

Geo-Environmental Investigation & Assessment

For a site at

Loreto College, Expansion Project

Undertaken for

Loreto College

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Executive Summary

Site Location	The site comprises land on the corner of 87 Moss Lane West and Chichester Road South in Manchester. It is centred on approximate Ordnance Survey National Grid Reference 383300E, 395989N with an indicative postcode of M15 5PE.
Development Proposals	The proposed scheme involves the development of a new three-storey educational building located on the south eastern corner of the land adjacent to the Chichester Road South and Moss Lane East junction. External areas are to comprise hardstanding for access and parking and soft landscaped amenity areas.
Ground Conditions	Ground conditions encountered during the intrusive investigation generally comprised made ground to depths of between 0.30m and 3.10mbgl, underlain by glacial deposits to a depth of 11.00mbgl (BH01) and in turn by completely weathered sandstone of the Chester Pebble Bed Formation to a maximum proven depth of 12.00mbgl.
Site Preparation and Earthworks	Site development will include the demolition of existing structures which should not proceed until an appropriate Asbestos survey of the existing building has been undertaken and any Asbestos Containing Materials (ACM) removed by an appropriately licensed contractor. Similarly, any demolition materials present on site and considered for re-use should be inspected with any ACM removed accordingly prior to crushing. Historical/existing foundations, ground floor slabs and other buried concrete/brick obstructions associated with current and former structures are envisaged. Where encountered, these will need to be broken out to suitable depths below formation levels where they are to impinge on the proposed buildings. Such materials removed as part of the clearance work, subject to appropriate screening and crushing, will be suitable for re-use as bulk fill beneath hard cover areas. The locations of all existing services will need to be accurately determine across the full footprint of the development area. It cannot be ruled out that services may need to be diverted to accommodate the proposed new structure. The existing culvert located in close proximity, will also need to be accurately delineated to ensure that its location and any associated easement does not impact on the proposed development layout. It should be noted that the re-use of excavated soils on site should be undertaken in accordance with guidance provided in the CL:AIRE Definition of Waste, Development Industry Code of Practice, Version 2, 2011 so that the activity is removed from Environmental Permitting.
Foundations	In consideration of the depths to competent bearing strata and the anticipated structural loads from the proposed multi-storey building, it is anticipated that the new structure could be supported on piles. Pile type, selection and design should to be undertaken in conjunction with a reputable, specialist piling contractor, ideally with experience of the local ground conditions. However, for preliminary considerations, a pre-cast driven concrete pile would minimise waste soil arisings but potential noise and vibration effects on the culvert may render this option unsuitable. Therefore, a bored pile solution is therefore likely to be the most appropriate solution for the site. Floor slabs for the new structures should be suspended unless underlain by fill which has been compacted to an appropriate specification.
New Pavements	New road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 2.5% in untreated made ground and natural cohesive strata.
Soakaways	In consideration of the proposed layout, retained culvert and areas of deeper made ground, soakaways might be considered a feasible drainage option if they could be located in the proposed new landscaping in the south-western section of the site.
Concrete Classification	The typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1 respectively.

Ground Contamination	The long-term exposure risk to human health based on chemical analyses is therefore confirmed to be low with no specific remediation requirements. Risks to controlled waters are also considered to be low with no specific remedial actions required.
Ground Gas	No ground gas protection measures are anticipated to be required. However, this would need to be revised upon completion of the gas monitoring.
Waste Soils	For preliminary guidance based on the current information, it is likely that made ground, would be classified as 'Non-hazardous' with natural soils classified as 'Inert' for landfill disposal. It will be the responsibility of the waste producer to undertake further testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines and Duty of Care requirements.

CONTENTS

1.0	INTRODUCTION	1
	Appointment	1
	Proposed Development	1
	Objective.....	1
	Scope	1
2.0	SITE LOCATION AND DESCRIPTION	2
	Site Location	2
	Site Description	2
	Topography.....	2
3.0	SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING	3
	Geology	3
	Radon.....	3
	Mining and Subsidence	3
	Environmental Setting	3
	UXO.....	3
	Site History	3
	Preliminary Contamination Risk Assessment	4
4.0	SITE INVESTIGATION	5
	Rationale.....	5
	Intrusive Works	5
	Monitoring Standpipes	5
	Geotechnical and Chemical Testing	5
	Leachate Analyses	6
	Gas and Groundwater Monitoring.....	6
5.0	GROUND CONDITIONS	7
	General	7
	Topsoil	7
	Made Ground	7
	Glacial Deposits	7
	Weathered Chester Pebble Beds	8
	Existing Culvert	8
	Geotechnical Testing.....	8
	Visual/Olfactory Evidence of Contamination	8
	Groundwater	8
	General	9
6.0	GEOTECHNICAL APPRAISAL	10
	Site Preparation.....	10
	Earthworks	10
	Foundations	11
	Floor Slabs	11
	Excavations and Groundwater	11
	External Pavements	11
	Concrete Design	11
	Drainage and Soakaways	12
7.0	GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)	13
	General	13

	Human Health	13
	Controlled Waters	14
	Soil Test Results	14
	Leachate Testing	14
	Discussion and Conclusions	15
8.0	GROUND GAS RISK ASSESSMENT	16
	Methodology	16
	Ground Gas Conceptual Model	16
	Results and Recommendations	17
9.0	OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS.....	18
	Excavated Soils.....	18
	Imported Fill.....	18
	Water Supply Pipes.....	18

APPENDICES

Appendix 01 -	Drawings
Appendix 02 -	Exploratory Hole Records
Appendix 03 -	Geotechnical Testing Results
Appendix 04 -	Chemical Analytical Results
Appendix 05 -	Gas and Groundwater Monitoring Results
Appendix 06 -	Site Specific Assessment Criteria

1.0 INTRODUCTION

Appointment

- 1.1 WML Consulting has been commissioned by Loreto College, to undertake a Geo-environmental Investigation and Assessment of a site referred to as Loreto College, Expansion Project.

Proposed Development

- 1.2 The proposed scheme involves the development of a new three-storey educational building located on the south eastern corner of the land adjacent to the Chichester Road South and Moss Lane East junction.
- 1.3 The location of the structure is has been determined, to a degree, due to the presence of the Corn Brook Culvert which extends roughly north-east to south-west across the central site area. External areas are to comprise hardstanding for access, with car parks to the north-western and north-eastern corners of the site. These will be interspersed with pedestrian walkways and general soft landscaping.
- 1.4 The proposed site plan with the preliminary landscape plan by 10architect, referenced LCNP-10A-V0-ZZ-DR-A-0010_P1, is presented in Appendix 01.

Objective

- 1.5 The objective of the ground investigation and assessment was to provide geotechnical recommendations for construction design purposes together with a geo-environmental risk assessment in terms of possible ground contamination.
- 1.6 To achieve the objective, the following tasks were undertaken:
- Review the existing desk study report for the site and design a Phase 2 Ground Investigation.
 - Characterise the ground conditions in terms of geology, soil geotechnical parameters and ground contamination from information provided by the ground investigation.
 - Provide recommendations regarding suitable foundations together with any other geotechnical considerations that could affect possible future development.
 - Determine a ground conceptual model for the site so as to undertake a ground contamination Generic Quantitative Risk Assessment (GQRA).

Scope

- 1.7 A Phase 1 Desk Study for the site has been undertaken by WML and is presented in the following report:
- Phase 1 Desk Study and Preliminary Geoenvironmental Assessment, Reference 10939G-WML-00-XX RP-G-0001, dated February 2023.
- 1.8 This report includes the findings of a Phase 2 Ground Investigation designed on conclusions and recommendations within the Phase 1 Desk Study. For ease of reference, the findings of the Desk Study are summarised in the following sections. However, the two reports are not exclusive and should be read in conjunction.
- 1.9 The ground investigation comprised the formation of window sample probeholes and cable percussive boreholes undertaken with reference to BS5930:2015 + A1:2020 Code of Practice for Ground Investigation and BS10175:2011 together with A2:2017, "Investigation of Potentially Contaminated Sites - Code of Practice" except where superseded by EN ISO 22475-1 "Geotechnical Investigation and Assessment – Sampling by Drilling and Excavation and Groundwater Measurements".
- 1.10 Geotechnical soil testing was undertaken in general accordance with guidelines provided in BS1377:1990 – Parts 1-9, "Method of Test for Soils for Civil Engineering Purposes". Samples for chemical analysis were obtained and handled generally in accordance with the current guidelines (BS10175: 2011 and A3:2017).

2.0 SITE LOCATION AND DESCRIPTION

Site Location

- 2.1 The site comprises land on the corner of 87 Moss Lane West and Chichester Road South in Manchester. It is centred on approximate Ordnance Survey National Grid Reference 383300E, 395989N with an indicative postcode of M15 5PE.

Site Description

- 2.2 At the time of the inspection in February 2023 the majority of the site comprised a disused single storey brick structure (former probation office) and car park to its west surrounded by areas of maintained grass landscaping to the north, south and east.
- 2.3 The north-eastern part of the site formed a separate gravel surfaced car park used by Loreto College to the north, and separated from the main part of the site by a metal fence.
- 2.4 An overhead service was noted to run roughly east to west across the car park forming the north-eastern part of the site.
- 2.5 A strip of concrete extended across the otherwise asphalt car park, in the north-western part of the site, this appears to indicate the location of Corn Brook culvert within this section of the site. The culvert is unmarked across the north-eastern half of the site.
- 2.6 Stands of semi-mature and mature deciduous trees were located in the south-western corner of the site and on the north-western site boundary. Further sporadic semi-mature deciduous trees were located on the eastern and north-eastern site boundaries.
- 2.7 Vehicular access to the main part of the site is from Tamworth Street to the west, with vehicular access to the car park forming the north-eastern part of the site from Chichester Road South to the east.

Topography

- 2.8 A topographical survey undertaken by Survey Operations, referenced 22L033/001, is reproduced within Appendix 01.
- 2.9 The site is generally commensurate with the surrounding area with the car park in the north-western section of the site ranging between 31.65m in its southern section to 34.45m AOD in the northern section of landscaping. The concrete apron surfacing Corn Brook varies between 31.79m AOD at the junction with Tamworth Street to 31.78m AOD to the north of the former probation office structure.
- 2.10 The grassed areas to the east and south of the site are generally undulating around 31.88m to 32.21m AOD and 31.70m to 32.00m AOD respectively. A larger grassed mound to the south-east indicates a maximum elevation of 33.64m AOD.
- 2.11 The car park in the north-eastern section of the site increases in elevation from the south-west at 32.33m to 32.98m AOD in the north-west.

3.0 SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING

3.1 The following paragraphs summarise the most relevant findings of the Phase 1 desk study report.

Geology

3.2 The BGS plans indicate that the site is underlain by the Glaciofluvial Sheet Deposits, indicated to mainly comprise sand and gravel. The drift deposits are in turn underlain by the Triassic Chester Pebble Beds Formation, indicated to comprise sandstone.

Radon

3.3 The site is not in a Radon Affected Area as defined by the UK Health Security Agency were less than 1% of properties are above the Action Level of exposure. Therefore, no radon protection measures are necessary for new structures as described in publication BR211 by the Building Research Establishment.

Mining and Subsidence

3.4 In consideration of the indicated geology, risks to the development from subsidence relating to shallow, unrecorded abandoned coal mine workings are considered low and can be discounted.

3.5 The risk from non-coal mining activity at the site is also considered low.

Environmental Setting

3.6 The bedrock underlying the site is classified as a 'Principal Aquifer'. The superficial strata is classified as a 'Secondary A Aquifer'.

3.7 The site is not within an Environment Agency Source Protection Zone (SPZ). No active groundwater abstraction licenses are located within 500m of the site.

3.8 The culverted Corn Brook extends roughly north-east to south-west across the central/northern section of the site, demarcated in the west by a concrete apron.

3.9 There are no active landfills located within 500m of the site. A historic landfill is located 111m north-east at Moss Side Shopping Centre. This is recorded to comprise inert and industrial waste deposited between 1994 and 1995.

3.10 There are no designated environmentally sensitive sites within 250m of the subject site.

UXO

3.11 A review of the University of Manchester's Online Map Collection, namely 'Record of location of aerial bombs on the City of Manchester' has revealed that a bomb strike was recorded within the north-western section of the site in 1940.

3.12 The Zetica UXO Unexploded Bomb Risk Map, indicates the site be located in a moderate risk areas with a high risk area extending from the western site boundary.

Site History

3.13 The earliest map dated 1849 indicates the site to comprise undeveloped land within a rural / agricultural setting with Corn Brook running roughly north-east to south-west across the central part. The north-eastern part of the site was occupied by gardens associated by Brookside Terrace to the north.

3.14 Sometime prior to 1889 the site had been developed with residential terraces, centred on Norfolk Street and Clarence Grove which ran across the eastern part of the site. A hotel was also located in the south-eastern corner of the site. Corn Brook was no longer shown running across the site and is understood to have been culverted.

- 3.15 By 1978 the site was cleared and appeared be landscaped with pedestrian pathways. By 1995 it had been redeveloped as a Probation Centre with a structure spanning the central and eastern parts and an area of car parking in the western part.
- 3.16 The site has remained in roughly this configuration to present day, with the northern-eastern part of the site being more recently utilised as an overflow car park for the college to the north.
- 3.17 The area surrounding the site has historically comprised undeveloped land in rural / agricultural until extensive residential development occurred sometime prior to 1889.
- 3.18 Localised clearance of residential terrace structures in the surrounding area had occurred between 1932 and 1949, including around 20m south-west, possibly as a result of bomb damaged during World War II.
- 3.19 A wider phase of terrace clearance occurred in the 1970's and 1990's, followed by further residential redevelopment and the construction of a shopping centre around 150m east of the site.
- 3.20 Historical industrial development in the immediate surrounding area is limited to a brewery located 75m south-east, which was built sometime prior to 1889 and has more recently undergone residential redevelopment.

Preliminary Contamination Risk Assessment

- 3.21 The approach at the Phase 1 Desk Study stage was precautionary until such time as uncertainties in the conceptual model could be verified by appropriate site investigation.
- 3.22 However, based on the site history and the proposed development scenario, potential pollution linkages were considered low or unlikely with associated preliminary risks generally being assessed as low.
- 3.23 Such uncertainties related in the main to the potential for ACM and asbestos fibres to be present within shallow soils resulting from unrecorded historical demolition. The level of historical contamination as a result of the site's brownfield status should also be established.
- 3.24 However, the presence of ground gas from nearby landfilling and a potentially infilled watercourse (adjacent to the culvert) could be wholly discounted. Therefore, a low/moderate risk to the proposed development from ground gas was assessed until such time as uncertainties in the conceptual model could be verified by detailed site investigation.

4.0 SITE INVESTIGATION

Rationale

- 4.1 Intrusive investigations were undertaken primarily to provide geotechnical parameters for structural design purposes but also to verify the preliminary site conceptual model and clarify the anticipated environmental risk.
- 4.2 In view of the reported UXO risk at the site on site support was provided by 1st Line Defence Ltd for the duration of the following intrusive works. This included a magnetometer scan of the exploratory holes as they progressed.
- 4.3 Window sample probeholes were undertaken to provide information on near surface deposits and to obtain samples for chemical analysis and geotechnical testing. Due to the small diameter of the probing equipment, the depth of penetration achieved is dependent on favourable ground conditions. As such, ground penetration may be restricted in circumstances where the ground is particularly strong or contains relatively large obstructions such as cobbles and/or boulders.
- 4.4 A cable percussive borehole was undertaken to provide information on deeper deposits and to obtain samples for geotechnical testing.
- 4.5 A hand pit was also formed along the line of the culvert immediately north-east of the concrete apron, in order to try and establish its depth below ground level.
- 4.6 The investigation locations were chosen so as not to impact on the presence of known/suspected services beneath the site, including the culverted Corn Brook which crosses the site from west to east. Access to parts of the site was restricted due to the presence of the existing disused structure.
- 4.7 Monitoring standpipes have been installed in probeholes for the measurement of gas and groundwater levels.
- 4.8 Chemical analysis of a general suite of contaminants was undertaken on selected samples of soil. This was to clarify the expected contamination risk.

Intrusive Works

- 4.9 The ground investigations were undertaken by LOT Geotechnics Ltd and Paul Blackledge Drilling Ltd on 10th March 2023. This comprised the formation of 6no window sample probeholes (WS01 to WS05 and WS05A) to a maximum depth of 5.00 metres below ground level (mbgl) and 1no cable percussive boreholes to a maximum depth of 12.50mbgl. A hand excavated trial pit was also undertaken to a depth of 0.80mbgl to examine the depth of the culverted Corn Brook which crosses the site.
- 4.10 The exploratory hole records are presented in Appendix 02 whilst the exploratory hole locations are shown on drawing 10939G-SK01-A in Appendix 01.

Monitoring Standpipes

- 4.11 Monitoring wells for groundwater measurements were installed in 3 no. probeholes, as indicated on the logs presented in Appendix 02.

Geotechnical and Chemical Testing

- 4.12 In-situ geotechnical testing was undertaken at regular intervals during the formation of the window samples and cable percussive boreholes in the form of Standard Penetration Tests (SPT's). The results for this testing are presented on the descriptive logs in Appendix 02.
- 4.13 Geotechnical soils testing was undertaken on selected samples for the following:

- Natural moisture content
- Liquid and Plastic limits.
- Quick Undrained Triaxial.

4.14 The results of the geotechnical testing are presented in Appendix 03.

4.15 Chemical analysis was undertaken on selected soil samples for the following contaminants of concern:

- Total arsenic, boron, cadmium, chromium VI, copper, lead, mercury, nickel, selenium, vanadium, zinc.
- Total cyanide, phenols, sulphur, sulphate.
- Speciated USEPA polyaromatic hydrocarbons (PAH).
- Total petroleum hydrocarbons (TPHCWG).
- BTEX & MTBE.
- Asbestos screen and identification.
- 2:1 water/soil sulphate extract, pH.

4.16 The results of the chemical analysis are presented in Appendix 04.

Leachate Analyses

4.17 In order to assess the potential risk to controlled waters, selected samples of soils were submitted for leachate preparation and analyses of the following suite of contaminants:

- Total arsenic, boron, cadmium, chromium VI, copper, lead, mercury, nickel, selenium, vanadium, zinc.
- Speciated (16) hydrocarbons (PAH).
- Total phenols, sulphur, sulphate.
- Sulphate extract, pH.

4.18 The results of the chemical analysis are presented in Appendix 04.

Gas and Groundwater Monitoring

4.19 Groundwater monitoring has been carried out on 1no occasion, to date, on 31st March 2023. The monitoring the results are presented in Appendix 05.

5.0 GROUND CONDITIONS

General

- 5.1 Ground conditions encountered during the intrusive investigation generally comprised made ground to depths of between 0.30m and 3.10mbgl, underlain by glacial deposits to a depth of 11.00mbgl (BH01) and in turn by completely weathered sandstone of the Chester Pebble Bed Formation to a maximum proven depth of 12.50mbgl.

Topsoil

- 5.2 The imported or historically reworked Topsoil was encountered within HP01, WS01, WS02, WS03 and WS04 from ground level to depths of between 0.20m and 0.30mbgl.
- 5.3 The topsoil generally comprised dark brown, organic sand.

Made Ground

- 5.4 Made ground was encountered within all of the exploratory from ground level or beneath the topsoil to depths of between 0.30m and 3.10mbgl.
- 5.5 Within BH01 the made ground comprised a surface horizon of asphalt underlain by brown, slightly sandy gravel of sandstone to a depth of 0.30mbgl.
- 5.6 The made ground generally comprised brownish grey to greyish brown, sandy gravel, and localised areas of gravelly sand and slightly gravelly, sandy clay to depths of between 0.70m and 3.10mbgl. A low cobble content was also locally recorded. Gravel sized fragments included brick, sandstone, concrete and locally ash, clinker, slate and metal. Cobbles sized fragments generally comprised brick.
- 5.7 WS02 was formed on top of the large grassed mound located to the south of the existing structure. This was formed by made ground extending to a depth of 2.20mbgl. The made ground comprised greyish brown, gravelly sand with pockets of sand clay and a low cobble content. Gravel sized fragments included brick, concrete and locally clinker. Cobble sized fragments included brick.
- 5.8 WS05 encountered an obstruction within the made ground at a depth of 0.70mbgl. This comprised a large lump of rebar within the made ground. Therefore the exploratory hole was reformed as WS05A approximately 6.00m east of WS05.
- 5.9 SPT 'N' values within the made ground ranged between 4 and 27 indicating the very variable nature of the deposits.

Glacial Deposits

- 5.10 Glacial deposits were encountered within all of the exploratory holes (with the exception of WS05) underlying the made ground from 0.30m and 3.10mbgl and extending to a maximum proven depth of 11.00mbgl within BH01.
- 5.11 The strata generally comprised interbedded cohesive and granular deposits to depths of between 4.30m and 4.55mbgl which generally comprised brown and grey mottled, slightly silty, sandy clay underlain by loose to dense orange to yellowish brown, variably gravelly sand.
- 5.12 Within the exploratory holes penetrating the granular deposits a lower horizon of glacial till was encountered from depths of between 4.30m and 4.55mbgl and extending to a depth of 11.00mbgl within BH01. These generally comprised soft becoming firm / stiff slightly silty, sandy clay.
- 5.13 SPT 'N' values within the upper horizons of cohesive deposits ranged between 7 and 17 indicating variably soft to stiff consistency.

- 5.14 SPT 'N' values within the granular glacial deposits ranged between 8 and in excess of 50 indicating a locally loose but generally medium dense to dense state of compaction.
- 5.15 SPT 'N' values within the lower glacial till ranged between 7 and 38 indicating a locally soft to firm but generally firm to stiff consistency.

Weathered Chester Pebble Beds

- 5.16 Within BH01 strata considered to represent the completely weathered Chester Pebble Beds Formation were encountered underlying the glacial till at a depth of 11.00mbgl, extending to a maximum proven depth of 12.50mbgl.
- 5.17 The sandstone was recovered as a very dense completely weathered reddish brown, weakly cemented sand.
- 5.18 SPT 'N' values within the weathered Chester Pebble Beds Formation ranged between 19 and in excess of 50 indicating the equivalent of a medium dense, becoming dense state of compaction.

Existing Culvert

- 5.19 HP01 was formed over the line of the culverted Corn Brook in order to examine the depth of cover above the culvert.
- 5.20 The trial pit HP01 encountered made ground to a depth of 0.80mbgl where the top of the brick culvert was encountered at a reduced elevation of 31.37m AOD.

Geotechnical Testing

- 5.21 Geotechnical testing undertaken on selected samples are summarised in the following table :

Test	Made Ground	Glacial Till
Natural Moisture Content	23%	14 – 32%
Liquid Limit	38%	28 – 60%
Plasticity Index	20% (Modified to 15%)	15 – 34% (Modified to 13.2 - 33.3%)
Atterberg Classification	Intermediate Plasticity	Low – High Plasticity
Quick Undrained Triaxial	-	28 kPa
Bulk Density	-	2.09Mg/m ³
Dry Density	-	1.70Mg/m ³

Visual/Olfactory Evidence of Contamination

- 5.22 No visual and/or olfactory evidence of significant ground contamination was identified within the exploratory holes during the investigation.

Groundwater

- 5.23 Groundwater was not encountered during the formation of the exploratory holes.
- 5.24 Initial monitoring recorded all standpipes to be dry indicating groundwater to be in excess of 3.00mbgl.
- 5.25 It should be appreciated that the groundwater observations described above have been undertaken during a very short period of time. Significant variations in the long-term groundwater regime may occur at other times, particularly with prolonged, extreme weather conditions, and that no account can be taken of such in this report.

General

- 5.26 It should also be appreciated that ground conditions may vary between and away from the exploratory hole positions, and that no account can be taken in this report of such variations.

6.0 GEOTECHNICAL APPRAISAL

Site Preparation

- 6.1 Site development will include the demolition of existing structures which should not proceed until an appropriate Asbestos survey of the existing building has been undertaken and any Asbestos Containing Materials (ACM) removed by an appropriately licensed contractor. Similarly, any demolition materials present on site and considered for re-use should be inspected with any ACM removed accordingly prior to crushing.
- 6.2 Historical/existing foundations, ground floor slabs and other buried concrete/brick obstructions associated with current and former structures are envisaged. Where encountered, these will need to be broken out to suitable depths below formation levels where they are to impinge on the proposed buildings. Such materials removed as part of the clearance work, subject to appropriate screening and crushing, will be suitable for re-use as bulk fill beneath hard cover areas.
- 6.3 As part of the site clearance, the removal of trees and other vegetation will be required and it is assumed that this will be undertaken in consultation with an ecological specialist. Should any trees be retained, it is assumed that the current development configuration has been outlined in consideration of this and specifically Root Protection Areas (RPA) as would need to be determined by the landscape architect.
- 6.4 Notwithstanding this, construction near any retained trees and importantly within any RPA's should be undertaken with due regard to guidance provided in BS5837:2012 'Trees in relation to design, demolition and construction – recommendations'.
- 6.5 The locations of all existing services will need to be accurately determine across the full footprint of the development area. It cannot be ruled out that services may need to be diverted to accommodate the proposed new structure.
- 6.6 The existing culvert located in close proximity, will also need to be accurately delineated to ensure that its location and any associated easement does not impact on the proposed development layout.

Earthworks

- 6.7 In consideration of the current site levels no significant earthworks would be anticipated, other than localised regrading across the majority of the site.
- 6.8 However, reductions in elevation would be required within the southern section of the site associated with the removal of the existing grassed mounds. Excavated soils from this mound would primarily include mixed granular and cohesive made ground.
- 6.9 In consideration of the proposed development, it is anticipated that the majority of excavated materials would be surplus to requirement and would need to be removed from site.
- 6.10 However, should excavated granular made ground be required for localised re-use, appropriate management would be required to enable optimisation of material through sorting, segregating and selective re-use.
- 6.11 Any excavated cohesive soils should not be used beneath structural areas or hard external areas, but might be suitable for direct re-use as or beneath subsoil within landscaped areas if required.
- 6.12 It should be noted that the re-use of excavated soils on site should be undertaken in accordance with guidance provided in the CL:AIRE Definition of Waste, Development Industry Code of Practice, Version 2, 2011 so that the activity is removed from Environmental Permitting.
- 6.13 In this respect, surplus materials will cease to be waste where it can be demonstrated that there is a certainty to their use and that only the quantities necessary for that purpose are used.

Foundations

- 6.14 Made ground and any soft / loose natural deposits should be considered unsuitable for the direct support of structural loads as they will be weak and compressible, leading to possibly unacceptable total and differential settlements.
- 6.15 In consideration of the depths to competent bearing strata and the anticipated structural loads from the proposed multi-storey building, conventional shallow spread foundations are not considered a suitable option.
- 6.16 Therefore, it is recommended that the new structure be supported on piles. Pile design should assume no side support (skin friction) for the pile sections surrounded by made ground and may need to be designed to withstand potentially negative skin friction effects within cohesive strata.
- 6.17 Pile type, selection and design should to be undertaken in conjunction with a reputable, specialist piling contractor, ideally with experience of the local ground conditions.
- 6.18 However, for preliminary considerations, a pre-cast driven concrete pile would minimise waste soil arisings but potential noise and vibration effects on the culvert may render this option unsuitable. Therefore, a bored pile solution is therefore likely to be the most appropriate solution for the site.
- 6.19 Foundation construction will also need to take account any remaining and/or new services, including the culvert crossing the site and, where they are in close proximity, may need to be taken down to beneath the lowest level of the service trench so that their structural integrity is maintained.

Floor Slabs

- 6.20 Floor slabs for the new structures should be suspended unless underlain by fill which has been compacted to an appropriate specification.

Excavations and Groundwater

- 6.21 Excavations at the site will be feasible using conventional hydraulic plant. All excavations at the site and specifically requiring man-entry, will need adequate lateral support, or will need to be battering back to a safe angle to ensure their stability.
- 6.22 Conventional 'sump and pump' dewatering measures are likely to be adequate to keep excavations dry.
- 6.23 However, it cannot be discounted that groundwater exclusion measures such as interlocking sheet piles, within deeper granular made ground, would be required to prevent excessive ingress of water during periods of prolonged rainfall. Such support measures will also reduce the risk of conditions that could lead to loss of ground beneath any nearby adjacent structures or infrastructure.

External Pavements

- 6.24 In consideration of the near surface ground conditions, it is recommended that new road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 2.5% in untreated made ground and natural cohesive strata.
- 6.25 The CBR will need to be reviewed and confirmed by site inspection and possibly suitable in-situ testing at formation levels following any earthwork operations and prior to pavement construction.
- 6.26 In any event, all formations should be proof-rolled with any soft, loose or otherwise unsuitable material being removed and replaced with compacted granular fill.

Concrete Design

- 6.27 Design/mix of buried concrete should be undertaken in accordance with the "Aggressive Chemical Environment for Concrete" (ACEC) classification, of BRE Special Digest 1:2005 (Concrete in Aggressive

Ground). With reference to the site history, it is deemed appropriate to classify the site as "Brownfield", with respect to BRE Special Digest, assuming mobile groundwater conditions.

- 6.28 Below the initial level of anticipated site strip the values of 2:1 water/soil extract for sulphate did not exceed 130mg/l.
- 6.29 Values of pH range from 7.9 to 8.6 indicating slightly alkaline conditions.
- 6.30 On the basis of these results, the typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1 respectively.

Drainage and Soakaways

- 6.31 In consideration of the proposed layout, retained culvert and areas of deeper made ground, soakaways are not considered to be a feasible drainage option for the site.

7.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

General

- 7.1 A review of the readily available information had concluded that the potential for exposure to ground contamination is unlikely to low leading to a low preliminary risk.
- 7.2 However, it has been considered prudent to undertake chemical analysis of the sub-surface soils to confirm the low human health risk status of the site.

Human Health

- 7.3 Selected samples have been analysed for a general suite of contaminants of concern and compared against Screening Levels (SL's) for human health to determine the significance of the measured concentrations in relation to the site conceptual model. Thus, a Generic Quantitative Risk Assessment has been undertaken in line with guidelines provided in Land Contamination Risk Management, October 2020.
- 7.4 The criteria for a limited number of contaminants have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.
- 7.5 Within the document, Category 4 Screening Levels (C4SL's) are described as being more pragmatic than previous screening criteria and represent concentrations in soil that present an 'acceptable' level of risk within the context of Part 2A.
- 7.6 The National Planning Policy Framework states that 'after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990'. Therefore, by inference, the C4SL's are appropriate for use in the planning context.
- 7.7 Although the SP1010 document states that C4SL only apply for a 'sandy loam soil with 6% soil organic matter', it is generally accepted that assessment criteria for metals are not sensitive to changes in soil organic content (SOM). The C4SL's have therefore been adopted as assessment criteria in this report for the listed metals within the SP1010.
- 7.8 Subsequent to SP1010, LQM/CIEH have published a document entitled 'The LQM/CIEH S4ULs for Human Health Risk Assessment' 2015. In brief, the document provides updated assessment criteria which have been derived in accordance with UK legislation, national as well as EA policy and using a modified version of the CLEA software and available guidance. The new screening criteria, or Suitable 4 Use Levels (S4ULs), are intended to provide a complete and updated replacement to the previous LQM/CIEH GAC of 2009. As such they are considered appropriate for use in this assessment for other contaminants not covered by C4SL's and/or for organic contaminants assuming a worst-case Soil Organic Matter (SOM) of 1% as an initial conservative assessment.
- 7.9 For each contaminant, S4UL's and C4SL's have been calculated for six land use scenarios, namely:
- Residential with homegrown produce.
 - Residential without homegrown produce.
 - Allotments.
 - Commercial.
 - Public Open Space, near residential housing.
 - Public Parks, remote from residential housing.
- 7.10 In light of the proposed development, the SL's for a "Commercial" end-use are considered appropriate for the assessment at this stage. A table of relevant SL's are provided in Appendix 06.

Controlled Waters

- 7.11 Generic criteria for the assessment of potential groundwater contamination have been derived from very conservative guidelines protective of drinking water and environmental quality, namely:
- UK Drinking Water Standards (DWS) as defined by The Water Supply (Water Quality) Regulations, 2016;
 - UK Environmental Quality Standards (EQS) for Freshwater, based on the United Utilities Hardness based on the postcode (M15 5PE) of soft; 0 – 50mg/l CaCO₃ and laboratory test results of 14 – 29mg/l.
 - Petroleum Products in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality, 2011.
- 7.12 A table of relevant SL's are provided in Appendix 06.

Soil Test Results

- 7.13 8no soil samples were analysed for a suite of Contaminants of Concern (CoC). All of the concentrations were measured below the SL's for a "Commercial" end-use.
- 7.14 The concentrations of TPH's from samples obtained at shallow depths within areas of car parking (BH01 & WS05) and within the grassy mound to be removed from site (WS02) were all measured below the SL's for a "Commercial" end-use.
- 7.15 No asbestos was detected within any of the 8no samples analysed.
- 7.16 A sample of asphalt from BH01 was analysed to determine the concentration of BaP, which, if the concentration exceeds 50mg/kg, may indicate that the asphalt is likely to contain coal tar at sufficient concentrations as to deem it hazardous waste. The analysis recorded a concentration of BaP of <0.10mg/kg, therefore suggesting that the asphalt does not contain coal tar at hazardous concentrations for disposal purposes.

Leachate Testing

- 7.17 3no samples of made ground were submitted for leachate preparation and testing for a range of contaminants of concern.
- 7.18 The majority of results were below the assessment criteria when compared to stringent drinking water and environmental standards (EQS with a water hardness of 0-50mg/l) with the following exceptions.

Contaminant	Ref Value ug/l		Concentration Exceedances ug/l		Sample
	EQS	UKDWS	EQS	UKDWS	
Copper	0.5	2000	5.3 – 7.4	-	WS01 – 0.50m WS03 – 0.80m WS05A – 0.70m
Lead	4	10	8.6 – 15	15	WS01 – 0.50m WS03 – 0.80m WS05A – 0.70m
Zinc	8	5000	9.1 & 10	-	WS01 – 0.50m WS05A – 0.70m

Discussion and Conclusions

Human Health

- 7.19 The chemical analysis results have confirmed that the site does not contain any significant and/or widespread contamination sources.
- 7.20 The long-term exposure risk to human health, based on the samples analysed, is therefore confirmed to be low with no specific remediation requirements.
- 7.21 Although not anticipated to be significant, any suspected area of contamination encountered beneath the existing floor slabs should also be managed as part of a watching brief to ensure that any suspected / encountered contamination is suitably remediated as part of site redevelopment.

Controlled Waters

- 7.22 Localised elevated leachable concentrations of lead were recorded within the made ground when compared to the stringent drinking water standards. In addition, when the results were compared against the EQS values for surface water concentrations of copper, lead and zinc exceeded the reference values.
- 7.23 The relatively low permeability of the cohesive glacial till underlying the site will limit vertical migration of any undetected mobile contamination from the site towards the underlying 'Principal' bedrock aquifer. However, in consideration of the proposed use of piles, it is anticipated that piling risk assessment would need to be undertaken.
- 7.24 Following development, the site will include new structures and hardstanding, including a positive drainage system, thus limiting downward movement of surface water and hence the potential for leachate generation. Therefore the potential to mobilise contaminants into the underlying aquifers will be significantly reduced.
- 7.25 Taking into consideration that the underlying superficial aquifer is not of the highest sensitivity and that the site is not within a designated SPZ with no groundwater abstractions within 500m of the site, such concentrations are not considered to pose a significant risk to controlled waters with no specific remedial actions anticipated.

8.0 GROUND GAS RISK ASSESSMENT

Methodology

- 8.1 Current guidance for the assessment of risk associated with the presence of hazardous ground gases (principally methane and carbon dioxide) is provided in two key documents, namely:
- Code of practice for the Characterisation and remediation from Ground Gas in Affected Developments. British Standard Institution (BS 8485: 2015 & A1:2019); and
 - Assessing Risks posed by Hazardous Ground Gases to Buildings CIRIA (C665, 2007).
- 8.2 The assessment presented herein is primarily based on the BS8485 document.
- 8.3 Hazardous ground gas qualitative risk assessment is based on a conceptual model similar to that used for soil and groundwater contamination sources (i.e., source-pathway-receptor pollutant linkages). A semi-quantitative estimate of risk can be assessed based on knowledge of the conceptual model and a measure of hazardous gas concentration and gas flow at the site within monitoring standpipes.
- 8.4 Based on the measured flow rates and hazardous gas concentrations, individual "hazardous gas flow rates" (Qhg) can be derived for each monitoring point, from which the "site characteristic hazardous gas flow rate" (Qhgs), and then the "Characteristic Situation" (CS) can be determined.
- 8.5 BS8485 provides guidance on the level of gas protection requirements based upon the characteristic situation and the proposed development based on building type as outlined in Table 3.

Table 3 - Building Types

	Type A	Type B	Type C	Type D
Ownership	Private	Private or commercial/ Public, possible multiple	Commercial / Public	Commercial / Industrial
Control (Change of use)	None	Some but not all	Full	Full
Room Sizes	Small	Small/ medium	Small to Large	Large Industrial/ Retail Park

- 8.6 The proposed development therefore is indicated to comprise the construction of Type C buildings which include commercial or public structures with small to large room sizes.

Ground Gas Conceptual Model

- 8.7 The site is not in Radon Affected Area, defined by the UK Health Security Agency as less than 1% of properties are above the Action Level of exposure. Therefore, no radon protection measures are necessary for new structures as described in publication BR211 by the Building Research Establishment.
- 8.8 There are no active landfills located within 500m of the site. A historic landfill is located 111m north-east at Moss Side Shopping Centre. This is recorded to comprise inert and industrial waste deposited between 1994 and 1995. In consideration of the age of the landfill (circa 30 years) it is unlikely to provide a significant source of landfill gas.
- 8.9 The presence of ground gas resulting from shallow unrecorded mine workings can be discounted based on the site geology.
- 8.10 No appreciable thickness of made ground which include significant organic content have been encountered beneath the site.

- 8.11 No natural deposits which include significant organic content have been encountered beneath the site.
- 8.12 However, it has been considered prudent to undertake ground gas monitoring, primarily for methane and carbon dioxide, with associated flow rates, on 1no occasion to date, on 31st March 2023.

Results and Recommendations

- 8.13 The results to date indicate concentrations of peak and steady state methane not exceeding 0.1% by volume in air (v/v) and peak and steady state carbon dioxide concentrations not exceeding 0.6 v/v. No detectable steady state ground gas flows were recorded.
- 8.14 The initial results give a maximum composite Q_{hg} value of 0.0006l/hr and indicate the site to classify as Characteristic Situation (CS) 1 – Very Low Gas Risk' with no specific ground gas protection measures anticipated.
- 8.15 However, the Characteristic Situation will need to be confirmed on completion of the ground gas monitoring and risk assessment in due course and should also be confirmed with the local authority Environmental Health / Building Control Officer prior to any building design being finalised.

9.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS

Excavated Soils

- 9.1 Excavation works undertaken during the development are likely to produce waste soils for which appropriate waste management will be required. In line with current sustainability principals, any waste soils should firstly be considered for re-use where possible by incorporation into the development.
- 9.2 However, due to the extent of the proposed redevelopment, it is envisaged that such excavated soil will, in the main, need to be removed from site under appropriate duty of care.
- 9.3 It should be noted that the chemical analysis results for disposal classification are assessed against different assessment criteria to those relating to contamination risk assessment. Soils that are deemed suitable for use in terms of risk to human health and the environment may not necessary be un-contaminated and could be classified as Non-Hazardous or even Hazardous for disposal purposes.
- 9.4 It will be the responsibility of the waste producer to undertake additional testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines.
- 9.5 For preliminary guidance based on the current information, it is likely that made ground, would be classified as 'Non-hazardous' with natural soils classified as 'Inert' for landfill disposal.
- 9.6 However, excavated soils which are contaminated with TPH compounds may classify as 'Hazardous' if disposed to landfill. Any soils containing ACM or significant asbestos fibres may also classify as 'Hazardous' following further quantification analysis.
- 9.7 In addition, for Inert and Hazardous waste disposal, allowance will need to be made for adequate Waste Acceptance Criteria (WAC) testing with appropriate consideration of the additional time and cost associated with this.
- 9.8 It will be the responsibility of the waste producer to undertake further testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines and Duty of Care requirements.

Imported Fill

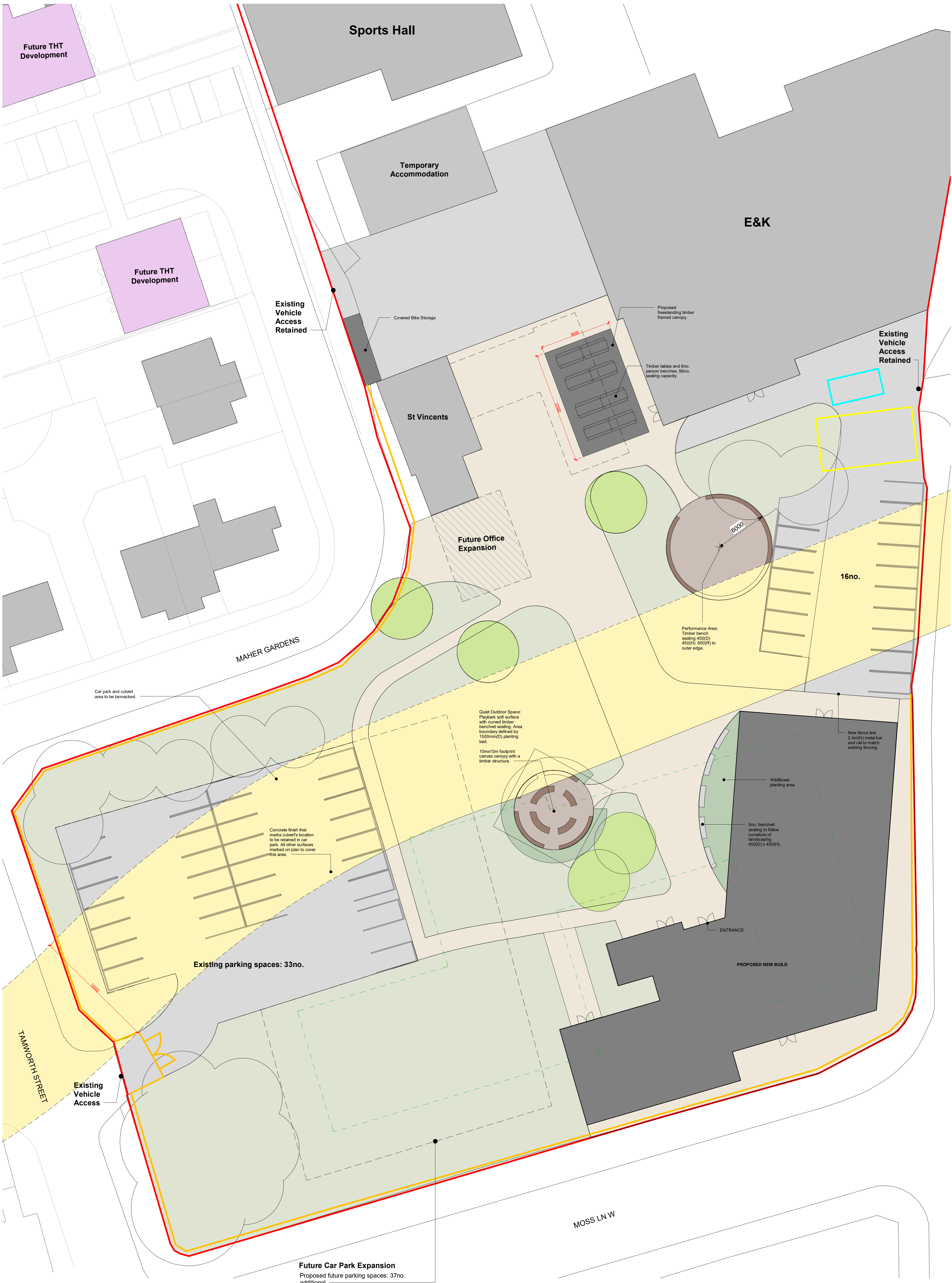
- 9.9 Imported fill will be subject to specific quality requirements and should be accompanied by appropriate certification to confirm its suitability. Allowance should also be made for testing imported fill materials prior to placement to ensure suitability.

Water Supply Pipes

- 9.10 The relevant water supply provider will need to be consulted with regards the selection of suitable water supply pipe materials for the development, should these be required. In light of the ground conditions encountered, the requirement for specific materials and measures to protect the water supply from ground contamination are not anticipated.

APPENDIX 01

Drawings



1

Proposed Landscaping Option 1

1 : 200

Key

- Site Boundary
- Ownership Boundary
- Grass
- Hard Landscaping (vehicle grade)
- Pathways
- New Build
- Timber Bench Seating

- Future THT Development
- Location of Culvert and 7m easement zone from culvert centre line. Exact location to be confirmed via specialist site survey.
- Existing Trees
- Proposed Trees

- Planting Areas
- Soft Landscaping - Playpark
- Lines of Demolition
- EV EV Parking (20% Manchester City Council TFGM EVI Strategy 2021)
- DIS Disabled Parking (3 +3% - DPA UK)

- 2.4m(H) metal and post rail fence to match existing
- Rainwater Harvesting Tank
- Attenuation Tank

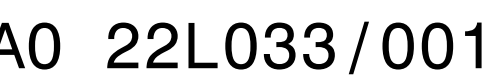
- Soft Landscaping:**
Grass/Planting. Approx. area size: 2675/100sqm
- Hard Landscaping:**
Tarmac Hardscape: 2260sqm
Pathways: Sudstech Permeable Paving in Lea. Approx. area size: 1130sqm

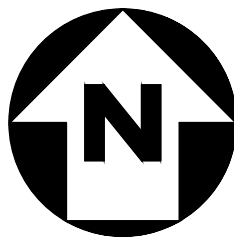


Scale 1:200



Client: Loreto College
Project: Loreto College Probation Land
Job No.: 1273
Date: 06/02/23
BIM Model: LCPL-10A-M3
QA: AD DD
Scale: As indicated@A1
Drawing: Proposed Landscaping Option 1
Rev notes: i109 - Landscaping





GENERAL NOTES

DO NOT SCALE FROM THIS DRAWING WORK TO FIGURED DIMENSIONS ONLY.

NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS ALLOWED WITHOUT PRIOR PERMISSION IN WRITING.

ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.

KEY

-  Cable Percussive Borehole
-  Windowless Sample Probehole
-  Hand Dug Trial Pit



Rev.	Amendment	Date	By	Chkd
PO1	FIRST ISSUE	02.03.23	DB	Log
Project LORETO COLLEGE EXPANSION				
ARCHITECT LORETO COLLEGE				
Title EXPLORATORY HOLE LOCATION PLAN				
WML Job No. 10939G	Drawn TB	Checked SCS	Date MARCH 23	Scale 1:200 @ A0
WML CONSULTING Civil, Structural & Geotechnical Engineers				
No 8 Oak Green East Road Stanley Green Business Park Chichester PO19 2SL Tel: 01243 882 0000 Fax: 01243 886 9210 e-mail: info@wmlconsulting.com www.wmlconsulting.com				
Drawing No 10939G/SK01 REV 01				

APPENDIX 02

Exploratory Hole Records

		Project Title: Loreto College - Expansion				BH01	
		Project Number: 10939G		Client: Loreto College			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 10/03/2023		Method: Cable Percussion		Driller: PB Drilling		Logged By: Driller	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.03 0.10 0.20 0.40	J D E D				0.10 0.30	Asphalt. (MADE GROUND)		
1.00 1.20 - 1.65	D SPT	N=8			1.00	Brown, slightly sandy, fine to coarse GRAVEL of sandstone. (MADE GROUND)		
2.00 - 2.45	SPT	N=17			1.50	Brownish grey, sandy CLAY. (GLACIAL TILL)		
3.00 - 3.45	SPT	pp 10/5mm			2.00	Loose brown SAND. (GLACIAL TILL)		
4.00 - 4.45	SPT	N=18			3.00	Medium dense SAND and GRAVEL. (GLACIAL TILL)		
5.00 - 5.45	U				4.00 4.30	Soft becoming firm/stiff Brown CLAY. (GLACIAL TILL)		
6.50 - 6.95	SPT	N=7			5.00 6.00 7.00 8.00	Borehole Continues		

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level		REMARKS No Groundwater Encountered 	Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> Daily Log Of Depths <table border="1"> <thead> <tr> <th colspan="3">Chiselling</th> <th colspan="3"> </th> </tr> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Hours</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	Date	Strike	Level	Minutes	Casing	Sealed																			Chiselling						Date	Casing	Water	From	To	Hours												
Date	Strike	Level	Minutes	Casing	Sealed																																														
Chiselling																																																			
Date	Casing	Water	From	To	Hours																																														

Scale: 1:50

			Project Title: Loreto College - Expansion				BH01		
			Project Number: 10939G		Client: Loreto College				
			GL (mAOD):		N Coord: 0		E Coord: 0		
Date: 10/03/2023			Method: Cable Percussion		Driller: PB Drilling		Logged By: Driller		
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe	
9.50 - 9.95	SPT	N=38			9.00	Soft becoming firm/stiff Brown CLAY. (GLACIAL TILL)			
11.00 - 11.45	SPT	N=19	10.00		11.00				
12.00 - 12.45	SPT	pp 50/85mm	12.00		Very dense reddish brown, weakly cemented SAND. (COMPLETELY WEATHERED SANDSTONE)				
			12.50						
			13.00			End Of Borehole At 12.50 m			
			14.00						
			15.00						
			16.00						

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
-  - Groundwater Strike
-  - Groundwater Level



REMARKS

No Groundwater Encountered

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed

Daily Log Of Depths

Date	Casing	Water	From	To	Hours

		Project Title: Loreto College - Expansion				WS01	
		Project Number: 10939G		Client: Loreto College			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 10/03/2023		Method: Window Sample		Driller: LOT Geotechnics Ltd		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.10	E	N=17			0.20	Turf over dark brown, organic SAND. (TOPSOIL)		
0.40	E				0.70	Greyish brown, gravelly SAND. Gravel is subangular, fine to coarse, including brick, concrete, sandstone and concrete. (MADE GROUND)		
0.50	E				1.00	Firm, orange brown and grey mottled, slightly silty, sandy CLAY. (GLACIAL TILL)		
	D				1.60			
1.20					2.00	Medium dense to dense, orange brown, slightly gravelly, medium to coarse SAND. Gravel is subrounded to rounded, fine to coarse, of mixed lithologies. (GLACIAL TILL)		
		N=27			3.00	End Of Borehole At 3.00 m		
		pp 50/220mm						
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level		REMARKS No Groundwater Encountered  Scale: 1:40	Water Strikes					
			Date	Strike	Level	Minutes	Casing	Sealed

		Project Title: Loreto College - Expansion				WS02	
		Project Number: 10939G		Client: Loreto College			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 10/03/2023		Method: Window Sample		Driller: LOT Geotechnics Ltd		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.50	E				0.25	Turf over dark brown, organic SAND. (TOPSOIL)		
1.50	E				1.00	Greyish brown, gravelly SAND with pockets of sandy CLAY. Gravel is subangular, fine to coarse, including brick, concrete and locally clinker. Low cobble content. Cobbles are subangular to brick. (MADE GROUND)		
					2.00			
					2.20			
					2.50		Firm, brown and grey mottled, slightly silty, sandy CLAY. (GLACIAL TILL)	
					2.50	End Of Borehole At 2.50 m		
					3.00			
					4.00			
					5.00			
					6.00			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level		REMARKS No Groundwater Encountered Hole located on mound, terminated at 2.50mbgl once natural strata encountered.	Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	Date	Strike	Level	Minutes	Casing	Sealed																		
Date	Strike	Level	Minutes	Casing	Sealed																						
		Scale: 1:40	Daily Log Of Depths <table border="1"> <thead> <tr> <th>Date</th> <th>Casing</th> <th>Water</th> <th>From</th> <th>To</th> <th>Hours</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	Date	Casing	Water	From	To	Hours																		
Date	Casing	Water	From	To	Hours																						

		Project Title: Loreto College - Expansion				WS03	
		Project Number: 10939G		Client: Loreto College			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 10/03/2023		Method: Window Sample		Driller: LOT Geotechnics Ltd		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.10	E				0.20	Turf over dark brown, organic SAND. (TOPSOIL)		
0.40	E				1.00	Brownish grey, sandy, angular to subangular, fine to coarse GRAVEL including sandstone, brick, concrete and ash. Low cobble content. Cobbles are subangular, including concrete and brick. (MADE GROUND)		
0.80	E				1.10			
1.30	D	N=6			2.00			
2.00	E	N=4			3.00	Greyish brown, slightly gravelly, sandy CLAY. Gravel is angular to subangular, fine to coarse, including sandstone, brick and rare clinker. (MADE GROUND)		
		N=10		3.10				
3.30	J			4.00				
		N=13		4.55	5.00	Medium dense, orange brown, slightly gravelly, medium to coarse SAND. Gravel is subrounded to rounded, fine to coarse, of mixed lithologies. (GLACIAL TILL)		
		N=13		5.00		Firm, brown, slightly silty, slightly sandy CLAY. (GLACIAL TILL)		
						End Of Borehole At 5.00 m		
					6.00			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 		REMARKS Scale: 1:40		Water Strikes					
				Date	Strike	Level	Minutes	Casing	Sealed
				13/03/2023	4				
				Daily Log Of Depths			Chiselling		
				Date	Casing	Water	From	To	Hours

		Project Title: Loreto College - Expansion				WS04	
		Project Number: 10939G		Client: Loreto College			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 10/03/2023		Method: Window Sample		Driller: LOT Geotechnics Ltd		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.40	E				0.20	Turf over dark brown, organic SAND. (TOPSOIL)		
		N=12			1.00	Brownish grey, sandy, subangular to subrounded, fine to coarse GRAVEL including sandstone and brick. (MADE GROUND)		
		N=27			2.00			
					2.30			
2.90	J	pp 50/165mm			2.75	Medium dense, yellow brown, slightly gravelly, medium to coarse SAND. Gravel is subrounded to rounded, fine to coarse, of mixed lithologies. (GLACIAL TILL)		
					3.00	Dense, orange brown, slightly gravelly, medium to coarse SAND. Gravel is subrounded to rounded, fine to coarse, of mixed lithologies. (GLACIAL TILL)		
						End Of Borehole At 3.00 m		
					4.00			
					5.00			
					6.00			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level		REMARKS No Groundwater Encountered 	Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	Date	Strike	Level	Minutes	Casing	Sealed																													
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Date	Casing	Water	From	To	Hours																																	
Date	Casing	Water	From	To	Hours																																	

Scale: 1:40

		Project Title: Loreto College - Expansion				WS05A	
		Project Number: 10939G		Client: Loreto College			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 10/03/2023		Method: Window Sample		Driller: LOT Geotechnics Ltd		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.70	E	N=7			0.25	Brownish grey, slightly sandy, subangular, fine to coarse GRAVEL including concrete, brick and sandstone with black geotextile membrane at base. (MADE GROUND)		
					1.00			
		N=11			1.20	Brownish grey, sandy, angular to subangular, fine to coarse GRAVEL including brick, sandstone, slate, ash and clinker. (MADE GROUND)		
					2.00			
2.30	J	pp 50/235mm			2.10	Soft to firm, orange brown and grey mottled, slightly silty, sandy CLAY. (GLACIAL TILL)		
					2.10			
					3.00	Medium dense to dense, orange brown, gravelly, medium to coarse SAND. Gravel is subrounded to rounded, fine to coarse, of mixed lithologies. (GLACIAL TILL)		
					3.00	End Of Borehole At 3.00 m		
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level		REMARKS No Groundwater Encountered 	Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	Date	Strike	Level	Minutes	Casing	Sealed																																									
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Scale: 1:40

	Project Title: Loreto College - 2023 Expansion		HP01
	Project Number: 10939G	Client: Loreto College	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 10/03/2023	Method: Hand Dug	Logged By: TPB	Scale: 1:20



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.40	E				0.30	Turf over dark brown, organic SAND. (TOPSOIL)	
					0.80	Dark brown, gravelly SAND. Gravel is subangular, fine to coarse, including brick and sandstone. Low cobble content. Cobbles are subangular, of brick. (MADE GROUND)	
					1.00	End Of Trial Pit At 0.80 m	
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered Brick obstruction at 0.80mbgl.	

APPENDIX 03

Geotechnical Testing Results



LABORATORY REPORT



Contract Number: PSL23/1853

Report Date: 12 April 2023

Client's Reference: 10939G

Client Name: WML Consulting
No 8 Oak Green Earl Road
Stanley Green Business Park
Cheadle Hulme
Cheshire
SK8 6QL

For the attention of: Tom Booth

Contract Title: Loreto College

Date Received: 22/3/2023

Date Commenced: 22/3/2023

Date Completed: 12/4/2023

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

T Watkins
(Senior Technician)

5 – 7 Hexthorpe Road,
Hexthorpe,
Doncaster,
DN4 0AR
Tel: 01302 768098
Email: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

Loreto College

Contract No:

PSL23/1853

Client Ref:

10939G

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



Loreto College

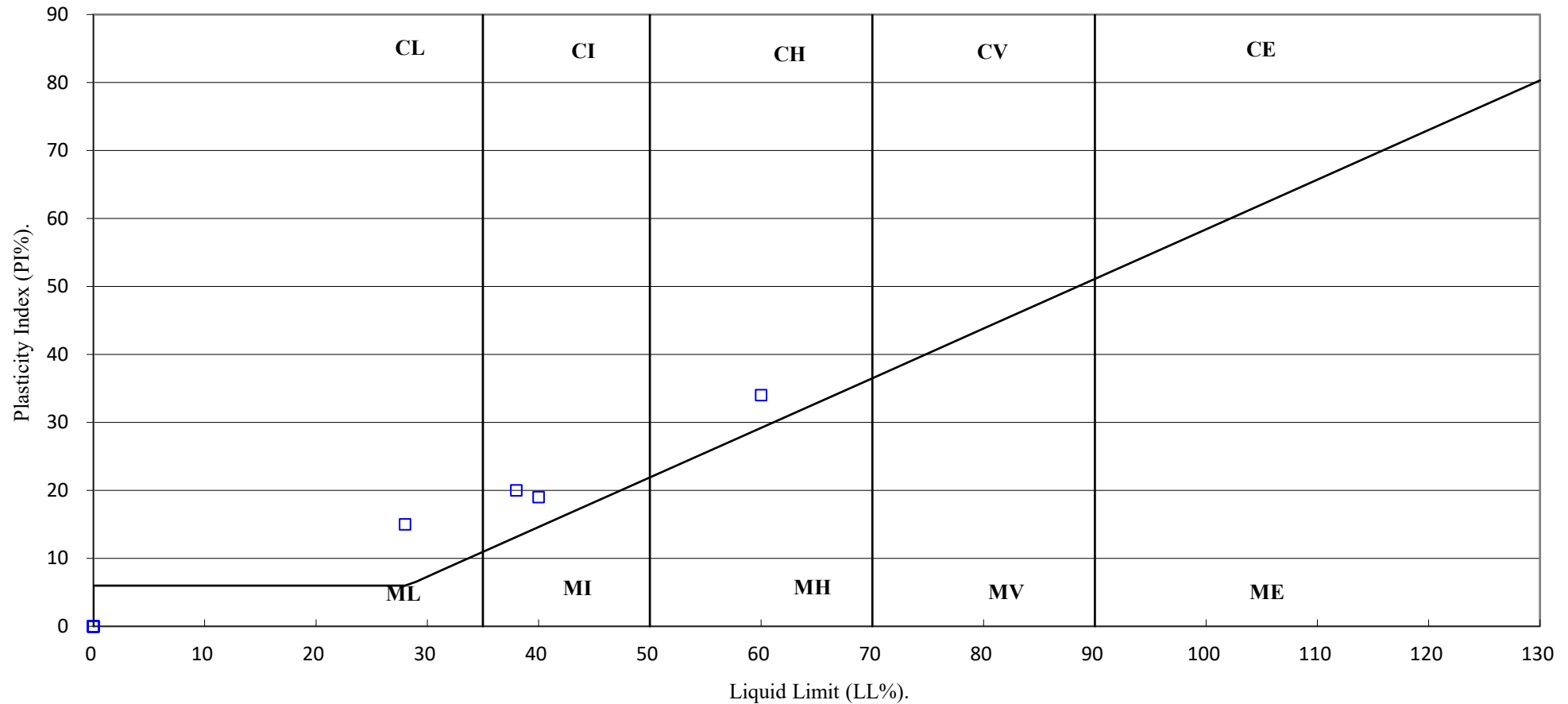
Contract No:

PSL23/1853

Client Ref:

10939G

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Loreto College

Contract No:

PSL23/1853

Client Ref:

10939G

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

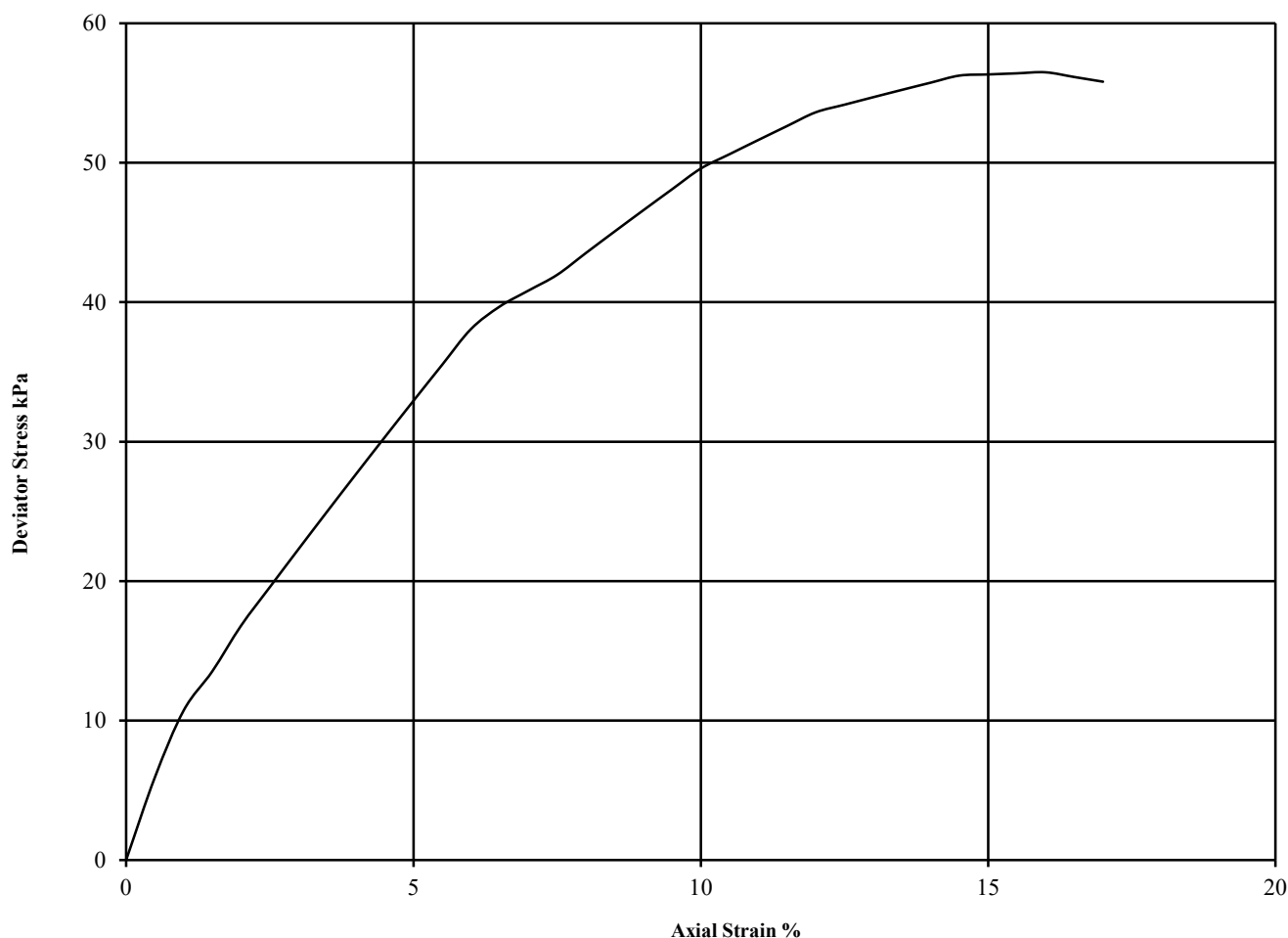
Hole Number: BH01

Top Depth (m): 5.00

Sample Number:

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		206	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	23	2.09	1.70	100	56	28	16.0	Plastic	



Loreto College

Contract No:

PSL23/1853

Client Ref:

10939G



Certificate of Analysis

Certificate Number 23-08306

Issued: 14-Apr-23

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 23-08306

Client Reference PSL23/1853

Order No (not supplied)

Contract Title Loreto College

Description 3 Soil samples.

Date Received 06-Apr-23

Date Started 06-Apr-23

Date Completed 14-Apr-23

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "Kirk Bridgewood".

Kirk Bridgewood
General Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 23-08306

Client Ref PSL23/1853

Contract Title Loreto College

Lab No	2152807	2152808	2152809
Sample ID	BH01	BH01	BH01
Depth	3.00	8.00	12.00
Other ID			
Sample Type	D	U	D
Sampling Date	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Metals						
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l	< 10	< 10	< 10
Inorganics						
pH	DETSC 2008#		pH	7.9	8.2	8.6
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l	20	7.0	14
Nitrate Aqueous Extract as NO ₃ (2:1)	DETSC 2055	1	mg/l	< 1.0	< 1.0	< 1.0
Sulphate Aqueous Extract as SO ₄ (2:1)	DETSC 2076#	10	mg/l	130	29	13
Sulphur as S, Total	DETSC 2320	0.01	%	< 0.01	0.08	0.02
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	0.01	0.04	0.02

Information in Support of the Analytical Results

Our Ref 23-08306
 Client Ref PSL23/1853
 Contract Loreto College

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2152807	BH01 3.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), Metals ICP Prep (182 days), pH + Conductivity (7 days)	
2152808	BH01 8.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), Metals ICP Prep (182 days), pH + Conductivity (7 days)	
2152809	BH01 12.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), Metals ICP Prep (182 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

APPENDIX 04

Chemical Analytical Results



Final Report

Report No.:	23-08831-1		
Initial Date of Issue:	29-Mar-2023		
Client	WML Consulting Ltd		
Client Address:	No. 8 Oak Green Stanley Green Business Park Earl Rd Cheadle SK8 6QL		
Contact(s):	Tom Booth		
Project	10939G Loreto College		
Quotation No.:		Date Received:	15-Mar-2023
Order No.:	10939G	Date Instructed:	15-Mar-2023
No. of Samples:	16		
Turnaround (Wkdays):	7	Results Due:	23-Mar-2023
Date Approved:	29-Mar-2023		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Leachate

Project: 10939G Loreto College

Client: WML Consulting Ltd	Chemtest Job No.:					23-08831	23-08831	23-08831
Quotation No.:	Chemtest Sample ID.:					1607960	1607965	1607973
Order No.: 10939G	Client Sample Ref.:					E	E	E
	Sample Location:					WS01	WS03	WS05A
	Sample Type:					SOIL	SOIL	SOIL
	Top Depth (m):					0.5	0.8	0.7
	Date Sampled:					10-Mar-2023	10-Mar-2023	10-Mar-2023
Determinand	Accred.	SOP	Type	Units	LOD			
pH	U	1010	10:1		N/A	6.8	7.2	7.5
Sulphur	N	1220	10:1	mg/l	1.0	2.0	8.0	2.9
Sulphate	U	1220	10:1	mg/l	1.0	6.1	24	8.7
Hardness as Ca	U	1415	10:1	mg/l	6	26	29	14
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	3.8	1.9	9.9
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	< 10	30	16
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11	< 0.11
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	7.0	5.3	7.4
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05	< 0.05	0.08
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.96	0.78	1.1
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	10	8.6	15
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	1.3	2.0	1.6
Vanadium (Dissolved)	U	1455	10:1	µg/l	0.50	2.2	1.6	6.3
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	9.1	5.4	10
Chromium (Hexavalent)	U	1490	10:1	µg/l	20	< 20	< 20	< 20
Naphthalene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	10:1	µg/l	2.0	< 2.0	< 2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: 10939G Loreto College

Client: WML Consulting Ltd	Chemtest Job No.:				23-08831	23-08831	23-08831	23-08831	23-08831	23-08831	23-08831	23-08831	23-08831
Quotation No.:	Chemtest Sample ID.:				1607958	1607959	1607961	1607962	1607963	1607964	1607967	1607968	1607969
Order No.: 10939G	Client Sample Ref.:				E	E	E	E	E	E	J	J	E
	Sample Location:				WS01	WS01	WS02	WS02	WS03	WS03	WS03	BH01	BH01
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.1	0.4	0.5	1.5	0.1	0.4	3.3	0.03	0.2
	Date Sampled:				10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023
	Asbestos Lab:				DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM			
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	-	-	-	-	-	-			
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected			
Moisture	N	2030	%	0.020	19	14	14	16	16	10	15	2.8	9.7
pH	U	2010		4.0	7.8	8.2	8.2	8.5	8.4	8.7	8.6		
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	2.2	0.93	0.49	0.47	0.50	< 0.40			
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010		
Total Sulphur	U	2175	%	0.010	0.060	0.070	0.076	0.17	0.076	0.039	0.019		
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	1.7	1.1	< 0.50	< 0.50	< 0.50			
Sulphate (Total)	U	2430	mg/kg	100	220	1100	1100	750	610	360			
Arsenic	U	2455	mg/kg	0.5	2.9	13	11	2.6	11	1.9			
Cadmium	U	2455	mg/kg	0.10	0.10	1.5	0.71	0.10	0.29	0.10			
Copper	U	2455	mg/kg	0.50	9.5	49	45	20	36	8.2			
Mercury	U	2455	mg/kg	0.05	0.05	0.42	0.45	< 0.05	0.23	< 0.05			
Nickel	U	2455	mg/kg	0.50	3.8	19	12	3.9	13	4.5			
Lead	U	2455	mg/kg	0.50	35	230	240	66	200	38			
Selenium	U	2455	mg/kg	0.25	< 0.25	0.68	0.83	< 0.25	0.55	< 0.25			
Vanadium	U	2455	mg/kg	0.5	4.4	19	13	4.5	16	4.4			
Zinc	U	2455	mg/kg	0.50	24	310	130	25	90	21			
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50			
Aliphatic VPH >C5-C6	U	2780	mg/kg	0.05				< 0.05					< 0.05
Aliphatic VPH >C6-C7	U	2780	mg/kg	0.05				< 0.05					< 0.05
Aliphatic VPH >C7-C8	U	2780	mg/kg	0.05				< 0.05					< 0.05
Aliphatic VPH >C8-C10	U	2780	mg/kg	0.05				< 0.05					< 0.05
Total Aliphatic VPH >C5-C10	U	2780	mg/kg	0.25				< 0.25					< 0.25
Aliphatic EPH >C10-C12	U	2690	mg/kg	2.00				< 2.0					< 2.0
Aliphatic EPH >C12-C16	U	2690	mg/kg	1.00				2.3					2.2
Aliphatic EPH >C16-C21	U	2690	mg/kg	2.00				< 2.0					< 2.0
Aliphatic EPH >C21-C35	U	2690	mg/kg	3.00				< 3.0					< 3.0
Aliphatic EPH >C35-C40	N	2690	mg/kg	10.00				< 10					< 10
Total Aliphatic EPH >C10-C35	U	2690	mg/kg	5.00				5.9					7.1
Total Aliphatic EPH >C10-C40	N	2690	mg/kg	10.00				< 10					< 10
Aromatic VPH >C5-C7	U	2780	mg/kg	0.05				< 0.05					< 0.05
Aromatic VPH >C7-C8	U	2780	mg/kg	0.05				< 0.05					< 0.05
Aromatic VPH >C8-C10	U	2780	mg/kg	0.05				< 0.05					< 0.05
Total Aromatic VPH >C5-C10	U	2780	mg/kg	0.25				< 0.25					< 0.25
Aromatic EPH >C10-C12	U	2690	mg/kg	1.00				6.0					5.4
Aromatic EPH >C12-C16	U	2690	mg/kg	1.00				9.3					8.6

Results - Soil

Project: 10939G Loreto College

Client: WML Consulting Ltd	Chemtest Job No.:				23-08831	23-08831	23-08831	23-08831	23-08831	23-08831	23-08831	23-08831
Quotation No.:	Chemtest Sample ID.:				1607958	1607959	1607961	1607962	1607963	1607964	1607967	1607968
Order No.: 10939G	Client Sample Ref.:				E	E	E	E	E	E	J	J
	Sample Location:				WS01	WS01	WS02	WS02	WS03	WS03	WS03	BH01
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.1	0.4	0.5	1.5	0.1	0.4	3.3	0.03
	Date Sampled:				10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023
	Asbestos Lab:				DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM		
Determinand	Accred.	SOP	Units	LOD								
Aromatic EPH >C16-C21	N	2690	mg/kg	2.00				18				12
Aromatic EPH >C21-C35	U	2690	mg/kg	2.00				55				21
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00				6.5				9.7
Total Aromatic EPH >C10-C35	U	2690	mg/kg	5.00				89				47
Total Aromatic EPH >C10-C40	N	2690	mg/kg	10.00				95				56
Total VPH >C5-C10	U	2780	mg/kg	0.50				< 0.50				< 0.50
Total EPH >C10-C35	U	2690	mg/kg	10.00				95				54
Total EPH >C10-C40	N	2690	mg/kg	10.00				100				64
Organic Matter	U	2625	%	0.40	8.8	5.6	6.3	4.1	5.9	2.0		
Benzo[a]pyrene	U	2700	mg/kg	0.10							< 0.10	
Benzene	U	2760	µg/kg	1.0				< 1.0				< 1.0
Toluene	U	2760	µg/kg	1.0				< 1.0				< 1.0
Ethylbenzene	U	2760	µg/kg	1.0				< 1.0				< 1.0
m & p-Xylene	U	2760	µg/kg	1.0				< 1.0				< 1.0
o-Xylene	U	2760	µg/kg	1.0				< 1.0				< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0				< 1.0				< 1.0
Naphthalene	U	2800	mg/kg	0.10	0.25	0.31	0.62	2.0	0.11	0.20		
Acenaphthylene	N	2800	mg/kg	0.10	0.27	0.19	< 0.10	< 0.10	< 0.10	< 0.10		
Acenaphthene	U	2800	mg/kg	0.10	0.68	0.90	0.60	4.1	< 0.10	< 0.10		
Fluorene	U	2800	mg/kg	0.10	0.67	0.94	0.44	3.2	< 0.10	< 0.10		
Phenanthrene	U	2800	mg/kg	0.10	6.4	8.8	4.1	29	0.97	2.0		
Anthracene	U	2800	mg/kg	0.10	2.0	2.3	0.86	7.7	0.26	0.57		
Fluoranthene	U	2800	mg/kg	0.10	12	12	5.1	32	1.9	1.7		
Pyrene	U	2800	mg/kg	0.10	8.9	9.9	4.7	25	1.8	1.6		
Benzo[a]anthracene	U	2800	mg/kg	0.10	4.7	4.7	2.3	13	0.88	0.59		
Chrysene	U	2800	mg/kg	0.10	4.8	4.2	2.3	14	0.94	0.44		
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	5.0	5.4	3.0	15	1.2	< 0.10		
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	2.0	1.9	0.98	4.9	0.29	< 0.10		
Benzo[a]pyrene	U	2800	mg/kg	0.10	3.9	4.3	2.3	10	0.94	0.76		
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	2.8	2.9	1.5	7.1	0.71	< 0.10		
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.49	0.45	0.24	1.1	< 0.10	< 0.10		
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	2.5	2.4	1.4	6.4	0.78	0.56		
Total Of 16 PAH's	N	2800	mg/kg	2.0	57	62	30	170	11	8.4		
Total Phenols	U	2920	mg/kg	0.10	< 0.10	< 0.10	3.6	< 0.10	< 0.10	< 0.10		

Results - Soil

Project: 10939G Loreto College

Client: WML Consulting Ltd	Chemtest Job No.:				23-08831	23-08831	23-08831	23-08831
Quotation No.:	Chemtest Sample ID.:				1607971	1607972	1607974	1607975
Order No.: 10939G	Client Sample Ref.:				J	E	J	E
	Sample Location:				WS04	WS05	WS05A	HP01
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				2.9	0.3	2.3	0.4
	Date Sampled:				10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023
	Asbestos Lab:					DURHAM		DURHAM
Determinand	Accred.	SOP	Units	LOD				
ACM Type	U	2192		N/A		-		-
Asbestos Identification	U	2192		N/A		No Asbestos Detected		No Asbestos Detected
Moisture	N	2030	%	0.020	7.4	5.7	9.8	15
pH	U	2010		4.0	8.4	8.5	8.6	8.5
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		< 0.40		0.42
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	0.085	< 0.010	< 0.010
Total Sulphur	U	2175	%	0.010	0.013	0.47	0.026	0.063
Cyanide (Total)	U	2300	mg/kg	0.50		0.50		< 0.50
Sulphate (Total)	U	2430	mg/kg	100		2500		420
Arsenic	U	2455	mg/kg	0.5		7.1		7.7
Cadmium	U	2455	mg/kg	0.10		0.33		0.20
Copper	U	2455	mg/kg	0.50		32		28
Mercury	U	2455	mg/kg	0.05		0.12		0.21
Nickel	U	2455	mg/kg	0.50		14		10
Lead	U	2455	mg/kg	0.50		90		98
Selenium	U	2455	mg/kg	0.25		0.53		0.40
Vanadium	U	2455	mg/kg	0.5		23		12
Zinc	U	2455	mg/kg	0.50		82		53
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50		< 0.50
Aliphatic VPH >C5-C6	U	2780	mg/kg	0.05		< 0.05		
Aliphatic VPH >C6-C7	U	2780	mg/kg	0.05		< 0.05		
Aliphatic VPH >C7-C8	U	2780	mg/kg	0.05		< 0.05		
Aliphatic VPH >C8-C10	U	2780	mg/kg	0.05		< 0.05		
Total Aliphatic VPH >C5-C10	U	2780	mg/kg	0.25		< 0.25		
Aliphatic EPH >C10-C12	U	2690	mg/kg	2.00		2.4		
Aliphatic EPH >C12-C16	U	2690	mg/kg	1.00		3.1		
Aliphatic EPH >C16-C21	U	2690	mg/kg	2.00		2.4		
Aliphatic EPH >C21-C35	U	2690	mg/kg	3.00		< 3.0		
Aliphatic EPH >C35-C40	N	2690	mg/kg	10.00		< 10		
Total Aliphatic EPH >C10-C35	U	2690	mg/kg	5.00		8.7		
Total Aliphatic EPH >C10-C40	N	2690	mg/kg	10.00		< 10		
Aromatic VPH >C5-C7	U	2780	mg/kg	0.05		< 0.05		
Aromatic VPH >C7-C8	U	2780	mg/kg	0.05		< 0.05		
Aromatic VPH >C8-C10	U	2780	mg/kg	0.05		< 0.05		
Total Aromatic VPH >C5-C10	U	2780	mg/kg	0.25		< 0.25		
Aromatic EPH >C10-C12	U	2690	mg/kg	1.00		4.6		
Aromatic EPH >C12-C16	U	2690	mg/kg	1.00		9.3		

Results - Soil

Project: 10939G Loreto College

Client: WML Consulting Ltd	Chemtest Job No.:				23-08831	23-08831	23-08831	23-08831
Quotation No.:	Chemtest Sample ID.:				1607971	1607972	1607974	1607975
Order No.: 10939G	Client Sample Ref.:				J	E	J	E
	Sample Location:				WS04	WS05	WS05A	HP01
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				2.9	0.3	2.3	0.4
	Date Sampled:				10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023
	Asbestos Lab:					DURHAM		DURHAM
Determinand	Accred.	SOP	Units	LOD				
Aromatic EPH >C16-C21	N	2690	mg/kg	2.00		21		
Aromatic EPH >C21-C35	U	2690	mg/kg	2.00		190		
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00		240		
Total Aromatic EPH >C10-C35	U	2690	mg/kg	5.00		230		
Total Aromatic EPH >C10-C40	N	2690	mg/kg	10.00		470		
Total VPH >C5-C10	U	2780	mg/kg	0.50		< 0.50		
Total EPH >C10-C35	U	2690	mg/kg	10.00		240		
Total EPH >C10-C40	N	2690	mg/kg	10.00		480		
Organic Matter	U	2625	%	0.40		10		4.4
Benzo[a]pyrene	U	2700	mg/kg	0.10				
Benzene	U	2760	µg/kg	1.0		< 1.0		
Toluene	U	2760	µg/kg	1.0		< 1.0		
Ethylbenzene	U	2760	µg/kg	1.0		< 1.0		
m & p-Xylene	U	2760	µg/kg	1.0		< 1.0		
o-Xylene	U	2760	µg/kg	1.0		< 1.0		
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0		< 1.0		
Naphthalene	U	2800	mg/kg	0.10		1.4		0.28
Acenaphthylene	N	2800	mg/kg	0.10		< 0.10		0.18
Acenaphthene	U	2800	mg/kg	0.10		1.4		0.35
Fluorene	U	2800	mg/kg	0.10		1.1		0.31
Phenanthrene	U	2800	mg/kg	0.10		7.2		3.0
Anthracene	U	2800	mg/kg	0.10		1.7		0.80
Fluoranthene	U	2800	mg/kg	0.10		7.6		5.8
Pyrene	U	2800	mg/kg	0.10		6.7		5.2
Benzo[a]anthracene	U	2800	mg/kg	0.10		3.3		2.9
Chrysene	U	2800	mg/kg	0.10		3.5		2.6
Benzo[b]fluoranthene	U	2800	mg/kg	0.10		4.5		3.9
Benzo[k]fluoranthene	U	2800	mg/kg	0.10		1.5		1.3
Benzo[a]pyrene	U	2800	mg/kg	0.10		3.6		3.2
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10		2.8		2.0
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10		0.38		0.29
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10		2.5		2.0
Total Of 16 PAH's	N	2800	mg/kg	2.0		49		34
Total Phenols	U	2920	mg/kg	0.10		< 0.10		< 0.10

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection

Test Methods

SOP	Title	Parameters included	Method summary
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

APPENDIX 05

Gas and Groundwater Monitoring Results

Gas & Groundwater Monitoring Record Sheet



Project Name:- Loreto College 2023 Expansion
Project No:- 10939G
Client:- Loreto College

Date:- 31/03/2023
Start Time:- 13:50
End Time:- 15:00
Ground Conditions:- Damp
Weather Conditions:- Cool, light drizzle

Atmospheric Pressure
Start:- 983
End:- 983
Trend:- Steady

Instrument:- Gas Data GFM436

Operator:- T Sheen

Hole ID	Peak Flow l/hr	Steady Flow l/hr	DP	CH4			CO2			Min O2 %	Peak H2S ppm	Peak CO ppm	Hexane %	Water Level mbgl	Base of Hole mbgl
				Peak %	Steady %	Qhg l/hr	Peak %	Steady %	Qhg l/hr						
WS01	<0.1	<0.1	0	0.0	0.0	0.0000	0.6	0.6	0.0006	19.3	0	0	0.000	Dry	2.91
WS03	<0.1	<0.1	0	0.0	0.0	0.0000	0.6	0.6	0.0006	19.7	0	0	0.000	Dry	2.99
WS04	<0.1	<0.1	0	0.0	0.0	0.0000	0.6	0.6	0.0006	19.5	0	0	0.000	Dry	1.90

Additional Comments

GAS MONITORING METHODOLOGY

1. The following are recorded upon arrival or at each location as the monitoring progresses:-
 - Operator name;
 - Instrumentation name i.e. Gas Data - GFM436;
 - Atmospheric pressure;
 - Time of commencement of the monitoring visit;
 - Ground conditions e.g. wet, dry waterlogged etc.;
 - General weather conditions, as the prevailing conditions may affect the results; and
 - Condition of the monitoring point e.g. damaged, covered etc.
2. The background oxygen concentration in the vicinity of the monitoring point is recorded to ensure that the instrument is zeroed.
3. Where appropriate, both the flow and pressure differential are recorded at each monitoring point prior to obtaining the gas concentrations.
4. Concentrations of light hydrocarbon gas, comprising methane (%v/v), carbon dioxide (%v/v), oxygen (%v/v), hydrogen sulphide (ppm), carbon monoxide (ppm) and hexane % are monitored continuously over a 90 seconds period. The highest concentrations of methane, carbon dioxide, carbon monoxide and hydrogen sulphide and the lowest concentration of oxygen are then recorded.
5. If/where concentrations stabilise after 90 seconds, the steady-state concentrations are recorded. If concentrations are still varying, monitoring is continued until steady-state conditions are attained and concentrations then recorded. The accuracy for light hydrocarbon gases is :-
 - Methane - +/-0.2% at 5%.
 - Carbon dioxide - +/-0.1% at 10%.
6. Depth to water level and base of installation are recorded as the movement of groundwater can affect gas migration and migration pathways to monitoring points.
7. The above steps are to be repeated at each monitoring point.
8. The following are then recorded upon completion of the monitoring process:-
 - Atmospheric pressure;
 - Time of completion of the monitoring visit.

Key For Gas Monitoring Records

BH/WS	- Readings taken from gas valve within borehole or window sample probehole.	PD	- Pressure differential measured in millibars
Flow	- Gas flow measured in litres per hour	%	- Percentage
<0.1	- Where flows are less than 0.1/hr are recorded	ppm	- Parts Per Million
CO ₂	- Carbon Dioxide	l/hr	- Litres per hour
O ₂	- Oxygen	CH ₄	- Methane
H ₂ S	- Hydrogen Sulphide	mbgl	- Metres below ground level
CO	- Carbon Monoxide	GSV	- Gas Screening Value

TEST DATE AND CONDITIONS			
Date		21/10/2022	
Atmospheric Pressure		980	mB
Ambient Temperature		22.1	°C
EnviroNics Serial No.		5089	

**GFM436 Final Inspection & Calibration
Check Certificate**

GAS DATA LTD

Unit 4, Fairfield Court

Seven Stars Estate

Wheler Rd

Coventry

CV3 4LJ

Tel 02476303311



GAS DATA

SYSTEM - ANALYSE - INFORM

Fax 02476307711

Customer	WML Consulting Ltd
Certificate Number	123587
Order Number	332396

Serial Number	12969
Software Version	G436-00.0027/0010

Recalibration DUE Date
21/10/23

Instrument Checks					
Keyboard	✓		Display Contrast	✓	
Pump Flow In	450	Accept > 200 cc/min	Pump Flow @ -200mB	300	Accept > 200 cc/min
Clock Set / Running	✓		Labels Fitted	✓	

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %
	Readings %		Readings %		Readings %	
	59.7	60	40.0	40	20.9	20.9
	Accept ±3.0		Accept ±3.0		Accept ±0.5	
	5.0	5	5.0	5	6.0	6
	Accept ±0.3		Accept ±0.3		Accept ±0.3	
Zero Reading 100% N2	0.0	0	0.0	0	0.0	0
	Accept ±0.0		Accept ±0.0		Accept ±0.1	

Optional Gas Checks						
Applied Gas & Range		Concentration Tested @ (ppm)	Instrument Readings (ppm)			
Gas Type	Range (ppm)		Zero Reading		Instrument Gas Reading	
H2S	5000	1500	0	Accept ±0.0	1500	Accept ±5.0
CO	2000	1000	0	Accept ±0.0	1000	Accept ±5.0
Hexane	2.0%	2.0%	0	Accept ±0.0	1.99	Accept ±10.0

Cross Gas Effects									
Applied Gas (ppm)		Instrument Readings (ppm)							
Gas Type	Concentration	Toxic 1:	H2S	Toxic 2:	CO	Toxic 3:	HEX		
H2S	1500	1500		0		0			
CO	1000	60		1000		0			
Hexane	2.0%	0		0		1.99			

Pressure Checks			
Atmospheric Pressure [AP] (mB)			
Current Atmospheric Pressure (mB)		Instrument Atmospheric Pressure Reading (mB)	
AP Open Ports		980	Accept ± 2.0
AP Port (Internal)	+800 mB	800	Accept ± 5.0
	+1200mb	1200	Accept ± 5.0

Flow Checks					
Borehole Flow			Differential Pressure		
Applied Reading (l/h)	Instrument Reading (l/h)		Applied Pressure (Pa)	Instrument Reading (Pa)	
-30	-30.0	Accept ± 3.0	-377	-377	Accept ± 50
-3	-3.0	Accept ± 1.0	-18	-18	Accept ± 6.0
0	0.0	Accept ± 0.0	0	0	Accept ± 0.5
3	3.0	Accept ± 0.5	17	17	Accept ± 3.0
30	30.0	Accept ± 3.0	376	376	Accept ± 50
60	59.6	Accept ± 6.0	1153	1142	Accept ± 130
90	90.0	Accept ± 9.0	2278	>>>>>	Accept ± 250

Temperature Checks		
Calibration Temperature	Instrument Temperature Reading $^{\circ}\text{C}$	
Applied Temperature $^{\circ}\text{C}$		
-10	-10.0	Accept ± 2.0
0	0.0	Accept ± 1.0
30	30.0	Accept ± 1.0
60	60.0	Accept ± 1.0
100	100.0	Accept ± 1.0

Technician:
Jack Rutland

Date Tested:
21/10/2022

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

APPENDIX 06

Site Specific Acceptance Criteria

Screening Levels for "Commercial" end use assuming a 1% SOM for Hydrocarbons.

Contaminant	Screening Levels for Commercial End Use (mg/kg)
Metals	
Arsenic	640
Boron	240,000
Cadmium	190
Chromium III	8,600
Chromium VI	33
Copper	68,000
Lead*	2330
Mercury	58
Nickel	980
Selenium	12,000
Vanadium	9,000
Zinc	730,000
Non Metals	
Phenol	440
Polyaromatic Hydrocarbons (PAHs)	
Benz[a]anthracene	170
Benzo[a]pyrene	35
Benzo[b]fluoranthene	44
Benzo[ghi]perylene	3,900
Benzo[k]fluoranthene	1,200
Chrysene	350
Dibenz[ah]anthracene	3.5
Fluoranthene	23,000
Indeno[123-cd]pyrene	500
Naphthalene	190
Pyrene	54,000

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* Where not included in the S4UL's criteria for a limited number of contaminants, namely lead, have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.

Contaminant	Screening Levels for Commercial End Use (mg/kg)
Volatile Organic Compounds	
Benzene	27
Ethylbenzene	5,700
Toluene	56,000
M - Xylene	6,200
O - Xylene	6,600
P - Xylene	5,900
Total Petroleum Hydrocarbons	
Aliphatic C5-6	3,200
Aliphatic C6-8	7,800
Aliphatic C8-10	2,000
Aliphatic C10-12	9,700
Aliphatic C12-16	59,000
Aliphatic C16-35	1,600,000
Aliphatic C35 - 44	1,600,000
Aromatic C5 - 7	26,000
Aromatic C7 - 8	56,000
Aromatic C8-10	3,500
Aromatic C10-12	16,000
Aromatic C12-16	36,000
Aromatic C16-21	28,000
Aromatic C21-35	28,000
Aromatic C35 - 44	28,000

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* Where not included in the S4UL's criteria for a limited number of contaminants, namely lead, have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.

The GAC's for the assessment of potential groundwater contamination have been derived from very conservative guidelines protective of drinking water and environmental quality, namely:

- UK Environmental Quality Standards (EQS) for Freshwater, 2000;
- Petroleum Products in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality, 2011.

Table 1: Inorganic Tier 1 Water Environment Screening Criteria

Contaminant	Units	Hardness Banding (CaCO ₃ mg/l)	EQS /WFD (Freshwater)	UK DWS
Arsenic	µg/l	-	50	10
Ammonia	mg/l	-	0.2	0.5
Boron	µg/l	-	2000	1000
Cadmium	µg/l	-	5	5
Chromium	µg/l	0-50	2	50
		50-100	10	
		100-150	10	
		150-200	20	
		200-250	20	
Copper	µg/l	0-10	0.5	2000
		10-50	0.5	
		50-200	3	
		200-250	8	
		>250	12	
Cyanide (Free)	µg/l	-	1	-
Cyanide		-	-	50
Iron	µg/l	-	1000	200
Lead	µg/l	0-50	4	10
		50-150	10	
		150-250	20	
		>250	20	
Mercury	µg/l	-	1	1
Nickel	µg/l	0-50	8	20
		50-100	20	
		100-150	20	
		150-250	40	
		>250	40	
Selenium	µg/l	-	-	10
Sulphate (SO ₄)	mg/l	-	400	250
Zinc	µg/l	0-50	8	5000
		50-150	15	
		150-250	50	
		>250	50	
pH	-	-	6-9	-

Table 2: Organic Tier 1 Water Environment Screening Criteria

Contaminant	Units	UK DWS	WHO
PAHs - The sum of • Benzo(b)fluoranthene, • Benzo(ghi)perylene, • Benzo(k)fluoranthene, • indeno(1,2,3-c,d)pyrene)	µg/l	0.1	-
Phenol (total)	µg/l	0.5	-
MTBE	µg/l	-	15
Aliphatic C5-C6	µg/l	-	15,000
Aliphatic C6-C8	µg/l	-	15,000
Aliphatic C8-C10	µg/l	-	300
Aliphatic C10-C12	µg/l	-	300
Aliphatic C12-C16	µg/l	-	300
Aliphatic C16-21	µg/l	-	(300) *
Aliphatic C21-35	µg/l	-	(300)*
Aromatic C6-C7	µg/l	1 (benzene)	10 (benzene)
Aromatic C7-C8	µg/l	-	700 (toluene)
Aromatic C8-C10	µg/l	-	300 (ethylbenzene)
Aromatic C10-12	µg/l	-	100
Aromatic C12-C16	µg/l	-	100
Aromatic C16-C21	µg/l	-	90
Aromatic C21-C35	µg/l	-	90

Notes

The WHO Guideline Values for petroleum products in drinking water have been applied in the absence of current TPH water quality standards. However, for the aromatic TPH bandings of C6-C7, C7-C8 and C8-C10, the more conservative UK specific WQS for benzene, toluene and ethylbenzene have been used.

In the absence of specific WHO Guideline Values for the aliphatic ranges C16-C21 and C21-C35, the guideline values for the aliphatic C8-C10 through to C12-C16 ranges of 300µg/l have been used. This is however considered conservative due to the increased stability and lower volatility of the longer chain aliphatics.