# Proposed St Ambrose High School

# **Ground Investigation Report**

October 2008 Final

Issue No 2 49339729 / GLRP0001



Project Title:	Proposed St Ambrose High School
Report Title:	Ground Investigation Report
Project No:	49339729
Report Ref:	GLRP0001
Status:	Final
Client Contact Name:	John Wyatt
Client Company Name:	North Lanarkshire Council
Issued By:	URS Corporation Ltd. 243 West George Street Glasgow G2 4QE United Kingdom Tel: + 44 (0) 141 226 3611 Fax: + 44 (0) 141 248 3773 www.urscorp.eu

#### **Document Production / Approval Record**

Issue No: 2	Name	Signature	Date	Position
Prepared by	Amie Paton			Graduate Engineer
Checked by	Gordon Williams Peter Morgan			Sr Environmental Engineer Principal Geologist
Approved by	lain Clow			Associate Director

#### **Document Revision Record**

Issue No	Date	Details of Revisions	
1		Original issue	
2	17/10/08	Minor amendments	

#### COPYRIGHT

© This Report is the copyright of URS Corporation Limited. Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.



# CONTENTS

Sectior	n F	Page No
EXECU	ITIVE SUMMARY	1
1.	INTRODUCTION	5
1.1. 1.2. 1.3. 1.4. 1.5.	Background Objectives of the Ground Investigation Objectives of the Report Scope of Works Limitations of the Report	5 5 6 6
2.	PREVIOUS REPORTS	7
2.1. 2.2.	Desk Study Report by URS Corp Ltd, 2005 Preliminary Ground Investigation by URS Corp Ltd, 2006	7 7
3.	THE SITE	8
3.1. 3.2. 3.3. 3.4. 3.5. 3.6.	Location and Topography Historical Development General Geology Mining Hydrogeology Hydrology	8 8 9 10 10
4.	PRELIMINARY CONCEPTUAL SITE MODEL	11
4.1. 4.2. 4.2.1. 4.2.2. 4.2.3. 4.3. 4.4. 4.5.	General Potential Sources On-Site Sources Off-Site Sources Summary Table of Potential Contamination Sources Receptors Pathways Pollutant Linkages	11 12 12 12 12 12 12 13 14 15
5.	RECENT GROUND INVESTIGATION WORKS	16
5.1. 5.2. 5.3. 5.4. 5.5. 5.6. 5.6.1. 5.7. 5.8. 5.8.1. 5.8.2.	General Trial Pits Cable Tool Percussion Boreholes Rotary Boreholes Cone Penetration Testing In-Situ Testing Standard Penetration Tests Gas and Groundwater Installations Laboratory Testing Geotechnical Testing Chemical Analysis	16 16 16 17 17 17 17 17 18 18 18



# CONTENTS

#### Section

#### Page No

6.	GROUND CONDITIONS	20
6.1.	General	20
6.2.	Topsoil	20
6.3.	Made Ground	20
6.4.	Peat	21
6.5.	Lower Lacustrine Deposits	. 22
6.6.	Glacial I III	23
6.7.	Bearock	20
6.0. 6.9	Gioundwalei	28
0.0.	043	20
7.	MINERAL STABILITY ASSESSMENT	31
7.1.	Geology	31
7.2.	Review of Mine Abandonment Plans	31
7.3.	Mineral Ground Investigations	32
7.4.	Assessment of Potentially Minerally Unstable Areas	. 34
7.5.	Mine Entries	36
8.	CONTAMINATION ASSESSMENT	38
8.1.	Assessment Methodology	38
8.2.	Soils	39
8.3.	Groundwater	41
8.4.	Tier 1 Qualitative Assessment	43
8.4.1.	Risk to Human Health	43
8.4.2.	Risks Associated with Ground Gas	.43
8.4.3.	Risk to the Water Environment	.44
8.4.4. o 5	Risk to the Bulit Environment	45
0.0.	General	.49 /0
8.5.2.	Potential Pollutant Linkages	50
0.0.2.		
9.	CONCLUSIONS AND RECOMMENDATIONS	53
9.1.	Site Details	53
9.2.	General Geology	53
9.3.	Mining	53
9.4.	Ground Conditions	54
9.5.		54
9.6.	Gas	56
9.7.	Bisk to Human Health	56
972	Risk to the Water Environment	56
9.7.3.	Risk to the Built Environment	57
9.8.	Foundation Assessment	58
9.9.	Earthworks and Services	59
9.10.	Waste Management	60



# CONTENTS

# SectionPage No9.11.Road Pavement Design609.12.Considerations for the Site to Remain in its Current Use619.12.1.Environmental Risk Assessment619.12.2.Mineral Stability61

Appendix A -	Site Location Plan
Appendix B -	Exploratory Hole Location Plan: School Building Investigation
Appendix C -	Exploratory Hole Location Plan: Open Space/Pitches Investigation
Appendix D -	Exploratory Hole Location Plan: Mining Investigation
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



# **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 betwee	en 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  $150 \text{kN/m}^2$  to  $200 \text{kN/m}^2$  will be available in stiff glacial till with settlements of less than 25mm. Where imposed building loads are expected to exceed  $150 \text{kN/m}^2$  to  $200 \text{kN/m}^2$ , 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 9<sup>th</sup> 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	9.9 10	16 17
Deposits	0.0 - 10	1.0 - 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 southeast.

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:



No	Source	Nature
S1	<ul> <li>Residual contamination in subsurface soils and fill, associated with the historical use of the site:</li> <li>1a. In soil/fill material beneath site;</li> <li>1b. In soil/fill material in adjacent ground.</li> </ul>	High pH; Hydrocarbons (TPH, PAH); Toxic metals; Asbestos; Inorganic contaminants (e.g. sulphate).
S2	<ul> <li>Free phase or dissolved contaminants in groundwater beneath site:</li> <li>2a. Originating from soils and fill materials at the site;</li> <li>2b Originating from other sources in adjacent ground.</li> </ul>	High pH; Hydrocarbons (TPH, PAH); Toxic metals; Inorganic contaminants (e.g. sulphate).
S3	<ul> <li>Gaseous or vapour phase contaminants:</li> <li>3a. Emanating from any of the above sources;</li> <li>3b. Emanating from other natural sources within or adjacent to the site.</li> </ul>	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:	
	<ul> <li>1a. Members of public accessing the site;</li> </ul>	
	<ul> <li>1b. Site Workers carrying out future intrusive works;</li> </ul>	
	• 1c. Future users.	
R2	The Water Environment:	
	<ul> <li>2a. Groundwater in superficial deposits beneath site;</li> </ul>	
	2b. Groundwater in bedrock beneath site;	
	<ul> <li>2c. Groundwater in superficial deposits or bedrock adjacent to the site, down hydraulic flow;</li> </ul>	
	• 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 wate groundwater, mainly affecting controlled waters:	r run-off or				
	- 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				
	<ul> <li>Groundwater within the underlying natural superficial deposits by leaching and migration of contaminants via shallow deposits.</li> </ul>	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;

- Cyanide;
- Cadmium;
- 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 betwee	een 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 <sup>3</sup> )	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<sup>1</sup>.

Cone Resistance (q <sub>c</sub> ) MPa	Description	Equivalent Su value from qc (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

<sup>&</sup>lt;sup>1</sup> 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 <sub>v</sub> m²/MN	C <sub>v</sub> (t90) m²/year	C <sub>v</sub> (t50) m²/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 <sub>v</sub> m²/MN	C <sub>v</sub> (t90) m²/year	C <sub>v</sub> (t50) m²/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	СН
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 <sup>3</sup> )	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 <sub>v</sub> m²/MN	C <sub>v</sub> (t90) m²/year	C <sub>v</sub> (t50) M²/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 <sub>v</sub> m²/MN	C <sub>v</sub> (t90) m²/year	C <sub>v</sub> (t50) m²/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 Investig	ations				·	·
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 Investig	ations					
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 southeastern 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<sup>2</sup> 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<sup>3</sup>/I 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.

<sup>&</sup>lt;sup>2</sup> 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:

Contaminant	URS GAC (mg/kg)	Concentration (mg/kg)	Position	Depth (mbgl)
		36	TP203	1.3
		27	TP231	3.1
Araania	20	21 TP235	0.5	
Arsenic	20	71 TP328		2.2
		24	TP337	0.5
		36	BH210	4
	500 TP21 580 TP23 510 TP23 460 TP30	500	TP210	1.8
		580	TP235	0.5
		TP238	4.1	
Lood		460	TP303	2
Leau	450	680	TP328	2.2
		630	TP337	0.5
		710	TP340	1.5
		3600	BH210	4

#### Made ground (27No. Samples)



Contaminant	URS GAC (mg/kg)	Concentration (mg/kg)	Position	Depth (mbgl)
		120	TP203	1.3
		110	TP210	1.8
		130	TP235	0.5
		120	TP238	4.1
		100	TP246	1.5
		120	TP255	0.5
Niekol	75	84	TP302	1
INICKEI	75	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
		1.7	TP203	1.3
		2.8	TP231	3.1
		9.4	TP302	1
	4 4	3.5	TP303	2
benzo(a)pyrene	1.1	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)
Aroonio	20	24	BH308	2
Arsenic	20	49	BH312	5
Chromium	200	440	BH312	5
Lood	450	6600	BH308	2
Leau		910	BH312	5
		130	TP219	4
Nickel	75	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
		1700	BH201	Made Ground
		1600	BH202	Peat
		7800	BH205	Made Ground
		1700	BH207	Silt/clay
	50	2400	BH210	Peat
Manganese (dissolved)	50	3600	BH211	Made Ground
		4800	BH302	Peat
		2400	BH305	Silt/clay
		1800	BH308	Peat
		220	BH311	Made Ground
Nitrite as NO2	30	270 510	BH308 BH311	Peat Made Ground
		4500	BH201	Made Ground
		4300	BH202	Peat
		4400	BH205	Made Ground
		4500	BH207	Silt/clay
Ammonical Nitrogen	1000	3000	BH210	Peat
Annonical Nillogen	1000	2831	BH211	Made Ground
		20592	BH302	Peat
		8108	BH305	Silt/clay
		0100	BH308	Peat
Aliphatics >C21-C35	10	740	BH205	Made Ground
Aromatics >EC21-	10	360	BH202	Peat
EC35	10	350	BH205	Made Ground
		0.28	BH202	Peat
Fluoranthene	0.2	0.37	BH205	Made Ground
		0.46	BH211	Made Ground
		0.17	BH202	Peat
Benz(a)anthracene	0.092	0.2	BH205	Made Ground
		0.21	BH211	Made Ground
		0.05	BH201	Made Ground
		0.27	BH202	Peat
Benzo(a)ovrene	0.02	0.29	BH205	Made Ground
Donzo(a)pyrono	0.02	0.04	BH207	Silt/clay
		0.25	BH211	Made Ground
		0.04	BH311	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
					TP201
					TP203
					TP231
					TP235
Sulphoto	26	2000	. 100 . 2200	10	TP238
Suphate	30	2000	>100 - 3800	10	TP303
					TP316
					TP328
					TP348
					BH210
					TP201
		0.5%	0.01% - 1.5%	5	TP231
Sulphur	36				TP238
					TP303
					BH210
Sulphide	36	250	>15 - 120	0	-
					TP203
	96	0,5		17	TP216
рп	00	8<5	3.6 - 7.7		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
					TP203
					TP231
					TP235
					TP238
					TP307
Arsenic	36	10	>3 – 71	11	TP319
					TP328
					TP337
					TP340
					BH205
					BH210
Cadmium	36	3	>02-95	2	TP302
Oddinidini	00	0	/0.2 0.0	L	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
					TP234
Mercury	36	1	<u> </u>	А	TP337
Weredry	00	I	20.4 0.0		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	-
					TP201
					TP203
					TP212
					TP219
					TP222
					TP226
					TP231
Petroleum					TP235
Hydrocarbons	31	50	43 – 3900	30	TP238
(TPH)					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:

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

#### Table 6.1 – Contamination Sources

## 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;	
	•	<ul> <li>1b. Site Workers carrying out future intrusive works;</li> </ul>	
	•	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	



	<ul> <li>Groundwater within the underlying natural superficial deposits by leaching and migration of contaminants via shallow deposits.</li> </ul>	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 subspace 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<sup>2</sup> to 200kN/m<sup>2</sup> will be available in stiff glacial till with settlements of less than 25mm.

Where imposed building loads are expected to exceed 150kN/m<sup>2</sup> to 200kN/m<sup>2</sup>, 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, countersigned 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 gasventing 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**



# Appendix B - Exploratory Hole Location Plan: School Building Investigation



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



# Appendix D - Exploratory Hole Location Plan: Mining Investigation



# 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, 1967
Scale	Peat Characteristics
1	Completely undecomposed peat; only clear water can be squeezed from peat
2	Almost undecomposed; mud free peat; water squeezed from peat is almost clear and colorless
12	Very little decomposition; very slightly muddy peat; water squeezed from peat is muddy; no peat houses through fingers when squeezed; residue retains structure of peat
13	Poorly decomposed; somewhat muddy peat; water squeezed from peat is muddy; residue is muddy
14	but it shows structure of pear 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
HB	Well decomposed; growth structure very indistinct; about two-thirds of peat passes through fingers when squeezed; residue consists mainly of roots and resistant fibers
10	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 Report issue: File number: Contract number: Factual Final

P:\20857\20857SIReport.doc

Issuing office:

Hamilton

20857

Originator:	,	
G E Kenned	y Senior Engineering Geologist	05 September 2008
Checked & approved:		

## For and on Behalf of Raeburn Drilling and Geotechnical Limited

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

This report is not to be used for contractual or engineering purposes unless the report text and front cover sheet are signed where indicated by both the originator of the report and the approver and the report is designated 'Final' on the cover sheet. The report is Confidential. It cannot be assigned without our express approval. We accept no liability to any third party using this report.

### TABLE OF CONTENTS

INTRODUCTI	ON	
LOCATION C	F SITE	
GROUND IN	/ESTIGATION	
erences		Total No of Text Pages: 3
		Figure
PENDIX A: Location Pl Site Plan	PLANS Jan	A1 A2
PENDIX B:	SITE WORK	
Notes on F	leid Procedules	
Key to Bor	enole and That Pit Recolds	B1 to B10
Borehole F	Records	BINBIO
Rock Core	Photographs	B11 to B40
	INTRODUCTI LOCATION O GROUND INV erences PENDIX A: Location Pl Site Plan PENDIX B: Notes on F Key to Bor Borehole F Rock Core	INTRODUCTION LOCATION OF SITE GROUND INVESTIGATION erences PENDIX A: PLANS Location Plan Site Plan PENDIX B: SITE WORK Notes on Field Procedures Key to Borehole and Trial Pit Records Borehole Records Rock Core Photographs

lofi

### 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.

P:\20857\20857SIReport.doc

### REFERENCES

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

		Site: ST AMBROSE HIGH SCHOOL, COATBRIDGE	Contract No: 20857	
DA	CRIDN	MINERAL INVESTIGATION		
	DRILLING AND GEOTECHNICAL LTD	Client: North Lanarkshire Council		
		Engineer. URS Corporation Limited		
		÷		
		·		
	- 5 A Stiller 11			FAL
		PI ANS		LIII-
				IF



	STAMBROSE HIGH SCHOOL, COATBRIDGE	20001
RAEBURN	Client: North Lanarkshire Council	
DRILLING AND GEOTECHNICAL LTD	Engineer: URS Corporation Limited	
-		*
	SITE WORKS	

	Cila:	AND POST WICH SCHOOL COATBRIDGE	Contract No: 20857
	QIIG.	STAMBROSE HIGH SCHOOL, COATBRIDGE	
RAEBURN	Cilent	North Lanarkshire Council	
I MAN MAN MAN DRILLING AND GEOTECHNICAL LID	Engine	eer: URS Corporation Limited	

#### 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

ML3 OHP Tel: 01698-711177

Geotechnical, Whistleberry Rd,

Raeburn Drilling and

04/08/2008 15:21:29

File: PIGINTWPROJECTS120857.GPJ

Style: NOTES FIELDWORKS

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 solls 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. 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 soll 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 soll 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 foll 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 plezometers.

#### 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.

NOTES ON FIELD PROCEDURES

RAEBUR

	0.00	AWBROSE HIGH OC	HOOL, COMBRIDGE		
EBU	RN Client:	North Lanarkshire Council	ION		
ORILLING AND GEOT	FECHNICAL LTD Engineer:	URS Corporation Limited			
SOIL SAMPLE	ES		mpler	1	
UX	General purpose tube	sample; A NO OI DIOWS to unve se	inpici		
40	NOTE: Tube samples recovered; suffix 'b' ind	are 100mm diameter unless othe dicates full penetration of sampler	rwise specified in the remarks. Suf not obtained; suffix 'c' indicates ful	fix 'a' Indicates sample ] penetration of sample	not r but
DUIT	Small Disturbed/Jar/T	ub sample			
B/LB	Bag/Large Bag sample	8			
	VERY AND ROCK OF				
CORE RECO	Tatal Care Recover	The total core recovered express	ed as a percentage of the core run	length	
TCR	Solid Core Recovery.	The core recovered as solid cylind	ders expressed as a percentage of	the core run length	
ROD	Rock Quality Designa	tion: The core recovered as solid	cylinders of length 100mm or more	expressed as a percer	ntage of core run le
RO-S/RO-R	Rotary Open Hole Dri	lling through Soll / Rotary Open H	ole Drilling through Rock		
FI	Fracture Index: The n	umber of discontinuities expresse	d as fractures per metre		
Flush: "Depth" i	indicates depth down to v	which recorded "Returns" relate			
CROUND M	ATER				
GROUND-W	Ground-water sample				
¥.	Ground-water encour	itered			
Ā	Depth to which groun	d-water rose			
Â	Ground-water cut off	by the casing			
	FIELD TESTS				
IN SITU AND	A Standard penaltalian	test (split barrel sampler(SPT)or	cone (CPT)); X is the penetration (	N) value;	
OF OF CPT=X a/b (ce	n) 'a' is blow/75mm for s	eating drive; 'b' is blows/75mm fo	r test drive; (pen) is test drive pene	tration if less than 300r	nm.
CBR	California bearing rat	lo test			
MCV	Moisture condition va	lue test			
к	Permeability test				
К НР	Permeablility test Hand penetrometer to	est			
K HP FV	Permeability test Hand penetrometer to Field vane test	est			
K HP FV HV	Permeability test Hand penetrometer to Field vane test Hand vane test	est			
K HP FV HV ID	Permeability test Hand penetrometer to Field vane test Hand vane test Density test	est			
K HP FV HV ID	Permeability test Hand penetrometer to Field vane test Hand vane test Density test	est			
K HP FV HV ID LEGENDS	Permeability test Hand penetrometer to Field vane test Hand vane test Density test	est 1 BS 5930:1999			
K HP FV HV ID LEGENDS Material legent # before a des	Permeability test Hand penetrometer to Fleid vane test Hand vane test Density test ds are in accordance with cription indicates that it is	BS 5930:1999 based on the Dniller's record.			
K HP FV HV ID LEGENDS Material legenx # before a desc	Permeability test Hand penetrometer to Field vane test Hand vane test Density test ds are in accordance with cription indicates that it is	est BS 5930:1999 a based on the Driller's record. R	OTARY DRILLING SIZES		
K HP FV HV ID LEGENDS Material legenx # before a desu INSTALLATI	Permeability test Hand penetrometer to Field vane test Hand vane test Density test ds are in accordance with cription indicates that it is IONS (BACKFILL)	est 1 BS 5930:1999 1 based on the Driller's record. Re	OTARY DRILLING SIZES	Nominal Dia	meler (mm)
K HP FV HV ID LEGENDS Material legens # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Hand vane test Density test ds are in accordance with corription Indicates that II is IONS (BACKFILL) Concrete	est I BS 5930:1999 I based on the Dniller's record. R Benionite	OTARY DRILLING SIZES	Nominal Dia	meter (mm) Core
K HP FV HV ID LEGENDS Material legens # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Hand vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est I BS 5930:1999 I based on the Driller's record. Rentonite	OTARY DRILLING SIZES	Nominal Dia Borehole	meler (mm) Core
K HP FV HV ID LEGENDS Material legenx # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Hand vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est I BS 5930:1999 I based on the Driller's record. Renionite	OTARY DRILLING SIZES	Nominal Dia Borehole 76	meler (mm) Core
K HP FV HV ID LEGENDS Material legens # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est 1 BS 5930:1999 9 based on the Driller's record. Rentonite Bentonite/cement grout	OTARY DRILLING SIZES	Nominal Dia Borehole 76 100	meler (mm) Core 54 76
K HP FV HV ID LEGENDS Material legens # before a desu INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est BS 5930:1999 based on the Driller's record. Renionite Benionite Benionite/cement grout	OTARY DRILLING SIZES Letter Slandard N H F	Nominal Dia Borehole 76 100 121	meler (mm) Core 54 76 92
K HP FV HV ID LEGENDS Material legenx # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription indicates that it is IONS (BACKFILL) Concrete	est BS 5930:1999 based on the Driller's record. Benionite Benionite/cement grout Solid ploe	OTARY DRILLING SIZES Letter Standard N H P S	Nominal Dian Borehole 76 100 121 148	meter (mm) Core 54 76 92 113
K HP FV HV ID LEGENDS Material legenx # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription indicates that it is IONS (BACKFILL) Concrete	est I BS 5930:1999 I based on the Dniller's record. Bentonite Bentonite/cement grout Solid pipe	OTARY DRILLING SIZES Letter Slandard N H P S Non-standard	Nominal Dian Borehole 76 100 121 145	meter (mm) Core 54 76 92 113
K HP FV HV ID LEGENDS Material legens # before a desu INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with coription Indicates that It is IONS (BACKFILL) Concrete	est n BS 5930:1999 pased on the Driller's record. Bentonite Bentonite/cement grout Solid pipe	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dia Borehole 76 100 121 145 108	meter (mm) Core 54 76 92 113 75
K HP FV HV ID LEGENDS Material legens # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Hand vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est BS 5930:1999 based on the Driller's record. Rentonite Bentonite/cement grout Solid pipe Stotled pipe	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dia Borehole 76 100 121 145 108	meler (mm) Core 54 76 92 113 75
K HP FV HV ID LEGENDS Material legens # before a desu INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est BS 5930:1999 based on the Driller's record. Bentonite Bentonite/cement grout Solid pipe Stotted pipe	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dia Borehole 76 100 121 145 108	meler (mm) Core 54 78 92 113 75
K HP FV HV ID LEGENDS Material legens # before a desu INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est BS 5930:1999 based on the Driller's record. Bentonite Bentonite/cement grout Solid pipe Stotted pipe Wooden piug	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dia Borehole 76 100 121 145 108	meler (mm) Core 54 76 92 113 75
K HP FV HV ID LEGENDS Material legenx # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription indicates that it is IONS (BACKFILL) Concrete	est a BS 5930:1998 a based on the Driller's record. Bentonite Bentonite/cement grout Solid pipe Stotted pipe Wooden plug	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dian Borehole 76 100 121 146 108	meter (mm) Core 54 76 92 113 75
K HP FV HV ID LEGENDS Material legens # before a desu INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with corption Indicates that it is IONS (BACKFILL) Concrete	est h BS 5930:1999 h based on the Driller's record. Bentonite Bentonite/cement grout Solid pipe Stotted pipe Wooden plug	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dia Borehole 76 100 121 145 108	meler (mm) Core 54 76 92 113 75
K HP FV HV ID LEGENDS Material legens # before a desc INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with corption Indicates that it is IONS (BACKFILL) Concrete	est h BS 5930:1999 h based on the Driller's record. Bentonite Bentonite/cement grout Solid pipe Stotted pipe Wooden plug therwise stated.	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dia Borehole 76 100 121 145 108	meler (mm) Core 54 76 92 113 75
K HP FV HV ID LEGENDS Material legens # before a desu INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est I BS 5930:1999 based on the Driller's record. Re Bentonite Bentonite/cement grout Solid pipe Stotted pipe Wooden plug therwise stated.	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dia Borehole 76 100 121 145 108	meler (mm) Core 54 76 92 113 75
K HP FV HV ID LEGENDS Material legens # before a desu INSTALLATI	Permeability test Hand penetrometer to Field vane test Density test ds are in accordance with cription Indicates that it is IONS (BACKFILL) Concrete	est BS 5930:1999 based on the Driller's record. Re Bentonite Bentonite/cement grout Solid pipe Stotted pipe Wooden plug therwise stated.	OTARY DRILLING SIZES Letter Standard N H P S Non-standard 412	Nominal Dia Borehole 76 100 121 148 108	meler (mm) Core 54 76 92 113 75

-			Site:	OT A	MDD	OSE HIGH SCHOOL COATBRIDGE	Contract I	No: 20	0857	
				SI P		INVESTIGATION	Borehole	No:	1	
<b>KA</b>	FRO	KV	Clier	it: Nor	h Lana	arkshire Council		1(	J1 ·	
	RILLING AND GEOTI	ECHNICAL LI	Engl	neer. URS	S Corp	oration Limited	Inspectio	on Pit to	1	.20
		Odent	Hon: Ma	tical		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core	Rolary C	open Ho Core Dri	lling to 4	3.50 3.50
ation: E 2	1454.3	Unental	uon. vel	avat		Barrel; Alr/ Water Flush				
NE	Samples and Ter	sis o	asion	Level				Jend	Nater	Back
Depth	Resuit	D	epth	(mOD)	Depth	Description of Strata		Le	Depth	E D
										いたいとうとういういたいと
,										
						- - - - - - -				いいいいいいいい
						-				11
marke				-	_			Diam	Borin	To Deptin
Descripti	on based on Driller	rs log. ted by band	to a der	th of 1.20r	n to clea	ur services.		125 114	12.0	0 1
un inspect	on pri was excava	ted by nand	IN H ORP		10 0.08			114	40.0	
						The second se	1==	PL 11		1
Driller	Originator	Struck Ros	e To (Time	er (mins) Cut	Off	Water Added         ChiseBing         Flush           From         To         From         To         To         Dep	In A	Fig N	0:	
WH	RD	1.05				Full AirWater 43.50	E	E	31	
Chk & App	Status						Ŋ.	S	heet 1	of 5
GK	Final		ł					S	cale 1:5	0

1

I.

						-	Site			DD	OSE HIGH SCHOOL COATBRIDGE	Contract	No: 2	2085	7	
	_						-	51	AM	BR	USE HIGH SCHOOL, OOATENEDOL	Borehole	No:			
ZΔ	F	FF	3		R	2 N		MI	NEF	AL	INVESTIGATION		1	01		
	DR	ILING	AND	GEOT	TECHN	UCAL L	TD Clie	nt: N	orthl	ana	income council					
							Eng	ineer: U	RS C	orp	bration Limited	Inspecti	on Pit	to tole to	1.20	)
			0			Nent	ation: Ve	Hical		-	Fouloment: Lorry (Bedford) Mounted Dando 250; 412 Core	Rotary	Core D	prilling to	43.50	)
ation: E	:21	1454	.3			Alente	auon. ve	lical			Barrel; Air/ Water Flush					
N	166	5922	.9	1			-	Lou		-			PE	Water	Ba	ackfi
Sample	S	Sample	es ar	nd Te	ests	C	asing	(mO		epth	Description of Strata		ege	Depth	qu	De
Depth	Type		Re	esult		C	Depth	82.6	54						10,	-
0.00								72.6	4 10	0.10	# Sendy gravely CLAY with sand bands		-0		1-	
													0		1	
										-					11	1
										1			- 0			
										-					1.1	
													9		1-	
															1	
						1							0		11	1
													-0		1.	
	1									1				-	1.	
															11:	-
														-	1)	
								69.	64 1	3.00	the second			-	DT.	11:
13.00	RO	-R		-							# SANDSTONE WITH MUDICIONE Danus		::::	1	M	11
		F	TCR	SCR	RQD	FI		69	14 1	3.50		0		-	T'	T
13.50	co	RE	100	96	55	16					Moderately weak and moderately strong thinly laminated yellow tine to coarse grained SANDSTONE with abundant micaceous laminae and	some				
											<ul> <li>carbonaceous laminae. Weathening is not evident. Subnorizontal in are medium spaced, rough and planar. Subvertical fractures are wide</li> </ul>	lely				
											spaced, rough and planar. Locally not intact at 13.70m: 0.15m thick mudstone band			}	1	
	1										1					
1						12										
	1										1		111			
											-			:		
											-					
											-		:::	:		
						4					-			:		
1						NI/	1						:::	:		
											-					
	1	-									-					
16.50	0 00	ORE	100	98	78	10	1				-					
											-					
								1.00					111			
													111	1		
	1					5	1				-		111	1		
											1					
											-		:::			
											1					
	1					1					]			:		
													:::	:		
											-		:::	:		
											at 19.10m: 0.40m thick mudstone band		:::	:		
						-					1			:		
19.5	olc	URE	93	86	47	2					1		:::	:		
											1		1:::		TOT	Dept
emarks														25 E	ioning	C
# Dascr An insp	riptio	n bas	ed or was e	n Dni excav	vated	by hai	nd to a di	epth of 1	.20m t	lo cla	ar services.			14	13.50	Ľ
								-	_	-	Water Added Chisellino Flush	R	Fic	No:		-
Driller		Orig	ginato	x F	Struc	* R	Ground-	me(mins)	Cut O	ff	From To From To Time(hr) Returns Type To Dep From To From To Time(hr) Full AirWater 43.5			D4		
WH			RU	Ī							Fuil Partialdi 40.0	B		Sheet	2 of	5
	pp	S	tatus									R		Scale	1:50	-
CIKAA												1 81			1000	

1

Ŧ

2	A	E	3	U	R		Site:	ST A MINE		OSE HIGH SCHOOL, COATBRIDGE INVESTIGATION Inkshire Council	Borehol	le No:	101	_	
		DRILLING	AND	GEOT	ECHN	CALL	TD Engi	neer: URS	Corpo	oration Limited	Inspec	tion Pit	to Hole to	1.20	0
ca	tion: E	271454	.3		0	ienta	ation: Ver	tical		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core	Rotary	Core L	Drilling to	43.50	)
	N	665922	2.9	_						Baller, All Haler Alen	-	g	Water	B	ackfi
- 21	Sample	Sampl	es ai	nd Te	sts	C	asing	(mOD)	Depth	Description of Strata		Leger	Depth	Symbo	De
	Depth 19.50	<u>چ</u>	R	esuit		-	Debru	82.64		see nevious sheet					
						12		62.34	20.30	Very weak thinly laminated dark grey carbonaceous MUDSTONE w plant fossil material. Weathering is evident as clay bands and a red strength. Subhorizontal fractures are medium spaced, rough and undulating. Subvertical fractures are widely spaced, rough and und Locally not intact	ith some uction in ulating.				
								61.24	21.40	Meet duil black COAL with mudstone laminations, some pyritisation	and		3		
	22.50	CORE	100	93	76	2 NI 2 NI 5		61.04	21.60	locally bright taminations. Weathering is not evident. Subnorzonal fractures are closely spaced, smooth and planar. Subvertical fractu- closely spaced, smooth and planar Moderately weak thinky laminated dark grey carbonaceous MUDST some forssit plant material and occasional ironstone nodules. Weat not evident. Subhorzontal fractures are closely spaced, rough and undulating. Subvertical fractures are widely spaced, rough and Locally not intact 	res are ONE with heiring is lulating.				
						NI/ 20		59.54	23.10	Moderately strong cross bedded yellow fine to coarse grained SAN with occasional carbonaceous laminae and some micaceous lamin Weathering is evident as orange iron staining. Subhorsconlai fractu closely spaced, rough and planar. Subvertical fractures are closely rough and planar. Locally not intact	DSTONE ae. res are spaced,				
						5									
						2									
	25.50	CORE	97	97	80	4									
						3									
						2									
	28.50	CORE	100	97	58	1									
						NI 13 11		53.54	29.1	0 Moderately weak and moderately strong thinly faminated dark gre MUDSTONE with some carbonaceous faminae and occasional in nodules. Weathering is evident as orange iron staining. Subhoriz fractures are closely spaced, smooth and planar. Subvertical frac widely spaced, smooth and planar. Locally not intact at 20.25m: 0.10m thick coal band	nstone ontal tures are		- mmmm		
_								52.6	1 30.0	0 below 29.60m: some sandstone laminae			iam P	Tof	) apti
e #A	marks: Descrip An inspe	otion bas ction pit	ed or was e	n Drill excav	er's loç ated b	, y hai	nd to a de	pin of 1.20	n to de	ar services.		1	25 1 14 4	2.00	1
	Driller WH	Ori	ginato RD	r	Struck	R	Ground-wa	ater le(mins) Cu	tOff	Water Added         Chiselling         Flush           From         To         From         To         Tume(hr)         Returns         Type         To         Air/Water         43.		Fig	No: B1		
c	hk & App	, s	tatus Inal	-							DURZ		Sheet Scale	3 of 1 1:50	ō

ł.

Loca	ition: E	271454	.3		One	anau	JOIL VEI	lical		Barrel; Air/ Water Flush	g	11/11/1	Ba	kfil
ress	Sample	Samp	les an	d Tes	ls	Ca	sing	Level (mOD)	Depth	Description of Strata	Legen	Depth	Symbol	Dep
Proc	Depth 28.50	TYP	Re	sult	>2	0	epin	82.64		Moderately strong cross bedded thinty 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 1	94	>27 >2	20		51.14	31.50	Moderately weak thinly laminated dark grey MUDSTONE with abundant yellow sandstone laminae, occasional incostone bands. Some cross bedding within sandstone laminae and occasional miceaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and undulating. Subvertical fractures are closely spaced, smooth and undulating				
30 30	37.5	CORE	100	93	54	>20 NI >20 >20 >20	12.00	45.5	4 36.0	<ul> <li>Very weak dull black COAL with locally bright laminae, some pyritisation, calcide veining and some plant fossil material in mudsione laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth, planar end undulating. Subvartical fractures are closely spaced, smooth and planar. Locally not infact</li> <li> at 36.66m: 0.05m mudstone band</li> <li>Moderately weak thinly laminated dark grey MUDSTONE with some micaceous laminae, abundent plant fossil material and occasional seandstone faminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are dosely spaced, smooth and slightly undulating. Subvertical fractures are dosely spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating. Subvertical fractures are medium spaced, smooth and slightly undulating.</li> </ul>				
00000		-				>20				1	-		To C	)epth
I MPROJECI	# Desc An insp	i: ription ba rection pi	sed or twas e	n Drille xcava	ated by	y har	nd to a de	pth of 1.2	0m to cl	ear services.		125 114	12.00 43.60	12

ca	tion: E	27145	54.3		0	Drien	itation: V	ertical			Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/ Water Flush	e Rolar	y Core D	nilling to	43.50	ockfil
1	N Sampla	Sam	ples a	nd Te	sts	-	Casing	Le (m(	vel OD)	Depth	Description of Strata		Legend	Water Depth	Symbol	Depth
	Depth 37.50	CORE	100	96	28	14		41	1.04	41.60	Moderately strong thinly laminated dark gray MUDSTONE with or vetow sandstone laminae, some micaceous laminae and occask ironstone bands. Waathering is not evident. Subhorizontal fracti closely spaced, smooth and planar. Subvertical fractures are me socred a smooth and planar.	ocasional nel ures are dium				
						16	-	3	9.14	43.50	END OF BOREHOLE					
1.00	emark # Desc An ins	s: pection t	pased o pit was	on Dr exca	iller's wated	log. 1 by l	hand to a	depth of	1.20	im to cl	ar services.		t	Diam 125 114	<u>To</u> Boring 12.00 43.50	Depih Casil 12.0

1

			SI	te: S	ST A	MBR	OSE	HIGH SC	HOOL, C	OATBR	RIDGE	Conuac	1 110. 2	2085		-
	-011		NI	N	INF	RAL	INVE	STIGATI	ON			Borehol	e No:	02		
<b>KA</b> t	-BU	K	C	lient:	North	Lana	arkshire	Council								
	ILLING AND GEOTI	ECHNICA	E	ngineer	URS	Corpe	oration	Limited				Inspec	tion Pit	to tole to	1.20	
			abalian: \	Indian			Fouion	nent: Lorry (E	Bedford) Mo	unted Da	ndo 250; 412 Core	Rotary	Core D	cilling to	48.20	
ation: E 27	1486.3	Oner	ntauori. Y	Ventical	,		Lquipi	Barrel;	Air/Water Fi	lush						
N 66	5865.9			11	evel								end	Water	Bec	ckfill
Sample	Samples and Te	\$(9	Casing	(п	nOD)	Depth			Desc	ription of S	Sirala		Leg	Depth	Symt	Dep
Depth 5	Result		Deptil	8	8.34	0.00	# TO	PSOIL							1.1	
Remarks: An inspect Ground-wa	on based on Dra on pit was excav ler was encounte	er's log. ated by ered at a	hand to a	depin n 16.80m	76.64	4 9.7		Sandy gravely	CLAY with se	and bands				125 114	くろうし、シャン・シャン・シャン・シャン・シャン・シャン・シャン・シャン・シャン・シャン・	
Driller WH	Originator RD	Siruck	Groun Rose To	id-water Time(ml	ns) Cu	t Off	Water From	Added To Fr	Chiseling om To	Time(hr)	Flush Returns Type To I Full AtrWater 16 30% Atr/Water 48	RALB	Fl	g No: B2 Sheel	1 of 5	5

-

1

		-		-	_		Citor		MART	ORE HIGH SCHOOL COATBRIDGE	Connaci	140. 7	085	1	
	_	_			_	-	51(0)	ST A	MBR		Borehole	No:		-	-
2A	F	EF	31	U	R	N	Clier	MINE	ERAL	INVESTIGATION	-	1	02		_
	DR	LLING.	AND	GEOTE	ECHNIC	AL LTD	Ensli		Coro	aration Limited	1		10	1 20	
							Engli	CORC ORC	, ooib		- Rotary	Open H	lole to	16.20	)
ation: E	27	1486.	.3		Ori	entatic	on: Ver	tical		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel: Air/Water Flush	Rotary	Core D	iung to	40.20	
N	4 66	5865.	.9									g	Mator	Ba	ackfi
Sample	S	ample	es an	d Tes	sts	Cas	ing	Level (mOD)	Depth	Description of Strata		egen	Depth	/mbol	De
Depth	Type		Re	sult		Dep	oth	86.34				-0		1	
0.00									-	see previous sheet		- 0		[1]	
									-			· ····		11-	
														6	
									-					11	1
													0	1-	
														1:	
														11	1
														11-	-
														E	
														1	
														N.	+
	1								1	N/			1	5	
														1	
												-0-		12	-
													2		'
									1			·0		1	-
										]			2	1	-
										-			-	[]	1
										-			1	1	1
										1				N	-
1.1	1					1				-		-0-	-	1)	1
	1							70 54	15.80	-			ŏ	00	11
15.80	ORC	-R		-		-		70.04	10.00	# SANDSTONE		:::		M	1.
		[	TCR	SCR	RQD	FI		70.14	16.2	Noderately strong thinly laminated yellow fine to coarse grained				11	1
16.20	olco	DRE	50	50	12	>20				SANDSTONE with occasional mudstone laminae, occasional m laminae and occasional convoluted bedding. Weathening is not	evident.				
								69.54	16.8	<ul> <li>Subhonzontal fractures are very closely spaced, rough and sign undulating. Subvertical fractures are closely spaced, rough and</li> </ul>	slightly		¥		
						NR		00.0	1	undulating # Possible PACKED WASTE (no recovery: no iron staining in at # possible 'backet back to be a processible 'bayement')	OVB		8		
		- 0								Inhology but knology below thay represent possible parenter,			8		
													8		
										1			8		
										-			8		
								68.0	4 18.3	)-	rey	<b>****</b>	8		
						>20		-		carbonaceous MUDSTONE with some micaceous laminae, abo fassil material, occasional yellow sandstone laminae and occas	ndant plant onal		1		
								67 4	4 189	Ironstone nodules. Weathering is evident as orange iron stalling Subhorizontal fractures are closely spaced, rough and slightly und	g. ndulating.	E	1		
								01.4	10.0	Moderately strong thinly laminated yellow fine to coarse grained	al	:::	-		
19.2	20 CO	ORE	100	93	60	>20				SANDSTONE with abundant micaceous latitude and occasion carbonaceous laminae. Weathering is not evident. Subhorizor are medium saced rough and planar. Subvertical fractures all	tal fractures e widely				
										spaced, rough and slightly undulating. Locally non intact	100 million 199		:		
							1								
						-						D	am	To D Boring	Dep
# Desci	riptio	n base	ed on	Drille	r's log	l.	la a de	nth of 4 00	m to de	ar services.		1	25	15 00 46.20	1
An Insp Ground	ection I-wat	er was	vas e enc	ounte	red at	a dept	h of 16.	80m.							
										Thick Fluch		Fin	No:		1
Driller		Orig	ginato	1	Struck	G Rose	round-with a To Tim	ater ne(mins) Ci	AOH	Vater Added University Time(hr) Returns Type To From To From To Time(hr) Returns Type To	Depth 16.80		po		
1.0 11 2		1	RD		16.8	0				30% Air/Water	6.20 8		DZ	201	c
WH	_		_								1 1 1 1		Snee	201	0

		DRILLING	AND G	EOT	ECHNICA	LLTDE	ilient: N ingineer: U	JRS	n Lana Corp	ration Limited Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core	Inspectic Rotary C Rotary C	on Pit Open H Core D	to tole to milling to	1.20 16.20 46.20	2
ca	N	271486	.3 .9		One	ILBUOH.	Vertical			Barrel; Air/Water Flush		ď		B	ackfil
-	Sample	Samp	les an	dTe	sts	Casing	Le (m(	vel DD)	Depth	Description of Strata		Legen	Depth	Symbol	Dept
	Depth 19.20	dA1	Re	Suit	1 N 8		86.	.34		see previous sheet					
	22.20	CORE	100	85	53 N		64	1.24	22.10	Very weak bright black COAL with some pyritisation and calcite veining Weathering is not evident. Subhorizontal fractures are very closely spa smooth and planar. Subvertical fractures are closely spaced, smooth planar. Locally non intact	aced, and				
					1		6	3.44	22.90	Moderately weak thinly laminated light grey MUDSTONE with some fos plant malerial, occasional micaceous laminae and occasional sandstor laminae. Weathering is not evident. Subhorizontal fractures are close spaced, smooth and slightly undulating. Subvertical fractures are wide spaced, smooth and slightly undulating. Locally non intact	si ne iy iy				
	25.20	CORE	100	98	67	3									
						1		30.14	26.2	Moderately strong cross bedded thinly isminated yellow fine to coarse grained SANDSTONE with abundant micaceous laminae and occasic carbonaceous laminae. Weathering is not evident. Subhorizontal fra- are medium spaced, smooth and slightly undulating. Subvertical fract are widely spaced, smooth and slightly undulating	onal ctures tures				
						6									
	28.20	CORE	100	98	65	9									
						4							blam	To	Dept
\$	emarks: # Descri An Inspe Ground-	ption ba action pit water wa	sed or was e as end	n Dril excav	ler's log. vated by lared at	hand to a depth c	a depth of 16.80m.	1.20	Im to c	ar services.			125	15.00 46.20	1
	nelino HW	0	RD	or L	Slruck	Grou Rose To	nd-waler p Time(min	s) C	UL Off	Water Added         Chiseling         Flush           From         To         From         To         Depl           From         To         From         Full         Alr/Water         18.80           30%         Alr/Water         48.20         30%         Alr/Water         48.20	RAUBU	FI	g No: B2 Sheet	3 of	5

ļ

2	tion: E	27148	6.3		Ori	entation	: Verti	cal		Barrei; Air/Water Flush				Ba	ckfill
	Nample	66586 Samp	oles a	nd Te	sts	Casir	9	Level (mOD)	Depth	Description of Strata		Legend	Water Depth	Symbol	Depth
	Dapih 28.20	Type	R	esult	-	Dept	h	86.34	-						
					8					see previous sneer					
										at 20.95m; 0.25m thick dark grey mudstone band					
	31.20	CORE	77	74	33	20									
									£						
						5									
						IP									
					ľ										
					-	3		52.79	33.5	Moderately weak thinly laminated dark grey carbonaceous MUI some fossi shell fragments and occasional ironstone nodules.	STONE with Weathering h and		1111		
				1		NI 2		52.1	4 34.2	undulating. Subvertical fractures are medium spaced, smooth undulating. Locally not intact	and signuy				
	34.20	CORE	100	99	65	7				SANDSTONE with abundant micaceous laminae, some carbor sanDSTONE with abundant micaceous laminae, some carbor laminae, occasional mudstone laminae and occasional convol weathering is not evident. Subhorizontal fractures are closely	aceous ited bedding. and medium				
										spaced, smooth and planar. Subvertical fractures are when your smooth and slightly undulating. Locally not intact	putoral				
						NI									
				+											
						11									
										-					
										-					
	37.2	CORE	95	5 92	63	13									
						>20				-					
										-					
										at 38.70m: 0.35m thick mica-nch band					
						1				1					
										-					
F	temarks	5:										F	Diam 125	Boring 15.00	Casin 15.00
	# Desc An Insp Ground	notion b bection p d-water v	ased oit was was e	on Dr s exca ncour	vated l tered a	y hand ta dept	to a de h of 15	pth of 1.1 .80m.	20m to c	ear services.			114	45.20	

	Ion: E	27148	6.3		10	rien	ation: Ve	rtical		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Co	re Rot	ary Co	re Dri	ling to	46.20	
	N	66586	5.9							Barrei, Airwaler i Iosh		1	2	Valer	Be	ckfill
s	ample	Sam	ples a	nd Te	ests	-	Casing	(mOD)	Depth	Description of Strata			Lege	Depth	Symbo	Depth
	Depth 37.20 40.20	CORE	R	esult 90	43	1	Depth	86.34	-	see previous sheet						
								45.34	41.00	Moderately weak think laminated dark grey carbonaceous MUC	STONE wi	th E				
					-	NI 2 NI		45.04	41.30	occasional ironstone bands and occasional plant rossi matchan Is not evident. Non intact Voorwaak duil black COAL with locally bright laminae. Weathe	ring is not					
						12			T	wident Non Intact Moderately weak thinly laminated dark gray carbonaceous MUI Moderately weak thinly laminated dark gray carbonaceous and	STONE wi	ith	-			
										sandstone laminae and occasional ironstone nodules. Weather evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are widely spaced, rough and	slightly slightly		=			1
								43.89	42.4	undulating	ned iron-ric	h :				
						9				Strong cross bedded thinly laminated yellow nee to coalse gial SANDSTONE with some carbonaceous laminace, some micace and occasional plant fossil material. Weathering is not evident	ous lamina Subvertic	e :				
										Subhorizontal fractures are closery spaced, smooth and plantal fractures are widely spaced, rough and slightly undulating						
	43.20	CORE	100	92	17	2				1						
						>20		42.5	9 43.7	-	bundant					
										Moderately weak using rainfield to the series and send some sail micaceous leminae, occasional ironstone bands and some sail laminae. Weathening is not evident. Subproizontal fractures a ennead semoth and planar. Subperfical fractures are medium	re closely spaced,			1		
						9	1			smooth and planar. Locally non intact			-			
						NI				-						
						1				-						
		1								1			_			
						1				5			-			
						N	7	10.	1 10				-	-	-	
17	-	-	-	-	-	4	j <u>c 15.00</u>	40.1	4 40.	END OF BOREHOLE						1
										-						
										1						
										1						
										-						
										-				1		
										-				1		
						_				1			Di	am F	To	Depth
	emarks # Desc	s: niption t	ased	on Dr	llers	log.		double of 4	an to a	aar services.			1	25	16.00 48.20	15.
R	An inc.	d-water	pit was was e	exca ncour	ivated	ata	depth of	16.80m.								
R	Ground															
R	Ground												1		-	
R	Ground		Origina	ator	Fire	de l	Ground	-water	Cut Off	Water Added         Chiseling         Flush           From         To         Time(nr)         Returns         Type	To Depth	RA	Fig	No:		
R	Drütei WH		Origina RD	alor	Stru	ick	Ground Rose To	l-water Time(mins)	Cut Off	Water Added         Chiselling         Flush           From         To         From         To         Time(nr)         Returns         Type           From         To         From         To         Time(nr)         Returns         Type           Soft         Alr/Water         30%         Alr/Water	To Depth 16.80 48.20	RAEB	Fig	No: B2 Shee	t 5 of	5

ļ

RAE	BUR	Clier CALLTD	ST A MINE ht: Nort	MBR ERAL In Lana	OSE HIGH SCHOOL, COATBRIDGE INVESTIGATION rkshire Council pration Limited	Contract Borehole	No: 2 No:	0857 03	1.20	
cation: E 2715	30.2 0	rientation: Ver	tical		Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Ar/Water Flush	- Rotary Rotary	Open I Core I	Hole to Drilling to	14.30 44.80	
N 6659	09.3	Casino	Level		Description of Strala	_	brage	Water	Belogu	Depti
Sample Sal Depth 2 0.00 RO-S	Result		(mOD) 82.08	Depth	# MADE GROUND					
Remarks: # Descriptor An Inspection Ground-wate Driller GM	based on Driller's I pit was excavated rwas not encounte Originator RD Schus	og. by hand to a d red. <u>Ground</u> ck Rose To T	water	cut Off	ear services.	To Depth 44.80		Diam 108 ig No: B3 Shee	To Boring 44.80	Depth Cc 12

R	RA			BI ND G	EOTE		N	Site: Client	ST A MIN Nor	MBRO ERAL In Lanar	DSE HIGH SCHOOL, COATBRIDGE	Borehole	No: 1	03	120	
Loc	ation:	E 27	1530.	2		Orie	entation	Engin	ical	5 Corpo	ration Limited Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush	Rolary Rolary	on Pit Open H Core D	to fole to milling to	14.30	-16
rogress	Samp Dept	N 66	Sample	3 es and Res	d Tesi sult	ts	Casir	ng th	Level (mOD) 82.08	Depth	Description of Strata		Legend	Water Depth	Symbol	De
	0.00								70.38	11.70	see provious sheet # Sandy gravelly CLAY					
chrical, Whistleberry KG, Hamilton Mus unv rev vivere titter and	-14	.90 C	ORE	TCR   100	SCR 1100	RQD 100 88	FI 2 NR 8		67.7	8 14.30	Strong thinly laminated yellow fine to coarse grained 'ron-rich S with some micaceous laminae, some mudstone laminae and s laminae. Weathening is not evident. Subhorizontal fractures a spaced, rough and planar. Subvertical fractures are widely sp and planar. Locally non intact	ANDSTONE ome sillstone re medkum acced, rough				
33 Reeburn Drilling and Geote	* 1	7.30	CORE	100	97	59	9									
09/2008 15:58							4									
20857.GPJ Printed: 05/							3								To	Dec
MOINTWPROJECTSV	Rema # Dr An I Gro	arks: escrip nspec und-v	tion ba tion pit vater wa	sed or was of as not	n Drill excav t encc	er's lo ated t	g. by hand ad.	to a d	epin of 1.	20m to cl	ear services.			Diam 108	Boring 44.80	
HOLE File: P	Di	iller SM	0	riginate RD	or	Struct	Ros	Fround-	waler ime(mins)	Cut Off	Water Added         Chiselling         Flush           From         To         To         Time(hr)         Returns         Type           From         To         From         Full         Air/Water	To Depth 44.60	F	ig No: B3 Shee	t 2 of	5

----

-----

	1011. C	27153	0.2		C	rien	tation: Ve	rtical		Air/Water Flush				
s	N ample_	66590 Samp	9.3 oles a	nd Te	ests		Casing	Level (mOD)	Depth	Description of Strata	egend	Water Depth	ymbol	Dept
1	Depth	Type	R	esult	-	_	Depth	82.08	20.20	see previous sheet			10	
	20.30	ORE	100	95	73	NI		61.58	20.50	Weak thinly laminated dark grey carbonaceous MUDSTONE with occasional listric surfaces. Weathening is not evident. Non infact				
						10		60.98	21.10	Strong thinky laminated yellow fine to coarse grained iron-non SAVLD FORCE with some micaceous laminae, some carbonaceous laminae and some fossi plant material (rooteis). Weathering is not evident. Subhorizontal fractures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and slightly undulating below 20.95m. Increasing to abundant carbonaceous laminae and				
						3				some convoluted bedding Strong thinly laminated dark grey iron-rich carbonaceous MUDSTONE with Strong thinly laminated dark grey iron-rich carbonaceous MUDSTONE with some ironstone bands and nodules, some sandstone and siltstone laminas and abundant plant fossil material (rootlets). Weathering is not evident Subhorizontal fractures are closely spaced, rough and silphty undulating. Subhorizontal fractures are widely spaced, rough and silphty undulating.				
								59,88	22.20	Strong thiniy laminated yellow fine to coarse grained iron-rich SANDSTONE with some micaceous laminae, some carbonaceous laminae, some mudstone and sitistone bands. Weathering is not evident. Subhorizontal frectures are medium spaced, rough and planar. Subvertical fractures are				
						3				widely spaced, rough and planar				
	23.30	CORE	100	100	88	8		-	*					
						2	-							
						8								
	26.30	CORE	100	100	60	14								
								54.7	8 27.3					
						8				Moderately strong thiny laminated dark grey MUDS Cover will occusion sandstone and sitsone laminae, occasional bands and nodules, some fossil plant material (leaves and rootlets), occasional listic 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 <sup>2</sup> . 0.05m thick coal band				
		4				17								
								53.6	8 28.0	Strong thinly laminated yellow fina to coarse grained iron-rich SANDSTONE with some silstone 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.				
	29.30	CORE	100	98	47	8								
3/7							12.00			-				
-	]		1	1		1						am E	loring	Cas 1 12

Loc	ation: E	271530	).2		Orie	ntation: Ve	rtical		Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Rotary C	ore D	rilling to	44.80	ť.
	N	66590	9.3				Level	-		end	Water	Ba	ickfi
ogress	Sample	Samp	les an Re	sult		Casing	(mOD)	Depth	Description of Strata	Leg	Depth	Sym	De
<u>L</u>	29.30				7 N 10		51.88	30.20	see pravious sheet Moderately strong thinty laminated dark grey MUDSTONE with abundant sandstone and occasional sitistone 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				
	32.30	CORE	100	83	30 N	0	49.33	32.75	Strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and stitstone laminae, some micaceous and carbonaceous laminae. Weathening 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				
						9	47.28	3 34.8	Weak dull black muddy COAL with mudstone bands, some pyritisation and locally bright taminae. Weathening is not evident. Subhorizontal fractures are very closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar. Locally non intact				
	35.70	CORE	95	95	59 2	11 17 17 17	48.1	8 35.9	Moderately strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and sitstone bands, some micaceous and carbonaceous laminae and some fossi 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				
						5 2 NI 8							
	38.8	0 CORE	100	95	32	9							
NIN I WWERDOEU LOUG	emarks # Desc An insp Ground	iption ba ection ph water w	sed on twas e as not	Drille excavi enco	ar's log. ated by untered	3 hand to a d	epth of 1.20	Om to cl	ar services.	0	Iam [	To I Joring 44.80	

-

-

R	RA	ORILLING	BAND GE	DTECHN		TD Clie	MIN ent: Nor pineer, UR	ERAL Ih Lan S Corp	ark	NVESTIGATION shire Council ation Limited	Inspect	ion Pit	to Hole to	1,20	_
.00	ation: E	271530	).2	C	rienta	ation: Ve	ertical		E	oulpment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush	Rotary	Core D	brilling to	44.80	ickfill
Progress	7	CORE	B.3 Result 100 92	Tests ilt 2 28	1 1 NI 20 3 NI 9 11 NI 1	Casing Depth	Level (mOD) 82.08 41.88	B 44.4		Description of Strata see previous sheet Moderately strong thinky taminated dark grey MUDSTONE with som sandstone and silistone taminae, some carbonacous and miceace Subhorizontal fractures are widely spaced, rough and slightly undulativ Subvertical fractures are widely spaced, rough and slightly undulativ Subvertical fractures are widely spaced, rough and slightly undulativ END OF BOREHOLE	e ius ating. Ig		Water Depth	Ba	Ckfill Depth
OLE FIRE P.(SINTWIPROJECIS) SUBSILISIN PRIMER UNIVERSITY SUCCESSION SUCCESSIO	Remark # Des An las Groun	s: cription b pection p d-water v	ased on it was ex vas not e Originator RD	Driller's ccavate ncount	log. d by h ered.	and to a Groun Rose To	depih of 1.	20m to 0	clea	Water Added Chiselling Flush From To From To Time(hr) Returns Type To Full ArWater 4	Depth (4.80	F	Diam 108 Fig No: B3		Depth Casinj 12.00

tion: E	271635.5	Oria	entation: \	Vertical		Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Alr/Water Flush	Rotary Core Drilling to	46.70								
N	666035.8 Samples a	nd Tests	Casing	Leve	Death	Description of Strata	2 Water 5 Depth	Backfill								
Depth 0.00	RO-S	esult	Depth	7	7.60 9.	# MADE GROUND										
# Desc An ins Ground	s: ription based pection pit was d-water was en	on Driller's lo excavated b acountered In	g. by hand to a workings	a depth of 1	.20m to c	ear services.		To Depth Boring Cas 48.70 17.								
5	Δ	F	31	U	R	N	Sile:	ST A		OSE HIGH SCHOOL, COATBRIDGE	Gor Bor	ehole I	No: 2	0857 04	7	
--------	--------------------------------------	----------------------------------	--------------------------------	------------------------------	---------------------------------	---------------------	-------------	---------------------	------------------	---	--	-------------------------------	---------------------------	--	------------------------	---------
		ORILLINK	GAND G	EOTE	CHNICA	L LTD	Engine	cal	S Corp	equipment Unimog Dando Multitec 10; 412 Core Barrel;	Ins Ro Ro	spectio blary O blary C	n Pit t pen H ore D	o tole to rilling to	1.20 17.30 46.70	
au		66603	5.8							Air/Water Flush		-	7		Bac	kfill
St	ampte	Samp	les an	d Test	ts	Casing		Level (mOD)	Depth	Description of Strata			Legend	Water Depth	Symbol	Dep
1	0.00	F						0.00		see previous sheet						
															ないないないないないないないないないないない	
	-17.10 -17.30	RO-R	TCR 100	SCR 93	RQD 72	F1 7 4		<u>69.7</u> 69.5	0 17.1 0 17.3	# SANDSTONE     Moderately strong light grey fine to coarse grained iron-rich SA     with some mudsions and sitistone laminas and some micaced     Weatharing is not evident. Subhorizontal fractures are mediur     rough and sighty undulating. Subvertical fractures are widely     rough and undulating	NDSTON Jus lamin spaced spaced,	νΕ αθ. Ι,		0,111,00,111,00,00,00,00,00,00,00,00,00,		1 1 1 1
					-	4									ToD	Peptr
te #AC	marks: Descr In insp Ground	iption ba ection p water w	ised or It was e vas enc	n Drille excava counte	r's log. Ited by red in v	hand to vorkings	a dep s.	oth of 1.2	0m to cl	aar services.			1	108	48.70	1
C	Dniller GM	р р	Driginato RD/EM Status	c –	Struck	Gro Rose	und-wa	iter e(mins) (	aut Off	Water Added Chiseling Flush From To From To Time(hr) Returns Type Full ArrWeter	<u>To Depin</u> 46.70	RAUBORZ	Fig	B4 Shee Scale	1 2 of 5 1:50	5

١

ĵ.

-

:--

LOC	auon: a	1 6660	35.8					Level		Air/Water Flush		end	Water	Bi	ickfill
ssauBou	Sample Depth	San	nples a	and T Resul	t	-	Casing Depth	(mOD) 86.80	Depth	Description of Strata		Feg	Depth	TWAS	Dep
<u>97</u>	17.30	CORE	100	100	27	20	17.00	66.50	20.30	see previous sheet Moderately weak and moderately strong thinky laminated off-white fine coarse grained SANDSTONE with some mudstone and sitstone lamin 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	to nae,				
	23.3	CORE	- 85	77	29	12 15 12	-								
and a second s	25.1	O COR	E 8	7 8	7 4	N N 5 17		61.9 61.2 60.6	0 24.9 0 25.6	# Possible PACKED WASTE (0.20m recovery of angular coal fragm Very weak duil black COAL with some pyritisation, calcite veining an locally bright lamines. NEOW. Non Intact (# driller indicates possible wasta and stoop) Moderately strong and strong cross bedded thinly laminated off-whit coarse grained SANDSTONE with some mudstone and sitistone lan some fossil plant material (leaves and rocts), some micaceous and carbonaceous laminae. Weathering is not evident. Subhorizontal fr	d some a packed te fine to ninae, ractures				
CONTRACTOR CONTRACTOR ACTION AND A REGARD AND A REPORT	-28	90 COF	RE s	10 1	800 3	e 	4	57.	90 28	are closely spaced, rough and planär. Subvertical fractures are wid spaced, rough and planär below 28,40m: a 0.50m ironstone band Moderalely weak thinly laminated dark grey MUDSTONE with occa sandstone and silstone laminate, occastonal micaceous laminate are carbonacous laminate, and occasonal plant fossi material (leaves Weathering Is not evident. Subhorizontal fractures are closely spat smooth and slightly undulating. Subvertical fractures are medium to smooth and slightly undulating.	sional nd .). spaced,				
WPROJECTS/20857.G	Remark # Des An Ins Groun	s: cription pection id-water	based pit wa	on D s exc ncou	avale	ilog. d by i d in w	nand to a d	epth of 1.2	tom to c	services.			Diam 108	To Boring 46.70	Dept

-----

-----

	M	6666	35.8			-					Air/Water Flush	_	0		B	ackfill
~	Sample	Sar	nples	and	Tests	5	Casing	Le (mi	OD) C	Depth	Description of Strata		Legen	Depth	Symbol	Dep
	28.90	Tyl	Т	Resi		10	Deput	88	0.80		see previous sheet					
	31.90	COR	= 10	0 10	0 8	9		5	4.50	32,30	Strong thinly laminated light gray fine to coarse grained iron-rich SANDSTONE with occasional micaceous faminae. Weathering i evident. Subhorizontal fractures are medium spaced, rough and Subvertical fractures are widely spaced, rough and planar	s not planar.				
	34.70	TOD TO	E ę	97 9	95	73	2		<u>51.25</u> 50.70	35.5	<ul> <li>Weak duil black muddy COAL with some pyritisation and locally laminas. Weathening is not evident. Subhorizontal fractures an spaced, smooth and planar. Subvertical fractures are closely si smooth and planar. Locally non intact</li> <li>Moderately weak thinly laminated dark grey MUDSTONE with o silisione and sandstone laminae, some carbonaceous laminae solution all gleaves and rootlets). Weathering is not evident.</li> </ul>	bright e closely paced, ccasional and plant und viating.				
	-37.7	70 CO	RE	97	97	70	2		49.80	37.0	Subvertical fractures are medium spaced, rough and stightly un Subvertical fractures are medium spaced, rough and stightly un Strong cross bedded thinly laminated off-while fine to coarse gr iron-nch carbonaceous SANDSTONE with abundant plant foss (leaves), occasional sitistone and mudstone laminae, coccasion (carbonaceous and micaceous bands and laminae. Weathering evident. Subhorizontal fractures are medium spaced, rough ar Subvertical fractures are widely spaced, rough end planar	ained 11 material al g is not nd planar.				
F	Remark # Desc	s: cription	base	d on	Drille	r's log	8		47.80	) 39.	Moderately weak thinly laminated dark grey MUDSTONE with stitstone, sandstone, micaceous and carbonaceous laminae, of ironstone nodules and some plant lossil material (leaves). We evident. Subhorizontal fractures are closely spaced, smooth a undulating. Subvertical fractures are widely spaced, smooth a undulating	some sccasional bathering is n ind slight ind slight	not	Diam 108	Ti Boring 46.70	

ļ

R	RA	E	BU	RI	Clie	MINE nt: North	RALI	NVESTIGATION	Borehole	3 No: 1	04	
Loca	ation: E	27163	5.5	Orient	Eng ation: Ve	ineer: URS	Corpor	alion Limited Equipment: Unimog Dando Multitec 10; 412 Core Barrel; Air/Water Flush	Rolary Rolary	jon Pit Open H Core D	to -lole to milling to	1.20 17.30 46.70
gress	N Sample	66603 Samp	5.8 Ites and Te	sts	Casing	Level (mOD)	Depth	Description of Strata		Legend	Water Depth	Back Digunds
Pro	40.70	CORE	100 100	70 >20		45.20	41.60	see previous sheet	ed Iron-rich			
	-			3				SANDSTONE with some micaceous, carbonaceous, sitistone ar mudstone laminae, occasional plant lossit material (leaves) and ironstone bands. Weathering is not evident. Subhorizontal fract medlum spaced, rough and planar. Subvertical fractures are wic rough and planar	recasional ures are tely spaced,			
	43.70	CORE	100 93	52 3		41.80	) 45.00	Moderately weak thinly laminated dark gray MUDSTONE with a	some			
				>2	0	40.1	0 46.70	suitatone, sandoura and consideration and planar fractures are medium spaced, smooth and planar fractures are medium spaced, smooth and planar fractures are medium spaced, smooth and planar	vident Subvertical			
2008 10:002 International Inte										-		
CTS/2085/.GPJ Primag. voiva	Remark	s									Diam 108	To D Boring 48.70
e: P:IGINTWPROJEC	Remark # Des An Ins Groun	s: pection b d-water	ased on Dr pit was exca was encour	ller's log. vated by tered in v	hand to a vorkings.	depth of 1.2	Om to cle	ar services.	F	2	108 Fig No:	48.70
CE FI	Drille	ir	Originator RD/EMc	Struck	Groun Rose To	d-waler Time(mins)	Cut Off	From To From To Time(try) Returns Type	46.70 A		B4	

ļ

Declement URS Corporation Limited       Inspection Prito         Contention: Vertical       Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barret, Atr/Water Flush         N 665945.3         Depth       Description of Strata       Implement: Lorry (Bedford) Mounted Dando 250; 412 Core Barret, Atr/Water Flush         Samples and Tests       Casing Cosino: E 271611.8       Depth Strata       Implement: Lorry (Bedford) Mounted Dando 250; 412 Core Barret, Atr/Water Flush         Dopth       Second       Casing       Level (mOD)       Depth       Description of Strata         0       Dopth       82.65       0.20       # TOPSOIL         0       WOD       Result       92.45       0.20       # TOPSOIL         0       WOD       Result       92.45       0.20       # TOPSOIL       1         0       WOD       Result       1       1       1       1         1       1       1       1       1       1       1         1       1       1       1       1       1       1         1       1       1       1       1       1       1         1       1	0 1.20 ole to 15.60 1
N 665945.3     Level (mOD)     Description of Strata     Page V       Depth     P. Result     Depth     0.20     # TOPSOIL       0.000     ROS     92.45     0.20     # TOPSOIL	Water Depth De
Deprin         JS         Nesson         Deprin         82.85         # TOPSOIL           0.000         RO-S         82.45         0.20         # MADE GROUND (peat and ash)         # MADE GROUND (peat and ash)	
Remarks:     72.95     9.70     # Sandy gravelly CLAY	「 - ハート・ハート・ハート・ハート・ハート・ハート・ハート・ハート・ハート・ハート・

-

•

ł

			-		5	Site:	ST A	MBF	OSE HIGH SCHOOL, COATBRIDGE	C	ontract	No: 2	0857	7	
λ			1	P	N		MIN	ERAL	INVESTIGATION	В	orehole	No:	05		
	DRILLIN	G AND G	EOTE	CHINICA	LLTD	Client	Nor	th Lan	arkshire Council	-					-
					E	Engine	er: URS	S Corp	bration Limited		Inspecti Rotary	on Pit	to tole to	1.20	
cation: E	27161	1.8		Orie	ntation:	Vertic	al	u.	Equipment: Lorry (Bedford) Mounted Dando 250; 412 Co Barrel: Air/Water Flush	re	Rolary	Core D	rilling to	47.30	
N	66594	5.3					Laural					2	Water	Bac	kfill
Sample	Samp	oles and	d Tes	sts	Casing		(mOD)	Depth	Description of Strata			Legel	Depth	Symbo	Dep
0.00	F	Rea	sun		Debui		82.65	-				0		1	
									see previous sheet						
												0		1.	
												0	- 1	1	
												- 9		1-	
														[]]	
												· • ·		1	
									-					1	
					1				-					1-	
									1			· • ·		11-	
-														5	
									-					1	
									-			· • · ·		1	
									-					1-	
									-				2	1	
						1			1			· • ·		.'	
								1	1				-	1	
									-				5	1-	
		TCR	SCRR		1		67.05	15.6		aulora	nd	-0		1-	
15.60	CORE	80	77	12 N	A				Very weak dark greyish brown sandy gravelly CLAY with suban subrounded fragments of mixed lithology. Weathering is evider reduction to clay material	ntas	114		2		
					3		66.55	16.1	Strong thinly laminated grey MUDSTONE with some micaceou	s lamína	ae,	E		R	11
									<ul> <li>occasional ironstone bands and some fossi plant material (lear bivalves). Weathering is not evident. Subhorizontal fractures a concad smooth and sitehity undulating. Subvertical fractures a</li> </ul>	are clos	ely sly		-	р <i>У/</i>	18
									spaced, smooth and sighty undulating. Locally non intact						
				>2	20			1	-						
1.															
									-			_			
	2			>	20			1							
1									-			_			
1												-			
18.60	CORE	100	97	22 1	0				OBIOW 10.00111, SOLIDE SANGASONE VANISHED						
					11				-						
				>	20							_			
									-			E	1	To De	Inth
emarks:			Dalla		-								em B 25 1	oring 5.00	Ca 15
# Desch An Inspe	peon ba action pit	Was ex	caval	ted by I ntered	nand lo e	depth	of 1.20	m to de	ar services.			1	14 4	7.30	
Qround-		11-1													
Driller	0	riginator	L		Groun	id-water	14.14 2	100	Water Added Chise/ling Flush	To Depth	R	Fig	No:		
WH		RD	S	Struck	Rose To	(Time(r		лОп	From 10 From 10 Foreign 10% Alr/Water 10% Air/Water	9.70 13.60 40.60	EB		B5	0.45	
Chk & Ap	p	Status						1	0% Alr/Water 10% Alr/Water	41.70 47.30	R		Scale	2 or 5 1:50	
GK		Final								1.010	N			200	_

2	A	E	-	3	U	F	RI	Site Clie	S Ment:	T AM	MBR RAL	OS IN	SE HIGH SCHOOL, COATBRIDGE	Borehol	IB NO:	105	5/		
2	tion: E	DR 27	1611	AND	GEO		Drien	Eng tation: Ve	ertical	URS	Corp	Eq	tion Limited	Inspec Rolary Rolary	lion Pit Open Core I	to Hole to Drilling	1.2 15 to 47	0 60 30	
Te	N	66	5945 Sampl	i.3 les ar	nd To	ests		Casing	Le	opul	Depth	-	Description of Strata	1	egend	Wate	ər İn	Bac	kfill Dep
	Depth 18.60	Type		Re	esult	-	_	Depth	82	2.65		-					ľ		
							12 NI/ 6						sea previous sneet						
	21.60	co	RE	100	98	43	7												
							>20		6	0.25	22.40	-	Very weak bright black muddy COAL with some pyritisation and cal veining. Weathering is not evident. Subhorizontal fractures are exi closely spaced, smooth and planar. Subvertical fractures are close	xite remely ly					
							NI						spaced, smooth and planar. Locally non-infact						
									4	59.20	23.4	5-	Moderately strong cross bedded thinly laminated yellow fine to coa grained SANDSTONE with abundant mudsione and sitstone lamin bitancerus laminas some carbonaceous laminas with fossi plant	se ae some naterial					
							8	-					(leaves) below 24.60m. Weathering is not evident. Subportionian are closely and medium spaced, rough and undulating. Subvertice fractures are medium spaced, rough and planar. Locally non intec						
	24.60	D C	ORE	100	97	55	5 3 N3 N3												
							ę	F					below 26.50m: 0.10m thick mudstone band						
	27.6	30 C	ORE	10	0 9	9 2	3 1	9		55.08	5 27.	60	Moderately strong thinly laminated dark grey MUDSTONE with oc ironstone bands and nodules, micaceous laminae, sandstone ban fossi plant material (leaves and rootists) and bivalve fossis. We not evident. Subhonzontal fractures are closely spaced, smooth Subvertical fractures are medium spaced, smooth and planar. Lo intact	casional inae, athering I and plana cally non	s				
							N	20				1 1 1							
								17											
F	Remark # Desc	s: cript	jon ba	ised	on D	nilor's	log.		donth	014.95		100	r sarvices.			Diam 125 114	Boi 15 47	To D ing 00 .30	(ep
	An ins Groun	oec d-w	tion pi ater w	t was vas no	ot en	avate count	d by ered	nand to a	asbru (	01 1.20									
-	Driffe WH	н I		Drigina RD	ator	SU	uck_	Ground Rose To	d-waler Time(m	ins) C	ut Off	F	Water Added Chise Eng Flush rom To From To Time(hr) Returns Type To 0% Alr/Water 1 Full Air/Water 1 Full Air/Water 1 Full Air/Water 4 0% Air/Water 1	Depth 70 360 0.60 1.70	CWIINS	Fig No B Sh	5 eet 3	of	5
	Chk &	APP C		Fina	al								10% Al/Water 4		J	SC	ale 1	.00	_

		DRILLIN	GAND	GEOT	ECHN	CALLT	Eng	ineer: UR	S Corpo	ation Limited	Inspection Rotary Ope	Pit to en Hole to	1.20	0
Loca	alion: E	27161	1.8		0	rientat	ion: Ve	rtical		quipment Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Alr/Water Flush	Rotary Col	e Drilling	1047.3	0
ress	N Sample	Sam	oles a	nd Te	sts	Ca	ising	Level (mOD)	Depth	Description of Strata		Wate Dept	withol m	D
Prog	Depth 27.60	Type	Re	esult	-	D	epth	82.65				-	6	T
	30.60	CORE	100	82	32	1 1 NI 12 6 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 4 NI 5 5 4 NI 5 5 4 NI 5 5 4 NI 5 5 4 NI 5 5 4 NI 5 5 4 NI 5 5 4 NI 5 5 5 4 NI 5 5 4 NI 5 5 5 4 NI 5 5 5 4 NI 5 5 5 5 5 5 5 5 5 5 5 5 5				between 34.40m and 35.80m: mudatone is light grey in colour				
	39.3	CORE	77	60	18	>20								
R	emarks: # Descr An inspe Ground	iption ba ection pr water w	sed or twas e as not	Drille encou	ar's log ated b untere	g. by hand	d to a de	apth of 1.20	Im to clea	services.	-	Diam 125 114	To Boring 15.00 47.30	Depi

i

-

-

R	A	E	B	U	R	N	Site:	ST A MINI	MBR ERAL h Lana	OSE HIGH SCHOOL, COATBRIDGE INVESTIGATION rkshire Council	Borehole	No:	05		_
.002	ation: E	27161	GAND	GEOTE	Or	ienta	D Engir	lical	6 Corpo	Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush	Rolary ( Rotary (	ion Pit t Open H Core Dr	ole to filling to	1.20 15.60 47.30	
SS	N	66594 Sam	5.3 ples ar	nd Tes	ats	Ci	asing	Level (mOD)	Depth	Description of Strata		Legend	Water Dapth	Bac	kfill Depth
Progre	Depth 39.30	Type	Re	esult	N	D 11	epth	82.65	-	see previous sheet					
						NI 5 NI 6		42.05	40.60	# Possible PACKED WASTE (0.40m recovery of mudstone fragme recovered as clayey gravel, complete loss of flush)	me fossil fractures				
	42.30	CORE	100	86	45	15		40.75	41.90	plant material (leaves). Weathering is not evident. Subvictures ar are widely spaced, rough and undulating. Subvartical fractures ar spaced, rough and undulating. Subvartical fractures ar grained SANDSTONE with some micaceous laminae, occasional grained SANDSTONE with some micaceous laminae, occasional carbonaceous laminae, some mudstone laminae, occasional plan material (leaves) and occasional ironstone nodules. Weathering J as orange iron staining. Subhorizontal fractures are closely and k medium spaced, rough and planar. Subvertical fractures are wide rough and planar	e widely arse It fossil s evident ocally ety spaced,				
						13 NI		38.5	5 44.1	0 Moderately strong thinly laminated light grey MUDSTONE with or sandstone laminae. Weathering is not evident. Subhorizontal fra sandstone unime encode amount and planar. Subvertical fra	ccesional actures are ctures are				
	44.3	CORE	100	97	53	13 NI/ 9				closely and medicin spaced, smooth and planar. Locally non intact					
Call Vyrillenout and a start						3									
Driling and Georgen	17					1	15.00	35	35 47.	30- END OF BOREHOLE				_	
15:58:48 Raebum															
Printed: 05/09/2006															
ROJECTS/20857.GPJ	Remark # Des	KS:	based pit wa	on Di	niler's avated	log.	and to a	depth of 1	.20m to	clear services.			Dlam 125 114	To Boring 15.00 47.30	Depth Ca: 15
File: P:/GINTWP	Grou	nd-water	Was f	not en	counte	ered.	Ground	waler		Waler Added Chiselling Flush	To Depth	2	ig No:	<u></u>	
EHOLE	Drill W	H	RI	0	Str	lick	Rose To	Time(mins)	Cut Off	From 10 From 0% ArrWater 10% ArrWater Full ArrWater	9.70 13.60 40.60		B5 She	et 5 of	5

Į

Bort E 271632.6         Oetentation: Vertical         Equipment. Lory (Bacford) Mounted Dando 250, 412 CORE         Netry Gaz Instigued         Barriel, Air/Water         Possible and 250, 412 CORE         Netry Gaz Instigued         Barriel, Air/Water         Barriel, Air/Water <t< th=""><th></th><th>DRILLIN</th><th>G AND GEOTEC</th><th>HNICAL LTD</th><th>ngineer: UR</th><th>S Corpo</th><th>ration Limited</th><th>Inspection Pit Rotary Open</th><th>to 1.20 Hole to 15.80</th></t<>		DRILLIN	G AND GEOTEC	HNICAL LTD	ngineer: UR	S Corpo	ration Limited	Inspection Pit Rotary Open	to 1.20 Hole to 15.80
No Boolds J.         Table         Casing         (mOU)         Depth         Description of Strata         g         Value         Value         G         Value	tion: I	E 27163	2.6	Orientation: \	/ertical		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush	Rotary Core L	Janing 1043.00
Dech S Resul Upp 654 015 PY0600 100 1005 015 015 PY0600 1005 015 015 PY0600 1005 015 PY0	Sample	Sam	s. I kes and Tests	Casing	Level (mOD)	Depth	Description of Strata	Legend	Water Depth E Depti
76.24 9.70 # Sendy graveby CLAY	0.00	RO-S	Result	bopti	85.94	0.15	# TOPSOIL # MADE GROUND (peal and ash)		
76.24 8.70 # Sandy gravely CLAY									
76.24 8.70 # Sandy gravely CLAY									
76.24 9.70 # Sandy gravelly CLAY									
76.24 9.70 # Sandy gravelly CLAY									
76.24 9.70		-							
To De					76	9.24 9.	0 - # Sandy gravelly CLAY		
Remarks:       Diam       Boring:         # Description based on Driller's log.       114       45.60         An inspection pit was excavated by hand to a depth of 1.20m to clear services.       114       45.60         Ground-water was not encountered.       Image: Complexity of the service of the	Remar # Des An In Grou	ks: scription b spection p nd-water	ased on Drille oft was excava was not encou	r's log. Ited by hand to intered.	a depth of 1.	20m to c	ear services.		Diam To Depth Boring Ca 114 45.60 16

ł

and from inst. ()	RILLINGF	UND G	LUIC	of aleon	2210	Engine	er. URS	6 Corp	pration Limited	Rotary Rotary	Open H Core Dr	ole to illing to	1.20 15.80 45.80	
ation: E 2	71632.	6		Orie	ntation	: Verti	cal		Barrel; Alr/Water Flush				Bac	Lfill
Sample	Sample	s and	Tes	s	Casin	g	Level (mOD)	Depth	Description of Strata		Legend	Water Depth	Symbol	Depth
15.80	CORE	TCR 1 100	95	80D 62 87	FI 1 3		70.4 70.2 70.1 69.6 65.	4 15.5 4 16.7 4 15.8 4 16.3 9 4 18.8 19	see previous sheet	occasional nlack ome nae and undulating utating utating over fine to ccasional nae. paced, roug planar				15.50
temarks:	tion has	ed on	Dalle	rsloo				1			D	iam 1 14	Boring 45.80	Casin 16.00
An inspect Ground-v	tion pit v rater wa	was ex s not e	encou	ited by	hand t	o a dej	oth of 1.2	Om to d	aar services.					

-----

		DRILLING	AND	GEOT	ECHN	CALLTD	inginer	Non er: URS	o Corp	bration Limited	on Pit	to Hole to	1.20	
a	tion: E	271632	2.6		0	ientation:	Vertic	al		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush	Core D	Drilling to	45.80	
	N	665853 Sampl	3.1 les ar	nd Te	sts	Casing		Level	Death	Description of Strata	egend	Water	Ba	Ckfill
	Depth 18.80	Type	Re	esult		Depth		85.94	-	Moderately strong thinly laminated dark grey MUDSTONE with some sendstone and sitstone 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			ŝ	
					-	5								
	21.80	ORE	100	97	90	5								
						3		63.54	22.40	Moderately strong and strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and sitstone taminae, 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								
	24 80	CORE	400	70	62	12		61.19	24.7	Moderately strong thinly laminated dark grey MUDSTONE with occasional     advance and sandshore laminae, occasional micaceous and carbonaceous				
	24.00	oone	100	10	UL.	12		60.64	25.3	aminae. Weathering is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are medium spaced, smooth and planar. Subvertical fractures are medium spaced, Strong cross bedded thinly faminated yellow fine to coarse greined SANDSTONE with occasional mudsione and sitstone laminae and some micaceous laminae. Weathering is not evident. Subhorizontal fractures are micaceous and reuro and planar. Subvertical fractures are widely spaced, J				
						14				Vough and planar Noderately strong thinly laminated dark grey MUDSTONE with occasional sendstone and situatione laminate and occasional shell fossi material. Weathening is not evident. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are widely spaced, smooth and planar, as apprive 0 and thick mussel band				
						9		59.34	26.6	Weak du black COAL with locally bright laminae and some pyritisation. Weakhening is not evident. Subhorizontel fractures are closely spaced, smooth and slightly undulating. Subvertical fractures are closely spaced, amooth and slightly undulating Moderately strong thinly laminated grey MUDSTONE with abundant sandstone and slightly undulating.				
	27.80	CORE	100	93	68	6				Iaminae, some fossi plant material (reaves) sind oucasional instruction nodules. Weathering is not evident. Subhorizontal fractures are midium spaced, rough and sightly undulating. Subvertical fractures are widely spaced, rough and sightly undulating				
						2	a.	57.2	4 28.7	0 Moderately strong and strong cross bedded thinly laminated yellow fine to coarse grained SANDSTONE with some mudstone and sitstone isminae.				
						3				<ul> <li>abundant micaceous and carbonaceous laminae and some pient rossi material (feaves). Weathering is not evident. Subhoricontal irrectures are medium spaced, rough and planar. Subvertical fractures are widely spaced, rough and planar</li> </ul>				
2	emarks: # Descri	ption has	sed of		er's lo	3		<u> </u>	_	1	11	Diam E	To D Boring 45.60	Pepth Ca
	An Inspe Ground-	ction pit water wa	was of	excav	vated to ounter	y hand to ad.	a dept	n of 1.20	im to de	ar services.				
	Driller WH	Or R	riginate	or	Struck	Grou	nd-wate	mins) C	ut Off	Water Added         Chiseling         Flush           From         To         Time(hr)         Returns         Type         To Depth           From         To         From         Full         AtrWater         45.80         E	Fi	g No: B6		-

2 ^	F	R		R	Si N	te: ST A	AMBR	OSE HIGH SCHOOL, COATBRIDGE Contract No INVESTIGATION Borehole No	2085 106	7	
	DRILL	NG AND	GEOTE	ECHNIC	AL LTD	ient: Nor	th Lana S Corpo	ration Limited	Pit to	1.20	
								Rolary Op Rolary Op Rolary Core Rolary Core	en Hole to re Drilling to	15.80	)
cation:	E 2716	32.6		On	entation: N	/enical		Barrel; Air/Water Flush		1 0	1.60
	N 6658	53.1 noles at	d Tes	sts	Casing	Level	T	Dependence Strata	Water Depth	loqu	Den
Depu	h &	Re	sult		Depth	(mOD) 85.94	Depth	Description of oracle		S	Deb
2 Depti 27.8 30.8		E 100	90	60	θ 11 5 3	<u>52.2</u> 51.3	4 33.70	Moderately strong thinly laminated dark grey MUDSTONE with some sandstone and sitistone laminate, occasional plant lossi 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. Strong cross bedded thinly laminated yellow fine to coarse grained SANIOSTONE with occasional mudatione and sitistone laminae, some micaceous laminae, 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 planar			
Rema group	39.80 CC) arks: escriptior inspection und-wate	RE 10( DRE 11 based - privas no	000 71 exca	8 60 Mer's k	14 12 3 10 29. by hand to ed.	49.	44 38.5 20m to c	ear services.	Diam 114	<u>Tin</u> Bonn 45.60	
REHOLE FUELYIC	riller VH	Origina RD/Ei	NC	Struc	Grou * Rose T	ind-water b (Time(mins)	Cut Off	Water Added         Chiseling         Flush           From         To         From         To         Time(hr)         Returns         Type         To Depth           From         To         From         Full         Air/Water         45.60         E	Fig No: B6 She	et 4 c	f5

i

i .

ł

÷

RA	BRILLING	<b>BU</b>	RI		lient:	MINI Nort	ERAL h Land	INVESTIGATION rkshire Council pration Limited	Bo	nspection Rotary Op	Pit to en Hole to	1.20 15.30	
cation: E	271720	2	Orien	tation:	Verti	cal		Equipment: Lorry (Bedford) Mounted Dando 250; 412 C Barrel; Air/Water Flush	ore F	Rotary Cor	e Drilling t	0 45.30	สป
Sample	Sample	es and Test	s	Casing		Level (mOD)	Depth	Description of Strata			B Water	Defunding Def	ep
	R0-5					91.28 89.88 87.48	1.60	# TUPSUL # MADE GROUND (clay) # MADE GROUND (peat and esh) # Sandy gravelty CLAY					
Remark # Desc An ins	s: cription ba pection pil	sed on Drille was excave	ers log. aled by	hand to	o a de	pth of 1.2	20m to d	lear services.			125 114	16.00 45.30	
Groun	d-water w	as not enco	untered	•									
Drille WH	or O	riginator RD	Struck	Gro Rose	ound-w To Tin	ater ne(min.s)	Cul Off	Water Added         Chiseling         Flush           From         To         From         To         Time(hr)         Returns         Type           From         To         From         To         Full         Alr/Wat           40%         Alr/Wat         20%         Alr/Wat	To Osp r 22.00 r 27.30 r 45.30	RQUAN R	Fig No: B7 She	et 1 of 5	5

1

.

1

-							-		ANTINOU CONTRAINCE	Contract	No: 2	0857	7	
						Site:	ST A	MBR	OSE HIGH SCHOOL, COATBRIDGE	Borehole	a No:			
2		FF	311	R	N	011	MINI	ERAL	INVESTIGATION		1	07		
		DRILLING	AND GEOT	ECHNIC	ALLTD	Client:	Nort	n Lana				2	1 00	
-					1	Engine	er: URS	Corp		Rotary	Open H	lole to	15.30	
1	tion: E 2	271720	.2	Orie	entation:	Vertic	al		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core	Rotary	Core D	nuing to	45.30	
	N	666021	.4						Barrel, Alliveater Fitish				Bad	ckfill
-	amila	Sampl	es and Té	sts	Casing		Level		Description of Strala		den	Water	Toque	Dent
1	Depth	ype	Result		Depth		(mOD) 91.48	Depth			1		S.	
	0.00								Please see previous page		1. 0.		1	
													1.	
											0		1	
													1.1	
					1						0		1.1	
											-0		N	
								1					1.	
Į											0		1	
													1	
									1		0	1	1.	
								1				-	1	
									-			-	1	
									] .				1.	
									-			T	1.	
					1	1		1 2	-			-	1.	1
									-			ē	1)-	
									1		-0	1	1.	
							76.58	14.9	-			0	50	14
	14.90	RO-R							# MUDSTONE				M	15
	15 30	COPE	TCR SCR	RQD	FI		76.18	3 15.3	Moderately weak thinly laminated dark grey MUDSTONE with occas	lonal	E	E	-	
	10.30	SOILE	100 00						silistone and sanosione raminae, occasional insurio surfaces, occasional plant fossil material (leaves) and occasional micaceous and carbon - plant fossil material (leaves) and occasional micaceous and carbon - leaving the surface weather of the surface sector of	sely	E	=		
									<ul> <li>spaced, smooth and planar. Subvertical fractures are widely spaced smooth and planar. Locally non Intact</li> </ul>			3		
												=		
					4							1		
									-			1		
									1			1	1	
												=		
					11				-			1		
									1					
									j		E	H		
								10				E		
	18.30	CORE	100 92	29	13				1		E	3		
											-	-		
									1		E	=		
					-				4					
					8		1		1			-		
									1		E	Ξ		
												lam	To D	apt
e	marks:	tion her		lar's lon							1	25	15.00	1
11/	An inspe	ction pit	was excal	valed by	hand to	a depti	n of 1.20	Om to cle	ar services.			14	45.30	
(	-DUNOI6	water Wa	IS NOT BUCK	unteret										
	Driller	Or	iginator	Struck	Grou Rose T	und-wate	r mins) C	ut Off	Water Added         ChiseJing         Flush           From         To         Time(hr)         Returns         Type         To Do           From         To         From         Full         Alr/Water         22.0	ph RAE	Fig	No: B7		
	10/1-1		F		1	1			40% Alr/Water 27.3	VID				
	WH							1	20% Air/Water 45.5			Sheet	2 of 5	5

-----

Loc	ation: F	27172	0.2		10	Drient	ation: Ver	tical		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Rotary Or Rotary Co	ore D	rilling to	45.30	
	N	66602	1.4		1			Laural		Banes, Alliverater Fresh	P	Water	Ba	ckf
ogress	Sample	Sam	oles al	nd Te	ests	-	asing Depth	(mOD)	Deplh	Description of Strata	Lege	Depth	Symbo	De
<u>a</u>	18.30	<u>e</u> ,				5				Please see previous page				
	24.30	CORE	85	95	29	>20 5 5		69.78 69.48 68.69 68.49 67.90 67.73	21.70 22.00 22.86 1 23.00 3 23.51 3 23.71	Strong cross-bedded thinly faminated yellow fine to coarse grained cross-bedded SANDSTONE with some mudstone and silistone laminae and some micaceous and carbonaceous laminae. Weathering is evident as orange inco sualning. Subhorizontal fractures are obsely spaced, rough and slightly undulating. O.40m recovered as very weak and weak thinly laminated black MUDSTONE with occasional listic surfaces. Weathering is evident as orange inco staining. Subhorizontal fractures are very closely spaced, smooth and slightly undulating. Subhorizontal fractures are very closely spaced, smooth and slightly undulating. Subhorizontal fractures are very closely spaced, smooth and slightly undulating. Locally not intact. # Driller indicates packed waste with a reducbon to 40% flush. New 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. Subvertical fractures are very deset spaced, smooth and planar. Subvertical fractures are very weaks man with some locally bright laminae, and abundan plant fossis material (laevas and roots). Weathering is not evident. Subhorizontal fractures are medium spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar very weak and weak dull black COAL with some locally bright laminae, some calcie veining and some pyritisation. Weathering is wident as orange from scalcie veining areas one pyritisation. Weathering is wident as orange from scalcie veining and some pyritisation. Weathering is evident as orange from scaling. Subhorizontal fractures are closely spaced, smooth and planar. Subvertical fractures are closely spaced, smooth and planar Modrately weak to moderately strong thinky laminated dark grey MuDSTONE with some silistone and sandsione laminae, some miccecous and carbonaceous laminae, some plant fossis material (laevas and roots), cocasionel konstone bands. W				
16	27.3	O CORE	100	100	37	9	15.00			- - - - - - - -				
						4				at 29.70m: 0.60m thick ironstone band	D		To C	)ept
IF.	# Desc An Insp Ground	ription ba rection p I-water w	t was tas noi	n Dri excav t enco	ter's l vated ounte	og. by he red.	ind to a de	apth of 1.2	0m to cł	ar services.	1	25 1 14 4	6.00 6.30	1

L

--

tion: E 2	71720.	2	-	Orie	ntation: '	Vertical			uipment: Lorry (Bedford) Mounted Dando 250; 412 Core	Rotary	Open H Core D	iole to hilling to	15.30	
N 6	66021.	4					lava		Ballel, Allywater Floor	-	pue	Water	Ba	ckfill
Sample	Sample	Res	Test	5	Casing Depth	(11	OD) D	epth	Description of Strata		Leg	Depth	Symb	Dept
Depth 27.30 30.30 CC	ORE 10	90	B7 1	5 6 2 2 51 1	2	9	57.58	33.90	Moderalely strong and strong thiny laminated off-white fine to coa grained SANDSTONE with occasional mudstone and sitistone lar some micaceous and carbonaceous laminate and occasional par material (leaves and roots). Weathering is not evident. Subhoriz fractures are medium to widely spaced, rough and planar. Subver fratures are widely spaced, rough and planar.	irse ninae it fosai tosai tical				
36.30	CORE	100	100	52	2		53.88	36.9	Moderately weak to moderately strong thinly laminated dark grey MUDSTONE with some sitistone and sandstone laminae, some and carbonaccous laminae, occasional ironstone bands and no- some fossi plent material (leaves). Weathering Is not evident. S fractures are medium spaced, smooth and plenar. Subvertical fr widely spaced, smooth and plenar. Strong and very strong cross bedded thinly laminated yellow find grained cross-bedded SANDSTONE with some mudefone and i faminae, some micaccous and carbonaccous laminae and occe ironstone bands. Weathering is not evident. Subhorizontal fractu- medium spaced, rough and plenar. Subvertical fractures are with rough and planar	micaceous Julas and Jubhorizonta actures are a to coarse sistona sistonal ares are fely spaced				
39.30	CORE	100	) 100	52	3								To	Depth

R	2	FI	R		R	Site	ST A	ERAL	OSE HIGH SCHOOL, COATBRIDGE	Bo	ntract No rehole No	<sup>2</sup> 20 0: 10	)857 )7		
		DRILLIN	GAND	GEOTEC	CHNICA	LTD	ineer: UR	s Corpo	Institute Countries	In	spection	Pit to		1.20	
		07470	0.0		Ories	Itation: Ve	artical		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core	e R	otary Ope otary Cor	en Ho re Dril	le to 1 ling to 4	15.30 45.30	
LOCA	auon: E	66602	1.4		oner	Heritorit VC			Barrel; Alr/Water Flush					Back	kfill
ress	Sample	Samp	des a	nd Test	\$	Casing	Level (mOD)	Depth	Description of Strata			legen	Vater Depth	D	ap
Prog	Depth 39.30	Type	R	esult	-	Depth	91.48	40.20	Please see previous page		- ::	::		-00	
					2		01.20		Moderately weak and moderately strong thinly leminated dark gre- MUDSTONE with occasional silicione and sandstone laminae, so micaceous and carbonaceous leminae and occasional ironslone e Weathening is not evident. Subhorizontal fractures are closely spa smooth and planar. Subvertical fractures are widely spaced, smooth and planar.	nne nodules aced, oth and					
							50.58	40.90	planar Strong and very strong cross bedded thinly laminated years grained cross-bedded SANDSTONE with mudstone and sitistone and micaceous and carbonaceous laminae. Weathering is not ev and micaceous and carbonaceous laminae, Weathering is not ev Subprotocalal infactures are medium spaced, rough and planar. S	to coan laminad Ident ubvertic	se e xal				
					6		49.78	41.70	fractures are widely spaced, rough and planar. Cooldy not deal of the planar. Cooldy not deal of the planar of the	y eous ar	id la				
	42.30	CORE	87	77 2	3 >20				carbonaceous lammae and occasional part toss mand, smooth a not evident. Subhorizontal (ractures are closely spaced, smooth a Subvatical fractures are medium spaced, smooth and planar. Lo Infact	and plar scally no	har.				
								-							
					8				-						
					1	2									
									-						
17/	Π					-	46.1	8 45.30	END OF BOREHOLE						
							-						-		
									-						
									-						
									-						
									-						
D'80'01															
212002															
nich :Da									-						
Anna I									1						
857.GP.									1						
CTSV20	Pomodu		_		-							Di	am E	To De Boring	90
NTWPROJEC	# Desci An Insp Ground	ription b ection p -water v	ased oit was was n	on Dnile excave ot encou	ated by untered	hand to a	depth of 1.	20m to d	ear services.			1	4	45.30	
File: P:/Glt	nellinG	_	Orlgina	ator	Struck	Ground Rose To	1-water Time(min)	Cut Off	Water Added         Chiseling         Flush           From         To         Time(hr)         Returns         Type           From         To         Flush         AinWater	To Depth 22.00	RAL	Flg	No:		L
	WH		RD			T			40% Air/Water 20% Air/Water	27.30 45.30	B		Sheel	15 of 5	5
SEHOLE				_									Santa	1.50	

ļ

RA	EBL	IRN	Site: ST MI Client: N	AMBR NERAL orth Lana	OSE HIGH SCHOOL, COATBRIDGE INVESTIGATION rkshire Council	Contract No: Borehole No:	2085 108	7
ocation: E	E 271706.5	Orientatio	Engineer: U n: Vertical	RS Corpo	ration Limited Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush	Inspection Pi Rotary Open Rotary Core	t to Hole to Drilling to	1.20 15.00 45.00
Sample Depth	Samples and Resu	rests Casi	th 87.1	el D) Depth 28	Description of Strata	Legend	Water Depth	Backdill Dept
Remark # Des	(s: cription based on C spection pit was exc	philer's log.		7 <u>7.86</u> 9.4	# Sandy gravely CLAY		125 114	- ハーン・シーン・シーン・シーン・シーン・シーン・シーン・シーン・シーン・シーン・シ

				-		1.0			-		THINK CONTRACT	Contract	No: 2	085	7	
	-					Si	te: S	ST A	MBR	ROS	E HIGH SCHOOL, COATBRIDGE	Borehol	e No:			
)		FF	21		RI	NL	N	AINE	RAL	- IN			1	08		
1		RUNG	AND GE	EOTEC	HNICA	LTD	lent:	Nort	n Lan	arksr	nire Council					
1		A THEAT OF				E	ngineer	URS	Corp	orati	on riumen	Rotary	Open H	lole to	15.00	0
		2054206	6		Orier	ntation: \	/ertica	-		Equ	ipment: Lorry (Bedford) Mounted Dando 250; 412 Core	Rolary	Core D	rilling to	45.00	D
L		/1/00.	.5			Augura 1	onice				Barrel; Alr/Water Flush	1		_	1 0	
	NE	65851	.5			T	TL	evel	-	-			end	Water	Ba	ackin
3	ample	Sample	es and	lest	\$	Casing	(n	nOD)	Depth	1	Description of Strata		Leg	Depth	Symt	Dep
C	lepth F	dK:	Res	ult	_	Deput	8	7.26		-			10.		1.	
ľ	0.00									1	see previous sheet				1	
þ										1			-0		11-	{
										1					[.'	
										1					11	1
										-					1.	
										-					1	
										-					N	
										1				5	1)	
	- 1									]			· · ·		1	1
										-				2	t.	+
										-				-	1	1
										1				10	1	1
										1				-	1.)	1
										1				D	ľ,	1
										]			-0_	5	11	-
										-				Ö	1:	1
									1 -	-			0	-	1	1
								72.95	144	10				io.	D	1
	14.40	RO-R				-		12.00	14.4		# SANDSTONE			]	M	01
														:	1	"
			TCR	SCRR	QD F	1		72.28	15.0	00	Moderately strong and strong cross bedded thickly and thinly lamit	nated		1	1	
	15.00	CORE	100	83	77 1	4				-	grevish white fine grained SANDSTONE with bands and laminate in mudsione, micaceous laminae and occasional carbonaceous laminate mudsione, micaceous laminae mudsione, micaceous laminae mudsione mudsione, micaceous laminae mudsione mu	inae. nd widely	111	3		
										1	Weathering is not evident. Subnorzonial nactures are increasing locally closely spaced, rough and undulating. Subvertical fracture	sare	1	:		
				1			11			]	medium spaced, rough and underword			:		
						_				-			111	:		
					[1	2				-			1.1	1		
										-						
	-									1						
									1	]			111			
						7	11			-			::		1	
			1							-			1			
										1						
										1						
	18.00	CORE	100	92	72	1				]			::			
										-			::			
								1		-				::		
										-				::		
	1					4				1				::		
		1								-				::		
	1									-				::		
								67.	36 19	9.90			F	<u> </u>	To	o Dep
	marke			1				-		_			-	125	Boring	1
-	# Descri	ption ba	sed on	Drile	r's log	hand to	a decih	of 1.2	Om to a	clear	services.			114	45.00	
	An inspe Ground-	water wa	as not	encou	intered	d.	~ achai									
											Glasting Flush		F	ig No:	-	_
			_	-		Grou	ind-water	r la v	0.04	Fre	Valer Added Crusewing Type To om To From To Time(hr) Returns Type To	Depth				
	Driller	0	riginato		Cin vale	PACA T	o Time!	nus	Qui Qui					1111		
	Driller WH	0	riginato EMC	F	Struck	Rose T	o Time(r	nuns)	ouron		Put Antraisi			She	et 2 o	f 5
	Driller WH	0	EMC Status		Sinck	Rose T	o Time(r	nins)	ouron		PUI ANTAIN			She	et 2 o	of 5 0

Ţ

2	A	E	B	U	TECH		N .LTO	Site: Client:	ST A MIN Nor	MBR ERAL	OSE HIGH SCHOOL, COATBRIDGE INVESTIGATION Investigation Limited Instance	B No:	108 108	1.20	
~	tion E	2717	06.5		10	Drien	tation:	Verti	cal		Equipment Lorry (Bedford) Mounted Dando 250; 412 Core Rolary	Open I Core D	tole to	15.00	
~~	N	6658	51.5								Barrel; Air/Water Flush	g	Moter	Ba	ckfill
1	Sample	Sar	nplesa	and T	ests		Casing		Level (mOD)	Depth	Description of Strata	Leger	Depth	Symbol	Dapt
	21.00	CORE	F 100	88 88 95	67 67	13 >20 2 4 6			(mOD) 87.26	21.90	Weak, moderately weak and moderately strong binky laminated dark grey         MUDSTONE with bands of carbonaceous mudstone, abundant fossil         bivatve remains, occasional fossil plant remains towards base and some         pyritisation. Weathering is not evident. Subhorizontal fractures are closely         spaced, rough and undulating.         at 20.80m: 0.07m thick iron-rich band of mudstone         Moderately strong and strong cross bedded thickly laminated greyish white         fine grained SANDSTONE with bands and iaminae of mudstone.         Weathering is not evident. Subhorizontal fractures are closely and medium spaced, rough and undulating. Subvertical fractures are closely and medium spaced, rough and undulating. Subvertical fractures are closely and medium spaced, rough and undulating.			31a	
R	-27.0		10 IC	0 8	8 62	2 1	4						Xam	To D Boring	
R	emarks # Desc An insp Ground	s: pection d-water	based pit was was n	on D s exc ot en	niler's avate count	log. d by h ared.	Grou	a dep	oth of 1.2	Om to d	Water Added Chiselling Flush From To From To Time(hr) Returns Type To Depth	F	125 114 g No:	15.00 45.00	11
	WH Chk & A	φρ	EM	C IS									B8 Shee Scale	t 3 of 4 1:60	5

-

•

Decide 1.3         Barroll (M/Weild' Prush)         Barroll (M/Weild' Pru	~	ation: F	27170	3.5		10	rientati	on: Ver	tical		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Ro	tary Open itary Core I	Drilling t	0 45.0	ō
Samples and Teshs         Casho (mod)         Casho (mod)         Deskh         Deskh         Besult (mod)         Deskh         Set (mod)         Deskh         Set (mod)         Set (mod) <th< th=""><th>~</th><th>N</th><th>66585</th><th>1.5</th><th></th><th></th><th></th><th></th><th></th><th></th><th>Barrel; Air/Water Plush</th><th>- 1 -</th><th>1</th><th>IB</th><th>ackfi</th></th<>	~	N	66585	1.5							Barrel; Air/Water Plush	- 1 -	1	IB	ackfi
2 Daolo B         Result         Depth         IP 200         Control         IP 200         Control           3000 CORE         100         IP 73         6		Sample	Samp	les ai	nd Te	sts	Ca	sing	Level	Denth	Description of Strata	egenc	Depth	Inthol	De
30.00 CORE       100       97       73       6         0       0       0       0       0       0       0         35.00       CORE       100       77       0       0       0       0         35.00       CORE       100       77       0 <td>0</td> <td>Depth</td> <td>Type</td> <td>Re</td> <td>esult</td> <td></td> <td>De</td> <td>pth</td> <td>87.28</td> <td>Deper</td> <td></td> <td></td> <td>1</td> <td>ŝ</td> <td>1</td>	0	Depth	Type	Re	esult		De	pth	87.28	Deper			1	ŝ	1
35300 CORE         00         27         0         200		30.00	ORE	100	97	73	5				see previous sheet				
33300 CORE         100         85         45         13           38000 CORE         100         77         40         20           40.00         200         77         40         20           40.00         200         77         40         20           40.00         200         77         40         20           40.00         200         77         40         20           40.00         20.00         77         40         20           40.00         20.00         77         40         20           40.00         20.00         77         40         20           40.00         20.00         77         40         20           40.00         20.00         77         40         20           40.00							6		56.36	30.90	Moderately weak and moderately strong thinly laminated grey MUDSTON with bands and laminae of sitsione and sandstone, micaceous laminae a locally ion-rich. Weakinering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating	id			
33.00 CORE         100         85         45         13           35.00 CORE         100         77         40         220           55.00 CORE         100         77         40         220           55.00 CORE         100         77         40         220           6         50.06         37.20         Moderately wak and moderately storeg thickly antihisted dill black muddy foasily and industring.         Subtraction of the formation of the grant							6								
38:00 CORE     100     77     40     >20     61.06     38:20		33.00	CORE	100	85	45	13								
36:00 CORE       100       77       40       >20         61:06       36:20															
36:00 CORE       100       77       40       >20															
38.00       CORE       100       77       40       >20       at 38.10m: 0.05m thick mussel band         38.00       CORE       100       77       40       >20       Moderately weak and moderately stong thickly laminated dull black muddy from the area standard for a plant for an area charmely remains. Weathering is not evident. Subtracting is not evident. Subtractis fractures are closely and medium spaced, rough and u							7								
Algorithm       Algorithm       Algorithm       Algorithm       Algorithm       Algorithm       To Der         Algorithm       Algor       Algorithm       Alg		36.00	CORE	100	77	40	>20		51.0	5 36.2	at 36,10m: 0.05m thick mussel band	dy			
39:00       CORE       93       82       67       6											Moderately weak and moderately such that interaction of a submatrix of the set of mudsions and submatrix plant COAL with bands and laminae of mudsions and sbundant fossil plant remains. Weathering is not evident. Subhorizontal fractures are extrem closely, very closely and closely spaced, rough and undulating. Subver fractures are closely spaced, rough and undulating	ely ical			
39:00 CORE       93       82       67       6 <ul> <li>48.36</li> <li>38.00</li> <li>Moderately strong and strong thickly laminated off-white fine grainad strong the strong and undulating strong and strong the strong and strong the strong and strong the strong and undulating strong and strong the strong and strong s</li></ul>							6		50.0	8 37.3	Moderately strong and strong cross bedded thickly and thinly laminated fine grained SANDSTONE with bands and laminae of mudsione, carbonaceous and micaceous laminae and some fossi plant remains. Weathering is not evident. Subhorizontal fractures are closely and mod spaced, rough and undulating. Subvertical fractures are medium space rough and undulating	grey			
39:00     CORE     93     82     67     6       39:00     CORE     93     82     67     6       And some pyritisation along fracture.     Weathering is not evident.       Subboronial fractures are closely and medium spaced, rough and undulating.							8		40.5	18 39	- - - -				
To Deg           Diam         Boring           125         15.00		39.00	CORE	93	82	67	6		40.		Moderately strong and strong thickly laminated off-white fine grainad SANDSTONE with bands and laminas of mudstone, micaceous lamina 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, roug and undulating	B h			
# Description based on Drillers log. 114 45.00 An inspection pit was excavated by hand to a depth of 1.20m to clear services. 114 Ground-water was not encountered.	R	lemarks: # Descri An inspe Ground-	ption ba action pi water w	ised o t was as no	n Drīl excav	ler's ko vated	og. by hand red.	d to a de	opth of 1.2	0m to cl	ar services.		Diam 125 114	To Boning 15.00 45.00	Dep

R	A	E	B	U	R	R	SII CI	e: S N	T A	MBR ERAL		SE HIGH SCHOOL, COATBRIDGE <u> NVESTIGATION</u> shire Council	Borehol	e No:	108		
		DRILLIN	GAND	GEOT	ECHN	CALL	TO Er	igineer.	URS	Corp	oora	ation Limited	Inspec Rotary Rotary	tion Pil Open Core I	to Hole to Drilling to	1.20 15.00 45.00	
oca	tion: E	27170	6.5		0	rienta	ation: V	ertical			E	Barrel; Air/Water Flush					
8	N	66585 Samj	1.5 ples ar	nd Te	sts	lo	asing	Le	vel		-	Description of Strata		gend	Water	Ballodin	Der
line	Depth	Lype	R	esult		C	Depth	(m 87	OD) .26	Debru				::::		ŝ	
	42.00	CORE	100	80	40	11 12		4	5.26	42.00		869 previous sheet Moderately strong and strong thinty laminated dark grey MUDSTON 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	E with				
						9					1	at 44.30m: 0.07m thick band of Ironstone					
						NI					-						
11/7		-				2	15.00		42.26	45.0	00	END OF BOREHOLE					
B	emarke														Diam	Too Booring 15 00	
R	# Desc An Insp Ground	ription b ection p -water v	ased c it was vas no	on Dri exca ot enc	ller's l vated ounte	og. by hi red.	and to a	depth o	of 1.20	Om to c	dear	r services.			126 114	15.00 45.00	
	Driller	Т	Original EMc	tor	Stru	ck I	Groun Rose To	nelsw-bi	ns) C	out Off	F	Water Added Chise@ing Flush rom To From To Tune(tr) Returns Type To D Full AtrWater 45	Pepth RAU	F	ig No: B8		_
	Chk & A	pp	Statu	\$											Shee	t 5 of 1:50	5

÷

		DALCING	UP OLUTEO	E	ngineer. URS	S Corp	Rolary Open Rolary Core	t to Hole to Drilling to	1.20 16.30 46.30	
ca	lion; E	271699.	1	Orientation:	Vertical	-	Equipment: Lorry (Bedrord) Mounted Dando 200, 412 0010 Barrel; Alr/Water Flush			Backfil
	Sample	Sample	s and Tests	Casing	Level (mOD)	Depth	Description of Strata	Legend	Water Depth	Dept
	0.00	FI					# TOPSOIL # MADE GROUND (peat and ash)			
	Remark # Des An In: Grout	<s: iccipition bas spection pit ad-water wa</s: 	sed on Drile was excave as not encou	or's log. ated by hand to untered.	0 a depth of 1.	. <u>51 9</u> 20m to o	.60 # Sandy gravelly CLAY clear services.		0,	To Depth Boring Ca 18.00 16 46.30

÷

----

	-	01		-	S	ite:	ST A	MBR	OSE HIGH SCHOOL, COATBRIDGE	Contract Borehole	No: 2	2085	7	
XA	DRILL	NG AND GE	JF		LTD E	lient: ingine	North er: URS	Corpo	rkshire Council	Inspect	on Pit	to	1.20	-
cation: E	2716	99.1	1	Orienta	ation: \	Vertic	al		Equipment: Lorry (Bedford) Mounted Dando 250; 412 Core Barrel; Air/Water Flush	Rotary	Core D	hole to Addling to	46.30	
N	16658 San	27.4	Tests	-		- 1	Level	-		-	pua	Water	Ba	ckfill
Sample Depth	8	Resi	ult	1	Depth		(mOD)	Depth	Description of Strata		Legi	Depth	Symb	Dep
-15.90 -16.30	TROR	TCR 80 80 6	CR RQI	D FI 8 2 NR 6			66.21 65.81 63.71 63.61	15.90 18.30	# SANDSTONE # SANDSTONE # SANDSTONE # Object of the second	whe nains. h and TONE ae, d.				15
									- undulating -					
# Descri An inspe Ground-	iption b ection p -water v	ased on D it was exc vas not en	niler's l avated counte	log. I by har ered.	I nd to a	depth	of 1.20n	n to clea	ar services.		DI 1: 1	am E 25 1 14 4	To De Boring (6.00 48,30	Cas 16
Driller WH		Originator EMc	Shu	ick Ri	Ground ose To	d-water Time(n	ilns) Cut	Off	Water Added         Chiseting         Flush           From         To         Time(rr)         Returns         Type         To Deptr           From         To         Time(rr)         Returns         Type         To Deptr           Vol         Full         Arr/Valer         17.60         0.94         Arr/Valer         47.80	RAUD	Fig	No: B9		
Chk & Ap GK	×p	Status Final	1							URZ		Sheet Scale	2 of 5 1:50	

	DRILLING	and G	EOTEC	CHNCA	Eng	ineer: URS	Corpo	ration Limited Inspection Rolary Op	Pit to	ole to	1.20 16.30 46.30	
ation: E	271699	.1		Orie	ntation: Ve	rtical		Equipment: Lorry (Beatora) Mounted Dando 200, 412 0010 Houry or Barrel; Air/Water Flush				
N	665827 Sampl	.4 es an	d Test	s	Casing	Level		Development Climits	gend	Water	Ba	ckfi
Dapth	a l	Re	sult		Depth	(mOD) 82.11	Depth	Description of Suara	Ĕ	Depin	EX.S	De
19.30				8				see previous sheet				
22.30	CORE	100	83 6	11 7 >20 4		60.31	21.80	Moderately strong and strong thickly and thinly laminated greyish white fine and medium grained SANDSTONE with bands and laminae of muditione, micaceous laminae and locally lion-rich. Weathering is not evident Subhorizontal fractures are very closely and closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undutating				
				12	2	57.91	24.20	Moderately strong thinly laminated dark grey MUDSTONE with sitistone and micaceous laminae. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating				
-25.30	CORE	87	80	72 1	3	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				
28.3	CORE	100	90	65 >	2 iR 5 20	54.7	8 27.3	Moderately weak and moderately strong thinly laminated black Moderately weak and moderately strong thinly laminated black carbonaceous MUDSTONE with occasional coal laminae and abundant carbonaceous MUDSTONE with occasional coal laminae and abundant forsultive remains. Weathering is not evident. Subhorizontal fractures are very closely and closely spaced, rough and undulating fractures are closely spaced, rough and undulating at 27.35m: 0.15m thick kon-rich mussel band				
					3	53.3	1 28.1	0 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 fossi plant remains. Weathering is not evident. Subhorizontal fractures are closely spaced, rough and undulating. Subvertical fractures are medium spaced, rough and undulating			To	Dep
temarks # Desc An insp Ground	; iption ba ection pit -water wa	sed or was e as not	Drille excava encou	r's log. ited by intered	hand to e d	lepth of 1.2	Om to cl	ar services.	1:	am 25 14	Boring 16.00 48.30	T