REPORT C9247
OCTOBER 2021

GEOENVIRONMENTAL APPRAISAL

of Land off
MONKS CROSS DRIVE, YORK

prepared for
LIDL GREAT BRITAIN LTD

QA Sheet

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EXECUTIVE SUMMARY

Introduction	Sirius Geotechnical Ltd was commissioned by Lidl Great Britain Ltd to undertake a Geoenvironmental Appraisal of land off Monks Cross Drive, York (the 'site'). It is understood that Lidl is considering development of the site with a food store, car parking, drive-through food outlet and soft landscaping.
National Grid Reference	462440, 455060.
Site Description	The site covers an area of c. 1.3 hectares and is essentially flat. The site comprises a single portal frame building, divided into two retail units, both of which are vacant. To the rear (west) of the building is a concrete-surfaced service yard. To the north and east of the building are customer car parking, surfaced with a combination of asphalt, block paving and concrete paving slabs. There is an electrical substation in, or immediately adjacent to, the northern part of the site.
Site History	The site was mostly undeveloped until an access road related to the wider Monks Cross development was built in the north of the site in the 1990s. The current buildings appear to have been constructed in late 1990s or early 21st Century.
Mining and Quarrying	There is no evidence from the desk-top or site investigation information to suggest that the site is affected by historical mining or quarrying.
Fieldwork	The site investigation took place on 9th and 10th September 2021 and comprised nine windowless sampler boreholes to a maximum depth of 5.0m below ground level (bgl).
Laboratory Testing	Soil samples were analysed for a range of commonly occurring contaminants. Disturbed soil samples were analysed for geotechnical parameters including Atterberg limits, moisture content and particle size distribution.
Ground Conditions	The investigation has identified hardstanding underlain by granular made ground across the site, to a maximum proven depth of 1.0m bgl. The made ground was recorded to be underlain by natural clay soils (Alne Glaciolacustrine Formation) of generally medium strength (becoming low strength with depth in some boreholes). Rockhead was not encountered by this site investigation.
Soakaways	Based on the proven ground conditions (i.e., natural deposits predominantly comprising low permeability clay), soakaway drainage is considered unlikely to be viable at the site.
Foundations and Floor Slabs	The use of spread foundations (e.g., pads and strips / trench fill) taken through any made ground to bear onto natural undisturbed cohesive soils (at least medium strength), may be a suitable foundation solution for the proposed drive-through food outlet, assuming that this is to be a lightly loaded, one-storey building. At this stage, due to the potential for excessive settlements to occur in shallow spread foundations within the clay soils underlying the site, piled foundations should be assumed to be required for the proposed food store building. The potential use of spread foundations can be reviewed following completion of the further site investigation works recommended below.

	A reinforced ground bearing floor slab could be considered if all made ground is removed and the resultant fill used to establish final site levels is classified, compacted and validated in accordance with an approved earthworks / engineering specification.
Sulphate Class	Any buried concrete structures (e.g., foundations) in contact with site soils should conform to the requirements for Design Sulphate Class DS-1 and ACEC Class AC-1.
Soil Contamination	Limited testing was undertaken. However, based on the results, no concentrations of soil contaminants indicative of a potential significant risk to human health have been identified by the site investigation and therefore no specific remedial measures are considered necessary in this respect at this stage. However, this is subject to review following completion of the recommended post-demolition site investigation works.
Groundwater Contamination	The risk from groundwater contamination associated with the site is low at this stage and remediation to protect controlled waters is not considered necessary.
Ground Gas	Ground gas monitoring and risk assessment has indicated Characteristic Situation 1 conditions, confirming the preliminary conceptual site model assumption that no significant potential sources of hazardous ground gases affect the site. Therefore, it is considered that no ground gas protection measures (including for radon) are required.
Invasive Plant Species	It is recommended that a survey is carried out by a specialist ecologist, to determine the presence / absence of invasive plant species, and the implications thereof.
Recommended Further Works	At this stage, due to current access restrictions, the following supplementary works are considered likely to be required in order to inform detailed design and fulfil planning requirements, etc., following disconnection of services into the site, demolition of existing buildings and site clearance: Trial pitting in order to confirm shallow ground conditions below areas of currently restricted access, (i.e., within existing building footprints). Static cone penetration testing (CPTs) in order to derive accurate soil parameter profiles below the proposed buildings, to facilitate detailed design of foundations, including assessment of potential settlements. Further geotechnical and chemical laboratory testing of soil / fill materials and groundwater. Supplementary Geoenvironmental Appraisal report.

The executive summary is an overview of the key findings and conclusions of the report. There may be other information contained in the body of the report which puts into context the findings of the executive summary. No reliance should be placed on the executive summary in isolation, particularly when deriving design detail/abnormal costs.

1. INTRODUCTION

Sirius Geotechnical Ltd (Sirius) was commissioned by Lidl Great Britain Ltd (Lidl), to undertake a geoenvironmental appraisal of land off Monks Cross Drive, York (the "site").

It is understood that Lidl is proposing to develop the site with a low-rise food store, with associated car parking, roadways and landscaping, as well as a drive-through food outlet, as shown on HTC Architects drawing ref. 2504 F418 Rev. A, dated 22/07/21, a copy of which is included within Appendix A.

The objectives of this appraisal were to:

Establish the historical development of the site and surrounding area from a review of available plans.

Establish the environmental setting of the site.

Undertake a limited investigation of near surface soil and groundwater conditions.

Determine the potential risks posed by any ground contamination and provide recommendations on remedial measures to manage such risks.

Establish the risks associated with hazardous ground gas.

Evaluate whether past mining or other extractive industries could have an influence on the site.

Provisionally provide advice relating to geotechnical issues associated with the site; and,

Provide outline recommendations for foundation / pavement design for the proposed development.

The desk study element of this investigation includes an assessment of information provided by Landmark Information Group (Envirocheck Report), the British Geological Survey (BGS) and online sources of information including the Coal Authority (CA) interactive viewer and the Environment Agency (EA).

A site inspection (walkover survey) was undertaken by a Sirius geoenvironmental engineer on 9th August 2021.

Fieldwork was undertaken on 9th and 10th September 2021, comprising the drilling of nine windowless sampler boreholes.

This report presents the factual information available during this appraisal, an interpretation of the data obtained and recommendations relevant to the defined objectives.

No proposed finished development levels have been provided to Sirius, and for the purposes of this Appraisal, it is assumed that levels will not change significantly from existing levels. If the proposed site layout is changed significantly from that referenced above, or if finished levels are to differ significantly from existing, this Geoenvironmental Appraisal may also require revision.

It should be noted that access to a significant proportion of the site for intrusive site investigation, including the majority of the footprint of the proposed food store building was not possible, due to the presence of the existing building and buried services. Therefore, the conclusions and recommendations given within this report are based on limited information and should be reviewed, and where necessary, revised, following further site investigation, undertaken following substantial demolition / site clearance.

Where the report refers to the potential presence of invasive plants (such as Japanese knotweed) or asbestos-containing materials (ACMs), such observations are for information only and should be verified by a suitably qualified expert.

The comments and opinions presented in this report are based on the findings of the desk study, ground conditions encountered during intrusive investigation works performed by Sirius and the results of tests carried out within one or more laboratories. There may be other conditions prevailing on the site which have not been revealed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by this investigation. Any diagram or opinion on the possible configuration of strata, contamination or other spatially variable features between or beyond investigation positions is conjectural and given for guidance only. Confirmation of ground conditions between exploratory holes should be undertaken if deemed necessary. Evaluation of ground gas and groundwater is based on observations made at the time of the investigation and monitoring visits. It should be noted that ground gas and groundwater levels and quality may vary due to seasonal and other effects.

This report has been prepared for the sole use of Lidl Great Britain Ltd. No other third party may rely upon or reproduce the contents of this report without the written approval of Sirius. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and the authors do not owe them any Duty of Care or Skill.

2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview

Location	The site is located within the wider Monks Cross shopping centre, approximately 3.5km to the north-east of York city centre. A site location plan is provided as Drawing No. C9247/01 within Appendix A.
National Grid Reference	462440, 455060.
Topography and Features	Refer to the Site Features Plan, Drawing No. C9247/02, in Appendix A. The site is essentially flat. The site comprises a single portal frame building, with exterior brick and steel cladding, divided into two retail units, both of which were vacant at the time of the walkover survey. The southernmost retail unit occupies around two thirds of the building, and all accommodation is at ground floor level. There is an open retail space, divided in two by a partition wall, with former fitting rooms at the rear (west). The northernmost retail unit occupies the remaining third of the building. There is a mezzanine first floor, as well as toilets and offices on the northern side of the building. To the rear (west) of the building is a concrete-surfaced service yard. To the north and east of the building are customer car parking areas (still accessible to the public), surfaced with a combination of asphalt, block paving and concrete paving slabs. There is an electrical substation in, or immediately adjacent to, the northern part of the site.
Approximate Site Area	1.3 hectares.
Site Boundaries	The western and southern boundaries are marked by a steel palisade fence. The northern and eastern boundaries are marked by trees and bushes.

Adjacent Land Uses	The site is adjoined to the north by offices. The site is bound to the east by Monks Cross Drive, beyond which lies the Monks Cross Shopping Centre. The site is bound to the south by a supermarket, and to the west by the Portakabin factory premises.

3. ENVIRONMENTAL SETTING

3.1. Introduction

Published environmental, geological and historical data relating to the site has been reviewed. A summary of relevant information is provided below, and a copy of the Envirocheck Report (including historical Ordnance Survey (OS) maps) is enclosed in Appendix B.

3.2. Site History

Table 3.1 presents a summary of the site history from 1853 to 2021, as determined from historical OS maps. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site, only those pertinent to the proposed development.

Table 3.1 Site History

Map Dates	On-Site Features	Off Site Features (all distances are approximate)
1853-4	The site forms part of several open agricultural fields, with a Shed in the north-western part.	The surrounding land comprises open fields.
1893	There is a small enclosure in the north-eastern corner of the site.	No significant changes noted.
1911-2	The Shed is no longer shown.	No significant changes noted.
1930-58	No significant changes noted.	No significant changes noted.
1967-70	The enclosure in the north-east of the site is labelled as a Pond.	There is another small Pond adjacent to the northern site boundary.
1982	No significant changes noted.	There is a Factory, including a Travelling Crane, 120m west of the site.
1986-90	The Pond within the site is no longer shown.	There is an additional industrial building and Travelling Crane at the Factory, 100m west of the site.
1992-9	An access road to land to the north off Monks Cross Drive crosses the north-eastern corner of the site.	The Monks Cross shopping centre has been built to the east of the site. In addition, there are offices adjoining the site to the north, and a supermarket adjoining the site to the south.
2021	The building currently occupying the site is shown.	No significant changes noted.

3.3. Published Geological Information

A summary of available published geological information is provided in Table 3.2.

Table 3.2 Geological Summary

Sources of Information	BGS 1:50,000 scale geological map, Sheet 63 – York (Solid and Drift Edition), 1983. BGS Geology of Britain Viewer (on-line service). BGS Lexicon of Named Rock Units (on-line service). BGS borehole records (on-line service). Coal Authority (CA) Interactive Map Viewer (on-line service). Envirocheck report, Ref 282893558_1_1, dated 2nd August 2021.
Made Ground	None recorded on the published maps, but some made ground is likely to be present given the development history of the site.
Superficial Deposits	The majority of the site is shown to be underlain by the Alne Glaciolacustrine Formation (silty clay), with the north-western corner of the site shown to be underlain by the Sutton Sand Formation (fine-grained wind-blown sand).
Solid Geology	The superficial deposits are shown to be underlain by the Sherwood Sandstone Group. No faults are shown to affect the site.
BGS Borehole Logs	There are three BGS borehole records located close to the southern site boundary. These are all cable percussion boreholes drilled in 1990, to depths of 21.2m – 21.7m below ground level (bgl). In summary, each borehole recorded topsoil from the surface to 0.6m bgl, overlying a sequence of firm to stiff sandy / silty clays, to depths of c. 13 – 15m bgl, below which depth, bands of dense to very dense sands and silts were also recorded. Rockhead was not recorded in any of these three boreholes. Groundwater was struck in each of the three boreholes, at depths ranging between 9.2m and 20.0m bgl, with final standing groundwater levels of 8.4m to 8.6m bgl.
Mining	The site is not located within the Coal Mining Reporting Area, as defined by the CA.
Quarrying	There are no BGS Recorded Mineral Sites within 500m of the site. Furthermore, inspection of historical OS mapping does not indicate the presence of any historically active quarries or clay / sand pits within 500m of the site.

3.4. Hydrology and Hydrogeology

A summary of available information pertaining to hydrology/ hydrogeology is presented in Tables 3.3 to 3.5.

Table 3.3 Surface Water Features

	Presence/location	Comments
Classified Watercourses	The nearest named watercourse to the site is the River Foss, located c. 1.2km to the north-west. According to the Environment Agency (EA) Catchment Data Explorer website[1], the site is within the 'Foss from the Syke to the River Ouse' catchment area.	The latest river classification data shows this watercourse to be classified as Moderate for ecological parameters and Fail for chemical parameters, with an overall classification of Moderate.
Unclassified Watercourses	Plans within the Envirocheck report show that there are land drains c. 300m south of the site.	
Licensed Surface Water Abstractions (within 1km)	None recorded.	
Other Surface Water Features (Canals, Ponds, Lakes, etc.) (within 250m)	There are two man-made rectangular ponds located c. 150m south-west of the site.	These are within the Portakabin factory premises.
Flood Risk Status	The Envirocheck report indicates that the site is located in Flood Zone 1.	

[1] https://environment.data.gov.uk/catchment-planning/WaterBody/GB104027064255

Table 3.4 Groundwater Occurrence and Abstraction

	Presence/location	Comments
Licensed Abstractions (within 1km)	There are no active groundwater abstractions recorded within 1km of the site.	There is a record for a revoked licence, located 460m west of the site.
Source Protection Zones (within 500m)	None recorded.	
BGS Groundwater Flooding Susceptibility	The north-western corner of the site (i.e., the area mapped as being underlain by the Sutton Sand Formation) is recorded to have *"limited potential for groundwater flooding to occur".*	

Table 3.5 Groundwater Vulnerability Status

	Environment Agency Classification
Superficial Aquifer Designation	The AIne Glaciolacustrine Formation is classified as Unproductive Strata, which are defined as, *"rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow".* The Sutton Sand Formation is classified as a Secondary A Aquifer, which are defined as, *"having permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".*
Bedrock Aquifer Designation	The Sherwood Sandstone Group is classified as a Principal Aquifer, which are defined as, "*layers of rock or drift deposits that have high intergranular and / or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale".*

3.5. Landfilling and Waste Management

Information on waste management and related activities that could impact upon the site is summarised in Table 3.6.

Table 3.6 Waste Management Activities

	Presence / Location	Comments
Landfills (within 1km)	None recorded.	
Other Licensed Waste Management Facilities (within 500m)	None recorded.	
Evidence of Fly-Tipping on Site?	No.	
Ground Gas Risk Assessment Required?	No.	No plausible significant potential sources of hazardous ground gases (e.g., carbon dioxide and methane) have been identified by the desk study and walkover survey.

3.6. Radon

The Envirocheck Report states that the site lies within an area in which **no radon protective measures are required**.

3.7. Other

Other potentially contaminative activities or environmental constraints are listed below. The entries relate to activities within approximately 250m of the site, with the exception of COMAH facilities where the assessment is extended to a distance of approximately 1km from the site:

There three active or potentially active local authority pollution prevention and control records within 250m of the site; two are for petrol filling stations, located c. 110m and 185m south-east of the site, with the other being for respraying of road vehicles, located 206m south-west of the site. There are also two Fuel Station Entries within the Envirocheck report, relating to two above petrol filling stations.

There are twelve Contemporary Trade Directory entries recorded within 250m of the site, including a photographic processors (inactive; 30m south-west of the site), laboratories (active; 137m north of the site), and a dry cleaners (inactive; 206m south-west of the site).

4. PRELIMINARY CONCEPTUAL SITE MODEL

Based on the desk study information, a combined preliminary conceptual site model and conceptual exposure model (CSM) has been developed for the proposed future land use (commercial). This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors to assess potential contaminant linkages.

A qualitative risk assessment has also been made of each contaminant linkage operating following the methodology described in Appendix C. The preliminary CSM is presented in schematic form in Drawing No. C9247/03, in Appendix A.

In summary, the following potential contaminant linkages have been assessed as posing a potentially unacceptable level of risk (defined as being greater than “low” risk) in the proposed end-use:

Inhalation, ingestion of, and dermal contact with, made ground or shallow natural soils in which asbestos-containing materials (ACMs; inhalation only) or elevated concentrations of metals, metalloids or organic contaminants (including hydrocarbons and PAHs) are present. These linkages are assessed as posing a **low to moderate** risk to construction workers and future site users;

Phytotoxic effects of metals (e.g., copper and zinc) within made ground on planting and landscaping within the proposed development, posing a **low to moderate risk**;

Attack of construction materials (concrete and plastic) by acids, sulphates and organic contaminants within soils and groundwater; this linkage is considered to pose a **low to moderate** risk to the built environment.

The above assessment does not include potential asbestos containing materials (ACMs) within existing building on the site. These are considered to pose a low risk to future site users and construction workers, taking account the age of the building and assuming that a suitable asbestos survey is carried out, and if present, that all ACMs are appropriately identified and removed prior to demolition.

5. FIELDWORK

5.1. Scope of Investigation

The information contained in this report is limited to land accessible during the investigation within the site boundary.

The investigation, which was supervised by a Sirius Geoenvironmental Engineer, took place on the 9th and 10th September 2021 and comprised nine windowless sampler boreholes (WS01 to WS09), to depths of between 0.35m and 5.0m bgl.

In order to avoid damage to underground services (and risk to workers) all borehole locations were scanned by a service avoidance specialist prior to drilling. Proposed exploratory hole locations were relocated away from any services or suspected services where necessary.

Hand-dug starter pits were excavated at each windowless sampling location in order to prove the absence of buried services prior to commencement of drilling. In WS07, the pit was terminated at 0.5m bgl, due to the rapid ingress of perched groundwater, potentially obscuring any services present. In WS08, a hard obstruction (intact concrete or similar) overlain by a layer of Terram geotextile was encountered at 0.35m bgl and the pit was terminated without drilling.

Installations for combined groundwater and ground gas monitoring (50mm uPVC standpipes with flush covers) were installed in WS01, WS03, WS05 and WS06.

5.2. Exploratory Hole Locations

The exploratory hole locations were selected using the findings of the preliminary conceptual site model in order to achieve general site coverage. Access to undertake site investigation within the existing buildings on the site was not permitted. Furthermore, the selection of exploratory hole locations was significantly constrained in some areas due to the presence of underground services.

Exploratory hole locations are shown on Drawing No. C9247/04, in Appendix A of this report.

5.3. Strata Description

Strata descriptions were logged in accordance with BS EN ISO 14688-1&2: 2018. Detailed descriptions of strata and groundwater observations made during investigation works, together with samples recovered and the results of in-situ field testing, are presented on the Engineer's records

in Appendix D. The depths of strata on the record sheets are recorded from current ground levels at each location.

5.4. Geotechnical Testing

Geotechnical laboratory testing on selected soil samples was carried out under subcontract by Socotec, a UKAS-accredited laboratory. Laboratory geotechnical test results are included within Appendix E of this report.

5.5. Chemical Testing

Selected soil samples were tested for a range of chemical parameters and potential contaminants under subcontract with Eurofins Chemtest, a UKAS-accredited laboratory. MCERTS-accredited analysis was used where available.

Groundwater samples were not taken from the site; the monitoring wells were purged of groundwater during the monitoring visits, but there was insufficient recharge to provide sufficient volumes for representative sampling.

The potential contaminants of concern identified by the preliminary conceptual site model were selected as the analytes for the samples recovered from the site. The results of chemical soil analysis, as received from the laboratory, are presented in Appendix E of this report.

6. GROUND CONDITIONS AND MATERIAL PROPERTIES

6.1. Strata Profile

A summary of the strata profile encountered as part of the investigation is provided in Table 6.1.

Table 6.1 Strata Profile

Strata	Depth Range (Thickness Range)	Description and Comments
Surface Hardstanding	Ground level (0.30m) Ground Level (0.15m to 0.20m) Ground level (0.10m)	Concrete was present at the surface in the service yard to the rear (west) of the existing building. Bound macadam / asphalt was present at the surface in most of exploratory holes. Paving slabs were present at the surface in WS07.
Made Ground	0.10m to 0.30m bgl (0.50m to 0.70m)	Made ground was encountered in all boreholes and mostly comprised sandy gravel of limestone and clinker (sub-base), locally also including brick, concrete and asphalt.
Alne Glaciolacustrine Formation	0.70m to 1.00m bgl (base not proven)	Firm (locally stiff) dark brown, mottled bluish grey slightly sandy slightly silty thinly laminated clay was recorded below the made ground, to depths of 2.0m to 2.8m bgl. This was underlain by firm (locally soft, locally stiff) dark brown sandy silty clay, to the full depth of investigation.

No soils through to be representative of the Sutton Sand Formation were encountered by this site investigation.

Rockhead was not encountered by this site investigation.

6.2. Material Properties

Made Ground

Particle size distribution testing was undertaken on three samples of granular made ground. The relevant exploratory hole logs have been amended with descriptions taken from the testing results, in accordance with BS EN ISO 14688:2018.

Alne Glaciolacustrine Formation

Seven Atterberg limit determinations undertaken on samples of the cohesive Alne Glaciolacustrine Formation soils revealed liquid limits of between 46% and 66%, plastic limits of between 22% and 30%, and plasticity indices of between 23% and 36%; indicating the material to be clay of medium to high plasticity. Calculation of the modified Plasticity Index values, in accordance with NHBC standards, indicate this material to have Medium volume change potential.

Thirty SPTs undertaken within these deposits recorded uncorrected 'N' values ranging between 7 and 13, with mean and median values of 9. An overall slight reduction in SPT 'N' values with depth is noted.

Indicative undrained shear strengths of cohesive soils can be derived by applying a correlation to SPT 'N' values according to the material's plasticity, after Stroud (1975). Based on a mean plasticity index of 30% for the cohesive Alne Glaciolacustrine Deposits, a correlation factor of 4.7 can be derived. Using Stroud's correlation, the SPT 'N' values indicate undrained shear strengths of between 33 and 61 kN/m^2 (with mean and median values of 44 and 42 kN/m^2, respectively), indicating the cohesive soils to be of generally medium strength, varying locally to low strength.

Twenty-two hand shear vane tests were undertaken within these deposits. Undrained shear strengths of between 34 and 72 kN/m^2 were recorded, with mean and median values of 54 and 53 kN/m^2 respectively, indicating the cohesive soils to be of generally medium strength, varying locally to low strength. As with the recorded SPT 'N' values, an overall slight reduction in recorded undrained shear strength values with depth is noted.

6.3. Groundwater

Rapid inflow of perched groundwater at 0.5m bgl was noted when excavating the starter pit for WS07.

Subsequent groundwater monitoring has identified groundwater levels to be standing between 1.00m and 1.99m bgl. When bailed dry, the groundwater within the boreholes recharges slowly during the monitoring visits, indicating that the water encountered within the boreholes is probably a limited volume perched within shallow granular made ground.

6.4. Visual / Olfactory Evidence of Contamination

During the ground investigation works no olfactory or visual evidence of hydrocarbon or similar contamination was identified.

Granular made ground including some clinker was noted in most of the boreholes; such soils commonly contain elevated concentrations of metals / metalloids and polycyclic aromatic hydrocarbons (PAHs).

6.5. Ground Gas

The ground gas monitoring was undertaken over four visits, the results of which are summarised in Table 6.2. Full details of the ground gas monitoring results are included in Appendix F.

Table 6.2 Summary of Gas Monitoring

Well	Peak Methane %v/v	Steady Carbon Dioxide %v/v	Minimum Oxygen %v/v	Peak Flow litres/hr	Steady Flow litre/hr
WS01	ND	ND – 0.2	18.6 – 19.7	ND	ND
WS03	ND	0.5 – 1.4	17.8 – 19.6	ND – 24.0	ND
WS05	ND	0.7 – 0.9	19.7 – 20.0	ND	ND
WS06	ND	1.3	20.0	2.3	ND

ND - Not Detected

The maximum peak concentrations of carbon monoxide or hydrogen sulphide recorded were 3 ppm and 1 ppm, respectively.

VOCs were not detected within the borehole atmospheres by the photoionisation detector (PID) instrument used on the first visit.

7. RESULTS OF CHEMICAL TESTING

7.1. Assessment Methodology

Soil Data

The laboratory test data for the relevant soil strata were reviewed for completeness and consistency. The results of chemical analysis undertaken as part of this investigation are provided in full within Appendix E.

For each potential contaminant of concern, analytical data for soil samples were evaluated against the relevant Generic Assessment Criterion (GAC), taking account of the soil organic matter (SOM) content. For this site, measured values were compared to GACs derived for a commercial end-use. Source data for GAC used within this assessment are provided in Appendix F.

Where the relative ratio of concentrations of genotoxic PAH compounds to benzo(a)pyrene falls within the range suitable for use of the surrogate marker approach (see explanation in Appendix F), the surrogate marker approach is used as an initial screening tool for genotoxic PAH concentrations in soil. Calculations show that all of the soil PAH analyses obtained for the site in which PAH compounds were recorded in concentrations greater than the laboratory's limit of detection (LoD) conform to the distribution requirements for the use of the surrogate marker approach.

7.2. Soil Analysis

Made Ground

Table 7.1 presents a summary of the analytical results obtained from samples of made ground, and their evaluation against the applicable GAC.

The lowest recorded soil organic matter (SOM) concentration within samples of this material tested was 2.6%. Therefore, in this instance, GAC have been applied based on 2.5% SOM, as shown within Table 7.1.

Table 7.1 Summary of Total Soil Concentrations – Made Ground

Determinand	No. of Samples Tested	Range of Results (mg/kg unless otherwise specified)	Stage 1 GAC (2.5% SOM)	No. of Samples Exceeding GAC	Samples Exceeding GAC
Metals and Metalloids					
Arsenic	2	16 – 17	630	0	-
Cadmium	2	0.17 – 0.25	190	0	-
Chromium (total)	2	8.8 – 8.9	8,600	0	-
Chromium (hexavalent)	2	<0.50	33	0	-
Copper	2	6.5 – 14	68,000	0	-
Lead	2	9.5 – 25	2,300	0	-
Mercury	2	<0.10	1,100	0	-
Nickel	2	10 – 11	980	0	-
Selenium	2	<0.20	12,000	0	-
Zinc	2	30 – 88	750,000	0	-
Other Inorganics					
Asbestos in soil matrix (present/absent)	2	NAD	Fibres Detected	0	-
pH (units)	2	9.6 – 10.9	<5 or >9	2 (>9)	WS07, 0.2m; WS09, 0.4m
Water soluble sulphate (g/l)	2	<0.010 – 0.20	0.5	0	-
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	2	<0.10	92,000	0	-
Acenaphthylene	2	<0.10	93,000	0	-
Anthracene	2	<0.10 – 0.20	540,000	0	-
Benzo(a)anthracene	2	<0.10 – 0.49	B(a)P	N/A	-
Benzo(a)pyrene	2	<0.10 – 0.54	27	0	-
Benzo(b)fluoranthene	2	<0.10 – 0.38	B(a)P	N/A	-
Benzo(k)fluoranthene	2	<0.10 – 0.34	B(a)P	N/A	-
Benzo(g,h,i)perylene	2	<0.10 – 0.38	B(a)P	N/A	-
Chrysene	2	<0.10 – 0.61	B(a)P	N/A	-
Dibenzo(a,h)anthracene	2	<0.10 – 0.30	B(a)P	N/A	-
Fluoranthene	2	0.35 – 0.87	23,000	0	-
Fluorene	2	<0.10	67,000	0	-
Indeno(1,2,3-c,d)pyrene	2	<0.10 – 0.43	B(a)P	N/A	-
Naphthalene	2	<0.10	260	0	-
Phenanthrene	2	<0.10 – 0.58	22,000	0	-
Pyrene	2	0.39 – 0.87	54,000	0	-
Others					
Total phenols	2	<0.10	440	0	-

NAD – No asbestos detected
B(a)P – Assessed using benzo(a)pyrene as a surrogate marker
N/A – Not applicable

Summary

No metals, PAH compounds, water-soluble sulphate or total phenols were recorded in soil concentrations that are greater than the respective GAC. Asbestos was not detected in either of the samples analysed.

Both analysed samples of this material were recorded to have pH values greater than (i.e., more alkaline than) the GAC, which is set to be protective against potential dermal irritation from contact with alkaline materials.

As well as the contaminants listed in Table 7.1, two samples of made ground were analysed for speciated total petroleum hydrocarbons (TPH). Neither of the samples were recorded to contain concentrations of any TPH species that are greater than the laboratory's respective LoDs.

Natural Soils

Table 7.2 presents a summary of the chemical analysis results for Alne Lacustrine Formation soils and their evaluation against the applicable GAC. The GAC for 1% SOM have been used within Table 7.2 in the first instance.

Table 7.2 Summary of Soil Analysis – Natural Soils

Determinand	No. of Samples Tested	Range of Results (mg/kg unless otherwise specified)	Stage 1 GAC (1% SOM)	No. of Samples Exceeding GAC	Samples Exceeding GAC
Metals and Metalloids					
Arsenic	1	3.7	630	0	-
Cadmium	1	<0.10	190	0	-
Chromium (total)	1	20	8,600	0	-
Chromium (hexavalent)	1	<0.50	33	0	-
Copper	1	22	68,000	0	-
Lead	1	15	2,300	0	-
Mercury	1	<0.10	1,100	0	-
Nickel	1	29	980	0	-
Selenium	1	<0.20	12,000	0	-
Zinc	1	37	750,000	0	-
Other Inorganics					
pH (units)	8	8.0 – 8.9	<5 or >9	0	-
Water soluble sulphate (g/l)	8	0.011 – 0.19	0.5	0	-
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	1	<0.10	75,000	0	-
Acenaphthylene	1	<0.10	76,000	0	-
Anthracene	1	<0.10	520,000	0	-
Benzo(a)anthracene	1	<0.10	B(a)P	N/A	-
Benzo(a)pyrene	1	<0.10	27	0	-
Benzo(b)fluoranthene	1	<0.10	B(a)P	N/A	-
Benzo(k)fluoranthene	1	<0.10	B(a)P	N/A	-
Benzo(g,h,i)perylene	1	<0.10	B(a)P	N/A	-
Chrysene	1	<0.10	B(a)P	N/A	-
Dibenzo(a,h)anthracene	1	<0.10	B(a)P	N/A	-
Fluoranthene	1	<0.10	23,000	0	-
Fluorene	1	<0.10	60,000	0	-
Indeno(1,2,3-c,d)pyrene	1	<0.10	B(a)P	N/A	-
Naphthalene	1	<0.10	110	0	-
Phenanthrene	1	<0.10	22,000	0	-
Pyrene	1	<0.10	54,000	0	-
Others					
Phenol	1	<0.10	440	0	-

B(a)P – Assessed using benzo(a)pyrene as a surrogate marker
N/A – Not applicable

Summary

No metals, PAH compounds, or phenol were recorded at concentrations greater than the respective adopted GAC within the sample of this material analysed. The samples analysed were recorded to have pH values and water-soluble sulphate concentrations within the acceptable range.

As well as the contaminants listed in Table 7.2, a sample of this material was analysed for speciated TPH; the sample was recorded to not contain concentrations of any TPH species that are greater than the laboratory's respective LoDs.

8. REVISED CONCEPTUAL SITE MODEL

The preliminary combined conceptual site model and conceptual exposure model, developed from the desk study information and presented in Section 4, has been revised in light of the ground investigation, chemical analysis and ground gas / groundwater monitoring results presented above.

The revised conceptual model has been developed for the proposed future land use (commercial). This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors. The revised conceptual model is presented in schematic form in Appendix A, as Drawing No. C9247/05.

8.1. Summary of Residual Contaminant Linkages

The qualitative risk assessment of identified contaminant linkages has also been revised, following the methodology described in Appendix B.

In summary, the revised CSM has not identified any residual contaminant linkages (defined as being greater than “low” risk) that could result in an unacceptable risk in the proposed end-use.

The above assessment does not include potential asbestos containing materials (ACMs) within existing building on the site. These are considered to pose a low risk to future site users and construction workers, taking account the age of the building and assuming that a suitable asbestos survey is carried out, and if present, that all ACMs are appropriately identified and removed prior to demolition.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1. General

This Geoenvironmental Appraisal has been performed for land off Monks Cross Drive, York.

It is understood that Lidl are proposing to develop the site with a low-rise food store, with associated car parking, roadways and landscaping, as well as a drive-through food outlet, as shown on HTC Architects drawing ref. 2504 F418 Rev. A, dated 22/07/21.

No proposed finished development levels have been provided to Sirius, and for the purposes of this Appraisal, it is assumed that levels will not change significantly from existing levels. If the proposed site layout is changed significantly from that referenced above, or if finished levels are to differ significantly from existing, this Geoenvironmental Appraisal may also require revision.

It should be noted that access to a significant proportion of the site for intrusive site investigation, including the majority of the footprint of the proposed food store building was not possible, due to the presence of the existing building and buried services. Therefore, the conclusions and recommendations given within this report are based on limited information and should be reviewed, and where necessary, revised, following further site investigation, undertaken following substantial demolition / site clearance.

9.2. Flood Risk

The Envirocheck report states that the site lies within Flood Zone 1.

However, as the site is greater than 1 hectare in area, it is likely that a formal flood risk assessment report would be required to support a planning application for redevelopment of the site.

9.3. Geotechnical

Mining and Quarrying

The site is outside the Coal Mining Reporting Area, designated by the CA, and therefore the risk to site stability from coal mining is considered to be negligible.

There is no evidence from the desk-top study or intrusive ground investigation that the site has been affected by the extraction of any other mineral resource.

Groundworks, Excavation Stability and Groundwater Dewatering

Following demolition of the site buildings, all intact foundations, floor slabs, buried services would require fully grubbing out within the footprint of the proposed building, and would require grubbing out / removal to an agreed depth outwith the proposed building footprint to allow construction of new paved areas, services, drainage, etc.

Based on the investigation data, it is considered feasible for granular materials, (for example crushed brick and concrete from demolition of buildings and grubbing up of slabs and foundations, etc.) generated as part of any groundworks / earthworks, and any imported fill material, could be sorted, classified and compacted in a controlled manner in accordance with an approved earthworks specification (including verification).

Based on limited laboratory test results (particle size distribution), and in accordance with the *Specification for Highway Works Series 600, Earthworks Tables 6/1 and 6/2*; the granular made ground would be classified as Class 1A (well graded granular material), which is suitable for use as General Fill.

Where cohesive soils are excavated, their re-use as general cohesive earthworks fill may be feasible. However, these materials will require classification prior to use on site. In addition, dependent on the performance requirements for cohesive fill material, improvement of the geotechnical properties may be required, e.g., by modification by the addition of lime.

Where site-won made ground soils, or clean natural soils imported from another development site are used within earthworks on the site, this should be undertaken in accordance with a Materials Management Plan (MMP), which should be agreed with CL:AIRE prior to development.

Excavation should generally be suitable for standard plant within made ground and natural soils. However, breakers may be required to break out intact substructures, including the existing building foundations and floor slabs.

Excavations into existing made ground and natural soils should be assumed to be potentially unstable. No man entry into unsupported excavations should be undertaken without an appropriate risk assessment. Reference to CIRIA Report 97, *Trenching Practice* (2001) and / or BS 5975:2019, *Code of Practice for Temporary Works Procedures and the Permissible Stress Design of Falsework*, should be made to establish suitable means of support or battering of excavation sides.

Based on the results of this investigation, groundwater inflows within shallow excavations (<2m) are considered to be likely across the site. Where groundwater is encountered at shallow depth, then it should be possible to deal with seepages through normal site pumping practices for any shallow excavations open for short periods of time. Should deeper excavations be required, or where excavations are open for extended periods of time, dewatering using an alternative method (e.g., sump pumping, sheet-pile cofferdams, or well pointing), in conjunction with excavation support, may be required.

It is recommended that an adequate drainage system for surface water be installed by a competent contractor in order to prevent surface water ponding or collecting, both during and post construction, as this may lead to deterioration of the subgrade.

Foundations

The investigation has identified hardstanding underlain by granular made ground across the site, to a maximum proven depth of 1.0m bgl. The made ground was recorded to be underlain by natural clay soils of generally medium strength.

Based on this information, made ground would not be expected at normal formation depths. Notwithstanding the above, should made ground be encountered at formation depth, this stratum is considered unsuitable to support foundations in its present condition, due to the potential for unacceptable total and differential settlements and low bearing resistance in parts. Foundations for the proposed buildings should therefore be extended through these soils to bear within the underlying competent natural strata (i.e., clays of at least medium strength).

Drive-through Food Outlet

It is assumed that this building will be of lightly loaded, one storey construction and on this basis, it is considered that spread foundations (strip / trench fill) may be suitable, taken down through made ground to bear onto natural soils of adequate bearing capacity.

The natural clay soils present are considered to have a characteristic undrained shear strength (Cu) of 45 kPa at a depth of 1m below existing ground level. The load that can be applied to a foundation is dependent on its shape and size. However, by way of example and in accordance with Eurocode 7, for an assumed maximum line load of 60 kN/m run on an external wall, founded on a 0.6m wide strip foundation within the medium strength clay at a depth of 1.0m bgl, estimated settlements would be in the range of 25mm to 35mm. Calculations indicate that for the same

foundation depth and width, a reduced line load of 50 kN/m run would result in settlements no greater than 25mm.

The above calculations are based on theoretical foundations. The bearing capacity and settlement performance of soils is a function of the undrained shear strength / relative density, consolidation parameters, foundation loading, foundation width and depth, and as such should be assessed once final designs are known.

Foundations should be taken below a line drawn up at 45° from the base of any existing or proposed underground services.

It should be noted that any groundwater encountered may have an adverse effect on foundation construction and performance, particularly in winter months (such as loosening of founding materials / instability of excavation walls etc.). This should be considered when designing foundations.

Should greater line loads than those considered above be proposed, piled foundations may be required for the drive-through food outlet building (see further discussion below).

Food Store

At this stage, without a detailed understanding of ground conditions from within the proposed food store building footprint, and information regarding structural loadings, etc., initial calculations indicate that excessive settlements could occur in the normally consolidated clay soils underlying the site, should conventional spread foundations (pad / strip / trench fill) be used to support structural loads imposed by the proposed food store building.

Accordingly, it is recommended as a provisional foundation solution that the use of piled foundations should be assumed to be required at this stage, pending the further site investigation works recommended in Section 9 of this report.

The design of the piled foundation solution would be the responsibility of the appointed piling contractor, but at this stage it is envisioned that bored piles utilising skin friction within the cohesive Alne Glaciolacustrine Formation soils would be used. Piling contractors have their own proprietary methods of working. It is therefore recommended that consultation with a specialist piling contractor takes place at an early stage in the construction planning process.

Intact foundations / substructures would need to be removed to avoid forming obstructions to foundation construction. The foundation arrangements of the current building on the site are not

known. However, the layout of new foundations should consider any relic foundations (including piles, if present), structures or other potential obstructions that are present, which would be revealed during enabling works.

The Sherwood Sandstone Group solid strata underlying the site at depth are classified as a Principal Aquifer. In view of this, the design and installation of any piles that may penetrate the drift deposits into the Principal Aquifer should be undertaken in accordance with EA Report NC/99/73[2].

Ground Floor Slabs

A reinforced ground bearing floor slab could be considered if all made ground is removed and replaced with a suitable hardcore type fill beneath. The excavated fill could be used beneath the floor/ to establish final site levels, providing this is classified, compacted and validated in accordance with an approved earthworks / engineering specification.

Concrete in Aggressive Ground

Based on the analysis summarised in Section 7, a Design Sulphate Class of DS-1 and an ACEC Class of AC-1 should be used for buried concrete structures, e.g., foundations.

Pavements

Based on a visual inspection of the made ground soils observed by this investigation, a CBR preliminary value of 5% (equivalent to a subgrade surface modulus of c. 49 MPa, as calculated in accordance with Highways England document CD225, *Design for New Pavement Foundations* (2020)) could be assumed for preliminary pavement design within these soils at this stage.

An indicative CBR value of 3% (equivalent to a subgrade surface modulus of c. 36 MPa) is suggested for the natural cohesive Alne Glaciolacustrine Formation soils at this stage.

Notwithstanding the above, it is recommended that in-situ CBR testing is carried out following completion of the enabling works, at finished formation level, to inform construction details of the proposed car park and access roads, etc.

[2] Environment Agency. 2001. EA Report NC/99/73, *Piling and Penetrative Ground Improvement Methods on Land affected by Contamination: Guidance on Pollution Prevention.*

Soakaways

Based on the proven ground conditions (i.e., natural deposits predominantly comprising low permeability clay), soakaway drainage is considered unlikely to be viable at the site.

9.4. Asbestos-Containing Materials (ACMs)

ACMs were not observed within the soils encountered during this investigation.

The possibility of fragments of asbestos-containing materials within made ground or shallow natural soils cannot be discounted. If encountered, advice should be sought from an appropriately qualified asbestos specialists and an appropriate strategy developed for the safe removal and disposal of the material.

An updated pre-demolition asbestos survey should be carried out prior to be the building being demolished.

9.5. Soil and Groundwater Contamination

Risk Evaluation for the Proposed Land Use (Commercial)

Human Health Receptors

Based on the results of the samples tested, no soil contamination was detected as part of site investigation works undertaken to date at concentrations considered to pose a potentially unacceptable risk to human health during normal occupancy in the proposed future site use.

Controlled Waters Receptors

It is acknowledged that no groundwater analysis has been undertaken as part of this investigation. This was due to the lack of groundwater volumes available for representative sampling. However, based on the site's hydrogeological setting (i.e., nearby, deep, BGS boreholes indicate the presence of significant thickness of low permeability Unproductive Strata overlying the Sherwood Sandstone Principial Aquifer, the absence of nearby groundwater or surface water abstractions and groundwater source protection zones within the general site area), it is considered that the risk to controlled waters associated with the proposed development of the site is low.

Utilities

It is recommended that the results of the chemical testing from the ground investigation are provided to the appropriate utility companies to determine the necessity for service protection.

Construction and Maintenance Workers

Contamination may pose acute or long-term chronic risks to workers during construction and maintenance. The potential risks must be specifically assessed as part of the health and safety evaluation for the works to be performed in accordance with prevailing legislation. Site practices must conform to the specific legislative requirements and follow appropriate guidance (e.g., HSE, 1991[3], CIRIA, 2016[4]).

Outline Remediation Requirements

At this stage, no specific remediation requirements are required for this site. However, this is subject to review following completion of the post-demolition site investigation works recommended in Section 10 of this report.

A suitable thickness of plant growth medium comprising subsoil (either site-won following confirmatory chemical analysis, or imported) and imported topsoil should be provided in soft landscaped areas.

Wherever site-won made ground soils and / or natural soils imported from another site are proposed to be re-used within the development, then it is recommended this be undertaken under a Materials Management Plan[5], which must be reviewed by a Qualified Person and their declaration submitted to CL:AIRE before works commence. This in turn requires that a Remediation Strategy / Design Statement be produced and approved by the Local Authority.

[3] Health and Safety Executive. 1991. *Protection of Workers and the General Public during Development of Contaminated Land.*

[4] CIRIA. 2016. *Environmental Good Practice on Site Pocket Book (Fourth Edition).*

[5] CL:AIRE. 2011. *The Definition of Waste: Development Industry Code of Practice*, Version 2. (or as amended).

9.6. Ground Gas

Summary of Results

Quantity of hazardous gas (Q_{hg}) values for methane and carbon dioxide have been calculated in accordance with BS8485:2015+A1:2019, *'Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings*' (hereafter referred to as, 'BS8485') on the basis of measured gas flows and concentrations, or an LoD of 0.1l/hr and 0.1% v/v, respectively, whichever is the higher (see Appendix F).

Methane was not detected in any monitoring well during the gas monitoring undertaken.

Carbon dioxide was detected in both monitoring wells, with a maximum steady concentration of 1.4% v/v, recorded in WS03 on the second monitoring visit.

Borehole gas flows were only detected within WS03 and WS06, with peak flow rates of 24.0 l/hr and 2.3 l/hr, respectively, recorded on the second monitoring visit. These peak flow rates reduced to <0.1 l/hr within 8 seconds or less of opening the gas tap for monitoring.

Steady borehole gas flow rates were not recorded in any borehole.

Revised Conceptual Site Model for Hazardous Ground Gases

Potential Ground Gas Sources

No significant potential sources of hazardous ground gases have been identified by either the desk study or the intrusive site investigation.

Potential Transport Pathways

Ground gases may migrate vertically or laterally from sources beneath or adjacent to the site through permeable strata (e.g., granular soils), or via preferential pathways (e.g., underground service ducts / trenches).

Potentially permeable granular made ground was encountered from shallow depth across the whole site, which could act as a pathway for migration of any ground gases present.

Receptors

Potential receptors to ground gas accumulation include future workers on the site, site construction / maintenance workers in excavations, etc., and the proposed building.

Ground Gas Risk Assessment

In accordance with the requirements of BS8485, the worst-possible case condition has been calculated for methane and carbon dioxide, as a 'worst-case' check in the first instance. BS8485 states that adopting the worst-possible case Q_{hg} as the Gas Screening Value (GSV) should be undertaken only when considered prudent and reasonable to do so. Furthermore, BS8576:2013, *Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds (VOCs)* states that steady state flows, rather than brief peak values on opening, should be used in risk assessments.

Based on the monitoring data summarised in Table 6.2 and detailed in Appendix F, worst-possible Q_{hg} values of 0.0240 l/hr for methane and 0.0014 l/hr for carbon dioxide have been calculated for this site. If these values are applied as GSVs for the site, then the results for both methane and carbon dioxide are indicative of Characteristic 1 (CS1) conditions, as defined by Table 2 of BS8485.

For CS1 conditions, it is necessary to consider the typical ground gas concentrations; BS8485 states that, should the typical methane concentrations be greater than 1%, and / or carbon dioxide concentration be greater than 5%, then an increase to CS2 should be considered.

For this site, no detectable methane was recorded, and the maximum recorded carbon dioxide concentration was less than 5% v/v.

It is therefore considered that CS1 conditions for both methane and carbon dioxide apply to the site. According to BS8485, **no ground gas protection measures are required** for developments with CS1 conditions.

The Envirocheck report states that no radon protection measures are required for the site.

Notwithstanding the above, gas monitoring of all excavations and / or underground spaces should be carried out prior to personnel entry, with continuous monitoring throughout the period of working. Gas monitoring should include as a minimum: methane, carbon dioxide, carbon monoxide, and oxygen. Gas monitors shall emit both audible and visual warnings. Alarm levels should be set with due regard to the relevant Occupational Exposure Limits given in HSE

EH40/2005, and for low oxygen concentrations. If any anomalous or significantly elevated gas / depleted oxygen concentrations are detected, then all personnel should immediately evacuate the area and the advice of an appropriate specialist be obtained before work continues.

9.7. Invasive Plants

No potentially invasive plant species were observed on the site at the time of the Sirius investigation. However, it should be noted that Sirius are not qualified ecologists.

It is recommended that a survey is carried out by a specialist ecologist, to confirm the presence or absence of invasive plant species, and the implications thereof.

9.8. Disposal of Soils

Any materials removed from site should be undertaken in accordance with current Duty of Care requirements and the Environment Agency Technical Guidance Document WM3, dated 2015. The waste may also be subject to Waste Acceptance Criteria (WAC) testing. In light of the regulations, it is recommended that discussion with landfill operators takes place at an early stage.

10. RECOMMENDED FURTHER INVESTIGATION WORKS

At this stage, due to current access restrictions, the following supplementary site investigation works are considered likely to be required in order to inform detailed design and fulfil planning requirements, etc., following disconnection of services into the site, demolition of existing buildings, and site clearance:

Trial pitting in order to confirm shallow ground conditions below areas of currently restricted access, (i.e., within existing building footprints);

Static cone penetration testing (CPTs) in order to derive accurate soil parameter profiles below the proposed buildings, to facilitate detailed design of foundations, including assessment of potential settlements;

Further geotechnical and chemical laboratory testing of soil / fill materials and groundwater;

Supplementary Geoenvironmental Appraisal report.

11. REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the site investigation. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/or other relevant organisations for their comment and approval prior to undertaking any works on site.