as proposed are therefore considered to be low provided appropriate design control measures are adopted during the construction phase of the school to limit the creation of new pathways, which would allow the lateral migration of contaminants.

8.4.4. Risk to the Built Environment

8.4.4.1. Supply Pipes

The following table records the soils assessment in relation to the Water Regulations Advisory Scheme (WRAS) guidance note 9-04-03:

Contaminant	No. of tests	WRAS criteria (mg/kg)	Range of results (mg/kg)	No. of exceedences	Location
Sulphate	36	2000	>100 – 3800	10	TP201 TP203 TP231 TP235 TP238 TP303 TP316 TP328 TP348 BH210
Sulphur	36	0.5%	0.01% - 1.5%	5	TP201 TP231 TP238 TP303 BH210
Sulphide	36	250	>15 – 120	0	-
pH	86	8<5	3.6 - 7.7	17	TP203 TP216 TP232 TP302

Contaminant	No. of tests	WRAS criteria (mg/kg)	Range of results (mg/kg)	No. of exceedences	Location
					TP307 TP309 TP316 BH201 BH202 BH204 BH205 BH208 BH210 BH213 BH302 BH307 BH309
Arsenic	36	10	>3 – 71	11	TP203 TP231 TP235 TP238 TP307 TP319 TP328 TP337 TP340 BH205 BH210
Cadmium	36	3	>0.2 – 9.5	2	TP302 BH210
Chromium (hexavalent)	36	25	>0.3	0	-
Chromium (total)	36	600	>4.5 – 200	0	-
Cyanide (free)	36	25	>1	0	-
Cyanide (complex)	36	250	>1 – 240	0	-
Lead	36	500	6 – 3600	7	TP210

Contaminant	No. of tests	WRAS criteria (mg/kg)	Range of results (mg/kg)	No. of exceedences	Location
					TP235 TP238 TP328 TP337 TP340 BH210
Mercury	36	1	>0.4 – 8.9	4	TP234 TP337 TP340 BH205
Selenium	36	3	>3	0	-
Thiocyanate	36	50	>1 – 18	0	-
Phenol	36	5	>0.15	0	-
Poly Aromatic Hydrocarbons (PAH)	36	50	0.054 – 130	1	TP302
Toluene Extractable	31	50	>0.01	0	-
Petroleum Hydrocarbons (TPH)	31	50	43 – 3900	30	TP201 TP203 TP212 TP219 TP222 TP226 TP231 TP235 TP238 TP255 TP303 TP307 TP315 TP316 TP324 TP326 TP328

Contaminant	No. of tests	WRAS criteria (mg/kg)	Range of results (mg/kg)	No. of exceedences	Location
					TP348 BH202 BH203 BH205 BH206 BH210

Given the elevated concentrations of sulphate, sulphur, pH, arsenic, cadmium, lead, mercury, PAH and TPH encountered throughout the site, it is recommended that wrapped iron be used for mains pipes laid on site.

Alternatively in areas where water and other service pipes are to be placed above groundwater, consideration should be given to the over-excavation of service trenches, to a minimum of double the pipe width and 300mm below the pipe level invert, in the vicinity of the elevated contaminant concentrations and backfilling using a suitable clean inert material. Should this be undertaken, it is considered that a standard HDPE plastic pipe will be suitable.

It should be noted that the laying of water pipes across any land where arsenic is identified is unacceptable without site remediation, such as removal of the contaminated soil.

In addition to the above an allowance should be made for ensuring that all joints and seals are adequately protected and all service trenches are over excavated and backfilled using a suitable clean, inert material.

8.4.4.2. Buried Concrete

Water soluble sulphate and pH tests were performed on samples collected during the intrusive ground investigation works. The results returned pH values in the range 3.6 to 7.7 with of the water-soluble sulphate concentrations being recorded to a maximum of 3.59g/l. These values were assessed against the BRE guidance, Special Digest 1:2005, “Concrete in Aggressive Ground”. Based on the BRE Special Digest the site has been classified as a Design Sulphate Class DS-3 and an Aggressive Chemical Environment for Concrete (ACEC) Class AC-4.

8.4.4.3. Future Earthworks

Earthworks comprising limited amounts of cut and fill operations may be required at the site to achieve final site levels to allow construction of the proposed school building. This is likely to be achieved using a combination of site won material as a priority and imported materials when suitable site-won materials are not available. Fill materials will consist of either imported material or site-won material, which is demonstrated to be suitable for use

through employment of representative chemical testing. These materials will also be structurally sound.

Site-Won materials

Some of the materials arising from excavations and potential cut operations may be suitable for re-use on site. In this regard made ground spoil will generally only be suitable for re-use where leachate levels are below set threshold concentrations or the material is being placed on top of existing contaminated material and the material is subsequently capped within the completed development. Cognisance should be made to the spatial distribution of contaminants recorded in this investigation so as to limit cutting operations in areas of the site where fill materials may not be suitable for reuse.

To assess the suitability of site-won material for reuse it will be necessary to agree a suitable method of assessment with the environmental services department of the council for classification purposes. Further Details are provided in Section 9.8.

8.4.4.4. Foundations

It is considered that the introduction of piled foundations as discussed in Section 9.8 at the site has the potential to introduce contaminant migration pathways specifically in relation to migration of soil gas. Assessment of this pathway and the need for inclusion of appropriate mitigation measures in the building design will be undertaken following the collection of representative future gas monitoring data as discussed in Section 8.4.2. This pathway remains a plausible pollutant linkage at this stage and has therefore been included in the developed conceptual site model in Section 8.5.

8.4.4.5. Waste Management

If land preparation activity includes some degree of land clearing, site grading and earthworks necessary to facilitate construction, in order to minimise off-site disposal costs, procedures should be implemented to retain as much material as possible on the site. However, any unidentified contaminated materials and general landfill material which is demonstrated to not be suitable for use using the adopted acceptance criteria will require to be handled and disposed of in accordance with the requirements of the Waste Management Licensing Regulations.

8.5. Developed Conceptual Site Model

8.5.1. General

The Conceptual Site Model (CSM) has been outlined in Section 4 of this Report in accordance with the principles of BS10175, whereby a Source, Pathway and Receptor must be present on site for ground contamination to present a significant risk.

The following developed CSM includes for the proposed development and the information obtained during the URS ground investigation and provides a detailed assessment of the pollutant linkages identified for the proposed use of the site.

A visual representation of the developed CSM is contained within Appendix K.

8.5.2. Potential Pollutant Linkages

The key sources, pathways and receptors identified on site are detailed below.

8.5.2.1. Contaminant Sources

The contamination sources identified during the investigations are summarised in Table 6.1 below:

Table 6.1 – Contamination Sources

No	Source	Nature
S1	Residual contamination in subsurface soils and fill, associated with the historical use of the site: • 1a. In soil/fill material beneath the site.	Hydrocarbons (TPH, PAH); Toxic Metals. Cyanide
S2	Dissolved contaminants in groundwater beneath the site: • 2a. Originating from fill materials at the site.	Manganese, Nitrite Ammoniacal Nitrogen, Aliphatics >C21-C35 Aromatics >EC21-EC35 Fluoranthene Benz(a)anthracene Benzo(a)pyrene
S3	Gaseous phase contaminants: • 3a. Emanating from the fill deposits and natural peat deposits.	Methane; Carbon dioxide.

8.5.2.2. Receptors

A number of potential receptors in the context of the proposed school development are considered be at risk from the potential contaminants identified in Section 8.5.2.1. These include:

- Human health receptors - construction workers and future site users;
- Shallow groundwater in superficial deposits;
- Ecological receptors;
- Construction materials;
- Nearby building structures.

Potential receptors of the identified contamination sources are summarised below in Table 6.2:

Table 6.2 – Potential Receptors

No.	Receptor
R1	Human Health related: • 1a. Members of public accessing the site; • 1b. Site Workers carrying out future intrusive works; • 1c. Future users.
R2	The water environment: • 2a. Groundwater in superficial deposits beneath site;
R3	Other environmental targets: • 3a. Future School Building/construction materials/property on site and nearby land; • 3b. Lanscaped areas of the proposed school development including sports pitches

8.5.2.3. Pathways

For a risk to be considered significant, a pathway must exist by which identified contaminants can move from a source to a potential receptor. Several potential pathways for contaminant migration have been identified at the site including:

- Dermal contact, ingestion and inhalation (e.g. during any future drilling or construction workers on site);
- Leaching and migration of contaminants to shallow groundwater;
- Generation and migration or accumulation of ground gases, resulting in, for instance, asphyxia or explosion;
- Root uptake from soil; and
- Direct contact with construction materials.

The possible pathways by which the identified contamination could impact on receptors are listed in Table 6.3 below (with the associated targets from Table 6.2 listed in the column on the right).

Table 6.3 – Potential Pathways

P1	**Via physical exposure pathways, mainly affecting human health targets:**	
	- Outdoor inhalation of dust.	**R1a, R1b**
	- Dermal contact with contaminated soil, dust or groundwater.	**R1a, R1b**
	- Ingestion or inhalation of contaminated soil, dust or groundwater.	**R1a, R1b**
P2	**Via mobilisation of subsurface contaminants into shallow groundwater, mainly affecting controlled waters:**	
	- Leaching and lateral migration of contaminants via shallow deposits and service runs.	**R2a** **R3a**

	- Groundwater within the underlying natural superficial deposits by leaching and migration of contaminants via shallow deposits.	**R2a,**
P3	**Via gas migration through subsurface soils or via underground structures.**	**R1c, R3a,**
P4	**Via direct uptake of contaminants from soil and water.**	**R3b**

9. CONCLUSIONS AND RECOMMENDATIONS

9.1. Site Details

The site is located within Coatbridge, North Lanarkshire. A review of historical records indicate that the site was previously occupied by the Townhead Landfill site, which came into operation in 1945 and closed in 1972. The site is also located within an area which is known to have been extensively mined.

9.2. General Geology

Published geological information records the site to be underlain by peat, glaciolacustrine clays, silts and sands and glacial till. The bedrock strata beneath these superficial deposits are recorded to comprise the Middle Coal Measures with the Virgin and Splint Coals subcroping along the southern boundary of the site and the Virtuewell Coal subcroping along the northern boundary.

Previous and current ground investigations generally confirm the expected sequence of strata.

9.3. Mining

The site is underlain by several coal seams at shallow depth, with areas of recorded workings in multiple seams. The stratigraphy, gleaned from various mine abandonment plans is summarised below:

Seam Name	Average seam thickness (m)	Average thickness of Intervening Strata (m)
Pyotshaw Coal	1.45	
		0.17
Main Coal	1.17	
		18.8 – 27.5
Splint Coal	0.79 (2.24 main roadway height)	
		2.5
Virgin Coal	0.71 (1.47 main roadway height)	
		36
Virtuewell Coal	0.91 (1.5 main roadway height)	
		33
Kiltongue Coal	1.52	

9.4. Ground Conditions

The sequence of strata as revealed by the recent ground investigations generally confirm the findings of the previous exploratory works and published geological information, and may be summarised as follows:

Stratum	Depth to Underside of Strata (mbgl)	Thickness (m)
Topsoil	0.05 – 0.70	0.05 – 0.70
Made Ground	0.60 – 8.45	0.45 – 8.30
Peat	3.50 – 9.60	0.30 – 5.50
Lower Lacustrine Deposits	7.00 – 13.80	0.40 – 3.65
Glacial Till	7.40 – 14.70	0.30 – 8.60
Rockhead	Encountered from between 7.40mbgl and 14.70mbgl.	

9.5. Mineral Stability

The proposed school site is underlain by the Pyotshaw/Main, Splint, Virgin and Virtuewell Coal Seams which are all recorded to be worked, predominantly by total extraction methods, beneath the site. Where worked, the seams were worked to outcrop.

From the review of the available information, the approximate extent of potential mineral instability beneath the proposed school site has been determined. It is considered that the Pyotshaw/Main, Splint, Virgin and Virtuewell Coal seams all underlie the site at shallow depth and pose a potential mineral instability constraint to surface development. The approximate areas affected by each of these coal seams are shown on URS Drawing Nos. 49339729/00013, 0014, 0015 and 0016, included in Appendix L. The areas affected are delineated between the seam outcrop location and the location of the required rock cover:seam thickness ratio. Two areas have been estimated:

- The area where the rock cover:seam thickness ratio is less than **10**; and
- The area where the rock cover:seam thickness ratio is less than **15**.

URS Drawing Nos. 49339729/0018 and 0019 (Appendix L) show the composite areas for all the coal seams where the rock cover:seam thickness ratios are estimated to 10 and 15 respectively. This reveals a central portion of the site where the rock cover:seam thickness ratio is greater than 15 and a piled structure could be located without the requirement for mineral consolidation works. However, this should be confirmed by a probe drilling exercise.

Although no direct evidence of unrecorded workings has been found, the presence of unrecorded workings cannot be fully discounted and the potentially minerally unstable areas should include areas outwith recorded workings.

It is envisaged that mitigation measures to ensure surface stability will comprise consolidation of the workings using grout pressure injection techniques. Areas outwith recorded workings, but within potentially unstable areas should be probe drilled during these works to confirm the extent of workings.

During any future grouting works, the Principal Contractor should take cognisance of the possible effects on the groundwater regime and the mineral stability beneath neighbouring areas and consider appropriate mitigate measures.

During the course of investigations, evidence of at least two mineshafts either within or immediately adjacent to the site has been found. A possible mine shaft may also be located approximately 20m to the east of the south-eastern corner of the site.

The presence of mine shafts is a risk to surface stability and likely to preclude any built development and adoptable roads immediately above or around these features. As a general rule a development exclusion zone equivalent to the depth to rockhead from the edge of the shaft is applied. However, this should be confirmed with the appropriate authorities.

9.6. Gas

Monitoring of the borehole installations for soil gas was carried out on four occasions between 1 August and 22 August 2008. Methane concentrations were recorded to a maximum of 68.7%, and carbon dioxide concentrations recorded to a maximum of 30.2%. Measurements of flow indicated that gas emission rates were zero. It is considered that these results are conflicting and therefore it is not possible to undertake a qualitative assessment of the risk posed by ground gases at the present time.

Current assessments undertaken using the Wilson and Card methodology (Ciria C665), based on worst-case conditions indicate Characteristic Situation 4 for the site. Typical protection measures recommended for CS-4 for a development of this nature would include proprietary gas resistant membranes and positively pressurised underfloor sub-space with monitoring facilities. For preliminary design purposes, it is considered prudent to assume worst-case conditions and it is recommended that incorporation of gas protection measures applicable for CS-4 should be allowed for in future cost plans.

It is recommended that due to the differing readings obtained to date and high concentrations of gas recorded on site, further gas monitoring be undertaken in order to allow a robust assessment of the risks posed to the built environment from gas emissions to be carried out. Following guidance from CIRIA C665 ‘Assessing risks posed by hazardous ground gases to buildings’ it is recommended that a further 12No. monitoring visits be undertaken over a period of six months. Actual gas-protection requirements may not require such high levels of protection. However, this will be re-assessed and modified as additional monitoring data becomes available.

It should also be noted that should the gas regime indicate significantly high positive rates of flow there might also be a requirement to install a passive gas-venting trench along the

northern boundary of the site to mitigate against any potential off-site migration of hazardous gases.

9.7. Contamination

A contamination assessment in which contaminant concentrations were screened against URS Generic Assessment Criteria (GAC) most applicable to the proposed school development (residential without water uptake end use) was undertaken.

The chemical analysis of representative soil samples has identified concentrations of some contaminants marginally elevated above their respective GAC in terms of human health and water environment risk assessment. .

9.7.1. Risk to Human Health

Elevated levels of arsenic, lead, nickel and benzo(a)pyrene were encountered at shallow depths at which it is possible that human receptors could come into contact with them. This may pose a potential risk to human health, as at these depths the pathways of soil/dust ingestion and dermal contact may be present. However, the concentrations of the contaminants recorded within 1mbgl were only marginally elevated above their respective GAC and the GACs are derived for a residential land use scenario based upon standard receptor parameters (child of 0-6 years exposed for 365 days per year), which is considered as being overly conservative given the proposed land use as a school. Comparing the recorded concentrations to their respective GACs for a commercial/industrial land use demonstrates all values to be less than assessment criteria thresholds. Therefore, despite the fact that similar concentrations of the following contaminants may exist at shallow depths in areas of the waste mass not analysed, the exceedances of the arsenic, lead, nickel and benzo(a)pyrene GACs in isolated samples are not considered to represent a potential significant risk of significant harm to human health receptors in the context of the proposed development,.

If materials and shallow groundwater are encountered at depth during future construction, enabling or maintenance works cognisance should be made to the spatial distribution of contaminants recorded and mitigation measures should be employed. Given the nature and concentrations of contaminants recorded in the natural soils it is considered that standard levels of PPE will be acceptable for use by maintenance workers.

Therefore, the risks to human health associated with the planned development of the site are considered to be low.

9.7.2. Risk to the Water Environment

Several contaminants have been recorded above assessment criteria in shallow/perched groundwater underlying the site including manganese, nitrite, ammoniacal nitrogen, fluoranthene, benz(a)anthracene, benzo(a)pyrene and TPH. Analysis of the leachate test data indicates that all chemical determinants were below the respective assessment criteria, with the exception of a single cadmium concentration and several phenol and sulphate concentrations. This would indicate that although there are elevated

concentrations of other contaminants present within shallow groundwater there are unlikely to be any remaining significant complete pollutant linkages between solid phase contaminants held in the landfill waste mass and shallow/perched groundwater.

Concentrations of inorganic contaminants manganese and ammoniacal nitrogen were elevated above assessment criteria at the majority of monitoring locations across the site.

Ammonium and Manganese are key indicator parameters of leachate generated by the breakdown of organic components of landfill waste, which is present at the site. However, given the age of the waste and the fact that the landfill closed in 1972 it is unlikely that these contaminants will persist and it would be expected to see a reduction in concentrations over time as they are flushed away through capillary action.

Considering the hydrological setting of the site, i.e. Lochend Loch approximately 500m to the west and Woodend approximately 800m to the northwest of the site it is unlikely that Ammonium and Manganese represent a significant risk to surface water receptors given the potential for dilution/attenuation across these distances and the fact that concentrations are likely to reduce over time.

Exceedances of other contaminants recorded in shallow/perched groundwater included nitrite, fluoranthene, benz(a)anthracene, benzo(a)pyrene and TPH fractions in the shallow fill deposits with some marginal impacts observed at isolated locations in the underlying natural drift deposits. Risks associated with these contaminants are considered to be low as cohesive silt and clay deposits have been encountered across the site at depth underlying the fill horizon and at ground level at the northern and southern extremities of the site. As such impacts generated by the made ground recorded across the site are likely to be retained in the shallow/perched groundwater table. Therefore, a direct pathway for leaching and subsequent vertical and horizontal migration of contaminants from the made ground materials to nearby surface water or through to moderately permeable regional groundwater receptors in the deep underlying bedrock is considered to be unlikely.

It is recommended that appropriate design control measures be adopted during the construction phase of the school to limit the creation of new pathways, which would allow the lateral migration of contaminants. This includes impact on surface water runoff by contact with exposed contaminated soils in service trenches, which should be managed by limiting the amount of time the trenches are left exposed.

9.7.3. Risk to the Built Environment

Risks to the built environment are considered to be low and can be summarised as follows:

9.7.3.1. Supply Pipes in Contaminated Land

Water supply pipes being laid directly in the existing made ground or natural soils on the site should be wrapped iron. Where an increase in the thickness of pipe bedding is possible, backfilling the trench with a clean inert material would allow a standard MDPE plastic pipe to be used.

9.7.3.2. Buried Concrete Requirements

Based on the guidance within the BRE Special Digest, the site has been classified as a Design Sulphate Class DS-3 and an Aggressive Chemical Environment for Concrete (ACEC) Class AC-4 for all materials across the site.

9.8. Foundation Assessment

The proposed development has not been finalised although it is understood to comprise a school building of two-storeys, although this may increase, with associated car parking, playground and football pitches. The foundation loadings have not been specified, however, the following general guidance is provided with respect to a typical school development.

The made ground is not considered to be a suitable bearing stratum for even light building loads owing to its variable nature, engineering properties and thickness. In addition to this the underlying soft natural deposits, e.g. the peat and lower lacustrine deposits, are not considered to be suitable bearing stratum.

As shallow deposits are not considered suitable bearing stratum, piled foundations may be used to transfer the building loads to a suitable bearing stratum at depth. It is considered that the glacial till deposits may provide a suitable bearing stratum for piled foundations. It is considered that a safe bearing capacity of 150kN/m^2 to 200kN/m^2 will be available in stiff glacial till with settlements of less than 25mm.

Where imposed building loads are expected to exceed 150kN/m^2 to 200kN/m^2, rockhead would be considered to be a suitable bearing stratum.

In the selection and design of piles recognition should be given to boulders and other granular obstructions in the glacial till, the potential for obstructions within the made ground and to the high concentrations of soil gases encountered during the site investigation. It is considered that drilled piles with permanent casing will be the required piling solution. Sleeving the casing may also be required to overcome the effects of negative skin friction from the settlement of the peat and overlying made ground.

It is recommended that a comprehensive programme of pile testing be carried out in order to confirm the performance of the piles and acceptability of construction techniques.

Consideration should be given to settlement of any ground bearing floor slabs, areas of hardstanding and service connections and their interaction with 'hard', piled foundation elements.

If the general surface level of the site is raised consideration should be given to negative skin friction effects arising form the long term consolidation of the weak, compressible soils under the weight of the new fill and the settlement of associated hardstanding areas and services.

It is considered that the introduction of piled foundations has the potential to introduce contaminant migration pathways specifically in relation to migration of soil gas.

Assessment of this pathway and the need for inclusion of appropriate mitigation measures in the building design will be undertaken following the collection of representative future gas monitoring data.

9.9. Earthworks and Services

Finished floor levels for the school have not been developed at this stage however as the site is generally flat lying it is considered that significant cut and fill will not be required during re-development.

All topsoil and vegetation, where it is present, should be stripped from beneath proposed development footprints, and hardstanding areas.

It should be noted that shallow excavations will encounter predominantly loose granular material. During site investigation works excavations carried out in the granular material were unstable, particularly where perched water was encountered, it is therefore recommended that any excavations encountering granular material be suitably battered or temporarily supported to avoid collapse of the excavation sides.

Allowance should be made for maintaining excavations in a dry and stable condition. Where excavations are taken down close to or below the groundwater table, provision should be made for groundwater control. Where dewatering is required care should be taken to ensure that excessive fines are not removed from the water bearing saturated alluvial soils.

Consideration should be given to long-term creep settlement of future service connections and their interaction with 'hard', piled foundation elements. Measures such as flexible connections should be considered. Additionally, increased falls of drainage pipes and hardstandings should be considered to mitigate against the effects of settlement.

Fill materials will consist of either imported material or site-won material, which is demonstrated to be suitable for use through employment of representative chemical testing.

Cognisance should be made to the spatial distribution of contaminants recorded in this investigation so as to limit cutting operations in areas of the site where fill materials may not be suitable for reuse.

To assess the suitability of site-won material for reuse it will be necessary to agree a suitable method of assessment with the Environmental Services Department of North Lanarkshire Council for classification purposes. A good knowledge of the nature of the fill materials has already been established through this investigation, however they may require further classification testing of material using agreed 'acceptance criteria' e.g. the Tier 1 GAC that have been used to complete the qualitative assessment detailed herein. Adherence to these acceptance criteria will ensure a high level of environmental protection at the site and will maximise the amount of materials that can be safely reused in line with sustainable development.

All earthworks should be carried out in accordance with the provisions of the Health and safety at Work Act and other relevant legislation and should recognise the types and concentrations of any contaminants present that have been identified by the investigation. Particular consideration should be given to the correct use of PPE (Personal Protective Equipment) and good personal hygiene to protect site personnel. In periods of dry weather when dust protection may become significant, control measures should be implemented such as spraying site surfaces with water.

If material is being removed off site then, dependant upon the nature of the soil, it should be handled and disposed of at a suitable facility in accordance with the Environmental Protection Act 1990, subsequent amendments and other relevant legislation.

9.10. Waste Management

If land preparation activities do include some degree of land clearing, site grading and earthworks necessary to facilitate construction, in order to minimise off-site disposal costs, procedures should be implemented to retain as much material as possible on the site. However, any unidentified contaminated materials and general landfill material which is demonstrated to not be suitable for use using the adopted acceptance criteria will require to be handled and disposed of in accordance with the requirements of the Waste Management Licensing Regulations.

In terms of general waste disposal, if material is required to be removed from site then, dependant upon the nature of the soil, it should be handled and disposed of at a suitable facility in accordance with the Environmental Protection Act 1990 and subsequent amendments and other relevant legislation. The Principal Contractor employed to undertake such works will keep up to date records of waste transfer notes, counter-signed by the landfill operative, surveyed locations of excavated materials, chemical testing results and any other relevant information.

9.11. Road Pavement Design

The made/disturbed ground deposits are highly variable and it is envisaged at this time that a full capping layer will be required for roads and car parking over made/disturbed ground. It is recommended that capping and sub-base thickness design is based on Interim Advice Note 73/06 Design Evidence for Road pavement foundations (Draft 11025).

Due to the variable nature of the made ground deposits encountered it is recommended that a preliminary design CBR value of <2% be adopted.

When formation level is exposed it should be proofed rolled before being check by a suitably qualified person and any soft, compressible or other unsuitable material be removed and replaced with a suitably compacted granular material.

Any deposits of soft, very loose, organic, very silty or otherwise unsuitable material encountered at formation level should be removed to a suitable sub-formation level reinstated using well compacted selected granular material.

Fine grained soils and coarse soils with high fines content are moisture sensitive and will deteriorate in the presence of water. Accordingly any formation within such soils should be protected as soon as possible after inspection and approval.

The fine-grained soils at the site should be considered frost susceptible and therefore not permitted within 450mm of the finished pavement surface.

Consideration should be given to the use of a geotextile separator to prevent intermixing of the granular road construction materials and any sub-grade that is clayey or characterised by high fines content.

Given the presence of a significant thickness of buried peat, it is recommended that early dialogue with the Local Roads Department be entered into to ensure an acceptable design for adoption.

9.12. Considerations for the Site to Remain in its Current Use

If the site is not developed as a school and remains in its current use as recreational playing fields the following points should be noted:

9.12.1. Environmental Risk Assessment

Based on the results of the investigation in terms of risks to human health receptors and risks to the water environment with the exception of risks arising from ground gas generation there are not considered to be any significant risks which would warrant remedial action.

It has been recommended a further 12No. monitoring visits be undertaken over a period of six months above in Section 9.6 that due to the differing readings obtained to date and the high concentrations of gas recorded. Should the gas regime indicate significantly high positive rates of flow there might also be a requirement to install a passive gas-venting trench along the northern boundary of the site to mitigate against any potential off-site migration of hazardous gases.

Future maintenance workers involved with sub-surface excavation should adhere to the advice given in Section 9.7.1.

9.12.2. Mineral Stability

No information on the shaft dimensions nor conditions upon abandonment was available. The presence of mine shafts can pose a risk to public safety due to the potential for collapse.

If the site is not developed as a school and remains in its current use as recreational playing fields it is recommended that the recorded mine shafts be dealt with in line with other known shafts in the North Lanarkshire Council area.

The risk from mineral stability as a result of shallow mineworkings is considered to be relatively low due to the current site use as playing fields.

However, it is recommended that ground maintenance staff be made aware of the recorded mineshafts and potentially minerally unstable areas and they be vigilant for signs of surface instability. Evidence may comprise areas of localised collapsed ground, surface cracking or ominous depressions.

Appendix A - Site Location Plan

Drawing No. 49339729/0001

Appendix B - Exploratory Hole Location Plan: School Building Investigation

Drawing No. 49339729/0007

Appendix C - Exploratory Hole Location Plan: Open Space/Pitches Investigation

Drawing No. 49339729/0008

Appendix D - Exploratory Hole Location Plan: Mining Investigation

Drawing No. 49339729/0006

Appendix E - URS Trial Pit Logs, 2008

Appendix F - Factual Report - School Building Investigation – Raeburn Drilling & Geotechnical, 2008

Appendix G - Factual Report -Open Space/Pitches Investigation – Raeburn Drilling & Geotechnical, 2008

Appendix H - Factual Report - Mining Investigation - Raeburn Drilling & Geotechnical, 2008

Appendix I - Von Post Humification Scale

Appendix J - Contamination Assessment

Appendix K - Conceptual Site Models

Appendix L - Areas of Recorded Coal Workings and Potentially Minerally Unstable Areas

Drawing Nos. 49339729/0013
49339729/0014
49339729/0015
49339729/0016
49339729/0018
49339729/0019

von Post Humification Scale Table Source: Damman and French, 1987	
Scale	**Peat Characteristics**
H1	Completely undecomposed peat; only clear water can be squeezed from peat
H2	Almost undecomposed; mud free peat; water squeezed from peat is almost clear and colorless
H3	Very little decomposition; very slightly muddy peat; water squeezed from peat is muddy; no peat passes through fingers when squeezed; residue retains structure of peat
H4	Poorly decomposed; somewhat muddy peat; water squeezed from peat is muddy; residue is muddy but it shows structure of peat
H5	Somewhat decomposed; muddy; growth structure discernible but indistinct; when squeezed some peat passes through fingers but most muddy water passes through fingers; compressed residue is muddy
H6	Somewhat decomposed; muddy; growth structure indistinct; less than one-third of peat passes through fingers when squeezed; residue very muddy
H7	Well decomposed; very muddy, growth structure indistinct; about one-half of peat passes through fingers when squeezed; exuded liquid has a "pudding-like" consistency
H8	Well decomposed; growth structure very indistinct; about two-thirds of peat passes through fingers when squeezed; residue consists mainly of roots and resistant fibers
H9	Almost completely decomposed; peat is mud-like; almost no growth structure can be seen; almost all of peat passes through the fingers when squeezed
H10	Completely decomposed; no discernible growth structure; entire peat mass passes through fingers when squeezed
	Dry peat
	Low moisture content
	Moderate moisture content
	High moisture content
	Very high moisture content

NORTH LANARKSHIRE COUNCIL

PROPOSED ST AMBROSE HIGH SCHOOL
AT DRUMPELLIER COUNTRY PARK
COATBRIDGE

REPORT ON MINERAL INVESTIGATION

Client:

North Lanarkshire Council

Consulting Engineers:

URS Corporation Limited

243 West George Street

Glasgow

G2 4QE

CONTRACT NO: 20857

Date of Issue: 05 September 2008

Report Issue: Final

Report Type: Factual

Proposed St Ambrose High School
At Drumpellier Country Park
Coatbridge

Report type	Factual
Report issue:	Final
File number:	P:\20857\20857SIReport.doc
Contract number:	20857
Issuing office:	Hamilton

Originator: .....

G E Kennedy	Senior Engineering Geologist	05 September 2008

Checked & approved: .....

W T Gourlay	Chief Geotechnical Engineer	05 September 2008

For and on Behalf of Raeburn Drilling and Geotechnical Limited

OPINIONS AND INTERPRETATION EXPRESSED IN THIS DOCUMENT ARE OUTSIDE THE SCOPE OF UKAS ACCREDITATION

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NORTH LANARKSHIRE COUNCIL

PROPOSED ST AMBROSE HIGH SCHOOL AT DRUMPELLIER COUNTRY PARK COATBRIDGE

FACTUAL REPORT ON MINERAL INVESTIGATION

Contract No 20713 **05 September 2008**

1. INTRODUCTION

It is proposed to construct a new school (St Ambrose High School) at Drumpellier Country Park, Coatbridge. On the instructions of URS Corporation Limited, Consulting Engineers to North Lanarkshire Council, and to their specification, an investigation was carried out to provide information on the ground conditions in relation to the mineral stability of the site. A factual report only was requested.

In this connection, investigations have also been undertaken to provide information on the ground conditions for foundation design and construction, and in relation to any geochemical contamination of the sites of the proposed school building and proposed open spaces/sports pitches. The findings are given in Raeburn Drilling and Geotechnical Limited Report Nos. 20855 and 20856, respectively.

The comments given in this report and any opinions expressed are based on the ground conditions encountered during the site work. There may be, however, conditions pertaining to the site which have not been disclosed by the investigation and which therefore could not be taken into account.

2. LOCATION OF SITE

The site is located within the north-east area of Drumpellier Country Park in Coatbridge (approximate National Grid reference NS 717 659). It is adjoined on the north by Townhead Road, on the east by Mosspark Road and on the west and south by grassed and wooded areas belonging to the Country Park.

A plan showing the approximate location of the site is given in Figure A1.

3. GROUND INVESTIGATION

The site work was carried out during the period 01 to 17 July, 2008, in accordance with the guidelines laid down in BS5930 (Ref. 1) and in-house procedures. The results of the site work are given in Appendix B.

Ten boreholes (Nos. 101 to 110) were sunk by rotary open hole and core drilling, at the positions shown on the site plan (Fig. A2). The depths of the boreholes, the descriptions of the strata encountered and comments on the ground-water conditions are given in the borehole records (Figs. B1 to B10). The positions and depths of the boreholes were determined by the Consulting Engineers, and set out on site by Raeburn Drilling and Geotechnical Limited.

Rock cores were taken at the depths shown on the borehole records and were despatched to the laboratory at Hamilton for examination and storage. Each core was uniquely identified and a transmittal note system used throughout transfer.

Photographs were taken of the rock core and a copy is presented in Figures B11 to B40.

The positions of the boreholes were surveyed by Fox McMaster Surveys Limited and the coordinates and the ground levels related to National Grid and Ordnance Datum, respectively, are given on the borehole records.

Senior Engineering Geologist **Chief Geotechnical Engineer**

For and on Behalf of Raeburn Drilling and Geotechnical Limited

Ground Investigation Department
Hamilton

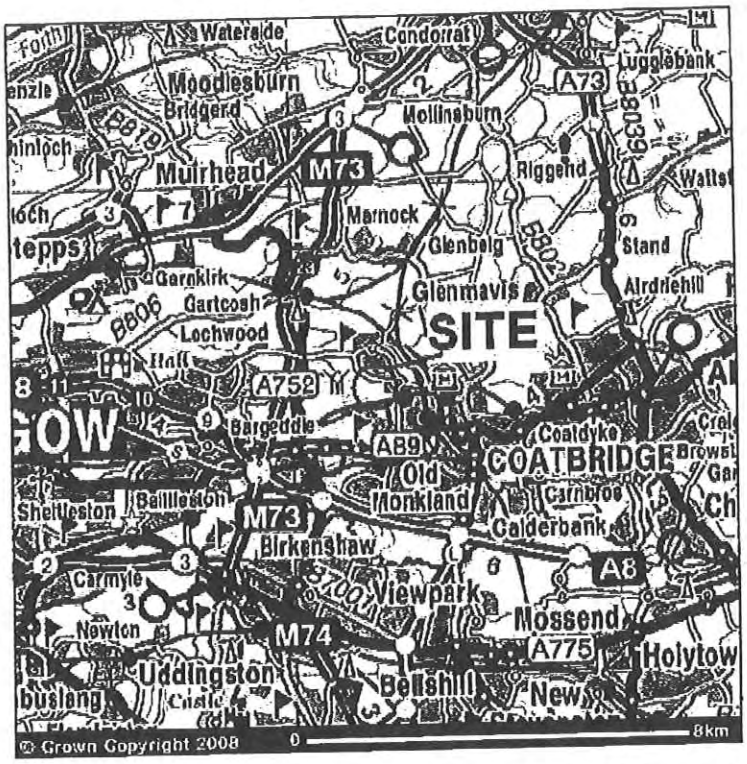
This report is not to be used for contractual or engineering purposes unless the report text and front cover sheet is signed where indicated by both the originator of the report and the approver and the report is designated 'Final' on the cover sheet.

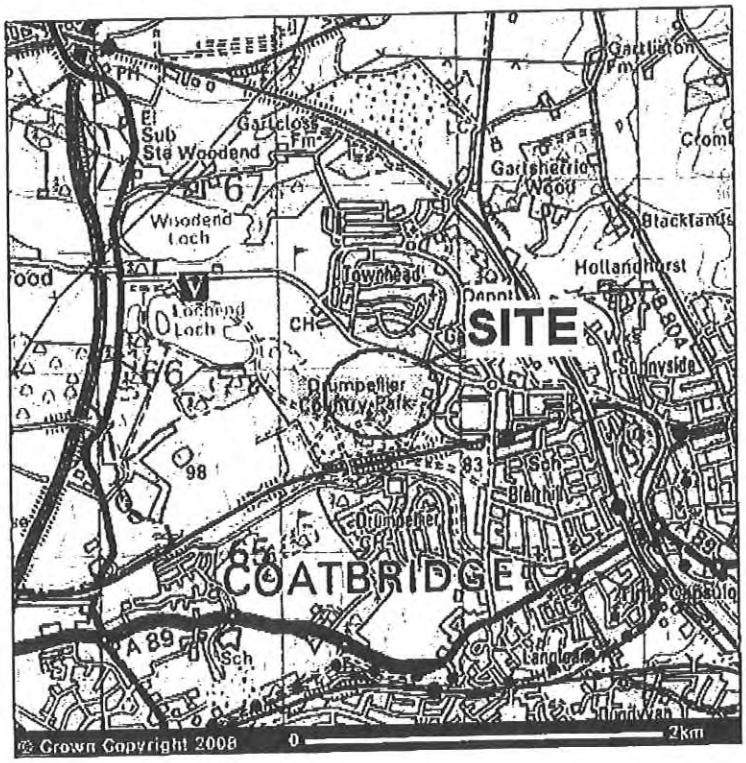
REFERENCES

(1) BS5930: Code of Practice for Site Investigations, British Standards Institution, 1999.

APPENDIX A
PLANS

RAEBURN DRILLING AND GEOTECHNICAL LTD	Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE MINERAL INVESTIGATION Client: North Lanarkshire Council Engineer: URS Corporation Limited	Contract No: 20857 Crown Copyright Licence No. 1000005786





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APPENDIX B
SITE WORKS

Boring

The standard method of boring in soil for ground investigation is known as the cable tool method. It uses various tools worked on a wire cable, typically a shell in non-cohesive soils such as sand and gravel, and a clay cutter in cohesive soils such as clay. Very dense soils, boulders or other hard obstructions are disturbed or broken up by chiselling and the fragments removed with the shell. Where the ground conditions require, the borehole is lined with driven steel casings of such sizes that the bottom of the borehole is not less than 125mm diameter.

Where there are constraints upon access, alternative methods of soft ground boring are available. However, each has limitations that need to be taken into account when assessing their suitability and the ground conditions inferred from their results.

Rotary Drilling

Rotary drilling is employed to extend ground investigation beyond the practical limit of cable tool boring in hard formations, commonly rock. Core drilling is used to obtain continuous intact samples of the formation and is generally undertaken with double tube swivel type core barrels fitted with tungsten or diamond bits as appropriate to formation type and hardness. Open-hole rotary drilling using tricone rock roller bits or tungsten insert drag bits, or down-the-hole hammers, is carried out where more limited information is sufficient, strata identification being made from cuttings only. Open-hole rotary drilling methods may also be employed for fast penetration of soils where detailed sampling is not required, prior to coring at depth. Air or water is the flushing medium normally used with rotary drilling methods. Where the ground conditions require, the borehole is lined with inserted or drilled-in casing.

Samples and In-situ Tests

Tube samples of cohesive soils are generally taken with a 100mm internal diameter open drive sampler known as a U100, with an area ratio of 30%. The sampler is driven into the soil at the bottom of the borehole by a sliding hammer. After a sample is taken, the drive head and cutting shoe are unscrewed from the sample tube and any wet or disturbed soil removed from either end. The sample tube is then sealed with wax and fitted with plastic end caps.

A range of more specialised equipment, e.g. piston or foil samplers, may be used to obtain higher quality samples in conditions where conventional open drive sampling is impracticable or unsatisfactory.

Disturbed samples are taken from the boring tools at regular intervals. The samples are sealed in airtight containers. Bulk samples are large disturbed samples from the boring tools, or from trial pits, generally where tube samples are unavailable.

The Standard Penetration Test, SPT, in accordance with BS1377:1990:Part 9:Clause 3.3, determines the resistance of soil to the penetration of a split barrel sampler. A 50mm diameter split barrel sampler is driven 450mm into the soil using a 63.5kg hammer with a 760mm drop, and the penetration resistance, the "N" value, is expressed as the number of blows required to achieve 300mm penetration below an initial penetration of 150mm, the seating drive, through any disturbed soil at the bottom of the borehole.

In coarse soils, the Cone Penetration Test (CPT) is conducted in the same manner as the SPT but using a 50mm diameter 60 degree apex solid cone point to replace the split barrel sampler.

Groundwater

Borehole water levels are recorded, together with the depths at which seepages or inflows of groundwater are detected and the observations noted on the borehole records. These observations may not give an accurate indication of groundwater conditions, for the following reasons:

(a) The borehole is rarely left standing at the relevant depth for sufficient time for the water level to reach equilibrium.
(b) A permeable stratum may have been sealed off by the borehole casing.
(c) It may have been necessary to add water to the borehole to facilitate progress.
(d) There may be seasonal, tidal or other effects at the site.

A more accurate record of groundwater behaviour may be obtained from standpipes or standpipe piezometers.

Gases

Determination and measurement of gases in the ground, commonly in relation to landfills, may be made directly from the ground surface, where a hole is formed by driving a solid and rigid steel spike to depths normally in the range 1.0 to 1.5m. Gas emissions are analysed using an appropriate portable analyser. However, research has shown that the small sample hole size and smearing effects can give a false negative result.

Where more accurate or longer term measurement of emissions is required, gas monitoring standpipes are installed in boreholes.

RAEBURN DRILLING AND GEOTECHNICAL LTD	Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE MINERAL INVESTIGATION Client: North Lanarkshire Council Engineer: URS Corporation Limited	Contract No: 20857

SOIL SAMPLES

U X	General purpose tube sample; X No of blows to drive sampler
UP	Piston sample NOTE: Tube samples are 100mm diameter unless otherwise specified in the remarks. Suffix 'a' indicates sample not recovered; suffix 'b' indicates full penetration of sampler not obtained; suffix 'c' indicates full penetration of sampler but limited recovery
D/J/T	Small Disturbed/Jar/Tub sample
B/LB	Bag/Large Bag sample

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery: The total core recovered expressed as a percentage of the core run length
SCR	Solid Core Recovery: The core recovered as solid cylinders expressed as a percentage of the core run length
RQD	Rock Quality Designation: The core recovered as solid cylinders of length 100mm or more expressed as a percentage of core run length.
RO-S/RO-R	Rotary Open Hole Drilling through Soil / Rotary Open Hole Drilling through Rock
FI	Fracture Index: The number of discontinuities expressed as fractures per metre

Flush: "Depth" indicates depth down to which recorded "Returns" relate

GROUND-WATER

W	Ground-water sample
▼	Ground-water encountered
▼	Depth to which ground-water rose
▽	Ground-water cut off by the casing

IN SITU AND FIELD TESTS

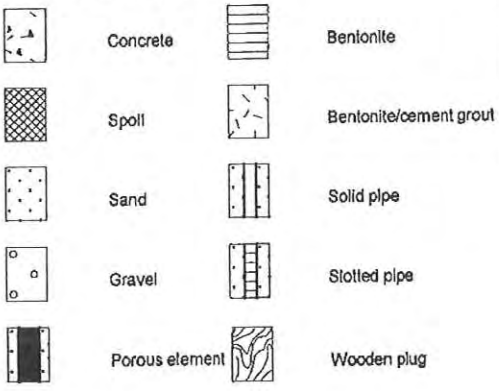
SPT=X a/b (pen) or CPT=X a/b (pen)	Standard penetration test (split barrel sampler(SPT)or cone (CPT)); X is the penetration (N) value; 'a' is blow/75mm for seating drive; 'b' is blows/75mm for test drive; (pen) is test drive penetration if less than 300mm.
CBR	California bearing ratio test
MCV	Moisture condition value test
K	Permeability test
HP	Hand penetrometer test
FV	Field vane test
HV	Hand vane test
ID	Density test

LEGENDS

Material legends are in accordance with BS 5930:1999

before a description indicates that it is based on the Driller's record.

INSTALLATIONS (BACKFILL)



ROTARY DRILLING SIZES

Letter	Nominal Diameter (mm)	
	Borehole	Core
Standard		
N	76	54
H	100	76
P	121	92
S	146	113
Non-standard		
412	108	75

DIMENSIONS

All dimensions in metres unless otherwise stated.

KEY TO BOREHOLE AND TRIAL PIT RECORDS

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 101

Inspection Pit to 1.20
Rotary Open Hole to 13.50
Rotary Core Drilling to 43.50

Location: E 271454.3
N 665922.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/ Water Flush

Progress	Sample Depth	Samples and Tests: Type	Samples and Tests: Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill: Symbol	Backfill: Depth
					82.64						
30/6 2008	0.00	RO-S			82.49	0.15	# TOPSOIL # MADE GROUND (ash and peat)				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.

Diam	To Depth: Boring	To Depth: Casing
125	12.00	12.00
114	43.50	

Driller	Originator	Chk & App	Status
WH	RD	GK	Final

Ground-water: Struck	Rose To	Time(mins)	Cut Off	Water Added: From	To	Chiselling: From	To	Time(hr)	Flush: Returns	Type	To Depth
									Full	Air/Water	43.50

Fig No: B1
Sheet 1 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINT\WPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:20 Reeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 101

Inspection Pit to 1.20
Rotary Open Hole to 13.50
Rotary Core Drilling to 43.50

Location: E 271454.3 N 665922.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/ Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	TCR	SCR	RQD	FI	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
									82.64						
	0.00								72.54	10.10	.... see previous sheet # Sandy gravelly CLAY with sand bands				13.00
	13.00	RO-R							69.64	13.00	# SANDSTONE with mudstone bands				13.40
	13.50	CORE		100	98	65	16		69.14	13.50	Moderately weak and moderately strong thinly laminated yellow fine to coarse grained SANDSTONE with abundant micaceous laminae and some carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar. Locally not intact .... at 13.70m: 0.15m thick mudstone band				
							12								
							4								
							NI 2								
	16.50	CORE		100	98	78	10								
							5								
							3				.... at 19.10m: 0.40m thick mudstone band				
	19.50	CORE		93	86	47	2								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.

Diam	To Depth Boring	To Depth Casing
125	12.00	12.00
114	43.50	

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	43.50

RAEBURN

Fig No: B1
Sheet 2 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 101

Inspection Pit to 1.20
Rotary Open Hole to 13.50
Rotary Core Drilling to 43.50

Location: E 271454.3
N 665922.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/ Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
								82.64						
	19.50					NI		82.34	20.30	.... see previous sheet				
						12				Very weak thinly laminated dark grey carbonaceous MUDSTONE with some plant fossil material. Weathering is evident as clay bands and a reduction in strength. Subhorizontal fractures are medium spaced, rough and undulating. Subvertical fractures are widely spaced, rough and undulating. Locally not intact				
								61.24	21.40					
						2		61.04	21.60	Weak dull black COAL with mudstone laminations, some pyritisation and locally bright laminations. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar				
						NI/2/NI/5				Moderately weak thinly laminated dark grey carbonaceous MUDSTONE with some fossil plant material and occasional ironstone nodules. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are widely spaced, rough and undulating. Locally not intact .... at 21.60m: 0.60m thick sandstone band				
	22.50	CORE	100	93	76	5								
						NI/>20		59.54	23.10	Moderately strong cross bedded yellow fine to coarse grained SANDSTONE with occasional carbonaceous laminae and some micaceous laminae. Weathering is evident as orange iron staining. Subhorizontal fractures are closely spaced, rough and planar. Subvertical fractures are closely spaced, rough and planar. Locally not intact				
						5								
						2								
	25.50	CORE	97	97	80	4								
						3								
						2								
	28.50	CORE	100	97	58	1								
						NI/13/11		53.54	29.10	Moderately weak and moderately strong thinly laminated dark grey MUDSTONE with some carbonaceous laminae and occasional ironstone nodules. Weathering is evident as orange iron staining. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar. Locally not intact .... at 29.25m: 0.10m thick coal band .... below 29.60m: some sandstone laminae				
								52.64	30.00					

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.

Diam	To Depth Boring	To Depth Casing
125	12.00	12.00
114	43.50	

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	RD										Full	Air/Water	43.50
Chk & App	Status												
GK	Final												

RAEBURN

Fig No: B1
Sheet 3 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Contract No: 20857

Borehole No: 101

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Inspection Pit to 1.20
Rotary Open Hole to 13.50
Rotary Core Drilling to 43.50

Location: E 271454.3
N 665922.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/ Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	28.50					>20		82.64		Moderately strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some micaceous laminae, occasional carbonaceous laminae and some convoluted bedding. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar				
	31.50	CORE	100	100	27	>20		51.14	31.50	Moderately weak thinly laminated dark grey MUDSTONE with abundant yellow sandstone laminae, occasional ironstone bands. Some cross bedding within sandstone laminae and occasional micaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and undulating. Subvertical fractures are closely spaced, smooth and undulating				
						>20								
						>20								
	34.50	CORE	100	94	14	>20								
						>20								
						NI		46.84	36.00	Very weak dull black COAL with locally bright laminae, some pyritisation, calcite veining and some plant fossil material in mudstone laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth, planar and undulating. Subvertical fractures are closely spaced, smooth and planar. Locally not intact				
						>20				.... at 36.65m: 0.05m mudstone band				
								45.54	37.10	Moderately weak thinly laminated dark grey MUDSTONE with some micaceous laminae, abundant plant fossil material and occasional sandstone laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating				
30/6	37.50	CORE	100	93	54	>20	12.00	45.14	37.60	Moderately strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some micaceous laminae and occasional convoluted bedding. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating				
						>20				.... at 38.40m: 0.45m thick mudstone band				
						>20								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.

Diam	To Depth Boring	To Depth Casing
125	12.00	12.00
114	43.50	

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	RD										Full	Air/Water	43.50
Chk & App	Status												
GK	Final												

Fig No: B1
Sheet 4 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 101

Inspection Pit to 1.20
Rotary Open Hole to 13.50
Rotary Core Drilling to 43.50

Location: E 271454.3
N 665922.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/ Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	37.50							82.64		.... see previous sheet				
	40.60	CORE	100	96	28	14								
						15		41.04	41.60	Moderately strong thinly laminated dark grey MUDSTONE with occasional yellow sandstone laminae, some micaceous laminae and occasional ironstone bands. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are medium spaced, smooth and planar				
						16								
1/7								39.14	43.50	END OF BOREHOLE				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.

Diam	To Depth Boring	To Depth Casing
125	12.00	12.00
114	43.50	

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	43.50

Fig No: B1
Sheet 5 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWAPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:23 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 102

Inspection Pit to 1.20
Rotary Open Hole to 16.20
Rotary Core Drilling to 46.20

Location: E 271486.3
N 665865.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
					86.34						
1/7 2008	0.00	RO-S			86.14	0.20	# TOPSOIL				
							# MADE GROUND (peat and ash)				
					76.64	9.70	# Sandy gravelly CLAY with sand bands				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered at a depth of 16.80m.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	46.20	

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	RD										Full 30%	Air/Water Air/Water	16.80 46.20
Chk & App	Status												
GK	Final												

Fig No: B2
Sheet 1 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION
Client: North Lanarkshire Council
Engineer: URS Corporation Limited

Contract No: 20857
Borehole No: 102

Inspection Pit to 1.20
Rotary Open Hole to 16.20
Rotary Core Drilling to 46.20

Location: E 271486.3 N 665865.9
Orientation: Vertical
Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	TCR	SCR	RQD	FI	Casing Depth	Level (mOD) 86.34	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	0.00										.... see previous sheet				
									70.54	15.80					15.80
	15.80	RC-R									# SANDSTONE				16.20
									70.14	16.20					
	16.20	CORE		50	50	12	>20				Moderately strong thinly laminated yellow fine to coarse grained SANDSTONE with occasional mudstone laminae, occasional micaceous laminae and occasional convoluted bedding. Weathering is not evident. Subhorizontal fractures are very closely spaced, rough and slightly undulating. Subvertical fractures are closely spaced, rough and slightly undulating		▼		
									69.54	16.60					
							NR				# Possible PACKED WASTE (no recovery: no iron staining in above lithology but lithology below may represent possible 'pavement')				
									68.04	18.30					
							>20				Moderately weak and moderately strong thinly laminated dark grey carbonaceous MUDSTONE with some micaceous laminae, abundant plant fossil material, occasional yellow sandstone laminae and occasional ironstone nodules. Weathering is evident as orange iron staining. Subhorizontal fractures are closely spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and slightly undulating				
									67.44	18.90					
	19.20	CORE		100	93	60	>20				Moderately strong thinly laminated yellow fine to coarse grained SANDSTONE with abundant micaceous laminae and occasional carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and slightly undulating. Locally non intact				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered at a depth of 16.80m.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	46.20	

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
16.80									Full	Air/Water	16.80
									30%	Air/Water	46.20

RAEBURN

Fig No: B2
Sheet 2 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 102

Inspection Pit to 1.20
Rotary Open Hole to 16.20
Rotary Core Drilling to 46.20

Location: E 271486.3
N 665865.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	19.20					1 NI 8		86.34		.... see previous sheet				
						6								
								64.24	22.10	Very weak bright black COAL with some pyritisation and calcite veining. Weathering is not evident. Subhorizontal fractures are very closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar. Locally non intact				
	22.20	CORE	100	85	53	NI								
								63.44	22.90	Moderately weak thinly laminated light grey MUDSTONE with some fossil plant material, occasional micaceous laminae and occasional sandstone laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are widely spaced, smooth and slightly undulating. Locally non intact				
						11								
						2								
						3								
	25.20	CORE	100	98	67	9								
								60.14	26.20	Moderately strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with abundant micaceous laminae and occasional carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are widely spaced, smooth and slightly undulating				
						11								
						6								
	28.20	CORE	100	98	65	9								
						4								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered at a depth of 16.80m.

Diam	To Depth Boring	To Depth Casing
125	16.00	15.00
114	46.20	

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full 30%	Air/Water Air/Water	16.80 46.20

Fig No: B2
Sheet 3 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:28 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 102

Inspection Pit to 1.20
Rotary Open Hole to 16.20
Rotary Core Drilling to 46.20

Location: E 271486.3
N 665865.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result			Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	28.20					8	86.34		.... see previous sheet				
						>20			.... at 30.95m: 0.25m thick dark grey mudstone band				
	31.20	CORE	77	74	33	5							
						NR	52.79	33.55	Moderately weak thinly laminated dark grey carbonaceous MUDSTONE with some fossil shell fragments and occasional ironstone nodules. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, smooth and slightly undulating. Locally not intact				
						3							
						NI							
						2	52.14	34.20	Moderately strong thinly laminated yellow fine to coarse grained SANDSTONE with abundant micaceous laminae, some carbonaceous laminae, occasional mudstone laminae and occasional convoluted bedding. Weathering is not evident. Subhorizontal fractures are closely and medium spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and slightly undulating. Locally not intact				
	34.20	CORE	100	99	65	7							
						NI							
						2							
						11							
	37.20	CORE	95	92	63	13							
						>20			.... at 38.70m: 0.35m thick mica-rich band				
						1							

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	46.20	

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered at a depth of 16.80m.

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	16.80
									30%	Air/Water	46.20

RAEBURN

Fig No: B2
Sheet 4 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:29 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 102

Inspection Pit to 1.20
Rotary Open Hole to 16.20
Rotary Core Drilling to 46.20

Location: E 271486.3
N 665865.9

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	37.20		1		86.34		.... see previous sheet				
	40.20	CORE	100 90 43 3								
					45.34	41.00					
			NI				Moderately weak thinly laminated dark grey carbonaceous MUDSTONE with occasional ironstone bands and occasional plant fossil material. Weathering is not evident. Non intact				
			2		45.04	41.30					
			NI		44.94	41.40	Very weak dull black COAL with locally bright laminae. Weathering is not evident. Non intact				
			12				Moderately weak thinly laminated dark grey carbonaceous MUDSTONE with some fossil plant material, some micaceous laminae, occasional yellow sandstone laminae and occasional ironstone nodules. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and slightly undulating				
					43.89	42.45					
			9				Strong cross bedded thinly laminated yellow fine to coarse grained iron-rich SANDSTONE with some carbonaceous laminae, some micaceous laminae and occasional plant fossil material. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are widely spaced, rough and slightly undulating				
	43.20	CORE	100 92 17 2								
			>20		42.59	43.75					
			NI				Moderately weak thinly laminated dull grey MUDSTONE with abundant micaceous laminae, occasional ironstone bands and some sandstone laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are medium spaced, smooth and planar. Locally non intact				
			9								
			NI								
			11								
			1								
			NI								
1/7			6								
			NI	15.00	40.14	46.20	END OF BOREHOLE				
			4								

Diam	To Depth Boring	To Depth Casing
125	16.00	15.00
114	46.20	

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered at a depth of 16.80m.

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	RD										Full	Air/Water	16.80
											30%	Air/Water	46.20
Chk & App	Status												
GK	Final												

RAEBURN

Fig No: B2
Sheet 5 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE

MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 103

Inspection Pit to 1.20
Rotary Open Hole to 14.30
Rotary Core Drilling to 44.80

Location: E 271530.2
N 665909.3

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
8/7/2008	0.00	RO-S			82.08		# MADE GROUND				

Diam	To Depth Boring	To Depth Casing
108	44.80	12.00

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
GM	RD										Full	Air/Water	44.80
Chk & App	Status												
GK	Final												

RAEBURN

Fig No: B3
Sheet 1 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWAPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:32 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 103

Inspection Pit to 1.20
Rotary Open Hole to 14.30
Rotary Core Drilling to 44.60

Location: E 271530.2
N 665909.3

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	TCR	SCR	RQD	FI	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	0.00								82.08		.... see previous sheet				
									70.38	11.70	# Sandy gravelly CLAY				
	14.30	CORE		100	100	100	2		67.78	14.30	Strong thinly laminated yellow fine to coarse grained iron-rich SANDSTONE with some micaceous laminae, some mudstone laminae and some siltstone laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar. Locally non intact				
	14.90	CORE		100	100	88	NR								
							8								
							5								
	17.30	CORE		100	97	59	9								
							4								
							3								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
108	44.60	12.00

Driller	Originator
GM	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	44.60

Fig No: B3
Sheet 2 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 103

Inspection Pit to 1.20
Rotary Open Hole to 14.30
Rotary Core Drilling to 44.80

Location: E 271530.2
N 665909.3

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests: Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill: Symbol	Backfill: Depth
								92.08						
	17.30					NI		61.88	20.20	.... see previous sheet				
										Weak thinly laminated dark grey carbonaceous MUDSTONE with occasional listric surfaces. Weathering is not evident. Non intact				
	20.30	CORE	100	95	73	NI		61.58	20.50					
						10				Strong thinly laminated yellow fine to coarse grained iron-rich SANDSTONE with some micaceous laminae, some carbonaceous laminae and some fossil plant material (rootlets). Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and slightly undulating				
								60.98	21.10	.... below 20.95m: Increasing to abundant carbonaceous laminae and some convoluted bedding				
										Strong thinly laminated dark grey iron-rich carbonaceous MUDSTONE with some ironstone bands and nodules, some sandstone and siltstone laminae and abundant plant fossil material (rootlets). Weathering is not evident. Subhorizontal fractures are closely spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and undulating				
						3								
								59.68	22.20					
						3				Strong thinly laminated yellow fine to coarse grained iron-rich SANDSTONE with some micaceous laminae, some carbonaceous laminae, some mudstone and siltstone bands. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
	23.30	CORE	100	100	88	8								
						2								
						6								
	26.30	CORE	100	100	60	14				.... at 26.90m: 0.15m thick mudstone band				
								54.78	27.30					
						8				Moderately strong thinly laminated dark grey MUDSTONE with occasional sandstone and siltstone laminae, occasional bands and nodules, some fossil plant material (leaves and rootlets), occasional listric surfaces and some carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar				
										.... at 27.50m: 0.05m thick coal band				
						17		53.58	28.50					
	29.30	CORE	100	98	47	8				Strong thinly laminated yellow fine to coarse grained iron-rich SANDSTONE with some siltstone and mudstone laminae, some carbonaceous laminae, some fossil plant material (leaves and some micaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
8/7							12.00							

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth: Boring	To Depth: Casing
108	44.80	12.00

Driller	Originator
GM	RD
Chk & App	Status
GK	Final

Ground-water: Struck	Rose To	Time(mins)	Cut Off	Water Added: From	To	Chiselling: From	To	Time(hr)	Flush: Returns	Type	To Depth
									Full	Air/Water	44.80

Fig No: B3
Sheet 3 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 103

Inspection Pit to 1.20
Rotary Open Hole to 14.30
Rotary Core Drilling to 44.80

Location: E 271530.2
N 665909.3

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
								82.08						
	29.30					7		51.88	30.20	.... see previous sheet Moderately strong thinly laminated dark grey MUDSTONE with abundant sandstone and occasional siltstone laminae, occasional ironstone bands and nodules, occasional plant fossil material (leaves) and occasional micaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar. Locally not intact .... at 31.00m: 0.10m thick sandstone band				
						NI								
						10								
						4								
	32.30	CORE	100	83	30	NR		49.33	32.75	Strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and siltstone laminae, some micaceous and carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar .... at 32.75m: 0.40m thick mudstone band				
						>20								
						6								
						9		47.28	34.80	Weak dull black muddy COAL with mudstone bands, some pyritisation and locally bright laminae. Weathering is not evident. Subhorizontal fractures are very closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar. Locally non intact				
						NI								
	35.70	CORE	95	95	59	NR		46.18	35.90	Moderately strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and siltstone bands, some micaceous and carbonaceous laminae and some fossil plant material (rootlets). Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar. Locally non intact				
						3								
						5								
						2								
						NI								
						6								
	38.80	CORE	100	95	32	9								
						3								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
108	44.80	12.00

Driller	Originator
GM	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	44.80

Fig No: B3
Sheet 4 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 103

Inspection Pit to 1.20
Rotary Open Hole to 14.30
Rotary Core Drilling to 44.80

Location: E 271530.2
N 665909.3

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	38.80							82.08						
								41.68	40.40	.... see previous sheet				
						1				Moderately strong thinly laminated dark grey MUDSTONE with some sandstone and siltstone laminae, some carbonaceous and micaceous laminae and some fossil plant material. Weathering is not evident. Subhorizontal fractures are widely spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and slightly undulating				
						NI								
	41.80	CORE	100	92	28	>20								
						3								
						NI								
						9								
						11								
						NI								
9/7						1	12.00	37.28	44.80	END OF BOREHOLE				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
108	44.80	12.00

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
GM	RD										Full	Air/Water	44.80
Chk & App	Status												
GK	Final												

RAEBURN

Fig No: B3
Sheet 5 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 104

Inspection Pit to 1.20
Rotary Open Hole to 17.30
Rotary Core Drilling to 46.70

Location: E 271635.5
N 666035.8

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
					86.80						
9/7 2008	0.00	RO-S					# MADE GROUND				
					77.80	9.00	# Sandy gravelly CLAY				

Diam	To Depth Boring	To Depth Casing
108	46.70	17.00

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered in workings.

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
GM	RD/EMc										Full	Air/Water	46.70
Chk & App	Status												
GK	Final												

Fig No: B4
Sheet 1 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:38 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 104

Inspection Pit to 1.20
Rotary Open Hole to 17.30
Rotary Core Drilling to 46.70

Location: E 271635.5 N 666035.8

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	0.00				86.80		.... see previous sheet				
					69.70	17.10					17.10
	17.10	RO-R	TCR SCR RQD FI		69.50	17.30	# SANDSTONE				17.50
	17.30	CORE	100 93 72 7				Moderately strong light grey fine to coarse grained iron-rich SANDSTONE with some mudstone and siltstone laminae and some micaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and undulating				
			4								
			4								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered in workings.

Diam	To Depth Boring	To Depth Casing
108	46.70	17.00

Driller	Originator
GM	RD/EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	46.70

Fig No: B4
Sheet 2 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 104

Inspection Pit to 1.20
Rotary Open Hole to 17.30
Rotary Core Drilling to 46.70

Location: E 271635.5
N 666035.8

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	17.30							86.80						
9/7							17.00	66.50	20.30	.... see previous sheet				
	20.30	CORE	100	100	27	20				Moderately weak and moderately strong thinly laminated off-white fine to coarse grained SANDSTONE with some mudstone and siltstone laminae, occasional carbonaceous laminae and plant fossil material (leaves). Weathering is not evident. Subhorizontal fractures are closely spaced, rough and planar. Subvertical fractures are closely spaced, rough and planar				
						17								
						12								
	23.30	CORE	85	77	29	15								
						12								
						NI		61.90	24.90	# Possible PACKED WASTE (0.20m recovery of angular coal fragments)				
						NI		61.20	25.60	Very weak dull black COAL with some pyritisation, calcite veining and some locally bright laminae. NEOW. Non intact (# driller indicates possible packed waste and stoop)				
	25.90	CORE	87	87	45	17		60.60	26.30	Moderately strong and strong cross bedded thinly laminated off-white fine to coarse grained SANDSTONE with some mudstone and siltstone laminae, some fossil plant material (leaves and roots), some micaceous and carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
						6								
						4				.... below 28.40m: a 0.50m ironstone band				
	28.90	CORE	90	90	30	14		57.90	28.90	Moderately weak thinly laminated dark grey MUDSTONE with occasional sandstone and siltstone laminae, occasional micaceous laminae and carbonaceous laminae, and occasional plant fossil material (leaves). Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating				

Diam	To Depth Boring	To Depth Casing
108	46.70	17.00

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered in workings.

Driller	Originator
GM	RD/EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	46.70

RAEBURN

Fig No: B4
Sheet 3 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 104

Inspection Pit to 1.20
Rotary Open Hole to 17.30
Rotary Core Drilling to 46.70

Location: E 271635.5 N 666035.8

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result			Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	28.90					10	66.80		.... see previous sheet				
						9							
	31.90	CORE	100	100	86	6							
							54.50	32.30	Strong thinly laminated light grey fine to coarse grained iron-rich SANDSTONE with occasional micaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
						5							
						4							
	34.70	CORE	97	95	73	2							
							51.25	35.55	Weak dull black muddy COAL with some pyritisation and locally bright laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar. Locally non intact				
						NI >20	50.70	36.10	Moderately weak thinly laminated dark grey MUDSTONE with occasional siltstone and sandstone laminae, some carbonaceous laminae and plant fossil material (leaves and rootlets). Weathering is not evident. Subhorizontal fractures are medium spaced, rough and slightly undulating. Subvertical fractures are medium spaced, rough and slightly undulating				
						5							
							49.80	37.00	Strong cross bedded thinly laminated off-white fine to coarse grained iron-rich carbonaceous SANDSTONE with abundant plant fossil material (leaves), occasional siltstone and mudstone laminae, occasional carbonaceous and micaceous bands and laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
	37.70	CORE	97	97	70	2							
						8	47.80	39.00	Moderately weak thinly laminated dark grey MUDSTONE with some siltstone, sandstone, micaceous and carbonaceous laminae, occasional ironstone nodules and some plant fossil material (leaves). Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are widely spaced, smooth and slight undulating				
						6							

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered in workings.

Diam	To Depth Boring	To Depth Casing
108	46.70	17.00

Driller	Originator
GM	RD/EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	46.70

Fig No: B4
Sheet 4 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWAPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:40 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 104

Inspection Pit to 1.20
Rotary Open Hole to 17.30
Rotary Core Drilling to 46.70

Location: E 271635.5
N 666035.8

Orientation: Vertical

Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth		Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	37.70								86.80		.... see previous sheet				
	40.70	CORE	100	100	70	>20									
									45.20	41.60					
						3					Strong cross bedded thinly laminated yellow fine to coarse grained iron-rich SANDSTONE with some micaceous, carbonaceous , siltstone and mudstone laminae, occasional plant fossil material (leaves) and occasional ironstone bands. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
						4									
	43.70	CORE	100	93	52	3									
						10			41.80	45.00					
						>20					Moderately weak thinly laminated dark grey MUDSTONE with some siltstone, sandstone and carbonaceous laminae, occasional ironstone bands and occasional plant fossil material. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are medium spaced, smooth and planar				
11/7							17.00		40.10	46.70	END OF BOREHOLE				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was encountered in workings.

Diam	To Depth Boring	To Depth Casing
108	46.70	17.00

Driller	Originator
GM	RD/EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	46.70

Fig No: B4
Sheet 5 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 105

Inspection Pit to 1.20
Rotary Open Hole to 15.60
Rotary Core Drilling to 47.30

Location: E 271611.8
N 665945.3

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
					82.65						
9/7 2008	0.00	RO-S			82.45	0.20	# TOPSOIL				
							# MADE GROUND (peat and ash)				
					72.95	9.70	# Sandy gravelly CLAY				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	47.30	

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	RD										0%	Air/Water	9.70
											10%	Air/Water	13.60
											Full	Air/Water	40.60
											0%	Air/Water	41.70
											10%	Air/Water	47.30
Chk & App	Status												
GK	Final												

Fig No: B5
Sheet 1 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 105

Inspection Pit to 1.20
Rotary Open Hole to 15.60
Rotary Core Drilling to 47.30

Location: E 271611.8
N 665945.3

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	0.00				82.65		.... see previous sheet				
			TCR SCR RQD FI		67.05	15.60					
	15.60	CORE	80 77 12 NA				Very weak dark greyish brown sandy gravelly CLAY with subangular and subrounded fragments of mixed lithology. Weathering is evident as reduction to clay material				16.10
			13		66.55	16.10	Strong thinly laminated grey MUDSTONE with some micaceous laminae, occasional ironstone bands and some fossil plant material (leaves and bivalves). Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are widely spaced, smooth and slightly undulating. Locally non intact				16.50
			>20								
			>20								
	18.60	CORE	100 97 22 10				.... below 18.60m: some sandstone laminae				
			NI								
			>20								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	47.30	

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)

Flush Returns	Type	To Depth
0%	Air/Water	9.70
10%	Air/Water	13.60
Full	Air/Water	40.60
0%	Air/Water	41.70
10%	Air/Water	47.30

RAEBURN

Fig No: B5
Sheet 2 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 105

Inspection Pit to 1.20
Rotary Open Hole to 15.60
Rotary Core Drilling to 47.30

Location: E 271611.8
N 665945.3

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	18.60					12		82.65		.... see previous sheet				
						NI 6								
	21.60	CORE	100	98	43	7								
						>20		60.25	22.40	Very weak bright black muddy COAL with some pyritisation and calcite veining. Weathering is not evident. Subhorizontal fractures are extremely closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar. Locally non intact				
						NI				.... at 22.80m: 0.20m thick clay band				
						8		59.20	23.45	Moderately strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with abundant mudstone and siltstone laminae, some micaceous laminae, some carbonaceous laminae with fossil plant material (leaves) below 24.60m. Weathering is not evident. Subhorizontal fractures are closely and medium spaced, rough and undulating. Subvertical fractures are medium spaced, rough and planar. Locally non intact				
						8								
	24.60	CORE	100	97	55	5								
						3								
						NI 3								
						NI 13								
						9				.... below 26.50m: 0.10m thick mudstone band				
	27.60	CORE	100	99	23	19		55.05	27.60	Moderately strong thinly laminated dark grey MUDSTONE with occasional ironstone bands and nodules, micaceous laminae, sandstone laminae, fossil plant material (leaves and rootlets) and bivalve fossils. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are medium spaced, smooth and planar. Locally non intact				
						>20								
						17								

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	47.30	

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									0%	Air/Water	9.70
									10%	Air/Water	13.60
									Full	Air/Water	40.60
									0%	Air/Water	41.70
									10%	Air/Water	47.30

RAEBURN

Fig No: B5
Sheet 3 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWMPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:45 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Contract No: 20857

Borehole No: 105

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Inspection Pit to 1.20
Rotary Open Hole to 15.60
Rotary Core Drilling to 47.30

Location: E 271611.8 N 665945.3

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth		Level (mOD) 82.65	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	27.60										.... see previous sheet				
	30.60	CORE	100	91	32	1 NI 14 NI 12 6 NI 5									
	33.60	CORE	100	82	23	4 NI 5 4 NI 4 NI 1					.... between 34.40m and 35.90m: mudstone is light grey in colour				
	36.30	CORE	90	72	0	8 NI NI >20 >20					.... below 36.30m: abundant ironstone nodules				
	39.30	CORE	77	60	18	>20									

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	47.30	

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off

Water Added From	To

Chiselling From	To	Time(hr)

Flush Returns	Type	To Depth
0%	Air/Water	9.70
10%	Air/Water	13.60
Full	Air/Water	40.60
0%	Air/Water	41.70
10%	Air/Water	47.30

RAEBURN

Fig No: B5
Sheet 4 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINT\WPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:47 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 105

Inspection Pit to 1.20
Rotary Open Hole to 15.60
Rotary Core Drilling to 47.30

Location: E 271611.8
N 665945.3

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	39.30					NI 16		62.65		.... see previous sheet				
						NI 5 NI 6		42.05	40.60	# Possible PACKED WASTE (0.40m recovery of mudstone fragments recovered as clayey gravel, complete loss of flush)				
								40.95	41.70	Moderately strong thinly laminated dark grey MUDSTONE with some fossil plant material (leaves). Weathering is not evident. Subhorizontal fractures are widely spaced, rough and undulating. Subvertical fractures are widely spaced, rough and undulating				
	42.30	CORE	100	86	45	15		40.75	41.90	Moderately strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some micaceous laminae, occasional carbonaceous laminae, some mudstone laminae, occasional plant fossil material (leaves) and occasional ironstone nodules. Weathering is evident as orange iron staining. Subhorizontal fractures are closely and locally medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
						13 NI		38.55	44.10	Moderately strong thinly laminated light grey MUDSTONE with occasional sandstone laminae. Weathering is not evident. Subhorizontal fractures are closely and medium spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar. Locally non intact				
	44.30	CORE	100	97	53	13 NI 9 3 1								
8/7							15.00	35.35	47.30	END OF BOREHOLE				

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	47.30	

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)

Flush Returns	Type	To Depth
0%	Air/Water	9.70
10%	Air/Water	13.60
Full	Air/Water	40.60
0%	Air/Water	41.70
10%	Air/Water	47.30

RAEBURN

Fig No: B5
Sheet 5 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 106

Inspection Pit to 1.20
Rotary Open Hole to 15.80
Rotary Core Drilling to 45.80

Location: E 271632.6
N 665853.1

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
					85.94						
10/7/2008	0.00	RO-S			85.79	0.15	# TOPSOIL # MADE GROUND (peat and ash)				
					76.24	9.70	# Sandy gravelly CLAY				

Diam	To Depth Boring	To Depth Casing
114	45.80	16.00

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	RD/EMc										Full	Air/Water	45.80
Chk & App	Status												
GK	Final												

Fig No: B6
Sheet 1 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:51 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 106

Inspection Pit to 1.20
Rotary Open Hole to 15.80
Rotary Core Drilling to 45.80

Location: E 271632.6
N 665853.1

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	0.00				85.94		.... see previous sheet				
											15.50
	15.50	RO-R			70.44	15.50					
			TCR SCR RQD FI		70.24	15.70	# SANDSTONE				
	15.80	CORE	100 80 62 NI		70.14	15.80	# COAL Very weak and weak dull black COAL with locally bright laminae, occasional pyritisation and calcite veining. Weathering is not evident. Non intact				16.00
			3		69.64	16.30	Moderately strong thinly laminated dark grey MUDSTONE with some carbonaceous laminae, occasional sandstone and siltstone laminae and some fossil plant material (leaves). Weathering is not evident. Subhorizontal fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are widely spaced, smooth and slightly undulating				
			3								
			1								
	18.80	CORE	100 95 87 1		67.04	18.90	Moderately strong and strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some micaceous laminae, occasional carbonaceous laminae, occasional mudstone and siltstone laminae. Weathering is not evident. Subhorizontal fractures are widely spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
			3		66.34	19.60	.... see next sheet				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
114	45.80	16.00

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	RD/EMc										Full	Air/Water	45.80
Chk & App	Status												
GK	Final												

Fig No: B6
Sheet 2 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWPROJECTS\20857.GPJ Printed: 05/09/2008 15:56:52 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 106

Inspection Pit to 1.20
Rotary Open Hole to 15.80
Rotary Core Drilling to 45.80

Location: E 271632.6
N 665853.1

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result			Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	18.80					4	85.94		Moderately strong thinly laminated dark grey MUDSTONE with some sandstone and siltstone laminae, occasional micaceous and carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are widely spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and slightly undulating				
						5							
	21.80	CORE	100	97	90	5							
							63.54	22.40					
						3			Moderately strong and strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and siltstone laminae, some micaceous laminae and occasional carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are widely spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and slightly undulating				
						2							
							61.19	24.75					
	24.80	CORE	100	73	62	12	60.94	25.00	Moderately strong thinly laminated dark grey MUDSTONE with occasional siltstone and sandstone laminae, occasional micaceous and carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are medium spaced, smooth and planar				
							60.64	25.30	Strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with occasional mudstone and siltstone laminae and some micaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
						14			Moderately strong thinly laminated dark grey MUDSTONE with occasional sandstone and siltstone laminae and occasional shell fossil material. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar				
							59.34	26.60	.... at 25.30m: 0.30m thick mussel band				
							59.24	26.70	Weak dull black COAL with locally bright laminae and some pyritisation. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are closely spaced, smooth and slightly undulating				
						9			Moderately strong thinly laminated grey MUDSTONE with abundant sandstone and siltstone laminae, some micaceous and carbonaceous laminae, some fossil plant material (leaves) and occasional ironstone nodules. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and slightly undulating				
	27.80	CORE	100	93	88	6							
							57.24	28.70					
						3			Moderately strong and strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and siltstone laminae, abundant micaceous and carbonaceous laminae and some plant fossil material (leaves). Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
						3							

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
114	45.80	16.00

Driller	Originator
WH	RD/EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	45.80

Fig No: B6
Sheet 3 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 106

Inspection Pit to 1.20
Rotary Open Hole to 15.80
Rotary Core Drilling to 45.80

Location: E 271632.6
N 665853.1

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	27.80							85.94		.... Please see previous page				
	30.80	CORE	100	90	62	4								
						8								
						2								
								52.24	33.70					
	33.80	CORE	100	92	60	11				Moderately strong thinly laminated dark grey MUDSTONE with some sandstone and siltstone laminae, occasional plant fossil material (leaves), occasional micaceous and carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
								51.34	34.60					
						5				Strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with occasional mudstone and siltstone laminae, some micaceous laminae, carboneceous laminae and occasional plant fossil material. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
						3								
								49.44	36.50					
	36.80	CORE	100	85	51	14				Moderately strong thinly laminated dark grey MUDSTONE with some sandstone and siltstone laminae, occasional fossil plant material and occasional micaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and planar. Subvertical fractures are widely spaced, rough and slightly undulating				
						12								
						3								
	39.80	CORE	100	78	60	10								

Diam	To Depth Boring	To Depth Casing
114	45.80	18.00

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator
WH	RD/EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	45.80

RAEBURN

Fig No: B6
Sheet 4 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 106

Inspection Pit to 1.20
Rotary Open Hole to 15.80
Rotary Core Drilling to 45.80

Location: E 271632.6
N 665853.1

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	39.80							85.94		.... Please previous page				
						9								
						13		44.44	41.50	Weak dull black COAL with locally bright laminae, some pyritisation and calcite veining. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are closely spaced, smooth and slightly undulating				
	42.80	CORE	100	67	52	18		43.74	42.20	Moderately strong and strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and siltstone laminae, some micaceous, carbonaceous laminae and occasional plant fossil material. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and slightly undulating				
						5								
						8								
10/7							16.00	40.14	45.80	END OF BOREHOLE				

Remarks:
Description based on Driller's log.
An Inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
114	45.80	16.00

Driller	Originator
WH	RD/EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	45.80

RAEBURN

Fig No: B6
Sheet 5 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 107

Inspection Pit to 1.20
Rotary Open Hole to 15.30
Rotary Core Drilling to 45.30

Location: E 271720.2
N 666021.4

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
					91.48						
16/7/2008	0.00	RO-S			91.28	0.20	# TOPSOIL				
							# MADE GROUND (clay)				
					89.88	1.60	# MADE GROUND (peat and ash)				
					87.48	4.00	# Sandy gravelly CLAY				

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.30	

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)

Flush Returns	Type	To Depth
Full	Air/Water	22.00
40%	Air/Water	27.30
20%	Air/Water	45.30

RAEBURN

Fig No: B7
Sheet 1 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 107

Inspection Pit to 1.20
Rotary Open Hole to 15.30
Rotary Core Drilling to 45.30

Location: E 271720.2
N 666021.4

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	0.00				91.48		.... Please see previous page				
					76.58	14.90					14.90
	14.90	RO-R					# MUDSTONE				15.30
			TCR SCR RQD FI		76.18	15.30					
	15.30	CORE	100 88 6 7				Moderately weak thinly laminated dark grey MUDSTONE with occasional siltstone and sandstone laminae, occasional listric surfaces, occasional plant fossil material (leaves) and occasional micaceous and carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar. Locally non intact				
			4								
			11								
	18.30	CORE	100 92 29 13								
			8								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.30	

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	RD										Full	Air/Water	22.00
											40%	Air/Water	27.30
Chk & App	Status										20%	Air/Water	45.30
GK	Final												

RAEBURN

Fig No: B7
Sheet 2 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWPROJECTS\20857.GPJ Printed: 05/09/2008 15:58:58 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 107

Inspection Pit to 1.20
Rotary Open Hole to 15.30
Rotary Core Drilling to 45.30

Location: E 271720.2
N 666021.4

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	18.30					5		91.48		.... Please see previous page				
	21.30	CORE	85	65	21	>20		69.78	21.70					
								69.48	22.00	Strong cross-bedded thinly laminated yellow fine to coarse grained cross-bedded SANDSTONE with some mudstone and siltstone laminae and some micaceous and carbonaceous laminae. Weathering is evident as orange iron staining. Subhorizontal fractures are closely spaced, rough and slightly undulating. Subvertical fractures are widely spaced, rough and slightly undulating				
						>20		68.68	22.80	0.40m recovered as very weak and weak thinly laminated black MUDSTONE with occasional listric surfaces. Weathering is evident as orange iron staining. Subhorizontal fractures are very closely spaced, smooth and slightly undulating. Subvertical fractures are closely spaced and slightly undulating. Locally not intact. # Driller indicates packed waste with a reduction to 40% flush				
								68.48	23.00					
						5		67.98	23.50	Very weak and weak dull black COAL with some locally bright laminae, some calcite veining and some pyritisation. Weathering is not evident. Subhorizontal fractures are very closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar.				
								67.73	23.75	Moderately weak thinly laminated dark grey MUDSTONE with occasional siltstone and sandstone laminae, occasional micaceous and carbonaceous laminae and abundant plant fossil material (leaves and roots). Weathering is not evident. Subhorizontal fractures are medium spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar				
										Very weak and weak dull black COAL with some locally bright laminae, some calcite veining and some pyritisation. Weathering is evident as orange iron staining. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar				
	24.30	CORE	100	95	29	5				Moderately weak to moderately strong thinly laminated dark grey MUDSTONE with some siltstone and sandstone laminae, some micaceous and carbonaceous laminae, some plant fossil material (leaves and roots), occasional ironstone bands. Weathering is not evident. Subhorizontal fractures are closely to medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar. Locally non intact. .... at 25.00m: 0.20m thick ironstone band				
						12								
						4								
16/7	27.30	CORE	100	100	37	9	15.00							
						8								
						4				.... at 29.70m: 0.60m thick ironstone band				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.30	

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	22.00
									40%	Air/Water	27.30
									20%	Air/Water	45.30

Fig No: B7
Sheet 3 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 107

Inspection Pit to 1.20
Rotary Open Hole to 15.30
Rotary Core Drilling to 45.30

Location: E 271720.2
N 666021.4

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	27.30							91.48		.... Please see previous page				
	30.30	CORE	100	100	65	6								
						2								
						2								
	33.30	CORE	90	87	61	12								
								57.58	33.90					
						1				Moderately strong and strong thinly laminated off-white fine to coarse grained SANDSTONE with occasional mudstone and siltstone laminae some micaceous and carbonaceous laminae and occasional plant fossil material (leaves and roots). Weathering is not evident. Subhorizontal fractures are medium to widely spaced, rough and planar. Subvertical fratures are widely spaced, rough and planar				
						3								
	36.30	CORE	100	100	52	4								
								54.68	36.90					
						2				Moderately weak to moderately strong thinly laminated dark grey MUDSTONE with some siltstone and sandstone laminae, some micaceous and carbonaceous laminae, occasional ironstone bands and nodules and some fossil plant material (leaves). Weathering is not evident. Subhorizontal fractures are medium spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar.				
								53.88	37.60					
						1				Strong and very strong cross bedded thinly laminated yellow fine to coarse grained cross-bedded SANDSTONE with some mudstone and siltstone laminae, some micaceous and carbonaceous laminae and occasional ironstone bands. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar				
	39.30	CORE	100	100	52	3								

Diam	To Depth Boring	To Depth Casing
125	16.00	16.00
114	45.30	

Remarks:
Description based on Driller's log.
An Inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	22.00
									40%	Air/Water	27.30
									20%	Air/Water	45.30

RAEBURN

Fig No: B7
Sheet 4 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINT\WPROJECTS\20857.GPJ Printed: 05/09/2008 15:59:00 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 107

Inspection Pit to 1.20
Rotary Open Hole to 15.30
Rotary Core Drilling to 45.30

Location: E 271720.2
N 666021.4

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
					91.48						
	39.30				51.28	40.20	.... Please see previous page				
			2				Moderately weak and moderately strong thinly laminated dark grey MUDSTONE with occasional siltstone and sandstone laminae, some micaceous and carbonaceous laminae and occasional ironstone nodules. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar				
					50.58	40.90					
			6				Strong and very strong cross bedded thinly laminated yellow fine to coarse grained cross-bedded SANDSTONE with mudstone and siltstone laminae and micaceous and carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar. Locally non intact				
					49.78	41.70					
	42.30	CORE 87 77 23	>20				Moderately weak to moderately strong thinly laminated dark grey MUDSTONE with occasional siltstone laminae, occasional micaceous and carbonaceous laminae and occasional plant fossil material. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are medium spaced, smooth and planar. Locally non intact				
			8								
			12								
17/7					46.18	45.30	END OF BOREHOLE				

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.30	

Remarks:
Description based on Driller's log.
An Inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator
WH	RD
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	22.00
									40%	Air/Water	27.30
									20%	Air/Water	45.30

RAEBURN

Fig No: B7
Sheet 5 of 5
Scale 1:50

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RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 108

Inspection Pit to 1.20
Rotary Open Hole to 15.00
Rotary Core Drilling to 45.00

Location: E 271706.5
N 665851.5

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
					87.26						
11/7/2008	0.00	RO-S			87.11	0.15	# TOPSOIL # MADE GROUND (ash and peat)				
					77.86	9.40	# Sandy gravelly CLAY				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.00	

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	EMc										Full	Air/Water	45.00
Chk & App	Status												
GK	Final												

RAEBURN

Fig No: B8
Sheet 1 of 5
Scale 1:50

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RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 108

Inspection Pit to 1.20
Rotary Open Hole to 15.00
Rotary Core Drilling to 45.00

Location: E 271706.5
N 665851.5

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	0.00				87.26		.... see previous sheet				
					72.86	14.40					14.40
	14.40	RC-R					# SANDSTONE				14.80
	15.00	CORE	TCR 100 SCR 83 RQD 77 FI 14		72.26	15.00	Moderately strong and strong cross bedded thickly and thinly laminated greyish white fine grained SANDSTONE with bands and laminae of mudstone, micaceous laminae and occasional carbonaceous laminae. Weathering is not evident. Subhorizontal fractures are medium and widely locally closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
			FI 12								
			FI 7								
	18.00	CORE	TCR 100 SCR 92 RQD 72 FI 1								
			FI 4								
					67.36	19.90					

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.00	

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator
WH	EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	45.00

RAEBURN

Fig No: B8
Sheet 2 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTW\PROJECTS\20857.GPJ Printed: 05/09/2008 15:59:04 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 108

Inspection Pit to 1.20
Rotary Open Hole to 15.00
Rotary Core Drilling to 45.00

Location: E 271706.5 N 665851.5

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	18.00					13		87.26		Weak, moderately weak and moderately strong thinly laminated dark grey MUDSTONE with bands of carbonaceous mudstone, abundant fossil bivalve remains, occasional fossil plant remains towards base and some pyritisation. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
	21.00	CORE	100	88	67	>20				.... at 20.80m: 0.07m thick iron-rich band of mudstone				
						2		65.36	21.90	Moderately strong and strong cross bedded thickly laminated greyish white fine grained SANDSTONE with bands and laminae of mudstone, carbonaceous and micaceous laminae and occasional fossil plant remains. Weathering is not evident. Subhorizontal fractures are closely and medium spaced, rough and undulating. Subvertical fractures are closely and medium spaced, rough and undulating				
						4								
	24.00	CORE	100	95	83	6								
						1								
						2								
	27.00	CORE	100	88	62	1								
						14								
						12				.... at 28.90m: 0.40m thick band of carbonaceous mudstone with occasional coal laminae				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.00	

Driller	Originator
WH	EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	45.00

Fig No: B8
Sheet 3 of 5
Scale 1:50

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RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 108

Inspection Pit to 1.20
Rotary Open Hole to 15.00
Rotary Core Drilling to 45.00

Location: E 271706.5
N 665851.5

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result				Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	30.00	CORE	100	97	73	5		87.28						
										.... see previous sheet				
								56.36	30.90					
						6				Moderately weak and moderately strong thinly laminated grey MUDSTONE with bands and laminae of siltstone and sandstone, micaceous laminae and locally iron-rich. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
						6								
	33.00	CORE	100	85	45	13								
						11								
						7								
	36.00	CORE	100	77	40	>20		51.06	36.20	.... at 36.10m: 0.05m thick mussel band				
										Moderately weak and moderately strong thickly laminated dull black muddy COAL with bands and laminae of mudstone and abundant fossil plant remains. Weathering is not evident. Subhorizontal fractures are extremely closely, very closely and closely spaced, rough and undulating. Subvertical fractures are closely spaced, rough and undulating				
						6		50.06	37.20					
										Moderately strong and strong cross bedded thickly and thinly laminated grey fine grained SANDSTONE with bands and laminae of mudstone, carbonaceous and micaceous laminae and some fossil plant remains. Weathering is not evident. Subhorizontal fractures are closely and medium spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
						8								
	39.00	CORE	93	82	67	6		48.36	38.90					
										Moderately strong and strong thickly laminated off-white fine grained SANDSTONE with bands and laminae of mudstone, micaceous laminae and some pyritisation along fracture. Weathering is not evident. Subhorizontal fractures are closely and medium spaced, rough and undulating. Subvertical fractures are closely and medium spaced, rough and undulating				

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.00	

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator
WH	EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	45.00

Fig No: B8
Sheet 4 of 5
Scale 1:50

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RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 108

Inspection Pit to 1.20
Rotary Open Hole to 15.00
Rotary Core Drilling to 45.00

Location: E 271706.5
N 665851.5

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	39.00		7		87.26		.... see previous sheet				
			2								
					45.26	42.00					
	42.00	CORE	100 80 40 11				Moderately strong and strong thinly laminated dark grey MUDSTONE with micaceous laminae and locally iron-rich. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are closely spaced, rough and undulating				
			12								
							.... at 43.75m: 0.07m thick band of ironstone				
			9				.... at 44.30m: 0.07m thick band of ironstone				
11/7			NI/ 2	15.00	42.26	45.00	END OF BOREHOLE				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	15.00	15.00
114	45.00	

Driller	Originator
WH	EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	45.00

Fig No: B8
Sheet 5 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWP\PROJECTS\20857.GPJ Printed: 05/09/2008 15:59:07 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 109

Inspection Pit to 1.20
Rotary Open Hole to 16.30
Rotary Core Drilling to 46.30

Location: E 271699.1
N 665827.4

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
14/7/2008	0.00	RO-S			82.11						
					82.01	0.10	# TOPSOIL # MADE GROUND (peat and ash)				
					72.51	9.60	# Sandy gravelly CLAY				

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	16.00	16.00
114	46.30	

Driller	Originator
WH	EMc
Chk & App	Status
GK	Final

Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
									Full	Air/Water	17.80
									0%	Air/Water	46.30

Fig No: B9
Sheet 1 of 5
Scale 1:50

Style: BOREHOLE File: P:\GINTWWPROJECTS\20857.GPJ Printed: 05/09/2008 15:59:10 Raeburn Drilling and Geotechnical, Whistleberry Rd, Hamilton ML3 0HP Tel: 01698-711177 E-mail: enquiries@raeburndrilling.com

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 109

Inspection Pit to 1.20
Rotary Open Hole to 16.30
Rotary Core Drilling to 46.30

Location: E 271699.1
N 665827.4

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result	TCR	SCR	RQD	FI	Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	0.00								82.11		.... see previous sheet				15.60
															15.90
	15.90	RO-R							66.21	15.90	# SANDSTONE				
	16.30	CORE		80	63	57	8		65.81	16.30	Moderately strong thickly laminated greyish brown fine and medium grained SANDSTONE with carbonaceous and micaceous laminae. Weathering is not evident. Subhorizontal fractures are closely and medium spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
							2								
									64.31	17.80	# Possible PACKED WASTE (no recovery with total loss of flush)				
							NR								
									63.71	18.40					
							6		63.61	18.50	Moderately strong poorly bedded thinly laminated grey seat MUDSTONE with occasional micaceous laminae and abundant fossil plant root remains. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are closely spaced, rough and undulating				
											Moderately strong and strong thinly and thickly laminated grey MUDSTONE with bands and laminae of siltstone and sandstone, micaceous laminae, some fossil plant remains, occasional pyritisation and locally iron-rich. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
	19.30	CORE		100	83	58	10								

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Diam	To Depth Boring	To Depth Casing
125	16.00	16.00
114	46.30	

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	EMc										Full	Air/Water	17.80
											0%	Air/Water	46.30
Chk & App	Status												
GK	Final												

RAEBURN

Fig No: B9
Sheet 2 of 5
Scale 1:50

RAEBURN DRILLING AND GEOTECHNICAL LTD

Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE
MINERAL INVESTIGATION

Client: North Lanarkshire Council

Engineer: URS Corporation Limited

Contract No: 20857

Borehole No: 109

Inspection Pit to 1.20
Rotary Open Hole to 16.30
Rotary Core Drilling to 46.30

Location: E 271699.1
N 665827.4

Orientation: Vertical

Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush

Progress	Sample Depth	Samples and Tests Type	Result			Casing Depth	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Backfill Symbol	Backfill Depth
	19.30					6	62.11		.... see previous sheet				
						11							
							60.31	21.80	Moderately strong and strong thickly and thinly laminated greyish white fine and medium grained SANDSTONE with bands and laminae of mudstone, micaceous laminae and locally iron-rich. Weathering is not evident. Subhorizontal fractures are very closely and closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
	22.30	CORE	100	83	67	>20							
						4							
							57.91	24.20	Moderately strong thinly laminated dark grey MUDSTONE with siltstone and micaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
						12							
							57.11	25.00	Moderately strong and strong cross bedded thickly and thinly laminated greyish white fine grained SANDSTONE with bands and laminae of mudstone, carbonaceous and micaceous laminae. Weathering is not evident. Subhorizontal fractures are medium spaced, rough and undulating. Subvertical fractures are widely spaced, rough and undulating				
	25.30	CORE	87	80	72	5							
						3							
							54.76	27.35	Moderately weak and moderately strong thinly laminated black carbonaceous MUDSTONE with occasional coal laminae and abundant fossil bivalve remains. Weathering is not evident. Subhorizontal fractures are very closely and closely spaced, rough and undulating. Subvertical fractures are closely spaced, rough and undulating .... at 27.35m: 0.15m thick iron-rich mussel band				
						2							
						NR							
						5							
	28.30	CORE	100	90	65	>20							
						3							
							53.21	28.90	Moderately strong and strong cross bedded thickly and thinly laminated greyish white fine and medium grained SANDSTONE with bands and laminae of mudstone, carbonaceous and micaceous laminae and occasional fossil plant remains. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				

Diam	To Depth Boring	To Depth Casing
125	16.00	16.00
114	46.30	

Remarks:
Description based on Driller's log.
An inspection pit was excavated by hand to a depth of 1.20m to clear services.
Ground-water was not encountered.

Driller	Originator	Ground-water Struck	Rose To	Time(mins)	Cut Off	Water Added From	To	Chiselling From	To	Time(hr)	Flush Returns	Type	To Depth
WH	EMc										Full	Air/Water	17.80
											0%	Air/Water	46.30
Chk & App	Status												
GK	Final												

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Fig No: B9
Sheet 3 of 5
Scale 1:50

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