



## BEESSLACK, PENICUIK



### GROUND INVESTIGATION REPORT INCORPORATING COAL MINING RISK ASSESSMENT (CMRA)

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## BEESLACK, PENICUIK

### GROUND INVESTIGATION REPORT

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WG684-45/R/F/02	Extract from the British Geological Survey Map – Drift & Solid



WG684-45/R/F/03C	Surveyed Locations of Site Investigations
WG684-45/R/F/04A	Summary of Ground Conditions

## EXECUTIVE SUMMARY

Johnson Poole & Bloomer Limited (JPB) were commissioned by Etive Consulting Engineers Limited, on behalf of Midlothian Council, to prepare a Ground Investigation Report for the site at Beeslack High School, Penicuik. The site is centred on National Grid Reference NT 25596 64426 and occupies an area of approximately 7.8ha. The purpose of the report was to appraise the ground conditions at the site and to determine what impact these may have on a proposed school development land use for the site.

A desk study was carried out by Pick Everard on behalf of Midlothian Council in May 2021 (Report Ref: TJG/CDK/210296/Struct17-2 R001). This document was supplied to JPB and information from this report has been used where appropriate.

Further site works have been undertaken to further investigate the area of the proposed school building and surrounding area, and this report has been updated to reflect this.

This section provides a brief summary of the investigation findings in relation to the geotechnical, mining, chemical contamination and gas emissions constraints at the site.

## Historical Background

On Site	Off Site
Greenfield	Commercial development immediately north of the site, with surrounding area mixture of residential and agricultural.

## Invasive Plants

No invasive plants were recorded on the date of the inspection.

No Japanese Knotweed, Giant Hogweed or Himalayan Balsam plants were identified during the walkover within the area of the site investigations. However an area of Giant Hogweed was identified within the field to the east, on the opposite side of Seafeld Moor Road.

No other invasive or non-native species, including Horsetail, Cotoneaster, and Himalayan Balsam were noted within the area of the site investigations. However, the ecologist noted the presence of some invasive or non-native species that may be of concern, including Horsetail during the visit within the field to the east on the opposite side of Seafeld Moor Road.

## Geology

The investigation has indicated the site to be underlain by made ground between 0.40m and 1.30m thick. This was typically described as either a slightly clayey sandy topsoil with brick, clay piping, glass, and ceramic, or a clayey sandy gravelly or gravelly sand with brick, ash, and burnt shale. The underlying natural soils were found to comprise sand and gravels with variable silt and clay content, with clay deposits also present onsite, shown to underlie the sand and gravel deposits. These deposits are then underlain by glacial till deposits to a maximum depth of 24.0m.

The rotary drilling encountered rockhead at between 18.0 m and 24.0 m. The strata were recorded as a sequence of sandstones and mudstones proven up to a maximum of 42m depth. No coal seams were encountered during the drilling works.

## Foundation Solution

### Strip/Trench foundations

Deposit Type	Foundation Option	Allowable Bearing Capacity based on a 0.6m wide foundation
Made Ground	Not suitable for strip founds. Vibro/piling as such it is advised that further discussions are held with them to confirm the foundation solution at the site.	N/A
Glacial till	Shallow Strip foundation. Deep trench foundation	60 kPa
Granular deposits	Shallow Strip foundation. Deep trench foundation	90 kPa

### Pad foundations

Deposit Type	Foundation Option	Allowable Bearing Capacity based on a 1m x 1m pad foundation
Made Ground	Not suitable for pad founds. Vibro/piling as such it is advised that further discussions are held with them to confirm the foundation solution at the site.	N/A
Glacial till	Pad foundation.	180 kPa
Granular deposit	Pad foundation. Deep trench foundation	174 kPa

### Coal Mining Risk Assessment

The table below summarises the potential risks associated with former mining legacy for the proposed development site, identified from list sources of information, in compliance with “Risk Based Approach to Development Management – Resources for Developers” published by the Coal Authority.

Mining Issue	Yes/No	Risk Assessment
Underground mining (recorded at shallow depths)	No	The documentary research has not found any records for shallow mining beneath the site.
Underground mining (recorded at depth)	No	The Coal Authority Coal Mining Report indicates that according to the records in their possession, the property is not within the zone of likely physical influence on the surface from past underground workings.
Mine entries (shafts and adits)	No	During the study no evidence of any mineshafts or adits being present within the site was encountered.
Coal mining geology (fissures)	No	CA report/web page indicates no evidence of any issues.
Record of past mine gas emissions	No	CA report/web page indicates no evidence of any issues.
Recorded coal mining surface hazard	No	CA report/web page indicates no evidence of any issues.
Surface mining (opencast workings)	No	CA report/web page indicates no evidence of any issues.

As with any coalfield/former mining area, there is the potential for unrecorded mine entries to be present. As in the development of all sites in former mining areas, vigilance should be maintained by all site workers during any ground excavations to identify any features suspected to be possible mine entries.

### Chemical Contamination and Gas Emissions

Based on the risk assessments carried out and in recognition of the following measures are required to address risks posed by ground gas emissions.

**The following recommendations are based on current site levels, it is recommended that they are reviewed, and if necessary revised, should significant earthworks be envisaged at the site, or once the cut/fill balance has been identified.**

Receptor	Measures required
<i>Chemical Contamination</i>	
Human Health   Contact with soil	No remedial measures are required.
Human Health   Inhalation of Dust and Vapours	No remedial measures are required.
Plant Growth	No remedial measures are required.
Invasive Plants	No remedial measures are required in the current investigation area. Giant Hogweed and Horsetail were recorded in the field to the east, and should this be developed then remedial measures will be required.
Building/ Concrete	pH values and sulphate concentrations indicate that the ground conditions fall within



Receptor		Measures required
<i>Chemical Contamination</i>		
Services		design sulphate class DS-1 and ACEC class AC-1 as defined in BRE Special Digest 1. Therefore, an appropriate concrete specification is required to protect building elements in contact with these conditions.
Building/ Services	Water supply pipes	No contaminant concentrations were identified which are considered to permeate water pipes or impact on their integrity. Therefore, no restriction is made on the type of water pipes which can be used on the site.
Surface Water		No remedial measures required.
Groundwater		No remedial measures required.
<i>Ground Gas Emissions</i>		
Human Health & Buildings/ Services		Elevated ground gas emissions were identified at the site. Remedial measures including passive venting and the incorporation of a ground gas resistant membrane and passive venting of the building solums, underslab voids/upfill and wall cavities is required.
<i>Radon</i>		
Human Health		Inspection of the BR 211 Appendix A radon map indicates that the site is not within an area where radon protection is required, and, therefore, no radon protective measures are required.

### Road Construction

Selective CBR test were carried out along the proposed roads and sports pitch locations and these indicated CBR values in the range of 0.4% to 4.7%. Some of the recorded CBR values were below 2.5% and therefore the material is a soft sub-grade as per Interim Advice Note 73/06 Revision 1 (2009) Design Guidance for Road Pavement Foundations (Draft Hd25) then the measures outlined in that document should be undertaken to address these issues.

Any material beneath the road will require to be placed in accordance with the Specification of Highway Works Series 600 and appropriate testing carried out to confirm the acceptability of the material.

Where localised made ground was present at the site, a full capping layer will be required.

### Site Verification

If Local Authority certification is to be sought for the proposed development, then the following remedial works which can be supervised by JPB are likely to require verification.

Constraint	Action
Remedial Strategy	Produce Remedial Strategy based on the findings of the site investigation in accordance with LCRM and obtain approval from the Local Authority.
Ground Gas Emissions	Ground gas resistant membrane in building solum. Passive venting of building solums, underslab voids/upfill and wall cavities.
Gas Monitoring Standpipes	As part of the development all boreholes must be decommissioned in accordance with SEPA guidance " <i>Decommissioning Redundant Boreholes and Wells</i> ".
Verification Statement	Produce verification statement in accordance with LCRM and obtain approval from the Local Authority.



## **PART ONE – INTRODUCTION**

### **1.0 INTRODUCTION AND OBJECTIVES**

#### **1.1 Introduction**

Midlothian Council are assessing the potential of a site located at Beeslack High School, Penicuik (JPB Drawing WG684-13/R/F/01). It is understood that the intended land use is for a 2 to 3 storey school building and associated external playground, landscaping, roads and car parking development. A client supplied drawing showing the current development proposals is given in Appendix 1.

A desk study was carried out by Pick Everard on behalf of Midlothian Council in May 2021 (Report Ref: TJG/CDK/210296/Struct17-2 R001). This document was supplied to JPB and information from this report has been used where appropriate. It is assumed that the findings of this document are accurate and that a copy of this is available to the reader of the current report and the reader is referred to the original supplied document for further details.

Due to changes in the proposed building positions, further investigations have been carried out to assess the geotechnical information under the proposed new locations.

This report has been prepared and written on behalf of Midlothian Council in the context of the purpose stated above and should not be used in any differing context. No duty of care extends to any third party that may make use of the information unless written confirmation has been provided by Johnson Poole & Bloomer. In addition, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore, with any change in circumstances, or after the expiry of one year from the date of the report, it should be referred to us for reassessment and, if necessary, amendment. No action or proceedings can be commenced against the JPB after the expiry of 12 years from the date of this report.

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#### **1.2 Objectives**

JPB were commissioned by Etive Consulting Engineers Limited, on behalf of Midlothian Council, to undertake site investigation works. The aim of the investigation was to provide information to identify environmental and geotechnical constraints which may have consequences in the design of the development and to provide information to be submitted as part of the planning process and in obtaining regulatory approvals.

Therefore, the investigations had the following objectives:

- To identify any chemical contamination constraints;
- To characterise the groundwater regime and identify any risks posed to water resources;
- To examine the ground gas regime and any constraints posed by gas emissions; and
- To determine a foundation horizon and potential foundation solution;

The investigation of the geotechnical, mining, chemical contamination and gas emission conditions is now complete and this report presents the factual investigation data and JPB's interpretation of the existing ground conditions. Potential development constraints are identified and appropriate remedial actions are recommended. Foundation design considerations are also discussed.

It is anticipated that during the course of any redevelopment works various local authority departments will become involved. We, therefore, advise that, where appropriate, our report and associated information are submitted to the regulatory bodies and approval obtained before detailed design, site works or other irrevocable actions are embarked upon.

## **PART TWO – STAGE 1 INVESTIGATION**

### **2.0 SITE RECONNAISSANCE**

#### **2.1 Site Walkover**

The site is located in the northern area of Bilston and is approximately centred on Ordnance Survey National Grid Reference NT 256 644 and covers an area of approximately 7.8 hectares. A selection of site photographs is presented in Appendix 2.

At the time of the site walkover on the 11<sup>th</sup> March 2022 the site was open grassland once used for agricultural grazing. The site was bounded by the A703 (Seafield Moor Road) which ran along the North-East boundary and Seafield Road which ran along the Northern boundary, as well as fences and a tree line that completely surrounded the site boundary.

The site topography slopes slightly towards the southern end.

These conditions remained the same during the 2024 investigations as it has been recorded above, although notes open overgrown grassland.

#### **2.2 Invasive Plant Survey**

An invasive plant survey was carried out during the works prior to commencement of the investigation and the report is included in Appendix 3. The report's main findings are summarised below.

No Japanese Knotweed, Giant Hogweed or Himalayan Balsam plants were identified during the walkover within the area of the site investigations. However an area of Giant Hogweed was identified within the field to the east, on the opposite side of Seafield Moor road.

No other invasive or non-native species, including Horsetail, Cotoneaster, and Himalayan Balsam were noted within the area of the site investigations. However, the ecologist noted the presence of some invasive or non-native species that may be of concern, including Horsetail during the visit within the field to the east on the opposite side of Seafield Moor Road.

### 3.0 APPRAISAL OF EXISTING INFORMATION

#### 3.1 General

Initial research undertaken prior to the site investigation works included a routine examination of available geological maps, past and present editions of the Ordnance Survey and relevant in-house data. A summary of information obtained from our researches is presented in the following section. A Phase 1 Geo-Environmental Desk Study Report has previously been produced by Pick Everard on behalf of Midlothian Council in May 2021 (Report Ref: TJG/CDK/210296/Struct17-2 R001). Additional researches have been carried out as indicated below.

#### 3.2 UXO Assessment

A Zetica Map has been obtained with regards to the assessment of any risks which may or may not be posed by Unexploded Ordnance (UXO) at the site. The map indicates the site to be in an area of low risk which are areas indicated as having 15 bombs per 1000 acres or less. A copy of this map can be found in Appendix 4.

#### 3.3 History of Land Use

An investigation of the past usage of the site can often provide an indication of the presence of potentially contaminated soils arising from processes associated with former land uses. These researches can help to identify any potential constraints to developments upon which physical investigations can then concentrate. A brief summary of the historical land use from the Pick Everard report is noted below.

The proposed site has remained undeveloped, recorded as an agricultural field since 1854. The surrounding area was predominantly agricultural before undergoing significant expansion in the mid to late 1900's, comprising residential and commercial developments, education facilities and road infrastructure. By 1957-1958 commercial developments are recorded immediately north of the site, which by 1972 are expanded along with a commercial development approximately 100m west of the site. Sand pits are recorded 500m and 600m east of the site. There is also evidence of underground mining in the area, with collieries and shafts recorded approximately 900m southeast and 950m northeast respectively.

Anecdotal information indicates that the field has been modified for better drainage and additional topsoil.

#### 3.4 Geology and Mining

An initial appreciation of the general geological conditions underlying the site was made from the Phase 1 Geo-Environmental Desk Study Report, and are summarised below in section 3.5.

The ground conditions are indicated to comprise topsoil underlain by potential localised made ground associated with the commercial developments immediately north of the site, underlain by alluvium (clay, silt sand and gravels), underlain by glacial till then by the Carboniferous Upper Oil Shale Group. Investigations required to determine a suitable bearing horizon

In addition to this report, JPB have commissioned a Coal Authority Consultants Report to further assess the risk to the proposed development arising from the possible presence of mining. Examination of the Consultants report shows no evidence of underground mining within the vicinity of the site and there is no current mining within influencing distance. The Coal Authority indicates the property is not within an area that could be affected by past recorded underground workings. Therefore, based on our researches **mining is not a constraint**.

The table below summarises the potential risks associated with former mining legacy for the proposed development site, identified from list sources of information, in compliance with "Risk Based Approach to Development Management – Resources for Developers" published by the Coal Authority.

Mining Issue	Yes/No	Risk Assessment
Underground mining (recorded at shallow depths)	No	The documentary research has not found any records for shallow mining beneath the site.
Underground mining (recorded at depth)	No	The Coal Authority Coal Mining Report indicates that according to the records in their possession, the property is not within the zone of likely physical influence on the surface from past underground workings.
Mine entries (shafts and adits)	No	During the study no evidence of any mineshafts or adits being present within the site was encountered.
Coal mining geology (fissures)	No	CA report/web page indicates no evidence of any issues.
Record of past mine gas emissions	No	CA report/web page indicates no evidence of any issues.
Recorded coal mining surface hazard	No	CA report/web page indicates no evidence of any issues.
Surface mining (opencast)	No	CA report/web page indicates no evidence of any issues.

Mining Issue	Yes/No	Risk Assessment
workings)		

As with any coalfield/former mining area, there is the potential for unrecorded mine entries to be present. As in the development of all sites in former mining areas, vigilance should be maintained by all site workers during any ground excavations to identify any features suspected to be possible mine entries.

### 3.5 Chemical Contamination and Gas Emissions

#### Chemical Contamination

Our researches have indicated that the site has been occupied by agricultural land throughout its history. It is less likely, therefore, that any significant chemical contamination will be present on site. However, testing for pesticide residues together with general contamination should be carried out to confirm ground conditions. The Phase 1 Geo-Environmental Desk Study Report by Pick Everard did highlight the potential for localised made ground in the northern area of the site associated with the commercial developments immediately north of the site. Any made ground encountered should be tested for a suite of chemical contaminants commonly encountered on brownfield sites.

Previous site uses including Agricultural Land Uses and Potential Localised Made Ground	
<i>Metals and metalloids</i>	Toxic metals and metalloids including; arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc.
<i>Inorganic</i>	Sulphides, sulphates, cyanides.
<i>Organics</i>	Petroleum hydrocarbons, PAHs, phenols, pesticides.
<i>Others</i>	Asbestos.

#### Ground Gas

##### On Site Sources

The site has been undeveloped throughout its history and is indicated to be underlain by sands and gravels, further underlain by glacial till, acknowledged to be a very low gas generation potential material. It is, therefore, unlikely that significant amounts of made ground or other sources of ground gas emissions will be present on site and, as a result, elevated ground gas concentrations are not expected. However, localised areas of made ground could potentially be present in the northern area of the site associated with the commercial development immediately north of the site. This on site gas source may cause a constraint to any future developments and further intrusive investigations are required to confirm ground gas conditions.

##### Off Site Source

Potential made ground associated with the adjacent commercial development could be a potential source of ground gas which could migrate towards the site, therefore, investigations are required to determine the level of risk posed by this off-site gas source.

##### Deep Seated Gas

The site lies within a Coal Authority Coal Mining Reporting Area (CMRA) and the CL:AIRE publication, "Technical Note – good practice for risk assessment for mine gas emissions" recommends that where a site lies within a CMRA further assessment of risks from a deeper gas source is required.

##### Radon

The supplied Phase 1 Geo-Environmental Desk Study Report indicates that the site is not at risk from radon.

## 4.0 STAGE 1 PRELIMINARY QUALITATIVE RISK ASSESSMENT

### 4.1 Stage 1 Preliminary Qualitative Risk Assessment

In assessing the research information within the Phase 1 Geo-Environmental Desk Study Report a Stage 1 Preliminary Qualitative risk assessment has been carried out in order to develop an Initial Conceptual Site Model for the site. The Conceptual Site Model (CSM), is generated in accordance with Guide to Good Practice for the Development of Conceptual Models and the Selection and Application of Mathematical Models of Contaminant Transport Processes in the Subsurface - National Groundwater & Contaminated Land Centre report NC/99/38/2 – Environment Agency 2001.

In the Stage 1 Preliminary Quantitative Risk Assessment the next step in assessing environmental risks and constraints for the site is to use the available research information to develop a Conceptual Site Model (CSM). The CSM describes how potential chemical sources at the site could contribute to increased levels of risk to potentially sensitive receptors. The CSM identifies the sources of contamination, the likely receptors and the potential pathways present which may link them. Where it appears that a pathway links a source to a receptor, this potential significant contaminant linkage should be the focus of site investigations.

The CSM is developed at an early stage and constantly reassessed in light of investigative findings. The first step in producing such a model is to identify whether there are potential hazards on site through desk top research together with the application of professional expertise and judgement. In addition, information regarding the site-specific environmental setting including geology, hydrogeology, hydrology etc., is gathered to identify the environmental resources which could be impacted by potential contaminants at the site. Within this context, a hazard is defined as a property that has the potential to cause harm to a receptor group.

A summary of this preliminary assessment is presented in the following ICSM table which summarises the individual source, pathway and receptors considered to be present.

SPR item	SPR item present based on desk study (Yes/No)	Comment
<b>Sources</b>		
S1 – Contamination from former land use	Yes	Site recorded to be greenfield, though it is known the ground has been modified for agricultural use. Significant made ground is not anticipated, therefore, no major source of contaminants anticipated, however potential for localised made ground in northern area of the site. Confirmatory investigations required.
S2 – Contamination from adjacent land use	Yes	Commercial development immediately adjacent to the north therefore potential for made ground to be present. Further investigations required.
S3 – Ground gas	Yes	Potential for localised ground gas generation. Localised made ground associated with the commercial development immediately adjacent to the north could contain biodegradable material and could degrade to produce elevated levels of gas.. Further investigations required.
S4 – Leachable contaminants	Yes	Potential for isolated made ground associated with commercial development adjacent to the north. Some potential made ground contaminants may be leachable or mobile. Further investigations required.
S5 – Contamination groundwater in mineworkings	No	Mining is not present under site.
S6 – Contamination from substation	Yes	Substation present in north west corner of site.
<b>Pathways</b>		
P1 – Contact with soil	Yes	Site is to be a school with associated playing fields and soft landscaping and, therefore, there is the potential for site occupiers to come into contact with the soils.
P2 – Ingestion of vegetables	No	Site is to be a school with associated playing fields and soft landscaping development and, therefore, it is not considered likely that site occupiers to grow their own produce.
P3 – Inhalation of dusts/vapours	Yes	Site recorded to be greenfield. No significant made ground expected, therefore, no major source of contaminants anticipated. Investigations required to confirm.
P4 – Ingestion of groundwater	Yes	Potential for contact with groundwater.
P5 – Building contact with soil	Yes	Site is to be developed and, therefore, buildings will be present on site.
P6 – Migration via services	Yes	Site is to be developed and, therefore, buildings and associated infrastructure will be present on site.
P7 – Perched groundwater	Yes	Researches indicate the potential presence of localised contaminated made ground, overlying granular alluvium and cohesive glacial till, therefore, perched groundwater may be present.
P8 – Vertical migration	Yes	Glacial till deposits are anticipated to underlie the site, which will significantly retard vertical migration. However, there is the potential for granular alluvium as well as sand and gravel

SPR item		SPR item present based on desk study (Yes/No)	Comment
			lenses within the till to be present which may allow some vertical migration.
P9 – Migration of gas		Yes	Potentially elevated levels of gas could migrate through potential localised made ground or within locally higher permeability lenses within the glacial till deposits.
P10– Groundwater flow through mineworkings		No	No mineworkings present beneath the site.
<b>Receptors</b>			
<i>Human Receptors</i>			
R1	Children & adults	Yes	Site is to be a school with associated playing fields and soft landscaping and, therefore, there is the potential for site occupiers to come into contact with the soils.
R2 – Workers & trespassers		Yes	The site is to be developed and, therefore, workers and potentially trespassers on site
R3 – Adjacent land users		Yes	Adjacent land users include a commercial development.
<i>Plant Receptors</i>			
R4 – Plants		Yes	Site is to be a school with associated playing fields and soft landscaping and, therefore, there is the potential for plant growth.
<i>Buildings/services receptors</i>			
R5 – Buildings and infrastructure		Yes	The site is to be developed and, therefore, buildings will be present on site.
<i>Water environment – surface waters</i>			
R6 – Major River		No	The River North Esk is located approximately 2km southeast of the site which is not considered to be within influencing distance of the site. In view of the distance to a major surface water, the localised nature of the made ground on site and the presence of intervening very low permeability glacial till soils which significantly retard contaminant migration, it is considered that there is no significant pathway present. In the absence of a significant pathway there is no significant contaminant linkage present and no further assessment is necessary.
R7 – Minor River/ Canal/ burn		Yes	The Phase 1 Geo-Environmental Desk Study Report by Pick Everard records the nearest minor surface water to the site as the Boghall Burn. This is recorded to be located within the central site area, flowing north to south, as well as immediately south of the site, flowing southwest to northeast. There is potential for any onsite perched groundwater within soils to be in hydraulic continuity with these surface waters.
<i>Water environment – groundwater abstraction</i>			
R8 – Shallow perched groundwater		No	According to the Phase 1 Geo-Environmental Desk Study Report by Pick Everard there are no groundwater abstractions recorded onsite or within the immediate surrounding area. <b>Therefore, in the absence of a receptor or water body no further assessment is required.</b>
R9 – Continuous groundwater in soil		No	No groundwater abstractions recorded within 1km. Natural superficial deposits are very low permeability glacial till, which do not constitute a water body. Although, granular alluvium is indicated to be overlying these till deposits, <b>in the absence of a receptor no further assessment is required.</b>
R10 – Continuous groundwater in rock		No	No groundwater abstractions recorded onsite or in the immediate surrounding area. Although the underlying rock is noted to be sedimentary and groundwater within these strata may be classed as a water body, <b>in the absence of an abstraction receptor no further assessment is required.</b>
<i>Water environment – groundwater resource</i>			
R8 – Shallow perched groundwater		No	There is potential for perched groundwater to be present within granular alluvium, overlying cohesive glacial till deposits. It is possible that the perched groundwater is localised and therefore is unlikely to meet the criteria outlined in the UKTAG (i.e. that in order to qualify as a body of groundwater an aquifer must be capable of supplying 10m <sup>3</sup> /day or 50 people on a continuous basis). <b>The perched water is not considered to be a groundwater body and as such is not a receptor. Confirmatory investigations required.</b>
R9 – Continuous groundwater in soil		Yes	Researches indicate the potential existence of very low permeability glacial till soils across the site which do not constitute a water body. However, the glacial till are indicated to be overlain by granular alluvium deposits, and any groundwater present in these strata may meet the criteria outlined in the WAT-PS-10-01 (Assigning Groundwater Assessment Criteria for Pollutant Inputs) and UKTAG (i.e. that in order to qualify as a body of groundwater an aquifer must be capable of supplying 10m <sup>3</sup> /day or 50 people on a continuous basis). Further investigations are required to confirm the level of risk to this receptor.
R10 – Continuous groundwater in rock		Yes	The rock strata are indicated to be sedimentary, with natural superficial deposits indicated to be very low permeability glacial till soils which significantly retard downward contaminant migration. However, granular alluvium are also indicated to be present onsite, which in combination with more granular till deposits may allow some migration towards the deeper



SPR item	SPR item present based on desk study (Yes/No)	Comment
		aquifer. It is considered that there is possibly an intact source-pathway-receptor linkage present and further investigations are required to confirm the level of risk to this receptor.
<i>Water environment – groundwater dependent terrestrial ecosystem (GDTE or wetland)</i>		
R11 – GDTE/Wetland	No	No GDTE/Wetland within 250m of the site.

#### 4.2 Methodology for Stage 1 Qualitative Assessment of Risk

Contaminants are likely to be present at the site and ground gases may be being generated, therefore risks posed by the site to receptors have been evaluated in accordance with the methodology given in the guidance document CIRIA C552. This methodology for risk evaluation is a qualitative method of interpreting the available data from the information gathering phase of the assessment. It involves the classification of the:

- magnitude of the probability (likelihood) of the risk occurring.
- magnitude of the potential consequence (severity) of risk occurring

The descriptions of the magnitudes of the consequences and likelihoods of risks occurring given in Tables 6.3 and 6.4 of CIRIA C552 have been used in this assessment.

Once the consequence and probability have been classified, a risk category, ranging from “very high risk” to “very low risk”, can be assigned to each possible contaminant linkage. The table below summarises the consequence versus probability matrix with the assigned risk category and the actions corresponding with the classification.

Comparison of Consequences v Probability					
		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/ Low risk
	Likely	High Risk	Moderate Risk	Moderate/ Low risk	Low Risk
	Low likelihood	Moderate Risk	Moderate/ Low risk	Low Risk	Very Low Risk
	Unlikely	Moderate/ Low risk	Low Risk	Very Low Risk	Very Low Risk
Estimated Risks					
Very high risk		There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not already undertaken) and remediation are likely to be required.			
High risk		Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present substantial liability. Urgent investigation (if not already undertaken) is required and remedial works may be necessary in the short term and are likely over the longer term.			
Moderate risk		It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that harm would be severe, or if any harm were to occur, it is more likely that the harm would be relatively mild. Urgent investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.			
Low risk		It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.			
Very Low Risk		There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.			



It is recognised that the current site use as agricultural land is a low sensitivity land use, at which risks to human health from site soils are low. However, the site is proposed to be re-developed and new, more sensitive receptors and additional pathways will be introduced. Consequently, the risks to site receptors have been evaluated below on the basis of the risk posed by soils in the redeveloped site.

### 4.3 Risks to Human Health

#### Soil Contamination Risks

Only localised made ground is anticipated to be present in the northern area of the site, associated with the commercial development immediately north of the site. It is not considered likely that significantly contaminated made ground will be present. There is however, potential for pesticide and herbicide residues to be present across the site. Contact with site soils is likely to occur across large areas of the site such as across playing fields and soft landscaping areas. However, human site users could be at risk from any potential contaminants present.

Exposure of sensitive receptors to contaminants from agricultural practices				
Probability of risk being realised		Consequence of risk being realised		Risk classification
<b>Likely</b>	There is a potential contaminant linkage and circumstances, under which an event could occur are possible.  Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	<b>Mild</b>	Potential for chronic damage to human health likely to result in "significant harm".	<b>Low/Moderate</b>

Exposure of sensitive receptors to contaminants from localised made ground				
Probability of risk being realised		Consequence of risk being realised		Risk classification
<b>Likely</b>	There is a potential contaminant linkage and circumstances, under which an event could occur are possible.  Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	<b>Medium</b>	Potential for chronic damage to human health likely to result in "significant harm".	<b>Moderate</b>

#### Ground Gas Risks

The site lies on glacial till overlain by localised made ground associated with the commercial development immediately adjacent to the north. Made ground is typically a low to moderate ground gas generation potential source. Consequently, there are potentially risks posed by ground gas at the site.

Migration of soil gas/vapours to on site properties from agricultural practices				
Probability of risk being realised		Consequence of risk being realised		Risk classification
<b>Unlikely</b>	The site lies on natural glacial till and no possible sources of ground gas generation have been identified.	<b>Medium</b>	Potential for chronic damage to human health likely to result in "significant harm".	<b>Low</b>

Migration of soil gas/vapours to on site properties from localised made ground				
Probability of risk being realised		Consequence of risk being realised		Risk classification
<b>Low Likelihood</b>	There is a potential contaminant linkage and circumstances, under which an event could occur are possible.  However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.	<b>Medium</b>	Potential for chronic damage to human health likely to result in "significant harm".	<b>Low/Moderate</b>

Overall, it is considered that a **low/moderate** risk should be assigned to risks to human health, although it is clear that some uncertainty remains as the presence of contamination and ground gas emissions has not been confirmed.

#### 4.4 Risks to Plant Growth

Based on the desk study information and ICSM made ground may be present in the northern area of the site at the site surface which, if present, is unlikely to be a suitable medium for healthy plant growth in any soft landscaped areas.

Phytotoxic Risks due to agricultural risks				
Probability of risk being realised		Consequence of risk being realised		Risk classification
<b>Unlikely</b>	The site lies on natural glacial till and no sources of contamination which could impact plant growth are likely.	<b>Medium</b>	Affect to Plant Growth	<b>Low</b>

Phytotoxic Risks due to localised made ground				
Probability of risk being realised		Consequence of risk being realised		Risk classification
<b>Low Likelihood</b>	There is a potential contaminant linkage and circumstances, under which an event could occur are possible.  However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.	<b>Medium</b>	Affect to Plant Growth	<b>Low/Moderate</b>

#### 4.5 Risks to the Water Environment

Groundwater contamination at the site due to the leaching of contaminants				
Probability of risk being realised		Consequence of risk being realised		Risk classification
<b>Low Likelihood</b>	Localised areas of made ground and potential contaminants from agricultural practices are present and there is a potential contaminant linkage and circumstances, under which an event could occur are possible.  However, it is by no means certain that a shallow groundwater resource receptor exists or that even over a longer period such an event would take place and is less likely in the shorter term.  The deeper groundwater receptor may be afforded some protection by overlying cohesive soils, but there is a potential contaminant linkage and circumstances, under which an event could occur are possible.	<b>Medium</b>	Pollution of sensitive water environment receptor	<b>Low/Moderate</b>

Surface water contamination at the site due to contaminants migrating to local waters				
Probability of risk being realised		Consequence of risk being realised		Risk classification
<b>Low Likelihood</b>	Potential for localised made ground and contaminants related to agricultural practices. Minor surface water recorded onsite and along southern boundary.  There is a contaminant linkage and circumstances, under which an event could occur are possible.	<b>Medium</b>	Pollution of sensitive water environment receptor	<b>Low/Moderate</b>

Surface water contamination at the site due to contaminants migrating to local waters				
Probability of risk being realised		Consequence of risk being realised		Risk classification
	However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.			

Overall, it is considered that a **low/moderate** risk should be assigned to risks to the water environment, although it is clear that some uncertainty remains as the presence of contamination and contaminant linkages has not been confirmed.

#### 4.6 Risks to the Buildings and Services

The site has been in agricultural use throughout its history, and limited extents of contamination are anticipated across the site, which could impact buildings and services.

It has been mentioned above that there is a possibility that localised areas of made ground may be present in the northern area of the site. Therefore, contaminants could potentially be present and could affect concrete building elements or service pipework including potable water supplies in these areas.

Overall, it is considered that a **low/moderate** risk should be assigned to risks to buildings and services in the **areas of localised made ground**, although it is clear that some uncertainty remains as the presence of contamination and contaminant linkages has not been confirmed.

#### 4.7 Objectives of the Site Investigation and Methodology

The initial conceptual site model was used to inform the design of the site investigation. Where chemical analysis data has been obtained for soils and waters, JPB's risk assessment methodology comprises an initial comparison of potential contaminant concentrations with Stage 2 Risk Assessment generic assessment criteria. The concentrations of contaminants exceeding these criteria and contaminants for which authoritative Stage 3 Risk Assessment criteria were not available are assessed in Stage 3 Risk Assessment, a site-specific quantitative risk assessment.

The Stage 3 Risk Assessment comprises a quantitative risk assessment of contaminant concentrations performed using appropriate risk assessment models and tools. These assessments are discussed in more detail in the later sections of this report.

In order to test and develop the initial CSM, the site investigations had the following objectives:

- To identify the extent of any potential localised made ground at the site (potential contaminant source)
- To identify the nature, extent and concentration of contaminants in soil, groundwater and ground gases.
- To determine if contaminants are leachable or otherwise mobile.
- To examine the ground gas regime at the site.
- To determine what threat the site poses to off site water receptors.
- To determine what threat the site contaminants pose to off site human receptors (occupants of adjacent properties).
- To determine what threat the site poses to on site human receptors (workers and occupants).
- To determine geotechnical properties of soils.
- To determine foundation solutions for development.
- To determine the soakaway properties of the soils.

In order to achieve these objectives, the investigation was designed to include the following; trial pitting, soakaway tests, terrier soil boreholes with standpipes installed, rotary openhole boreholes and specialist laboratory testing of recovered soil and water samples for geotechnical and chemical characteristics. Monitoring of ground gas concentrations and groundwater levels in standpipes was also undertaken. These investigations are described in more detail in the following section of this report.

## PART THREE – SITE INVESTIGATIONS

### 5.0 SITE INVESTIGATIONS

#### 5.1 Programme of Works and Investigation Rationale

The design and performance of this site investigation takes cognisance of the guidance given in BS 10175 – Investigation of Potentially Contaminated Sites – Code of Practice – BSI 2011 and BS5930. Investigation points were located where access, ground conditions and underground services allowed. It should be noted that soil and rock conditions are highly variable and may differ between sampling points and this may affect interpolation. Additional features may exist buried at depth and undetected by investigation. The surveyed locations of all trial pits and boreholes are shown on JPB Drawing WG684-13/R/F/03.

Work Item	Description	Appendix
Trial pit excavations	<b>26 trial pits</b> , to between 1.60 m and 3.10 m depth roughly between a 25m and 50m grid, undertaken by a Johnson Poole & Bloomer Engineering Geologist between the 11 <sup>th</sup> and 12 <sup>th</sup> May 2022.  <i>2024 Investigation</i> 19 Trial pits to between 1.50m to 3.0m depth, undertaken by Johnson Poole & Bloomer Engineering Geologist between 25 <sup>th</sup> and 26 <sup>th</sup> June 2024.	Appendix 7
Rationale	To investigate the nature, extent and engineering properties of the soils underlying the site and recover soil samples for chemical analysis.	
Soakaway tests	<b>Undertaken in four trial pits</b> (SA01 to SA04) in accordance with BRE Digest 365.  <i>2024 Investigation</i> <b>Undertaken in four trial pits</b> (TP07A to TP10A) in accordance with BRE Digest 365.	
Rationale	To investigate the potential for discharge of surface run off to soakaways.	
Hand Dug Pits	<b>1 hand dug pit</b> (HP01) was excavated to a depth of 0.50m on the 31 <sup>st</sup> of May 2022 by a Johnson Poole & Bloomer technician.	
Rationale	To obtain a soil sample adjacent to the sub station for chemical analysis.	
Terrier Soil Boreholes	<b>17 soils boreholes</b> (S01 to S017), to depths of between 3.50 m and 5.20 m, were sunk by Aitken Laboratories Ltd across the site between 16 and 24 May 2022.	Appendix 8
Rationale	To investigate the nature, extent and engineering properties of the soils underlying the site and recover soil samples for geotechnical and chemical analysis.	
Cable Percussive Boreholes	<i>2024 Investigation</i> Five cable percussive boreholes, including re-drills, (CP101 to CP103), to depths of between 3.4 m and 18.6 m, were sunk by Aitken Laboratories Limited across the site between 23 <sup>rd</sup> August and 5 <sup>th</sup> September 2024.	
Rationale	To investigate the nature, extent and engineering properties of the soils underlying the site and recover soil samples for geotechnical analysis. Specific targeted investigations are discussed below.	
Geotechnical testing	<b>Geotechnical laboratory</b> testing of soil and rock samples was performed by Aitken Laboratories Ltd and MATtest and included the following: i) Bulk Density. ii) Moisture Content and Atterberg Limits. iii) Undrained triaxial compression testing. iv) One dimensional consolidation testing. v) Particle Size Distribution (PSD). vi) Plate Load Test.	Appendix 8
Rationale	To determine engineering properties of the soils underlying the site.	
Rotary drilling	<b>Three rotary openhole boreholes</b> (R1 to R3), to depths of between 40.0 m and 42.0 m, were sunk by Hydracrat Limited across the site between 12 and 13 May 2022.  <i>2024 Investigation</i> <b>Two rotary cored boreholes</b> (R101 to R102), to depths of between 27.5 m and 28.5 m, were sunk by Hydracrat Limited across the site between 26 <sup>th</sup> and 27 <sup>th</sup> June 2024.	Appendix 9
Rationale	To install standpipes into the underlying rock strata, and obtain samples of rock for testing.	
Chemical contamination testing	<b>27 soil samples</b> (5 made ground and 22 natural), <b>4 groundwater samples</b> and <b>3 surface</b> were analysed by i2 Analytical at our instruction.  The soil testing programme comprised the following chemical parameters; <b>asbestos (presence and type), pH, total sulphate, water soluble sulphate, sulphides, total phenols, total cyanide, Total Petroleum Hydrocarbons (TPH), Polyaromatic Hydrocarbons (PAH), arsenic, mercury, selenium, lead, total chromium, hexavalent chromium, cadmium, copper, nickel, zinc, water soluble boron and percentage soil organic matter (SOM).</b>	Appendix 10

Work Item	Description	Appendix
	<p>In addition to the above testing programme, <b>1 soil sample (HP01)</b> was also tested for a range of PCBs. This sample was then tested for leachability for the following chemical parameters; <b>pH, water soluble sulphate, sulphides, total phenols, total cyanide, arsenic, mercury, selenium, lead, total chromium, cadmium, copper, nickel, zinc, calcium, and magnesium.</b></p> <p>The groundwater and surface water testing programme comprised the following chemical parameters – <b>arsenic, mercury, selenium, copper, nickel, zinc, lead, chromium (total), hexavalent chromium, cadmium, calcium, iron, magnesium, manganese, boron, sulphate, chloride, sulphide, cyanide, phenols, DOC, BOD, ammoniacal nitrogen, phosphate, speciated PAH, BTEX and TPH (GC).</b> Samples were tested on site for <b>pH, conductivity, dissolved oxygen and temperature.</b></p>	
Rationale	To determine concentrations of potential chemical contaminants in the soils, surface water and groundwater underlying the site.	
Gas and water monitoring	<p><b>Gas and water monitoring</b> at standpipes installed in all 17 of the terrier soil boreholes and the 3 rotary boreholes was carried out. Levels of methane, carbon dioxide, oxygen, nitrogen, carbon monoxide, hydrogen sulphide and atmospheric pressure were recorded. Flow rates were also recorded.</p> <p>Following the collection of the gas data the depth to any water present within the standpipes installed in the boreholes was measured using a dipmeter.</p> <p>Copies of the calibration certificates are also included in this Appendix.</p>	Appendix 11
Rationale	To determine the groundwater and ground gas regimes at the site	
On site testing of ground and surface waters	<b>Ground and surface water samples</b> were tested on site for the following key parameters: <b>temperature, dissolved oxygen level, pH and conductivity.</b> Recovered groundwater samples were tested for a wide range of potential contaminants as discussed in the following sections.	Appendix 11
Rationale	To determine concentrations of potential chemical contaminants in the surface water and groundwater underlying the site.	

In addition to JPB's investigation protocol, the following targeted investigations were carried out.

Targeted Investigation Point	Target	Specific Analysis (if required)
TP7 – TP10	Proposed 4G sports pitch	Soakaways and CBR testing
TP11 – TP16	Proposed car parking	CBR testing
CP101 – CP103	Proposed building footprint	Geotechnical testing
R101 – R102	Proposed building footprint	Geotechnical testing

## 5.2 Contamination Assessment Sampling Protocols

### Soil Sampling

As no historical features were identified during the desk study researches a non-targeted investigation approach was used. In the investigations, locations were spread across the site to achieve appropriate site coverage, with the three deeper rotary boreholes were positioned in areas of the proposed building footprint. For main investigations BS10175 indicates that "typical" densities can vary between 10m and 25m centres. However, given the predominantly greenfield nature of the site throughout its history, JPB consider that investigations at between 25m and 50m centres is more appropriate. This was confirmed by trial pits which showed that soils at the site predominantly comprised natural deposits, with localised made ground.

For this site, with an area of approximately 7.8ha, this is equivalent to between 31 and 126 investigation locations. During the initial works a total of 47 investigation locations (26 trial pits, 1 hand dug pit, 17 terrier soil boreholes, and 3 rotary boreholes) and 45 samples (28 chemical and 17 physical) had been undertaken. The additional investigation involved (19 trial pits, 5 cable percussive soil boreholes, and 2 rotary boreholes). This give a total of 71 investigation locations, which falls in the middle of the above requirements for a main investigation for a site of this size.

### Groundwater and Surface Water Sampling

Following purging attempts were made to recover water samples from all of the boreholes. During this exercise representative samples were recorded from boreholes S02, S04, S14, and S17.

Surface waters were also recovered from the Boghall Burn both upstream and downstream of the site.

## PART FOUR – GEOTECHNICAL

### 6.0 SITE GEOLOGY

#### 6.1 General

The general geological conditions beneath the site were assessed from the available information including a review of geological map.

The recent investigations appear to confirm the anticipated geological conditions with localised made ground, which are underlain by glacial till deposits. Bedrock geology has been confirmed as comprising of mudstone and sandstone of the Upper Oil Shale Group. A summary of the ground conditions is shown on JPB Drawing WG684-45/R/F/04.

#### 6.2 Made Ground

Made ground was encountered in seven of the trial pits (TP05, TP07, TP09, TP11, TP12, TP15, and TP25) and six of the boreholes (S01, S05, S06, S09, S11 and S12) at the site. Isolated areas of made ground was predominantly encountered along the boundaries of the site, and more frequently along the western and northern areas of the site. Made ground was recorded to between 0.40m and 1.30m thick. Within the excavated trial pits, made ground comprised of brown slightly clayey sandy topsoil containing brick, clay piping, glass, and ceramic. Made ground encountered in the six boreholes typically comprised of brown and reddish brown clayey sandy gravel/gravelly sand or sandy gravelly clay containing brick, ash, and burnt shale.

#### 6.3 Natural Deposits

The site is covered by a layer of topsoil which varies in thickness from 0.20m to 0.70m where made ground is not present.

In boreholes S01, S02, S03, S06, S08, S09, S10, S11, and S14 this is generally underlain by a medium dense and dense brown and reddish brown silty sand and gravel, and clayey gravelly sand, to between 1.20 m and 4.40 m depth. This is generally underlain by a firm and stiff consistency greyish brown, brown, and brownish grey sandy slightly gravelly clay, becoming increasing in cobble content with depth. This horizon was encountered at between 1.40 m (S10) and 2.10 m (S01) to a maximum depth of 4.10 m. In S03 and S14, this clay horizon was further underlain by granular deposits comprising of a medium dense silty gravelly sand to a depth of 3.70 m, and medium dense grey clayey gravelly sand with pockets of clay and cobbles to a depth of 5.20 m, respectively.

In boreholes S04, S05, S07, S13, S15, S16, and S17 the sand and gravel horizon was not encountered at shallow depth, with the topsoil layer immediately underlain by the above clay horizon. In S05 and S17, the clay horizon is then underlain by a medium dense greyish brown and brown sand with variable amounts of silt, clay and gravel, at thicknesses of 0.40 m (S05) and 1.60 m (S17), to depths of 3.40m and 2.90m respectively.

In S12, a soft mottled brown and grey sandy gravelly clay was encountered from 0.80m to 1.40m depth, which further underlain by made ground where present, or natural deposits.

The rotary drilling indicates that the above granular and cohesive soils are underlain by boulder clay from between 9.0 m (R01 and R02) and 13.0 m (R03) depth, to between 18 m (R02) and 24 m (R03) depth.

#### *2024 Investigation*

A layer of topsoil which varies in thickness from 0.10m to 0.70m was recorded during the 2024 investigation.

In the boreholes, this is generally underlain by a medium dense and dense brown clayey gravelly sand to between 2.40m and 3.4 m depth.

In trial pits TP1 – TP6, TP14 – TP15 this is generally underlain by a dense brown clayey gravelly sand to between 0.70m and 2.70m depth. Trial pits TP1 to TP3, TP6, TP14 – TP15 encountered a very sandy gravel layer to between 1.50m and 3.00m depth.

Underlying the granular deposits, trial pits TP2 – TP6, TP15 – TP16 encountered a firm to stiff consistency, medium to high strength sandy clay from 1.20m to a maximum proven depth of 3.00m.

In trial pits TP7 – TP13 the sand and gravel horizon was not encountered at shallow depth, with the topsoil layer immediately underlain by the above the clay horizon generally described as firm to stiff consistency, medium to high strength sandy clay from 1.20m to a maximum proven depth of 3.00m to a maximum proven depth of 3.00m.

#### 6.4 Solid Geology



In both the 2023 and 2024 investigation, the rotary drilling encountered rockhead at between 18.0 m and 24.0 m. The strata were recorded as a sequence of sandstone, and mudstone. The sandstone strata were generally recorded to be less thick than the mudstone strata. These strata were proven up to a maximum of 42m depth. No coal seams were encountered during the drilling works.

## 6.5 Groundwater

Water was recorded in the trial pits and boreholes as follows. The remainder were recorded as dry.

Trial Pit/Borehole	Depth (m)	Comment
TP03	2.30	Ingress
TP07	1.40	Slight ingress
TP08	1.90	Moderate ingress
TP09	2.10	Ingress
TP15	2.50	Ingress
TP18	2.70	Moderate ingress
TP19	2.00	Moderate ingress
TP20	1.80	Ingress
TP22	1.70	Slight ingress
TP23	1.50	Slight ingress
TP24	1.20	Rapid ingress
TP25	1.60	Moderate ingress
S03	2.60	Water strike
S04	2.70	Water strike
S09	2.10	Water strike
S10	1.90	Water strike
S11	2.00	Water strike
S17	1.60	Water strike

### 2024 Investigation

Trial Pit/Borehole	Depth (m)	Comment
TP01	1.5	Moderate seepage. Trial pit terminated due to water and instability
TP02	1.3	Moderate seepage
TP05	3.0	Slight seepage
TP06	1.8	Moderate seepage
TP14	2.0	Moderate seepage
TP15	1.4	Slight ingress
TP16		Pit was wet
CP101B	3.0	Water strike

The standpipes installed during the investigation were subsequently monitored and the results are summarised in the following table.

BH	Surface level (mAOD)	Response Zone	Response Materials	Water Depths Recorded (m)					
				31/05/2022	15/06/2022	07/07/2022	25/07/2022	09/08/2022	24/08/2022
S01	171.0	1m to 5.2m	Sand & gravel, and clay.	2.09	2.38	2.73	2.22	2.31	2.43
S02	170.7	1m to 4.2m	Sand and gravel, and clay.	1.37	1.58	DRY	1.79	1.9	1.96
S03	169.7	1m to 4m	Sand & gravel, and clay.	DRY	2.34	2.42	2.38	2.44	2.4
S04	170.5	1m to 4.2m	Clay.	1.62	1.76	DRY	1.97	2.21	2.17
S05	168.6	1m to 5.2m	Made ground, sand, and clay.	DRY	2.22	2.28	2.32	1.81	2.23
S06	167.5	1m to 4m	Made ground, sand and gravel,	2.17	1.98	2.09	2.12	DRY	1.96

BH	Surface level (mAOD)	Response Zone	Response Materials	Water Depths Recorded (m)					
				31/05/2022	15/06/2022	07/07/2022	25/07/2022	09/08/2022	24/08/2022
			and clay.						
S07	169.1	1m to 4m	Sand, and clay.	1.61	1.67	DRY	1.85	1.93	1.77
S08	167.1	1m to 4m	Sand and gravel	1.88	1.78	1.88	2.13	1.96	1.75
S09	169.1	1m to 3m	Sand and gravel, and clay.	1.43	1.46	DRY	1.5	1.56	1.75
S10	168.0	1m to 3m	Sand, gravel, and clay.	DRY	1.55	1.66	1.71	1.92	1.61
S11	166.8	1m to 4m	Sand and gravel.	1.77	1.57	1.70	1.78	DRY	1.54
S12	168.8	1m to 4m	Clay.	1.20	1.06	DRY	1.41	1.67	1.66
S13	167.5	1m to 3m	Clay.	1.82	1.22	1.27	1.5	1.84	2.43
S14	166.0	1m to 4m	Sand and gravel, clay, and sand.	1.25	1.32	1.44	1.54	1.26	1.37
S15	167.2	1m to 4m	Clay.	0.85	0.94	1.09	1.22	1.57	1.4
S16	166.2	1m to 3m	Clay, and sand.	DRY	1.12	DRY	1.57	1.92	2.17
S17	165.3	1m to 4m	Clay, and sand.	1.11	1.24	1.37	1.47	2.1	1.25
R01	170.5	24m to 30m	Mudstone	9.38	9.72	9.28	8.97	8.94	8.71
R02	168.4	19m to 22m	Mudstone	20.92	21.09	21.04	21.34	21.32	19.42
R03	168.1	24m to 27m	Mudstone	19.23	19.70	19.92	19.78	5.21	19.54

We can confirm that an oil interface probe was used during the gas and water monitoring program, and this did not record the presence of any product within the borehole, and no visual or olfactory evidence was noted.

Results of recent groundwater monitoring of the shallower terrier soil boreholes generally recorded groundwater levels within the shallow superficial materials at levels between 0.85 and 2.73 metres below existing ground level. These groundwater levels were recorded within both cohesive and granular superficial deposits. Recent monitoring indicates fluctuating groundwater levels showing variation across the site and between standpipes, without a clear hydraulic gradient and direction of flow. However, groundwater levels are generally shallower in the southern area of the site, which suggests a general groundwater flow from southeast to northwest.

The monitoring of the deeper rotary boreholes indicates a significant variation between groundwater levels in R01 and in R02 and R03. Groundwater levels recorded within R01 ranged between 9.28m and 9.72m, which are significantly shallower than those recorded in R02 and R03, which ranged between 19.23m (R03) and 21.09 (R02). Given the significant hydraulic gradient, the shallower groundwater level recorded at R01 could be due to an installation issue rather than representative of groundwater levels within the bedrock strata.

The made ground deposits recorded across the site contain granular deposits (sand, gravel, brick, ash), therefore it is likely that these materials will be relatively free draining with hydraulic connection with the underlying natural deposits.

## 7.0 ENGINEERING CHARACTERISTICS OF THE SUPERFICIAL MATERIALS

### 7.1 General

The results of the in situ and laboratory geotechnical testing of the samples recovered during the 2022 and 2024 investigations are included in Appendix 8. The soil parameters from the in situ and laboratory testing of samples are summarised in the following table.

### 7.2 Made Ground

Standard penetration tests were carried out within the made ground deposits. These indicated uncorrected N values of 30-36. It should be noted that the made ground is inherently variable and therefore this value may not be representative of the deposit as a whole.

### 7.3 Natural Superficial Deposits

#### *Cohesive*

<b>Material Type</b>	Glacial till
<b>Natural Moisture Content (%)</b>	9.1-24%
<b>Plastic Limit (%)</b>	13-19%
<b>Liquid Limit (%)</b>	21-36%
<b>Plasticity Index (%)</b>	7-23%
<b>Soil type based on plasticity chart</b>	Clay of low to intermediate plasticity
<b>Soil descriptions from PSD</b>	Slightly silty, gravelly, sandy clay
<b>Range of consistency</b>	Soft to stiff consistency
<b>Soil Density (Mg/m<sup>3</sup>)</b>	2.10-2.31
<b>Hand Vane tests results</b>	32-114kPa
<b>Undrained triaxial test results</b>	<b>c =</b> 11-130kPa <b>Φ =</b> 0.9-21.1°
<b>Average Shear Strength</b>	19-250kPa
<b>Undrained Shear Strength Classification</b>	Low to very high strength
<b>Standard Penetration Test (SPT) N values</b>	11-38
<b>Mass Shear Strength (c) based on SPT value using Stroud Correlation</b>	60-266kPa
<b>Undrained Shear Strength Classification</b>	Medium to very high strength
<b>Modulus of volume compressibility (m<sub>v</sub>) based on SPT value (Stroud)</b>	0.054-1.666m <sup>2</sup> /MN
<b>Compressibility</b>	Low to medium compressibility
<b>California Bearing Ratio (CBR) value (%)</b>	0.4 – 4.7

#### *Granular*

<b>Material Type</b>	Glacial
<b>Soil descriptions from PSD</b>	Slightly clayey slightly silty sandy gravel
<b>Standard Penetration Test (SPT) N values</b>	12-35
<b>State of Compaction</b>	Medium dense to dense.

## 8.0 FOUNDATION DESIGN CONSIDERATIONS

### 8.1 General

Based upon the engineering properties of the soils as discussed in previous sections of this report, we would offer the following comments regarding suitable founding horizons. The wall loadings for the proposed development are unknown at present but are assumed to be in the range of 50 kN/m to 75 kN/m, and column loads are indicated to range from 750kN to 2500kN.

### 8.2 Made Ground

The investigation has indicated the site to have localised areas of made ground. Due to the inherent variability of this material it is considered that this horizon would not be very suitable as a founding horizon in its present condition.

### 8.3 Natural Deposits

#### *Strip foundations*

The granular glacial deposits lie at shallow depths across parts of the site. Where this material lies within foundation depth then a conservative design would be to assume an N value at foundation level at shallow depth of around 15. From this, the allowable bearing capacity for 0.6m, 0.8m and 1.0m wide strip foundations placed at 600mm depth or 300mm into the natural, whichever is shallower, with all settlement within acceptable limits less than 25mm are summarised below in the following table.

Width (m)	Allowable Bearing Capacity (kN/m <sup>2</sup> )	Equivalent Line Loading (kN/m run of foundation)
0.6	150	90
0.8	145	116
1.0	140	140

The cohesive glacial till deposits lie at shallow depths across parts of the site. Where this material lies within foundation depth then a conservative design would be to assume a shear strength at foundation level at shallow depth of around 45kN/m<sup>2</sup>. From this, the allowable bearing capacity for 0.6m, 0.8m and 1.0m wide strip foundations placed at 600mm depth or, where made ground is present at 600mm depth, 300mm into the natural, whichever is shallower, with all settlement within acceptable limits less than 25mm are summarised below in the following table.

Width (m)	Allowable Bearing Capacity (kN/m <sup>2</sup> )	Equivalent Line Loading (kN/m run of foundation)
0.6	100	60
0.8	97	77
1.0	94	94

#### *Pad Foundations*

Cohesive glacial materials were recorded beneath the made ground and allowable bearing pressures for various sized pad foundations within the materials were calculated using a conservative shear strength value of 60kN/m<sup>2</sup>. It is assumed that these are placed at a minimum of 1.5m depth in the natural ground or at 0.3m penetration into the cohesive glacial soils where made ground is present at 1.5m depth. All settlements are within acceptable limits less than 25mm. The allowable bearing pressures are summarised in the following table.

Width (m)	Allowable Bearing Pressure (kN/m <sup>2</sup> )	Maximum Column Loading (kN/m)
1.0m x 1.0m	174	174
1.5m x 1.5m	162	364
2.0m x 2.0m	122	488
3.0m x 3.0m	87	783

Granular deposits lie were recorded and allowable bearing pressures for various sized pad foundations within the materials were calculated using a conservative a conservative N value at foundation level at shallow depth of around 15. It is assumed that these are placed at a minimum of 1.5m depth in the natural ground or at 0.3m penetration into the cohesive glacial soils where made ground is present at 1.5m depth. All settlements are within acceptable limits less than 25mm. The allowable bearing pressures are summarised in the following table.

Width (m)	Allowable Bearing Pressure (kN/m <sup>2</sup> )	Maximum Column Loading (kN/m)
1.0m x 1.0m	180	180
1.5m x 1.5m	165	371
2.0m x 2.0m	150	600
3.0m x 3.0m	140	1260

Based on the above and the indicated loadings pads would be unable to accommodate all of the proposed column loads, unless the size of the pad was increase. If it is not possible to increase the size of the pads, then piling may be required. As such further discussion with specialist contractors are advised.

#### 8.4 Rock Strata

Borehole information from the previous phase of site investigation indicates weathered rockhead was encountered at between 18.0m to 24.0m in the west. Recent investigations indicates rockhead was encountered at 22.0m depth. This would be the suggested founding horizon if loadings cannot be achieved in the clay although the piles should be socketed into the competent rock until set has been achieved. It is recommended that discussions are held with specialist piling contractors with regard to the final depth and size of piles but it is concluded the high loadings could be accommodated within the rock.

A presumed bearing capacity for the rock would be at least 250kN/m<sup>2</sup>.

#### 8.5 General Comments

pH values and sulphate levels were recorded above laboratory reporting limits therefore an assessment was carried out in accordance with BRE Special Digest 1. The ground conditions indicate design sulphate class DS-1 and ACEC class AC-1. **Therefore, concrete specifications should be such as to be protective of buildings exposed to these conditions.**

During site works, should any localised softening of the soils be encountered then these materials should be removed and replaced with well compacted hardcore. In addition, it is imperative that the foundation excavations are kept dry to ensure the integrity of the glacial till deposits as this material is very sensitive to wetting. All excavations should be examined to ensure that the material is consistent with that used in the assessment.

The foundations may span material varying between granular to cohesive in nature and therefore the possibility of differential settlement should be taken into account during the design work.

Groundwater was encountered during the investigation at depths between 1.20m to 2.70m. As such this should be encountered during any excavations during the site development works. Therefore, during the design of any excavations at the site due consideration should be given to the control of surface water and possible ground inflow and sidewall stability, with all necessary precautions being taken to ensure safe working conditions. This should be carried out in accordance with Health & Safety and CDM Guidance.

#### 8.6 Percolation Testing

##### *2022 Investigation*

JPB was required to assess percolation rates in the underlying soils at two locations in the general spirit of BRE Digest 365. Trial pits TP1 and TP4 were located at positions to test the suitability of the soils for soakaway trenches. Percolation testing was undertaken in the pits (Appendix 12).

##### *2024 Investigation*

JPB was required to assess percolation rates in the underlying soils at four locations in the general spirit of BRE Digest 365. Trial pits TP7A, TP8A, TP9A and TP10A were located at positions to test the suitability of the soils for soakaway trenches. Percolation testing was undertaken in the pits (Appendix 12).

BRE Digest 365 recommends calculation of infiltration rate from the time taken for the water volume to fall from 75% to 25% of the effective storage depth of the pit. Due to the impermeable nature of the clay the water level did not drop during the test period, and therefore the clay would not be deemed suitable as a soakaway.

#### 8.7 Compaction Characteristics and Foundations on Upfill

It is understood that in order to obtain the necessary development levels a cut and fill exercise will take place at the site as outlined above. As such we have assessed the potential for recompaction of the arising materials. The samples were tested from a range of depths in the areas where the excavations are most likely to occur using a 4.5kg rammer to determine optimum moisture content and maximum dry density..

TP	Depth (m)	Natural Moisture Content $\omega$ (%)	Optimum Moisture Content (%)	MDD	Dry Density from compaction test at NMC $\rho_d$ (Mg/m <sup>3</sup> )	Particle Density of soil $\rho_s$ (Mg/m <sup>3</sup> )	Particle Density of water $\rho_w$ (Mg/m <sup>3</sup> )	Air voids $V_a$ (%)	% compaction based on MDD
CP102	3	15.0	7.9	2.05	1.72	2.62	1.00	8.55	83.90
CP103	4	15.0	8.5	2.05	1.76	2.57	1.00	5.12	85.85
		AV Fails		MDD Fails				2.00	2.000
		Total Tests		Total Tests				2.00	2.000

Based on the information it can be seen that the majority of the materials encountered would appear to be generally unsuitable for reuse as an engineering fill without some form of improvement such as lime/cement stabilisation. The cut and fill operations should be carried out in accordance with a recognised Earthworks Specification such as the BS6031:2009 Code of Practice for Earthworks or the Specification for Highway Works Series 600 for road construction. A second option would be to place the clay material by tracking in. In both cases the foundation solution would be placement on the underlying rock.

Should this material be considered for reuse across the site, the earthworks will require to be controlled and carried out in dry weather. The material will only be suitable to be excavated and replaced in a single operation. Once the glacial till has been exposed it is likely to degrade due to moisture and every effort should be maintained to protect the material and to only expose limited areas at a time.

There are therefore two options for the cut and fill operations. The first option would be to compact the clay on site to in excess of 95% compaction and less than 5% air voids. This would then be tested for its bearing capacity which is likely to be of the order of 75kN/m<sup>2</sup>. The foundations on this material would also have to be reinforced semi-rafts which are capable of spanning 3m and cantilevering 1.5m. After the bearing capacity has been determined the upper material would have to be monitored to determine when the residual period of consolidation settlement has been completed. An estimate would be at least 6 months to 2 years.

The second option would be to place the clay material by tracking in and subsequently piling to the underlying glacial till deposits.



## 9.0 ROAD CONSTRUCTION

The investigation has indicated that the site is underlain by localised areas of made ground then natural soil deposits comprising alluvial deposits and glacial till.

Any material beneath the road will require to be placed in accordance with the Specification of Highway Works Series 600 and appropriate testing carried out to confirm the acceptability of the material.

Selective CBR test were carried out along the proposed roads and sports pitch locations and these indicated CBR values in the range of 0.4% to 4.7%.

Some of the recorded CBR values were below 2.5% and therefore the material is a soft sub-grade as per Interim Advice Note 73/06 Revision 1 (2009) Design Guidance for Road Pavement Foundations (Draft Hd25) then the measures outlined in that document should be undertaken to address these issues. The guidance is as follows:

*The minimum permitted Design CBR is 2.5% CBR. Where a subgrade has a lower CBR it is considered unsuitable support for a pavement foundation. It must therefore be permanently improved using one of the options given in the following paragraphs.*

*The material at the surface can be removed and replaced by a more suitable material. If the depth of relatively soft material is small, it can be replaced in its entirety, although it may only be necessary to replace the top layer. The thickness removed will typically be between 0.5 and 1.0m.*

*Although the new material may be of better quality, the new Design CBR should be assumed to be equivalent to 2.5%, in order to allow for effects of any softer underlying material and the potential reduction in the strength of the replacement material to its long-term CBR value.*

*If the soil is cohesive, a lime (or similar) treatment may be appropriate, subject to soil suitability being demonstrated. Details of various soil treatments are given in HA44 (DRAB 4.1.1). The new Design CBR should again be assumed to be equivalent to 2.5% unless agreed otherwise under Departure from Standard approval. HA 74 (DMRB 4.1.6) contains further advice on stabilisation.*

The investigation has confirmed that there is no constraint to any adoptable roads on the site due to shallow abandoned mineworkings.

### *Site Operatives During Construction of the Development*

No elevated contaminants were recorded and the risks from exposure to any contaminated materials are considered to be low. Normal Health and Safety precautions should be implemented during the works. Site personnel should maintain vigilance to detect any unpleasant odours, strangely coloured made ground, made ground other than generally observed during this investigation, fibrous materials or chemical residues in order that they can be assessed by suitably qualified personnel.

While no specific unusual risks have been identified, any development works should be carried out in accordance with the Construction Industry Research and Information Association (CIRIA) Report 132 entitled "A Guide for Safe Working on Contaminated Sites 1996".

There are no requirements for gas remedial works in the road although adequate health and safety provisions should be made with regard to monitoring gas levels within any trenches formed on site.

### *Roads Maintenance Workers in the Completed Development*

While there no specific unusual risks have been identified, any works should be carried out in accordance with the Construction Industry Research and Information Association (CIRIA) Report 132 entitled "A Guide for Safe Working on Contaminated Sites 1996".

No elevated contaminants were recorded and the risks from exposure to any contaminated materials are considered to be low. Normal Health and Safety precautions should be implemented during the works. Site personnel should maintain vigilance to detect any unpleasant odours, strangely coloured made ground, made ground other than generally observed during this investigation, fibrous materials or chemical residues in order that they can be assessed by suitably qualified personnel.

### *General*

As with any construction or maintenance activity, risks to workers should be managed by appropriate health and safety risk assessments/COSHH undertaken in the normal manner by the employer prior to works being undertaken as required by health and safety legislation.

## PART FIVE – CHEMICAL CONTAMINATION AND GAS EMISSIONS ASSESSMENT

### 10.0 STAGE 2 GENERIC QUANTITATIVE RISK ASSESSMENT - CHEMICAL CONTAMINATION

#### 10.1 Introduction

The Stage 2 generic quantitative assessment of risk to human health, property, ecology, surface water and ground water considers the potential for exposure based on comparison of the results to conservative generic criteria. JPB's risk assessment methodology is discussed in detail in Appendix 6 and is summarised in the flow chart presented in that appendix.

In terms of human health, the guideline concentration appropriate to the proposed end use of the site is used in the interpretation of the results. As the site is proposed for development as a school, there are no assessment criteria available, therefore, the most relevant criteria (assuming a degree of conservatism) have been adopted, the criteria for a residential development with no plant uptake. At Stage 2 all soil contaminant concentrations are compared with GACs. If necessary, at Stage 3 representative soil contaminant concentrations are calculated and used for comparison with assessment criteria.

#### 10.2 Risk Assessment

The following tables summarise the results of the Stage 2 assessment. For C4SLs, S4ULs and EIC/AGS/CL:AIRE values derived using 1% soil organic matter have been adopted where available. JPB derived GAC have been derived conservatively assuming site soils have 1% soil organic matter. For JPB derived GAC, the tables showing the CLEA 1.07.1 outputs for the JPB generated GAC are given in Appendix 13

##### Human Health - Chemical Contamination

Parameter	Concentration range (mg/kg)	Concentration range exceeding JPB GAC (mg/kg)	GAC Residential without plant uptake (mg/kg)	Source of GAC	Location of exceedances
Arsenic	5.1 – 12	None	40	S4UL	None
Boron	<0.2 – 0.6	None	11000	S4UL	None
Cadmium	<0.2 – 0.4	None	85	S4UL	None
Chromium (III)	28 – 91	None	910	S4UL	None
Hexavalent Chromium (Chromium (VI))	Below Detectable Limits	None	6	S4UL	None
Copper	13 – 30	None	7100	S4UL	None
Lead	14 – 55	None	310	C4SL	None
Mercury (Inorganic mercury)	Below Detectable Limits	None	56	S4UL	None
Nickel	20 – 51	None	180	S4UL	None
Selenium	Below Detectable Limits	None	430	S4UL	None
Zinc	40 – 140	None	40000	S4UL	None
Cyanides	Below Detectable Limits	None	24.5	JPB GAC	None
Toluene	Below Detectable Limits	None	880	S4UL	None
Ethylbenzene	Below Detectable Limits	None	83	S4UL	None
Benzene	Below Detectable Limits	None	3.3	C4SL	None
o - xylene	Below Detectable Limits	None	88	S4UL	None
p & m - xylene	Below Detectable Limits	None	82	S4UL	None

Parameter	Concentration range (mg/kg)	Concentration range exceeding JPB GAC (mg/kg)	GAC Residential without plant uptake (mg/kg)	Source of GAC	Location of exceedances
Phenols	Below Detectable Limits	None	440	S4UL	None
Aliphatic TPH EC <sub>5</sub> – EC <sub>6</sub>	Below Detectable Limits	None	42	S4UL	None
Aliphatic TPH >EC <sub>6</sub> – EC <sub>8</sub>	Below Detectable Limits	None	100	S4UL	None
Aliphatic TPH >EC <sub>8</sub> – EC <sub>10</sub>	Below Detectable Limits	None	27	S4UL	None
Aliphatic TPH >EC <sub>10</sub> – EC <sub>12</sub>	Below Detectable Limits	None	130	S4UL	None
Aliphatic TPH >EC <sub>12</sub> – EC <sub>16</sub>	Below Detectable Limits	None	1100	S4UL	None
Aliphatic TPH >EC <sub>16</sub> – EC <sub>35</sub>	Below Detectable Limits	None	65000	S4UL	None
Aromatic TPH >EC <sub>5</sub> – EC <sub>7</sub>	Below Detectable Limits	None	370	S4UL	None
Aromatic TPH >EC <sub>7</sub> – EC <sub>8</sub>	Below Detectable Limits	None	860	S4UL	None
Aromatic TPH >EC <sub>8</sub> – EC <sub>10</sub>	Below Detectable Limits	None	47	S4UL	None
Aromatic TPH >EC <sub>10</sub> – EC <sub>12</sub>	Below Detectable Limits	None	250	S4UL	None
Aromatic TPH >EC <sub>12</sub> – EC <sub>16</sub>	Below Detectable Limits	None	1800	S4UL	None
Aromatic TPH >EC <sub>16</sub> – EC <sub>21</sub>	Below Detectable Limits	None	1900	S4UL	None
Aromatic TPH >EC <sub>21</sub> – EC <sub>35</sub>	Below Detectable Limits	None	1900	S4UL	None
Naphthalene	Below Detectable Limits	None	2.3	S4UL	None
Acenaphthylene	Below Detectable Limits	None	2900	S4UL	None
Acenaphthene	Below Detectable Limits	None	3000	S4UL	None
Fluorene	Below Detectable Limits	None	2800	S4UL	None
Phenanthrene	Below Detectable Limits	None	1300	S4UL	None
Anthracene	Below Detectable Limits	None	31000	S4UL	None
Fluoranthene	Below Detectable Limits	None	1500	S4UL	None
Pyrene	Below Detectable Limits	None	3700	S4UL	None
Benz(a)anthracene	*	*	*	*	*
Chrysene	*	*	*	*	*
Benzo(b)fluoranthene	*	*	*	*	*
Benzo(k)fluoranthene	*	*	*	*	*
Benzo(a)pyrene	Below Detectable Limits	None	3.2	S4UL	None
Indeno (1,2,3-CD) pyrene	*	*	*	*	*
Dibenzo(a,h)anthracene	*	*	*	*	*
Benzo(g,h,i)perylene	*	*	*	*	*
PCBs (non dioxin-like) Sum of seven	Below Detectable Limits	None	0.63	JPB GAC	None

Parameter	Concentration range (mg/kg)	Concentration range exceeding JPB GAC (mg/kg)	GAC Residential without plant uptake (mg/kg)	Source of GAC	Location of exceedances
congeners					
PCBs (dioxin like)	Below Detectable Limits	None	None available – Automatic Stage 3 Assessment required where MRL exceeded		None

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\* Parameter assessed using the benzo(a)pyrene surrogate marker approach.

PAH ratios have not been calculated as all samples had low or no appreciable PAH contents.

### Human Health - Asbestos

Twenty seven soil samples were scheduled for laboratory testing for the presence of asbestos. Asbestos was not identified within any of the samples scheduled for analysis.

### Phytotoxicity – Soils

Parameter	Concentration range (mg/kg)	Concentrations exceeding GAC (mg/kg)	GAC (mg/kg)	Source of GAC	No. and location of exceedances
Copper	13 – 30	None	pH dependent	MAFF Guidance	None
Zinc	40 – 140	None	pH dependent	MAFF Guidance	None
Nickel	20 – 51	None	pH dependent	MAFF Guidance	None
Cadmium	<0.2 – 0.4	None	3	MAFF Guidance	None
Lead	14 – 55	None	300	MAFF Guidance	None
Mercury	Below Detectable Limits	None	1	MAFF Guidance	None
Chromium	28 – 91	None	400	MAFF Guidance	None
Selenium	Below Detectable Limits	None	3	MAFF Guidance	None
Arsenic	5.1 – 12	None	50	MAFF Guidance	None

### Buildings and Services

#### Buildings and Services – Soils Effect on Concrete

Parameter	Concentration Range	SSAC BRES1/BRE PBMCL
pH	6.3 – 8.1	<5 or >8
Total Sulphate	63 – 780 mg/kg as SO <sub>4</sub>	Not Applicable
Water soluble sulphate	1.4 – 45 mg/L as SO <sub>4</sub>	Not Applicable

### Water Environment

#### 1. Groundwater Resource Receptors

A review of the potential water environment receptors at the site was undertaken in the light of the information gained during site investigations.

The site has been shown to be underlain by topsoil and isolated areas of made ground, underlain by cohesive and localised granular soils, further underlain by a significant thickness of glacial till which is not a water body. Water monitoring at standpipes has confirmed the presence of groundwater within surface soils, however, some monitoring positions were recorded as being dry during this period, and during the investigation, a number of trial pits were also recorded as dry. In order for a groundwater resource receptor to exist it must have sufficient areal extent, which SEPA defines as “average thickness and physical properties combined to produce a deposit with resource potential”. SEPA does not define what minimum horizontal area is required, but does indicate that the deposits are required to comprise more than 2m thickness of continuous saturated sand or gravel (or coarser material) in any one excavation. Although, granular deposits in excess of 2m thick were observed onsite, they were not observed continuously across the site.

Therefore, we consider that the localised granular deposits in the area of the site are not continuous on site or locally and do not, therefore, meet SEPA's definition of a water body.

The underlying bedrock aquifer is sedimentary, however has been shown to predominantly comprise of significant thicknesses of mudstone, with minor horizons of sandstone, therefore is likely to have only minor permeability. In addition, the underlying bedrock aquifer will be afforded protection by thick, very low permeability glacial till overlying it. On the basis of this information groundwater resource receptors are considered to be absent from the site and no further assessment of groundwater quality at the site is required.

## 2. Surface Water Receptors

### Contaminant Sources

No soil contaminants were recorded exceeding the human health GAC. As discussed above, although groundwater has been recorded within monitoring standpipes, as granular deposits are not considered to be continuous across the site, the identified groundwater is not considered to represent a water body. However, the recorded groundwater in surface soils may potentially form a pathway to identified surface water environment receptors. These pathways and receptors are discussed further below.

### Pathways

Monitoring has identified shallow groundwater which could act as a pathway for contaminant movement. Although granular deposits are present, they have been recorded as containing both clay and silt which will result in variable permeability, and the deposits are not considered to be continuous across the site. In addition, intervening cohesive soils are also present onsite which will significantly retard the migration of groundwater towards the nearby minor surface waters.

Vertical movement would be inhibited by the low permeability clays and silts, and underlying glacial till deposits which extend up to 24m below the site.

### Receptor

Some granular materials were recorded to be present at shallow depth at the site, however, this was not a continuous stratum. For example while sands and gravels in excess of 2m thick were present at boreholes S06, S08 and S11, the majority of boreholes where granular deposits were recorded, were then underlain by silty clays, and further underlain by significant thickness of boulder clay. Due to the intervening low permeability glacial tills, vertical migration of the shallow groundwater to groundwater within the underlying bedrock will be inhibited.

In order for a receptor to exist it must have sufficient aerial extent, which SEPA defines as "average thickness and physical properties combined to produce a deposit with resource potential". SEPA does not define what minimum horizontal area is required. However, we consider that the localised granular deposit in the area of the site is not continuous on site or locally and does not, therefore, meet SEPA's definition of a water body. Given the small area, groundwater at the site could not and would not be exploited economically. In addition, we consider that given its extent this stratum does not represent an exploitable resource as such a source must meet UKTAG's requirement that it must be able to supply on a continuous basis.

### Conclusion

Having reviewed the potential linkage to a potential shallow groundwater resource receptor, the above comments indicate that there is no source of contamination at the site, pathways to a down gradient assessment point are highly restricted and the granular deposit is of limited extent, does not represent an exploitable resource and does not therefore meet the definition of a water body or groundwater resource receptor. On this basis and in the absence of a receptor, it is therefore concluded that there are no significant risks posed by the site to groundwater resource receptors and that as other receptors are absent, lack pathways to them or too distant to be impacted, **no remedial measures are required to protect local water environment receptors.**

### Leachates

Parameter	Concentration Range (µg/L unless stated otherwise)	Groundwater Receptors		Surface Water receptors	
		RPV/DWS (source) (µg/L unless stated otherwise)	No. and location of exceedances	EQS/MRL (Source) (µg/L unless stated otherwise)	No. and location of exceedances
Arsenic	<1.0	10	None	50	None
Cadmium	<0.08	5	None	Hardness dependant	None

Parameter	Concentration Range (µg/L unless stated otherwise)	Groundwater Receptors		Surface Water receptors	
		RPV/DWS (source) (µg/L unless stated otherwise)	No. and location of exceedances	EQS/MRL (Source) (µg/L unless stated otherwise)	No. and location of exceedances
Chromium	0.5	50	None	4.7	None
Copper	6.1	2000	None	22.58 (m-BAT tool)	None
Lead	1.9	10	None	3.67 (m-BAT tool)	None
Mercury	<0.5	1 (MRL)	None	0.07	None
Nickel	3.2	20	None	14.89 (m-BAT tool)	None
Selenium	<4.0	10	None	10	None
Zinc	4.9	5000 (*)	None	27.07 (m-BAT tool)	None
Cyanide	<10	50	None	1 (free cyanide)	None
Sulphate	5.1	250mg/L	None	400mg/L	None
Sulphide	<5.0	MRL	None	MRL	None
Phenol	<1.0	0.5 (*)	None	7.7	None

\* - indicates a parameter where no maximum concentration is given in the Water Supply (Water Quality) Scotland Regulations 2001 and as such the value from the Water Supply (Water Quality) Scotland Regulations 1990 has been used.

#### Groundwater

Parameter	Concentration Range (µg/L unless stated otherwise)	Groundwater Receptors		Surface Water receptors	
		RPV/DWS (source) (µg/L unless stated otherwise)	No. and location of exceedances	EQS/MRL (Source) (µg/L unless stated otherwise)	No. and location of exceedances
Arsenic	0.21 – 0.68	10	None	50	None
Cadmium	<0.02 – 0.11	5	None	Hardness dependant	None
Chromium	<0.2 – 0.3	50	None	4.7	None
Copper	2.9 – 9.6	2000	None	22.58 (m-BAT tool)	None
Lead	<0.2 – 0.3	10	None	3.67 (m-BAT tool)	None
Mercury	<0.05	1 (MRL)	None	0.07	None
Nickel	1.3 – 8.9	20	None	14.89 (m-BAT tool)	None
Selenium	<0.6 – 1.3	10	None	10	None
Zinc	6.1 – 11	5000 <sup>(1)</sup>	None	27.07 (m-BAT tool)	None
Cyanides	Below Detectable Limits	50	None	1 (free cyanide)	None
Sulphate	13.5 – 38.3	250mg/L	None	400mg/L	None
Chloride	8 – 190	250mg/L	None	250mg/L	None
Sulphide	Below Detectable Limits	MRL	None	MRL	None
Phenol	1.2 – 1.4	0.5 <sup>(1)</sup>	4 exceedances (S02, S04, S14, and S17)	7.7	None
Iron	7 – 120	200	None	1000	None
Calcium	55 – 130	250mg/L <sup>(1)</sup>	None	MRL	None
Magnesium	8.2 – 22	50mg/L <sup>(1)</sup>	None	MRL	None
Manganese	10 – 4200	50	3 exceedances (S02, S04, and S17)	325.80 (m-BAT tool)	2 exceedances (S02 and S04)
Boron	24 – 56	1000	None	2000	None
BOD <sub>5</sub>	1 – 5				
Ammoniacal Nitrogen	0.028 – 0.18	0.5mgNH <sub>4</sub> /L	None	0.3mg total NH <sub>4</sub> -N/L	None
Phosphate (as P)	40 – 70	2200	None	100	None



Parameter	Concentration Range (µg/L unless stated otherwise)	Groundwater Receptors		Surface Water receptors	
		RPV/DWS (source) (µg/L unless stated otherwise)	No. and location of exceedances	EQS/MRL (Source) (µg/L unless stated otherwise)	No. and location of exceedances
Benzene	Below Detectable Limits	1	None	10	None
Toluene	Below Detectable Limits	700	None	74	None
Ethylbenzene	Below Detectable Limits	300	None	20	None
Xylenes	Below Detectable Limits	500	None	30	None
Aliphatic TPH EC <sub>5</sub> – EC <sub>6</sub>	Below Detectable Limits	15,000 <sup>(2)</sup>	None	10 (MRL)	None
Aliphatic TPH >EC <sub>6</sub> – EC <sub>8</sub>	Below Detectable Limits	15,000 <sup>(2)</sup>	None	10 (MRL)	None
Aliphatic TPH >EC <sub>8</sub> – EC <sub>10</sub>	Below Detectable Limits	300 <sup>(2)</sup>	None	10 (MRL)	None
Aliphatic TPH >EC <sub>10</sub> – EC <sub>12</sub>	Below Detectable Limits	300 <sup>(2)</sup>	None	10 (MRL)	None
Aliphatic TPH >EC <sub>12</sub> – EC <sub>16</sub>	Below Detectable Limits	300 <sup>(2)</sup>	None	10 (MRL)	None
Aromatic TPH >EC <sub>8</sub> – EC <sub>10</sub>	Below Detectable Limits	300 <sup>(2)</sup>	None	10 (MRL)	None
Aromatic TPH >EC <sub>10</sub> – EC <sub>12</sub>	Below Detectable Limits	100 <sup>(2)</sup>	None	10 (MRL)	None
Aromatic TPH >EC <sub>12</sub> – EC <sub>16</sub>	Below Detectable Limits	100 <sup>(2)</sup>	None	10 (MRL)	None
Aromatic TPH >EC <sub>16</sub> – EC <sub>21</sub>	Below Detectable Limits	90 <sup>(2)</sup>	None	10 (MRL)	None
Aromatic TPH >EC <sub>21</sub> – EC <sub>35</sub>	Below Detectable Limits	90 <sup>(2)</sup>	None	10 (MRL)	None
Total TPH	Below Detectable Limits	90 <sup>(3)</sup>	None	10 (MRL)	None
PAH (sum of 4) <sup>(4)</sup>	Below Detectable Limits	0.1	None	N/A	N/A
Anthracene	Below Detectable Limits	N/A	N/A	0.1	None
Benzo(a)pyrene	Below Detectable Limits	0.01	None	0.01	None
Fluoranthene	Below Detectable Limits	N/A	N/A	0.1	None
Naphthalene	Below Detectable Limits	N/A	N/A	2	None

<sup>1</sup> - indicates a parameter where no maximum concentration is given in the Water Supply (Water Quality) Scotland Regulations 2001 and as such the value from the Water Supply (Water Quality) Scotland Regulations 1990 has been used.

<sup>2</sup> - indicates a parameter where no maximum concentration is given in the Water Supply (Water Quality) Scotland Regulations 2001 and as such the value from the World Health Organisation document WHO/SDE/WSH/05.08/123 (2005): Water Petroleum Products in Drinking Water has been used.

<sup>3</sup> - value assumed worst case from document used above <sup>(2)</sup>.

<sup>4</sup> - PAH (sum of 4) is the sum of the concentrations of; Benzo(b)fluoranthene; Benzo(k)fluoranthene; Benzo(ghi)perylene and Indeno(123cd)pyrene.

#### Surface Water

Parameter	Concentration Range (µg/L unless stated otherwise)	Surface Water receptors	
		EQS/MRL (Source) (µg/L unless stated otherwise)	No. and location of exceedances
Arsenic	0.3 – 0.93	50	None
Cadmium	<0.02 – 0.04	Hardness dependant	None
Chromium	0.3 – 1.6	4.7	None
Copper	2.7 – 23	22.58 (m-BAT tool)	None
Lead	<0.2 – 0.3	3.67 (m-BAT tool)	None
Mercury	Below Detectable Limits	0.07	None

Parameter	Concentration Range (µg/L unless stated otherwise)	Surface Water receptors	
		EQS/MRL (Source) (µg/L unless stated otherwise)	No. and location of exceedances
Nickel	0.9 – 2.7	14.89 (m-BAT tool)	None
Selenium	Below Detectable Limits	10	None
Zinc	8.5 – 88	27.07 (m-BAT tool)	None
Cyanides	Below Detectable Limits	1 (free cyanide)	None
Sulphate	5.63 – 22.2	400mg/L	None
Chloride	22 – 140	250mg/L	None
Sulphide	Below Detectable Limits	MRL	None
Phenol	<1.0 – 2.1	7.7	None
Iron	11 – 200	1000	None
Calcium	41000 – 80000	MRL	None
Magnesium	5000 – 13000	MRL	None
Manganese	2 – 290	325.80 (m-BAT tool)	None
Boron	24 – 35	2000	None
BOD <sub>5</sub>	<1.0 – 1.8		
Ammoniacal Nitrogen	0.029 – 0.92	0.3mg Total NH <sub>4</sub> -N/L	<b>SW2</b>
Phosphate (as P)	40 – 200	100	<b>SW2</b>
TPH	Below Detectable Limits	10 (MRL)	None
Benzene	Below Detectable Limits	10	None
Toluene	Below Detectable Limits	74	None
Ethylbenzene	Below Detectable Limits	20	None
Xylenes	Below Detectable Limits	30	None
Anthracene	Below Detectable Limits	0.1	None
Benzo(a)pyrene	Below Detectable Limits	0.01	None
Fluoranthene	Below Detectable Limits	0.1	None
Naphthalene	Below Detectable Limits	2	None

### 10.3 Summary

#### Human Health

No soil concentrations exceeded human health GACs, therefore, **no remedial measures are required to protect human health from contamination risks.**

#### Phytotoxicity

No soil concentrations exceeded phytotoxicity GACs, therefore, **no remedial measures are required to protect healthy plant growth.**

#### Water Environment

No soil leachate concentrations exceeding groundwater or surface water GACs were recorded. The only exceedances of GACs recorded in groundwater samples were phenol and manganese, which were found at concentrations exceeding their respective groundwater GAC's, but not exceeding their respective surface water GAC's. As no phenol exceedances were recorded within site soils, phenol identified within groundwater is not considered to be derived from onsite contamination. In addition, the identified exceedances are only marginally elevated. The elevated manganese concentrations are thought to be as a result of natural processes including mineralisation.

Exceedances of the respective GAC's for ammoniacal nitrogen and phosphate were recorded within surface water samples. Ammoniacal nitrogen and phosphate are likely to be present due to agricultural practices such as silage and fertiliser usage, with ammoniacal nitrogen also present due to naturally occurring microbial action. In addition, no

exceedances were recorded in the surface water sample collected downstream of the site indicating the exceedances recorded in sample SW2 are not significantly impacting surface water downstream of the site.

The initial conceptual site model indicated that only the following water environment receptors were potentially present at the site; the adjacent minor surface water, groundwater resource receptors in natural superficial soils and in the aquifer in the underlying sedimentary rock. The following review of the ICSM and site data in relation to those receptors identifies whether a receptor actually exists and whether an intact contaminant linkage to identified receptors is present.

Further investigations have indicated that no elevated leachable soil contaminants are present within site soils, however some minor elevated contaminants have been recorded in site groundwater and the adjacent surface water. It is considered likely that these are due to natural mineralisation, microbial or agricultural processes. Although elevated contaminants have been recorded in the shallow groundwater, due to the presence of a significant thickness of glacial till, it is considered that there is no significant groundwater pathway to the deeper bedrock aquifer groundwater resource receptor.

The parameters detailed above are present at relatively low concentrations and it is likely that these are due to natural mineralisation, microbial or agricultural processes and we do not consider that these represent a significant risk to water environment receptors. Therefore, it is concluded that **no remedial measures are required to protect water environment receptors.**

#### *Buildings and Services*

pH values and sulphate concentrations indicated that the ground conditions fall within design sulphate class DS-1 and ACEC class AC-1 as defined in BRE Special Digest 1.

The requirements for water supply pipes are outlined in the Water Supply Pipes section of this report.

## 12.0 WATER SUPPLY PIPES

The following assessment has been undertaken in accordance with Scottish Water guidance and UK Water Industry Research (UKWIR) guidance document, "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites", UKWIR report reference 10/WM/03/21, 2010. Investigations at the site have confirmed the following conditions.

The site currently comprises agricultural land.

Historical OS maps indicate that the site has been greenfield from the earliest available OS map until the present day.

No industrial, commercial or residential land uses are shown on OS maps and the land has been unoccupied.

Soils encountered during previous and recent investigations comprised topsoil or isolated made ground without any significant contamination, overlying natural clay and sand and gravel soils shallow to the surface, further underlain by glacial till deposits.

No evidence of contamination or significant thickness of made ground soils was encountered other than reworked natural soils.

The site has been greenfield throughout its history and according to researches and a site walkover visit no toxic chemicals are stored in the areas of the site under consideration and there is no evidence available that they have been stored on site in the past. Current Scottish Water Guidance - Water Pipe Draft Guidance Version 3.1, indicates that provided desk study information is sufficient, an intrusive investigation including chemical testing will not be required on sites where contaminants are not present such as greenfield sites.

There is, therefore, no restriction on the type of pipe materials which can be used for water supply pipes at the site, other than those imposed by the relevant current Standards and Codes of Practice. On the basis of the above assessment we, therefore, **recommend that Polyethylene (PE) plastic pipes are suitable for use as water supply pipes at the site.**

It should be noted that the water company may require that a PID survey of the route of water supply pipes is undertaken, extending to 15m either side of the pipe route, in order to confirm that no unexpected chemical contamination is present. Alternatively, this requirement can be satisfied by upgrading pipe materials to PE-Al-PE barrier pipe, which would be protective of water supplies.

## 13.0 GAS EMISSIONS RISKS

### 13.1 General

Due to the presence of localised made ground at the site, gas monitoring was undertaken at standpipes installed in 17 of the terrier soil boreholes and 3 of the deeper rotary boreholes.

The assessment of ground gas as a potential constraint to development has been the subject of a great deal of research and published guidance. Ground gas can be a concern for several reasons; flammable gases may cause an explosion, accumulation of gases within poorly ventilated areas may lead to asphyxia or toxic gases may cause harm to those exposed to them. Some physical properties of ground gases are tabulated below.

Gas	Explosive Range	Density at 20°C	Toxicity (% by volume in air)*
Methane	5-15% by volume	0.72 kg/m <sup>3</sup>	30 (low)
Carbon dioxide	N/A	1.98kg/m <sup>3</sup>	0.5 (high)
Carbon monoxide	12.5-74.2% by volume	1.25kg/m <sup>3</sup>	0.02 (high)
Hydrogen sulphide	4.2-46% by volume	1.54kg/m <sup>3</sup>	0.001 (high)

\* short term occupational exposure limits. The long term occupational exposure limit for carbon monoxide is 30ppm and for hydrogen sulphide is 5ppm.

#### *Gas Emissions Sources*

The desk based information and initial CSM identified the following potential gas generation sources at the site;

Isolated mineral made ground in the northern area of the site – typically a low generation potential source.

Natural mineral soils, sands, gravels and clays – normally a low generation potential source. Glacial till where present is highly likely to be a very low gas generation material, and would not normally be considered to be a significant gas generation source.

These sources are discussed further below, in the light of data obtained during intrusive investigations and monitoring.

### 13.2 Analysis of Results

Gas measurements recorded at borehole standpipes are summarised in the table below.



Summary of Gas Monitoring Results

Borehole	Response zone	Response Strata	Number of monitoring occasions	Methane (% by volume)		Carbon dioxide (% by volume)		Oxygen (% by volume)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Peak Flow Rate (l/hr) (*)	Steady State Flow Rate (l/hr)	Groundwater Depths (m)	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max			Min	Max
S01	1m to 5.2m	Sand & gravel, and clay.	6	<0.1	<0.1	<0.1	1.6	19.4	21.8	<1	2	<1	<1	0.1	0.1	2.09	2.73
S02	1m to 4.2m	Sand and gravel, and clay.	6	<0.1	<0.1	<0.1	2.7	19.3	22.2	<1	1	<1	<1	<0.1	<0.1	DRY	1.96
S03	1m to 4m	Sand & gravel, and clay.	6	<0.1	0.1	<0.1	1.8	19.6	21.6	<1	1	<1	<1	0.1	0.1	DRY	2.44
S04	1m to 4.2m	Clay.	6	<0.1	<0.1	<0.1	2.2	19.1	22.0	<1	1	<1	<1	<0.1	<0.1	DRY	2.21
S05	1m to 5.2m	Made ground, sand, and clay.	6	<0.1	<0.1	<0.1	1.0	19.6	21.4	<1	2	<1	1	0.2	0.1	DRY	2.32
S06	1m to 4m	Made ground, sand and gravel, and clay.	6	<0.1	<0.1	<0.1	1.5	20.3	21.6	<1	1	<1	<1	0.1	0.1	DRY	2.17
S07	1m to 4m	Sand, and clay.	6	<0.1	<0.1	<0.1	4.3	18.1	22.0	<1	1	<1	<1	<0.1	<0.1	DRY	1.93
S08	1m to 4m	Sand and gravel	6	<0.1	<0.1	<0.1	1.9	19.9	21.5	<1	1	<1	<1	0.2	0.1	1.78	2.13
S09	1m to 3m	Sand and gravel, and clay.	6	<0.1	<0.1	<0.1	4.0	18.6	22.2	<1	1	<1	<1	<0.1	<0.1	DRY	1.75
S10	1m to 3m	Sand, gravel, and clay.	6	<0.1	<0.1	<0.1	1.5	19.6	21.2	<1	1	<1	1	0.1	0.1	DRY	1.92
S11	1m to 4m	Sand and gravel.	6	<0.1	<0.1	<0.1	1.9	20.2	21.6	<1	1	<1	<1	0.1	0.1	DRY	1.78
S12	1m to 4m	Clay.	6	<0.1	0.1	<0.1	2.6	18.7	22.2	<1	1	<1	1	<0.1	<0.1	DRY	1.67
S13	1m to 3m	Clay.	6	<0.1	0.2	<0.1	1.5	19.6	21.7	<1	1	<1	1	0.1	0.1	1.22	2.43
S14	1m to 4m	Sand and gravel, clay, and sand.	6	<0.1	<0.1	<0.1	2.0	20.0	21.3	<1	1	<1	<1	0.1	0.1	1.25	1.54
S15	1m to 4m	Clay.	6	<0.1	<0.1	<0.1	2.2	19.5	22.0	<1	1	<1	1	<0.1	<0.1	0.85	1.57
S16	1m to 3m	Clay, and sand.	6	<0.1	<0.1	<0.1	5.1	17.9	21.7	<1	1	<1	<1	0.1	0.1	DRY	2.17
S17	1m to 4m	Clay, and	6	<0.1	<0.1	<0.1	1.5	19.7	21.3	<1	8	<1	<1	0.4	0.3	1.11	2.10



Borehole	Response zone	Response Strata	Number of monitoring occasions	Methane (% by volume)		Carbon dioxide (% by volume)		Oxygen (% by volume)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Peak Flow Rate (l/hr) (*)	Steady State Flow Rate (l/hr)	Groundwater Depths (m)	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max			Min	Max
		sand.															
R01	24m to 30m	Mudstone	6	<0.1	3.0	<0.1	0.2	14.8	21.8	<1	92	<1	1	0.2	0.2	8.71	9.72
R02	19m to 22m	Mudstone	6	<0.1	13.0	<0.1	2.8	0.2	21.5	<1	40	<1	3	0.4	0.3	19.42	21.34
R03	24m to 27m	Mudstone	6	<0.1	<0.1	<0.1	0.8	20.0	21.3	<1	51	<1	1	0.2	0.1	5.21	19.92

N.B - (\*) Negative flows recorded.



Gas flows ranged between -0.4L/h and 0.4L/h over the period of monitoring. The negative flows were recorded and ranged between -0.4L/h and -0.1L/h. Negative flows were recorded on days of higher atmospheric pressure therefore appear to be due to fluctuations in groundwater levels. Although these negative flows could become positive when there is a change in future groundwater levels, the monitoring across the site to date has not recorded significant positive flows, therefore it is considered unlikely that these negative flows would become significantly positive.

### 13.3 Risk Assessment and Conclusions

#### *Ground Gas Sources*

The investigations have recorded isolated areas of made ground in various locations across the site which were highlighted as potential sources of ground gas. However, due to the nature and composition of the made ground encountered, it is considered to be of low generation potential. The underlying natural superficial material comprised of sands and gravels, with underlying clays. No organic rich strata were observed therefore the natural superficial deposits are not considered to be a source of ground gas.

#### *Mine Gas Source – Tier 2 gas risk assessment*

The Coal Authority Report indicates that the site is not within the likely zone of influence from workings. The Coal Authority viewer indicates the site is outwith areas of shallow workings or probable workings.

In addition, there is thick, very low permeability soil cover across the site, which from site investigations show extends to between 18m to 24m in thickness. CL:AIRE publication, “Technical Note – good practice for risk assessment for mine gas emissions” indicates that where meets the following criteria it is considered to lie in a “Negligible Risk Zone” and no mitigation or further action is required.

No mine entries within 50m of the site boundary.

Workings are at depths of in excess of 150m.

No faults or pathways connecting the surface to deeper unflooded workings

The site is outwith areas of shallow workings or probable workings on the Coal Authority viewer.

Given the above information, it is concluded that the site lies within a “Negligible Risk Zone” and no further assessment of risks from a deeper gas source is required.

#### *Tier 1 ground gas risk assessment*

JPB use the following generic screening levels to determine whether a potential risk exists: methane <1% by volume in boreholes and carbon dioxide <5% by volume in boreholes, providing borehole flow rates do not exceed 7 L/h and 1.4 L/h respectively. As a maximum methane value of 13.0% and a carbon dioxide value of exceeds their respective screening values a more detailed Tier 2 assessment is required.

#### *Tier 2 ground gas risk assessment*

During the gas monitoring atmospheric pressure varied from 986mb to 1012mb with 3 set of readings undertaken when values were below 1000mb. No significant variations in flow rates have been recorded in conjunction with the variation in atmospheric pressure. On the basis of this information and site conceptual factors such as geology, site gas generation sources etc. it is concluded that barometric pressure is not a significant driver for gas emissions at the site.

#### *Foreseeable Events*

BS8576 indicates “foreseeable events such as flooding and extreme weather conditions may influence the sites ground gas regime”, however, the applicability of such a general remark to this specific sites needs to be considered carefully, and would caution that not all remarks made in British Standards apply to all sites.

In addition, the “predictability” of some of the “foreseeable events” referred to in BS8576 is questioned. Determining the effect of global warming or extreme weather events is beyond even government agencies in anything but the broadest scale, and certainly not on the scale of a small site at a particular inland location.

In general, in view of the location of the site at approximately 165mAOD and approximately 9 miles inland, it is not considered that sea level rise would have any effect on the site. In addition, in this case there are no surface flooding issues affecting the site to our knowledge.

## Groundwater Driver

Groundwater was noted at depths between 0.85m and 2.73m in the soil borehole standpipes. Although relatively shallow groundwater levels have been recorded, as there have been no significantly elevated flow rates recorded, the shallow groundwater levels and resulting low headspace have not resulted in the piston effect creating high flow rates. Variation in groundwater is therefore **not considered to be a driver** for gas generation.

## Piled Foundation Solution

The foundation solution may involve the use of piling, and the potential for new gas migration pathways to be introduced by piling has been discussed further below.

The influence of piling operations has been reviewed in, "Piled foundations and pathways for ground gas migration in the UK", (Wilson and Mortimer, 2017). The authors note that; *"Monitoring of gas emissions below building floor slabs has shown that the presence of axially loaded piled foundations has not increased the risk posed by the presence of gas in the ground that is not under significant pressure"*. The document also states, *"In many development sites, the gas in the ground is from low-generation sources such as made ground or alluvium and is not under significant pressure"*. The Geology section indicates that natural soils at the site comprise either glacial till or glaciolacustrine clays. The site sources are, therefore, very low gas generation sources not under significant gas pressure, as confirmed by monitoring data from these strata. In addition, there are a number of sealing mechanisms which come into play when various types of piles are installed.

The specific pile type has still to be determined, however, for both pre-cast concrete and steel tube piles the document states that, "For all but the closest spacing (1-2 m or less), gas flow through piles will be a lot less than the general flow out of the ground over the whole building area". Given the nature of the pile design at the site, piles will generally not be within the 1 to 2m as indicated as very close spacing, and, consequently, will not increase gas flow.

In addition, as discussed in the gas risk assessment above, gas protection measures are being installed which are capable of protecting buildings from the measured gas flow conditions.

It is recommended that the above assessment is reviewed, and if necessary updated, when the specific pile type for the affected plots has been determined.

## Gas Assessment

BS8485 requires that the "worst case" scenario is checked as a precursor to any more detailed assessment. Therefore, maximum recorded gas concentrations and flow rates and Characteristic Situation evaluations based on the modified Wilson and Card approach outlined in CIRIA C665 are summarised in the table below. In these calculations we have used the term Hazardous Gas Flow Rate as used in BS8485 this is also known as Gas Screening Value in CIRIA C665. As the proposed development is not classed as low-rise housing with a ventilated underfloor void of at least 150mm, Situation B has been adopted for the purposes of the gas assessment.

Gas	Maximum gas concentration (% by volume)	Maximum borehole flow rate (L/h)	Hazardous Gas Flow Rate (L/h)	Site Characteristic Situation
Carbon dioxide	5.1	0.4	0.0204	1
Methane	13.0	0.4	0.052	1

Guidance in CIRIA C655 indicates that where carbon dioxide concentrations exceed 5% by volume and methane exceeds 1% by volume, consideration should be given to advancing the site characteristic situation from situation 1 to situation 2.

The results indicate that conditions at all boreholes were calculated to be CS-1, except at R01, R02, and S16. The elevated methane concentrations above the 1% tier 1 generic screening level were recorded in boreholes R01 and R02 which have response zones of 24m to 30m, and 19m to 22m below ground level respectively, and lie below 13m and 9m of low permeability glacial till respectively. These elevated methane values are therefore from a naturally occurring deep seated source, rather than from the surface.

The marginally elevated carbon dioxide concentration was recorded at S16 and therefore recorded at shallow depth and does pose a risk to the development. As no made ground was recorded at S16, it would the elevated carbon dioxide concentration is naturally occurring within site soils in this area of the site. As no significantly elevated methane and carbon dioxide concentrations have been recorded during the monitoring to date, this indicates that made ground encountered elsewhere onsite is not a source of ground gas.

Section 2.6.8 of CIRIA C665 states that “low permeability strata such as clays can inhibit and/or provide a barrier to gas migration”. Therefore, although these data are indicative of CS-2 conditions at depth, it is considered that in this case the recorded thickness of competent glacial till will provide an effective barrier to upward gas migration from these strata to the surface. This is confirmed by monitoring data from soils boreholes with response zones in soils adjacent to R01 and R02. These soils boreholes all recorded very low gas concentrations at low-negligible steady state flow rates in the soil strata above the much deeper gas source in rock.

On the basis of the above assessment and comments, it is considered that the source is present at depth, but at much of the site there is no significant pathway for gas migration to the surface. However, where the superficial glacial till cover is <10m in thickness it is considered that would be prudent to install gas protection measures as a precaution.

Based on the above assessment it is considered that the recorded methane concentrations the site was found to be a Characteristic Situation 1 site, while on the basis of the carbon dioxide concentrations the site was found to be a Characteristic Situation 2 site. It is, therefore, considered that overall the site is a Characteristic Situation 2 site and there is **a source, intact contaminant linkages are present and remedial works are required.**

#### *Risks Posed By Carbon Monoxide*

##### *Shallow Standpipes*

Elevated carbon monoxide was recorded at S17 on one occasion, with a recorded concentration of 8ppm by volume. Carbon monoxide concentrations recorded in the rest of the shallow boreholes onsite ranged between <0.1ppm and 2ppm by volume. The carbon monoxide concentrations recorded at S17 in subsequent monitoring rounds were low, with a maximum concentration of <0.1ppm by volume. The concentrations recorded are considerably below carbon monoxide's lower explosive limit of 12% by volume and levels at which carbon monoxide would be considered to be toxic by inhalation. Therefore, the levels of carbon monoxide recorded in the shallow standpipes are **not considered to represent a source of gas emissions and no remedial measures are required.**

##### *Deeper Standpipes*

Elevated carbon monoxide was recorded at R01 and R02, during the first monitoring round, with maximum concentrations of 92ppm and 27ppm by volume respectively; however subsequent monitoring rounds recorded concentrations of less than 10ppm by volume for borehole R01, though borehole R02 recorded further readings of 40ppm and 15ppm in later visits. Elevated carbon monoxide concentrations were also recorded at R03 during the third monitoring visit, with a maximum concentration of 51 ppm by volume. The concentrations recorded are considerably below carbon monoxide's lower explosive limit of 12% by volume, although they are above levels at which carbon monoxide would be considered to be toxic by inhalation. However, the elevated carbon monoxide concentrations have been recorded at significant depth, and in addition there is a significant thickness of low permeability glacial till cover which will significantly retard gas migration. Therefore, the levels of carbon monoxide recorded at R01, R02, and R03 are **not considered to represent a source of gas emissions and indicate that remedial measures are not required.**

## 14.0 RECOMMENDATIONS FOR CHEMICAL CONTAMINATION AND GAS

### 14.1 Validated Conceptual Site Model & Requirement for Remedial Measures

A reassessment of the initial conceptual site model in the light of information gained from both the site investigations and risk assessments has been undertaken and a resultant validated conceptual site model compiled. As the potential sources identified in the initial CSM table have now been either identified to be present or absent the source terms and contaminant linkages are re-assessed below.

SPR item මූලාශ්‍රය	SPR item present based on site investigations (Yes/No)	Comment පිළිතුරු
<b>Sources</b>		
S1 – Contamination from former land use - Human Health	No	Risk assessment found no significant risks to human health. No remedial measures are required.
S1 – Contamination from former land use - Phytoxicity	No	Risk assessment found no phytotoxic risk at the site. No remedial measures are required.
S1 – Contamination from former land use - Water Pipes	No	No contaminant concentrations were identified which are considered to permeate water pipes or impact on their integrity. Therefore, no restriction is made on the type of water pipes which can be used on the site.
S1 – Contamination from former land use - Concrete Specification	No	pH values and sulphate concentrations indicated that the ground conditions fall within design sulphate class DS-1 and ACEC class AC-1 as defined in BRE Special Digest 1. Therefore, concrete specifications should be such as to protect building elements in contact with these conditions.
S2 – Contamination from adjacent land	No	No evidence was encountered of contamination migration onto site from adjacent land. No remedial measures are required.
S3 – Ground gas	Yes	Risk assessment found ground gas risks at the site. Remedial measures required.
S4 – Leachable/mobile contaminants	No	Water environment assessment indicated no significant risks posed to water environment receptors. No remedial measures required.
S5 – Contamination groundwater, in mineworkings	No	No mine workings present beneath the site.
S6 – Contamination from substation	No	Investigations found risks from substation contamination. Remedial measures required.

Significant Contaminant Linkage			SPL item present based on SI & risk assessment (Yes/No)	Comment
Source	Pathway	Receptor		
		Human receptors		
S3 – Ground gas	P9 – Migration of gas	R1 – Children & adults	Yes	Ground gas risks identified by assessment. Remedial measures required

## 14.2 Selection of Remedial Actions

The reassessment of the conceptual site model has confirmed the need for remedial actions to sever identified contaminant linkages with respect to ground gas risks. Based on the type and level of ground gases at the site, the following remedial actions have been evaluated in order to select the most appropriate remedial actions to address the identified contaminant linkages.

Contamination Linkage	Options Considered	Comments	Considered Further (Y/N)
Ground gas Emissions	Removal of all made ground at site for disposal to landfill (Source removal).	Made ground is not considered to be the source of the gas generated at the site.	N
	Removal of all gas source at site for disposal to landfill (Source removal).	Source is natural site soils and a deeper gas source. Source removal is not technically feasible	N
	Break contaminant linkage by incorporation of a barrier system (Sever pathway).	Contaminant linkage can be broken using a gas barrier system.	Y

## 14.3 Reuse of On-site Materials

SEPA's "Land remediation and waste management guidelines" set out SEPA's approach to regulating the remediation of contaminated sites under the waste regulatory regime.

In general, if materials are to avoid becoming waste, they must be suitable to be reused within an existing site boundary without resulting in an unacceptable risk of harm to human health or pollution of the environment.

To be suitable for reuse materials must also meet the six conditions outlined in the above guidance;

1. The use is a necessary part of the planned works.
2. The material is suitable for that use.
3. The material does not require any processing or treatment before it is reused.
4. No more than the quantity necessary is used.
5. The use of the material is not a mere possibility but a certainty.
6. The use of the soil will not result in pollution of the environment or harm to human health.

Materials which require treatment (such as bioremediation) to make them suitable for use may potentially be reused on site, however, the treatment will require to be licensed or permitted under waste legislation.

It should be noted that the above guidance indicates that SEPA does not consider asbestos to be a suitable material for backfilling or other construction purposes. "Bulk" asbestos must not be backfilled or otherwise reused in site works.

Investigations have confirmed that soils are likely to be suitable for reuse. However, the suitability of soils for specific uses will have to be confirmed, and conditions 1, 4 and 5 will have to be satisfied, which can be established when details of soils movements and site levelling are available.

## 14.4 Disposal of Waste Materials to Landfill

Waste soil or made ground materials which cannot be accommodated at the site or and is not suitable for reuse at another site should be removed to an appropriately licensed landfill site or "soil hospital" facility. Such material should be disposed of in accordance with the current waste regulations following pre-notification to SEPA.

It should be noted that due to the implementation of the Landfill Directive it is likely that any material being disposed of from the site will require some form of pre-treatment. This may include minimisation or stabilisation.

### *Waste Classification and Waste Acceptance Criteria Testing*

All waste material disposed of to landfill from the site will require to undergo testing in order to characterise the waste properties of the material and to determine an appropriate disposal route. This process will require the assessment of general chemical test results to characterise any hazardous properties the waste may have. Depending on the circumstances, the process may also include assessment of Waste Acceptance Criteria (WAC) testing in order to aid the selection of appropriate disposal route. These tests are a legal obligation and no material will be able to be accepted at a landfill unless the results of the tests are available. The time taken for this testing should be factored into any programme for the site.

No testing for waste acceptance criteria (WAC) has been undertaken onsite to date. If any waste soils are produced as part of the development suitable WAC testing should be undertaken to ensure wastes are disposed of at suitable licensed facilities.

#### 14.5 Chemical Contamination

No elevated contaminants in relation to human health, plant growth or the water environment were recorded and, therefore, no remedial measures are required.

#### 14.6 Site Personnel

The generation of dust during site works may expose site operatives or the occupiers of adjacent properties to health risks and should be managed by the provision of appropriate PPE and adoption of appropriate site practices as described in CIRIA document 132 "A guide for safe working on contaminated sites".

No elevated contaminants were recorded and the risks from exposure to any contaminated materials are considered to be low. Normal Health and Safety precautions should be implemented during the works. Site personnel should maintain vigilance to detect any unpleasant odours, strangely coloured made ground, made ground other than generally observed during this investigation, fibrous materials or chemical residues in order that they can be assessed by suitably qualified personnel.

It should be noted that care should be taken during the site development works to ensure that no spillage of fuel or other liquids or detrimental material occur on site. This is due to the fact that any spilled material has a high probability of contaminating the ground and surface waters. As such all works should be carried out in accordance with the requirements of the Scottish Environment Protection Agency as set out in Pollution Prevention Guidelines PPG5: "Works in, near or liable to affect watercourses" and PPG6: "Working at construction and demolition sites" and other relevant documents.

#### 14.7 Buildings and Services

pH values and sulphate concentrations indicated that the ground conditions fall within design sulphate class DS-1 and ACEC class AC-1 as defined in BRE Special Digest 1. Therefore, concrete specifications should be such as to protect building elements in contact with these conditions.

No contaminant concentrations were identified which are considered to permeate water pipes or impact on their integrity. Therefore, no restriction is made on the type of water pipes which can be used on the site.

#### 14.8 Gas and Vapour Emissions

##### Ground Gases

Based on the gas levels encountered, the site classified as a Characteristic Situation 2 site and therefore the following remedial measures are required in order to satisfy the local authority. It is advised that discussions should be held with the Local Authority to confirm that these remedial works will meet their requirements.

Remedial measures will be installed in all **school buildings** in order to protect the development from elevated ground gas emissions, including the incorporation of a suitable gas membrane and passive venting of the building solums, underslab voids/upfill and wall cavities.

Site Classification (CIRIA C665)	Characteristic Situation 2 site. Type C buildings, school with small to large rooms.
Remedial Measures Required	
Required Gas Protection Score (from BS8485)	
	2.5
In order to achieve this level of protection the following remedial measures are required.	

The following is a brief summary of the types of remedial measures that are required at the site. The relevant tables, and related footnotes are given in BS8485, CIRIA (C665) and NHBC Report No. 10627-R01(04) and **the reader should refer to these for full details of the requirements.**

Item	Specification	Score	Comments
<b>a) Venting/dilution</b>			
Pressure relief pathway (usually formed of low fines gravel or with a thin geocomposite blanket or		0.5	<i>If the layer has a low permeability and/or is not terminated in a venting trench (or similar), then</i>



Item	Specification	Score	Comments
strips terminating in a gravel trench external to the building).			the score is zero.
<b>b) Barriers – Floor Slab</b>			
Cast in situ monolithic reinforced concrete suspended floor slab with limited service penetrations that are cast into slab.		1 or 1.5*	<p>It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum.</p> <p>Breaches in floor slabs such as joints have to be effectively sealed against gas ingress in order to maintain these performances.</p> <p>*To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in.</p>
<b>c) Barriers-Membranes</b>			
<p>Proprietary ground gas resistant membrane meeting all of the criteria below, installed to reasonable levels of workmanship in line with current good practice under independent inspection.</p> <ul style="list-style-type: none"> <li>• sufficiently impervious, both in the sheet material and in the sealing of sheets and sealing around sheet penetrations, to prevent any significant passage of methane and/or carbon dioxide through the membrane; a membrane with a methane gas transmission rate &lt;40.0 ml/day/m<sup>2</sup>/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1: 2007 manometric method) is regarded as sufficiently impervious.</li> <li>• sufficiently strong <sup>B)</sup> to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc); and to withstand in-service stresses (e.g. settlement if placed below a floor slab);</li> <li>• sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc);</li> <li>• capable, after installation, of providing a complete barrier to the entry of the relevant gas; and</li> <li>• verified in accordance with CIRIA C735**</li> </ul>		2	<p>The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and the integrity of joints.</p> <p><sup>B)</sup> For example, reinforced LDPE (virgin polymer) membranes having a minimum mass per unit area of 370 g/m<sup>2</sup> and not significantly less than 0.4 mm thickness between the reinforcement scrim (tested in accordance with Procedure D (2 mm diameter tip) of BS EN ISO 9863-1:2016) installed above floor slabs are considered sufficiently strong to meet the performance criteria (see also C.3). Thicker and more robust membranes or an additional membrane protection layer should be installed directly beneath cast-in-situ floor slabs.</p> <p>Service entries should be sealed with expanding foam and covered with liquid membrane.</p>
<b>Total</b>		3.5	

\*\* JPB gas protection measures verification procedures will take due cognisance of the guidance give in CIRIA C735 where applicable.

All of the above protection elements must meet the appropriate individual quality requirements given in BS8485 (2015) and its Annexes.

In the construction of the above remedial measures the following should be adhered to.

Where the solum is to be vented by via a granular blanket this should not be less than 300mm thickness without gas drains/pipework and be formed minimum 20mm gravel (no fines).

## 14.9 Invasive Plant Survey

An invasive plant survey was carried out during the works prior to commence of the investigation. The report's main findings are summarised below.

No Japanese Knotweed, Giant Hogweed or Himalayan Balsam plants were identified during the walkover within the area of the site investigations. However an area of Giant Hogweed was identified within the field to the east, on the opposite side of Seaford Moor road.

No other invasive or non-native species, including Horsetail, Cotoneaster, and Himalayan Balsam were noted within the area of the site investigations. However, the ecologist noted the presence of some invasive or non-native species that may be of concern, including Horsetail during the visit within the field to the east on the opposite side of Seafield Moor Road.

#### 14.10 Site Verification

If Local Authority/NHBC certification is to be sought for the proposed development then the following remedial works, which can be supervised by JPB, are likely to require verification:

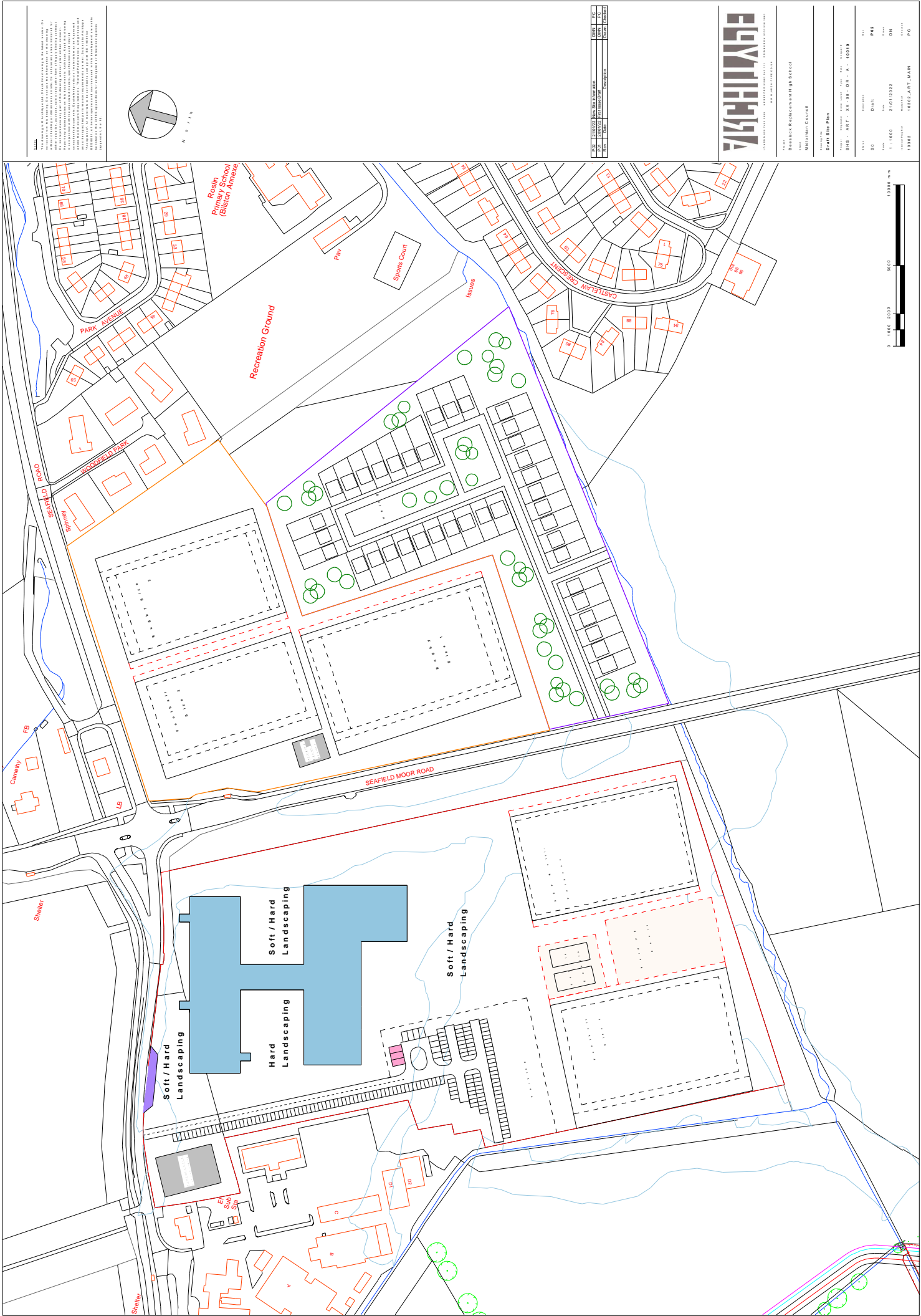
Constraint	Action
Remedial Strategy	Produce Remedial Strategy based on the findings of the site investigation in accordance with LCRM and obtain approval from the Local Authority.
Ground Gas Emissions	Ground gas impermeable membrane in building solum. Passive venting of building solums, underslab voids/upfill and wall cavities.
Gas Monitoring Standpipes	As part of the development all boreholes must be decommissioned in accordance with SEPA guidance " <i>Decommissioning Redundant Boreholes and Wells</i> ".
Verification Statement	Produce verification statement in accordance with LCRM and obtain approval from the Local Authority.





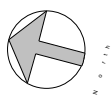
## **APPENDICES**

### **Appendix 1      Drawings**



Notes:

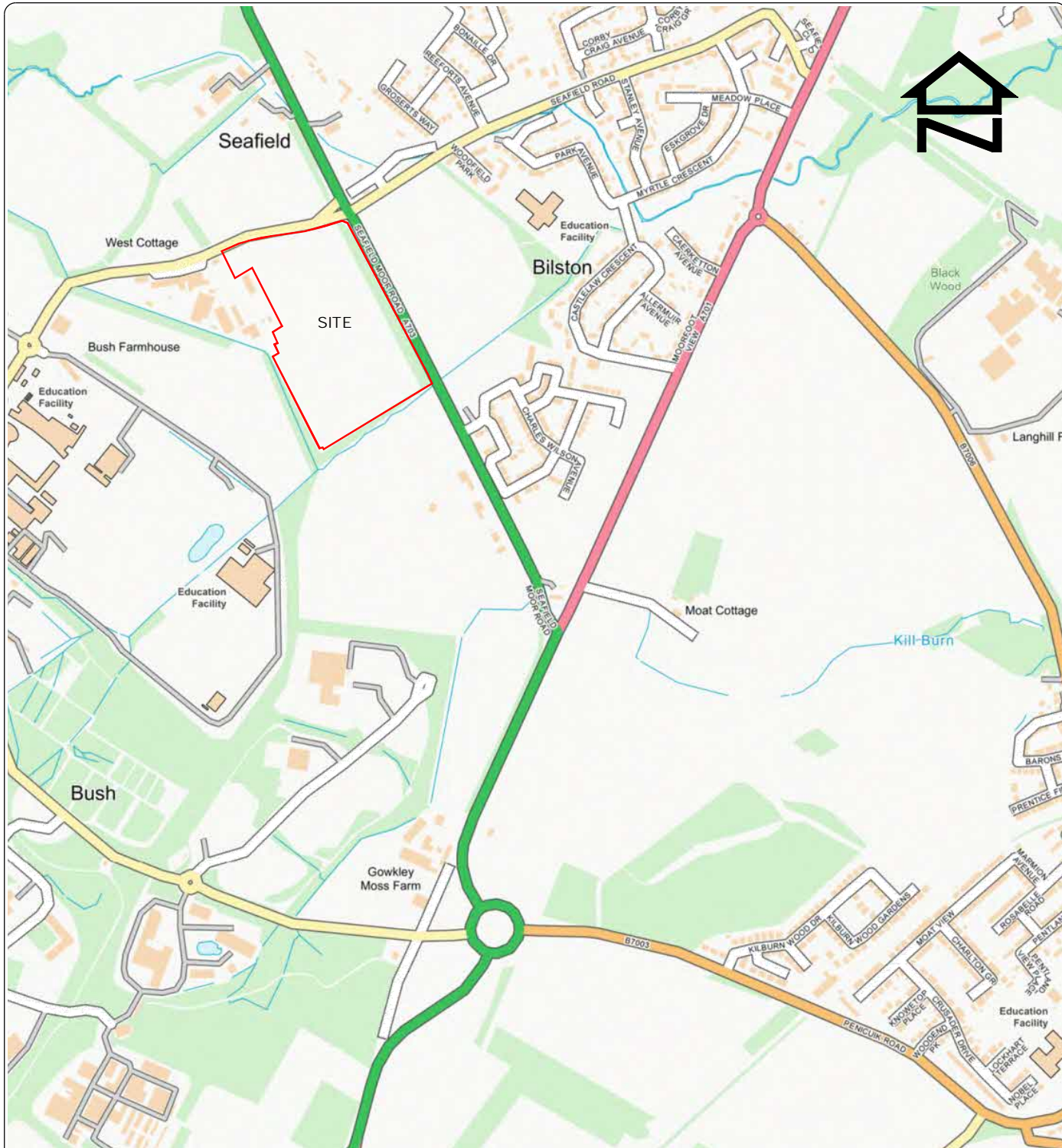
1. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.
2. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.
3. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.
4. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.
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6. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.
7. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.
8. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.
9. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.
10. The plan is a site plan and does not show the actual ground level. The ground level is shown on the attached site plan.



Item	Quantity	Unit	Notes
1. Soft / Hard Landscaping	1000	m <sup>2</sup>	
2. Hard Landscaping	500	m <sup>2</sup>	
3. Soft Landscaping	200	m <sup>2</sup>	
4. Hard Landscaping	100	m <sup>2</sup>	
5. Soft Landscaping	50	m <sup>2</sup>	
6. Hard Landscaping	25	m <sup>2</sup>	
7. Soft Landscaping	10	m <sup>2</sup>	
8. Hard Landscaping	5	m <sup>2</sup>	
9. Soft Landscaping	2	m <sup>2</sup>	
10. Hard Landscaping	1	m <sup>2</sup>	

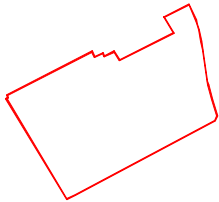
**BESSBROOK R. JOHNSON HIGH SCHOOL**

Item	Quantity	Unit	Notes
1. Soft / Hard Landscaping	1000	m <sup>2</sup>	
2. Hard Landscaping	500	m <sup>2</sup>	
3. Soft Landscaping	200	m <sup>2</sup>	
4. Hard Landscaping	100	m <sup>2</sup>	
5. Soft Landscaping	50	m <sup>2</sup>	
6. Hard Landscaping	25	m <sup>2</sup>	
7. Soft Landscaping	10	m <sup>2</sup>	
8. Hard Landscaping	5	m <sup>2</sup>	
9. Soft Landscaping	2	m <sup>2</sup>	
10. Hard Landscaping	1	m <sup>2</sup>	



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<div> <div></div> <div>CLIENT</div> <div>MIDLOTIAN COUNCIL</div> </div>						
<div> <div></div> <div>JOB TITLE</div> <div>BEESLACK HIGH SCHOOL</div> </div>						
<div> <div></div> <div>DRAWING TITLE</div> <div>SITE LOCATION PLAN</div> </div>						
<div> <div>SCALES</div> <div>1:1000</div> </div>	<div> <div>ORIG.DRG SIZE</div> <div>A4</div> </div>	<div> <div>DATE</div> <div>JUL/2024</div> </div>	<div> <div>DRAWN BY</div> <div>FF</div> </div>	<div> <div>APPROVED BY</div> <div>ARB</div> </div>	<div> <div>DRAWING No.</div> <div>WG684-45/R/F/01</div> </div>	



— SITE BOUNDARY

NOTES

THIS STATEMENT OF SITE CHARACTERISTICS IS A SUMMARY OF THE INFORMATION PROVIDED BY THE CLIENT AND IS NOT A GUARANTEE OF THE ACCURACY OF THE INFORMATION PROVIDED. THE CLIENT IS RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION PROVIDED. THE CONSULTANT HAS CONDUCTED VISUAL INSPECTIONS OF THE SITE AND HAS IDENTIFIED THE FOLLOWING CHARACTERISTICS:

- THE SITE IS A GRAVEL PIT.
- THE SITE IS ADJACENT TO A ROAD.
- THE SITE IS ADJACENT TO A RAILWAY.
- THE SITE IS ADJACENT TO A RESIDENTIAL DEVELOPMENT.
- THE SITE IS ADJACENT TO A COMMERCIAL DEVELOPMENT.
- THE SITE IS ADJACENT TO A PUBLIC OPEN SPACE.
- THE SITE IS ADJACENT TO A WATER BODY.
- THE SITE IS ADJACENT TO A NATURAL HABITAT.
- THE SITE IS ADJACENT TO A CULTURAL HERITAGE SITE.
- THE SITE IS ADJACENT TO A HISTORIC SITE.
- THE SITE IS ADJACENT TO A MONUMENT.
- THE SITE IS ADJACENT TO A REMAINING BUILDING.
- THE SITE IS ADJACENT TO A REMAINING WALL.
- THE SITE IS ADJACENT TO A REMAINING FENCE.
- THE SITE IS ADJACENT TO A REMAINING GATE.
- THE SITE IS ADJACENT TO A REMAINING DOOR.
- THE SITE IS ADJACENT TO A REMAINING WINDOW.
- THE SITE IS ADJACENT TO A REMAINING ROOF.
- THE SITE IS ADJACENT TO A REMAINING CHIMNEY.
- THE SITE IS ADJACENT TO A REMAINING TOWER.
- THE SITE IS ADJACENT TO A REMAINING WALL.
- THE SITE IS ADJACENT TO A REMAINING FENCE.
- THE SITE IS ADJACENT TO A REMAINING GATE.
- THE SITE IS ADJACENT TO A REMAINING DOOR.
- THE SITE IS ADJACENT TO A REMAINING WINDOW.
- THE SITE IS ADJACENT TO A REMAINING ROOF.
- THE SITE IS ADJACENT TO A REMAINING CHIMNEY.
- THE SITE IS ADJACENT TO A REMAINING TOWER.

DATE	FOR	TO

Johnson  
Poole &  
Bloomer

Consultants

GEO-ENVIRONMENTAL & MINERALS

MIDCOTMAN

COOK

PROJECT TITLE

BEESLACK HIGH SCHOOL

PROJECT FILE

BEESLACK HIGH SCHOOL

- SOLID

PROJECT NO

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PROJECT NO

ARB

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1100

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## **Appendix 2      Site Photographs**





**Plate 1:** Photo taken from the centre of site facing the North-West corner.

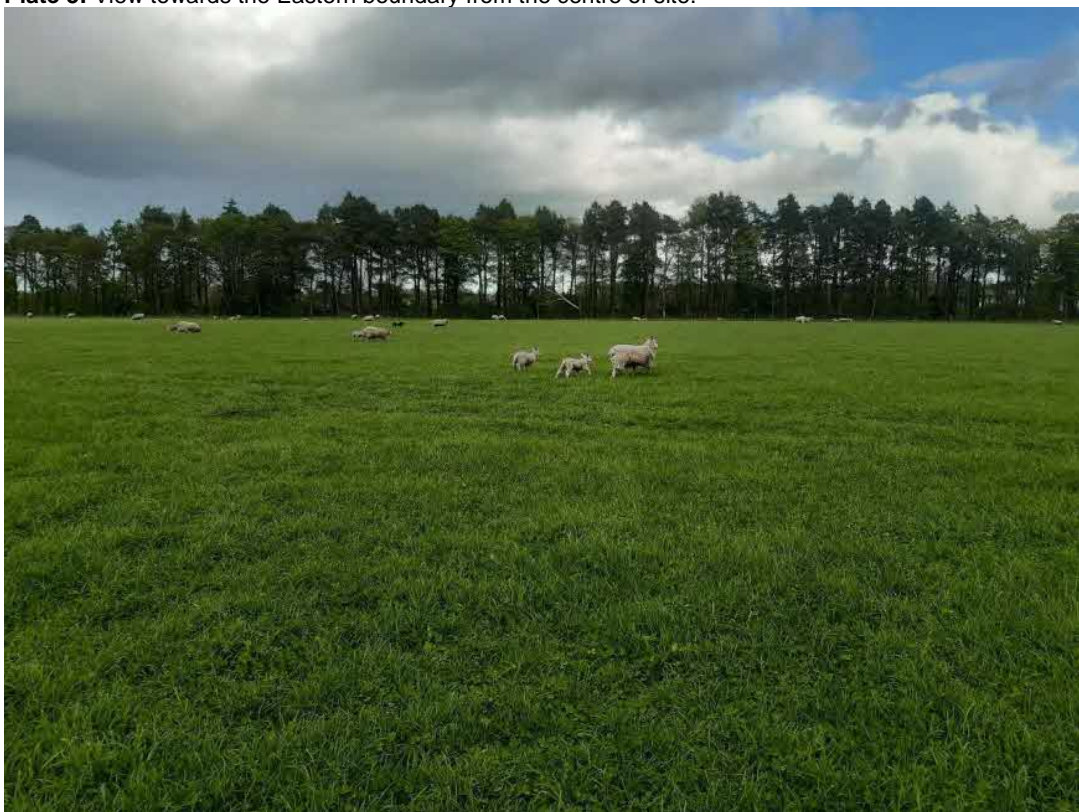


**Plate 2** Photo looking towards the Northern boundary of the site.





**Plate 3:** View towards the Eastern boundary from the centre of site.



**Plate 4:** View towards the Western boundary from the centre of the site.



## **Appendix 3      Invasive Plant Survey**

Johnson Poole and Bloomer  
50 Speirs Wharf  
Glasgow  
G4 9TB

16<sup>th</sup> May 2022

Job No: S3754

FAO: Martin Keir

INVASIVE WEEDS SURVEY

BEESLACK HS, SEAFIELD MOOR ROAD, ROSLIN EH25 9RQ

Dear Sir

Thank you for your recent enquiry. As requested, we have carried out a survey of the development area and recorded our findings in relation to the presence of problematic non-native and native invasive weeds. Our survey document is attached.

Legislated plants are still listed on Schedule 9 of the Wildlife & Countryside (Scotland) Act 1981; however, this has been largely superseded and expanded by the Wildlife and Natural Environment (Scotland) Act 2011 (WANE) which gives the relevant authorities more robust enforcement powers in terms of clean up orders/fines etc.

While there are many non-native plants/weeds which negatively impact our native environment, the purpose of our survey is to identify species which we believe may present a risk in some way to your development, your end users, environment etc.

Your Survey Findings

Giant Hogweed has been recorded; we would refer you to the recommendations made in the report.

In relation to non-controlled plant species, our problematic native Horsetail has been recorded and we would refer you to the recommendations made in the report.

Our attached "Why Manage ...." sheets will provide a basic overview of the constraints that you should be aware of.

If you have requested a management quotation, then this will follow. If you have not requested a quotation but would like to be sent one, or just need further advice, please do not hesitate to contact us.

### **About KleerKut**

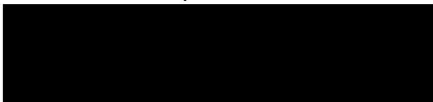
We have specialised in the management of invasive weeds since 2006 and are now one of the UK leaders. We work with the NHS, various Local Authorities and many of the housebuilders and contractors. The success of our company in this area, is due to our understanding of invasive weeds and how they affect the construction industry. Our team includes engineers and project managers with extensive site experience who ensure that the operations side of the business always provides the best practical solution to the client.

We were invited to join the Property Care Association (PCA) where our directors sit on the UK's first Invasive Weeds Control Group. We have also been part of the Invasive Weed Education Strategy Group and examiners for the PCA's Certificated Surveyor of Japanese Knotweed (CSJK) accredited training programme.

Environment, Health and Safety, Quality Control – these are key areas of importance to us – which is why we achieved ISO 9001, 14001 & 18001. KleerKut are accredited members of SMAS Safe Systems in Procurement demonstrating our commitment to working safely in partnership with our clients and sub-contractors. We are also members of Constructionline currently working on improving our status from Silver to Gold. By being members of the PCA our works are Government endorsed through their Trustmark scheme, allowing us to provide RICS and lender approved solutions and Insurance Backed Guarantees.

We hope this information is useful to you and we would be delighted to be considered for any future tenders. If you have any queries in relation to this site or any other site, please do not hesitate to contact me at this office.

Yours faithfully



Tina Griffen Lloyd

**For KleerKut Ltd**

INVASIVE WEEDS SURVEY INFORMATION	
BEESLACK HS, SEAFIELD MOOR ROAD, ROSLIN EH25 9RQ	REF: S3754

S1	KLEERKUT SURVEYOR	Jenni Mouat	SURVEY DATE	11/05/2022
	REPORT PRODUCED BY	Tina Griffen Lloyd	REPORT DATE	16/05/2022

S2	SURVEY INFORMATION	
	SEASON	
	Spring/ Early Summer	Most species should be visible, other than Japanese Knotweed under herbicide treatment, regrowth from fragments, new growth coming through mowed lawns etc.
	GENERAL DESCRIPTION	
	The site comprises of two agricultural fields which are divided by Seafield Moor Road and a strip of mature woodland.	
	The field to the west is currently being used for sheep grazing with hedgerows and woodlands around the perimeter.	
	The field to the east is currently being used for crops with hedgerows around most of the perimeter and some mature trees, and to the southeast is a tarmac public footpath.	
CAVEATS RELEVANT TO THIS SURVEY		
The survey findings are limited to a degree as the area is currently being grazed and used for growing crops which has resulted in limited visible vegetation throughout.		

S3A	SURVEY FINDINGS – JAPANESE KNOTWEED ( <i>Reynoutria japonica</i> ), HYBRID KNOTWEED ( <i>Reynoutria x bohemica</i> ), GIANT KNOTWEED ( <i>Reynoutria sachalinensis</i> )			
	Controlled in Scotland under Schedule 9 of the Wildlife & Countryside (Scotland) Act 1981 since superseded by the Wildlife and Natural Environment (Scotland) Act 2011 (WANE)			
	REF	WITHIN THE SITE (m or m <sup>2</sup> )	OUTWITH THE SITE (m or m <sup>2</sup> )	GENERAL DESCRIPTION
	N/A	-	-	No visible evidence at the time of our inspection.
	Comments:			

Note: Any sizes are approximate and based upon growth/evidence visible at the time of inspection. These measurements do not include the overall area affected by the rhizomes/roots and this can extend many metres from the main stands. The extent and depth of rhizomes will vary depending on ground and growing conditions. Japanese Knotweed undergoing herbicide management can be difficult to find particularly during the winter months – KleerKut should be notified if any management is being undertaken.



<b>S3B</b>	<b>SURVEY FINDINGS – GIANT HOGWEED (<i>Heracleum mantegazzianum</i>) &amp; HIMALAYAN BALSAM (<i>Impatiens glandulifera</i>)</b> Controlled in Scotland under Schedule 9 of the Wildlife & Countryside (Scotland) Act 1981 since superseded by the Wildlife and Natural Environment (Scotland) Act 2011 (WANE)		
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REF	WITHIN THE SITE (m or m <sup>2</sup> )	OUTWITH THE SITE (m or m <sup>2</sup> )	GENERAL DESCRIPTION
GH1	32m <sup>2</sup>	-	Giant Hogweed ( <i>Heracleum mantegazzianum</i> ) Suspected Giant Hogweed was observed in the top western corner of the field to the east of Seafield Moor Road. This area is bare compared to the rest of the field with scorched leaves, some of which look like GH.
Comments: Agricultural herbicide management may have impacted visible growth at this location.			

Note: Any sizes are approximate and based upon growth/evidence visible at the time of inspection. Himalayan Balsam dies back quickly after autumn frosts and often little residue remains, it can be difficult to find in winter months and early spring and may require a follow up inspection during the growing season where it is a risk.

<b>S3C</b>	<b>SURVEY FINDINGS – OTHER LEGISLATED SPECIES</b> Controlled in Scotland under Schedule 9 of the Wildlife & Countryside (Scotland) Act 1981 since superseded by the Wildlife and Natural Environment (Scotland) Act 2011 (WANE)		
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REF	WITHIN THE SITE (m or m <sup>2</sup> )	OUTWITH THE SITE (m or m <sup>2</sup> )	GENERAL DESCRIPTION
N/A	-	-	No visible evidence of any other controlled plant species which are considered a risk to the development.
Comments:			

Note: Sizes are approximate and based upon growth/evidence visible at the time of inspection. Other controlled species may have been noted during the visit however are not considered a risk to client or development.

<b>S4</b>	<b>SURVEY FINDINGS – PROBLEMATIC NON-LEGISLATED SPECIES</b> Native plant species, not controlled by legislation, however often problematic in the construction industry. Highly invasive, persistent and known to cause damage to infrastructure.		
-----------	--	--	--




REF	WITHIN THE SITE (m or m <sup>2</sup> )	OUTWITH THE SITE (m or m <sup>2</sup> )	GENERAL DESCRIPTION
Horsetail ( <i>Equisetum arvense</i> )			
HT1	6m <sup>2</sup>	-	Sporadic Horsetail observed along field edge in bare soil and among crops. It is possible that the infestation may cover a larger area.

HT2	1m <sup>2</sup>	-	Sporadic Horsetail observed along field edge among crops. It is possible that the infestation may cover a larger area.
HT3	10m <sup>2</sup>	-	Sporadic to prolific Horsetail observed along field edge among crops, grass and other vegetation.
Comments: The Horsetail infestations have no signs of herbicide management. As the growing season progresses more Horsetail may emerge.			
Caveat for Horsetail Findings			
<p>While Horsetail was evident during our survey, we would caveat our findings on the basis that the infestation sizes recorded are indicative. They are generally based on the more densely infested areas and due to the nature of Horsetail spread from spores; new growth will continually emerge at new locations as it spreads across a site.</p> <p>Horsetail tends to emerge particularly in wet boggy ground once soils have been disturbed so vigilance should be maintained during development even in areas which have no visible growth above ground.</p> <p>Unmanaged Horsetail can spread rapidly over short periods of time in the correct growing conditions especially on vacant land, so survey findings can change rapidly during the growing season.</p>			
<p>Note: Any sizes are approximate and based upon growth/evidence visible at the time of inspection. Horsetail can be difficult to find in dense/tall grasses and other vegetation and may be more extensive than indicated in this report. Horsetail can also spread rapidly in good growing conditions and infestation sizes may increase quickly over a short period of time after the survey has been carried out. Our findings regarding Horsetail are not limited to those noted above.</p>			

S5	<b>SURVEY RECOMMENDATIONS</b>
	<p>Suspected Giant Hogweed was identified within the survey area. It was difficult to identify however there were scorched leaves visible and some of which looked like Giant Hogweed. The growth may have been impacted by herbicide.</p> <p>This is an injurious plant which can cause serious burns to both humans and animals/pets. There is much more public awareness regarding this hazardous plant now and tabloids are interested in these types of stories which can result in bad publicity. It is important to protect both your workers and members of the public when you are aware of its presence.</p> <p>Giant Hogweed and its seeds are controlled by legislation in Scotland meaning that enforcement with 'clean up' orders can be put in place by regulatory bodies. Live vegetation and soils containing the seedbank are classified as controlled waste falling under current Waste Management Regulations. It is a highly invasive plant which spreads quickly with soil movement.</p> <p>We recommend that an Invasive Weeds Management Plan is put in place as soon as possible to manage the risk of spread onto uncontaminated areas of the site and prevent spread out-with the site. This species should be managed to ensure that works are carried out in compliance with SEPA recommendations, current legislation and ensuring that Best Practice is followed by the developer.</p> <p>Horsetail was identified within this survey area.</p> <p>Although Horsetail is not controlled by legislation it is a highly invasive perennial weed which spreads quickly and vigorously, reproducing through spores and root fragments. As it often causes damage to roads and</p>

	<p>footways, we would recommend that some form of management/treatment is carried out to minimise the risk of future damage to roads, infrastructure and delay to road adoptions. For this reason, we would recommend that Horsetail is managed as part of the development works.</p> <p>We recommend that the developer/contractor agrees a suitable remediation strategy with a specialist contractor prior to commencing works on site.</p> <p>We would advise caution in the area where there is suspected Giant Hogweed during any site investigation works to ensure that this infestation is not accidentally disturbed and spread. Should there be any concern or queries when carrying out the work, KleerKut can be contacted for guidance.</p>
--	---

<b>S6</b>	<b>GENERAL SURVEY TERMS &amp; CONDITIONS</b>
	<p>Our surveys are based on a visual inspection of the area.</p> <p>Invasive weeds undergoing herbicide management can be difficult to find. KleerKut should be informed of any management being undertaken.</p> <p>Any sizes are provided are approximate and based upon growth/evidence visible at the time of inspection.</p>

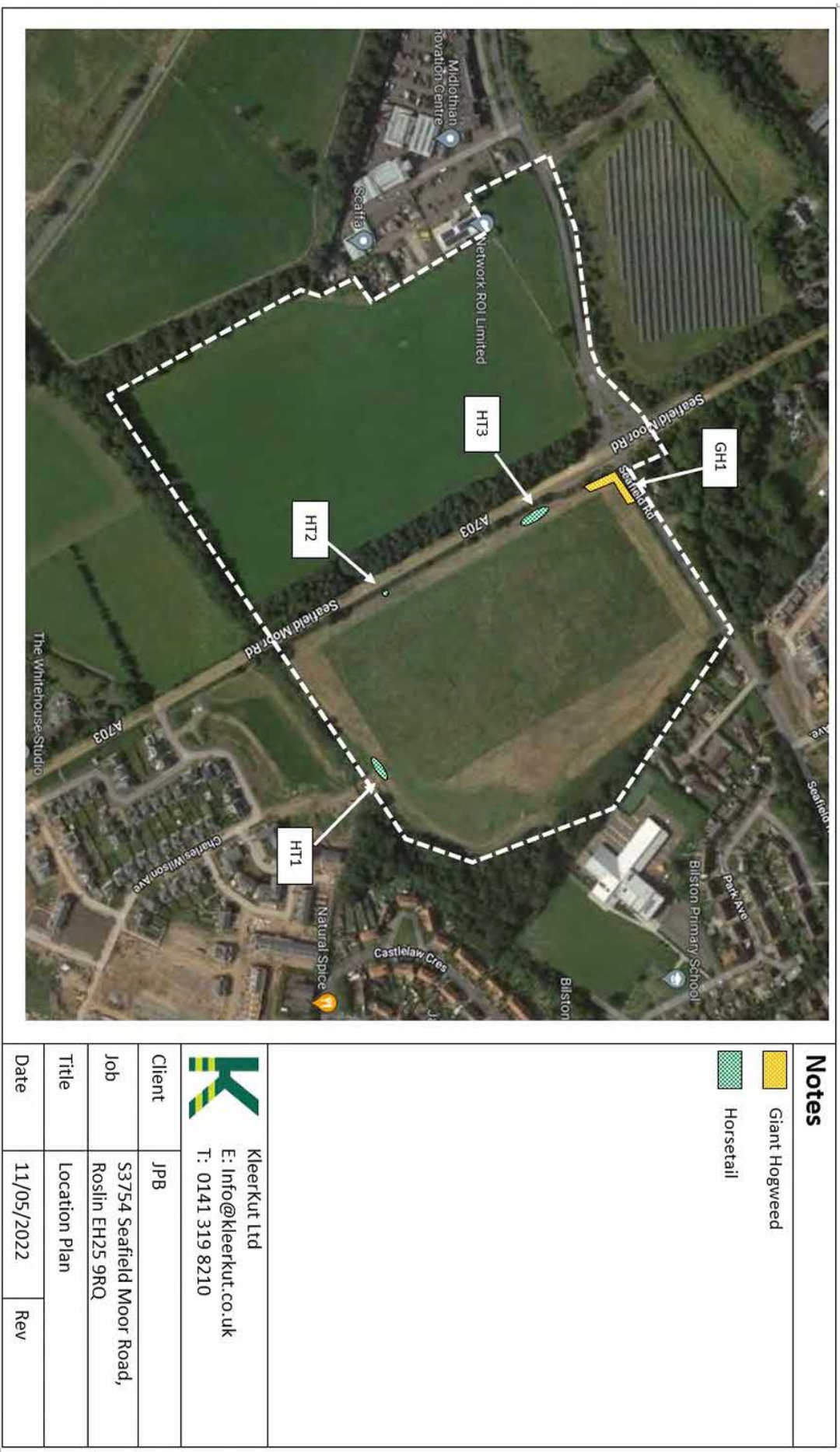
<b>S7</b>	<b>SIGN OFF</b>		
	<table> <tr> <td> <p><b>Report Written by: Tina Griffen Lloyd</b></p> <p><b>Signature:</b> </p> </td><td> <p><b>Date: 16/05/2022</b></p> </td></tr> </table>	<p><b>Report Written by: Tina Griffen Lloyd</b></p> <p><b>Signature:</b> </p>	<p><b>Date: 16/05/2022</b></p>
<p><b>Report Written by: Tina Griffen Lloyd</b></p> <p><b>Signature:</b> </p>	<p><b>Date: 16/05/2022</b></p>		

## Appendices

*Appendix A – Survey Location Plan*

*Appendix B – Survey Photographs*







GH1 Giant Hogweed



GH1 Giant Hogweed



GH1 Giant Hogweed



HT1 Horsetail



HT2 Horsetail



HT3 Horsetail



#### **Appendix 4      Zetica Bomb map and Coal Authority Report**



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The Coal  
Authority

# Consultants Coal Mining Report

114, Penicuik Road  
Roslin  
Midlothian  
EH25 9NT

Date of enquiry:	11 May 2021
Date enquiry received:	11 May 2021
Issue date:	11 May 2021

Our reference:	51002543952001
Your reference:	278326596_1



# Consultants

## Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

### Client name

NLIS Hub

### Enquiry address

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Roslin  
Midlothian  
EH25 9NT

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 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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## Section 1 –Mining activity and geology

### Past underground mining

No past mining recorded.

### Probable unrecorded shallow workings

None.

### Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

### Mine entries

None recorded within 100 metres of the enquiry boundary.

### Abandoned mine plan catalogue numbers

None available.

### Outcrops

No outcrops recorded.

### Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

### Opencast mines

None recorded within 500 metres of the enquiry boundary.

### Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

## Section 2 –Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

### Site investigations

None recorded within 50 metres of the enquiry boundary.

### Remediated sites

None recorded within 50 metres of the enquiry boundary.

### Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

### Mine gas

None recorded within 500 metres of the enquiry boundary.

### Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.



## Section 3 –Licensing and future mining activity

### Future underground mining

None recorded.

### Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

### Court orders

None recorded.

### Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

### Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

### Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

## Section 4 –Further information

Based on the responses in this report, no further information has been highlighted.

## Section 5 –Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at [groundstability@coal.gov.uk](mailto:groundstability@coal.gov.uk)**.

### Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

### Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

### Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

### Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

### Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

### Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

### Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

### **Opencast mines**

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

### **Coal Authority managed tips**

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

### **Site investigations**

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

### **Remediated sites**

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

### **Coal mining subsidence**

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

### **Mine gas**

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

### **Mine water treatment schemes**

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial –mitigating the impact of existing pollution or Preventative –preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

### **Future underground mining**

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

### **Coal mining licensing**

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

### **Court orders**

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

### **Section 46 notices**

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

### **Withdrawal of support notices**

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

### **Payment to owners of former copyhold land**

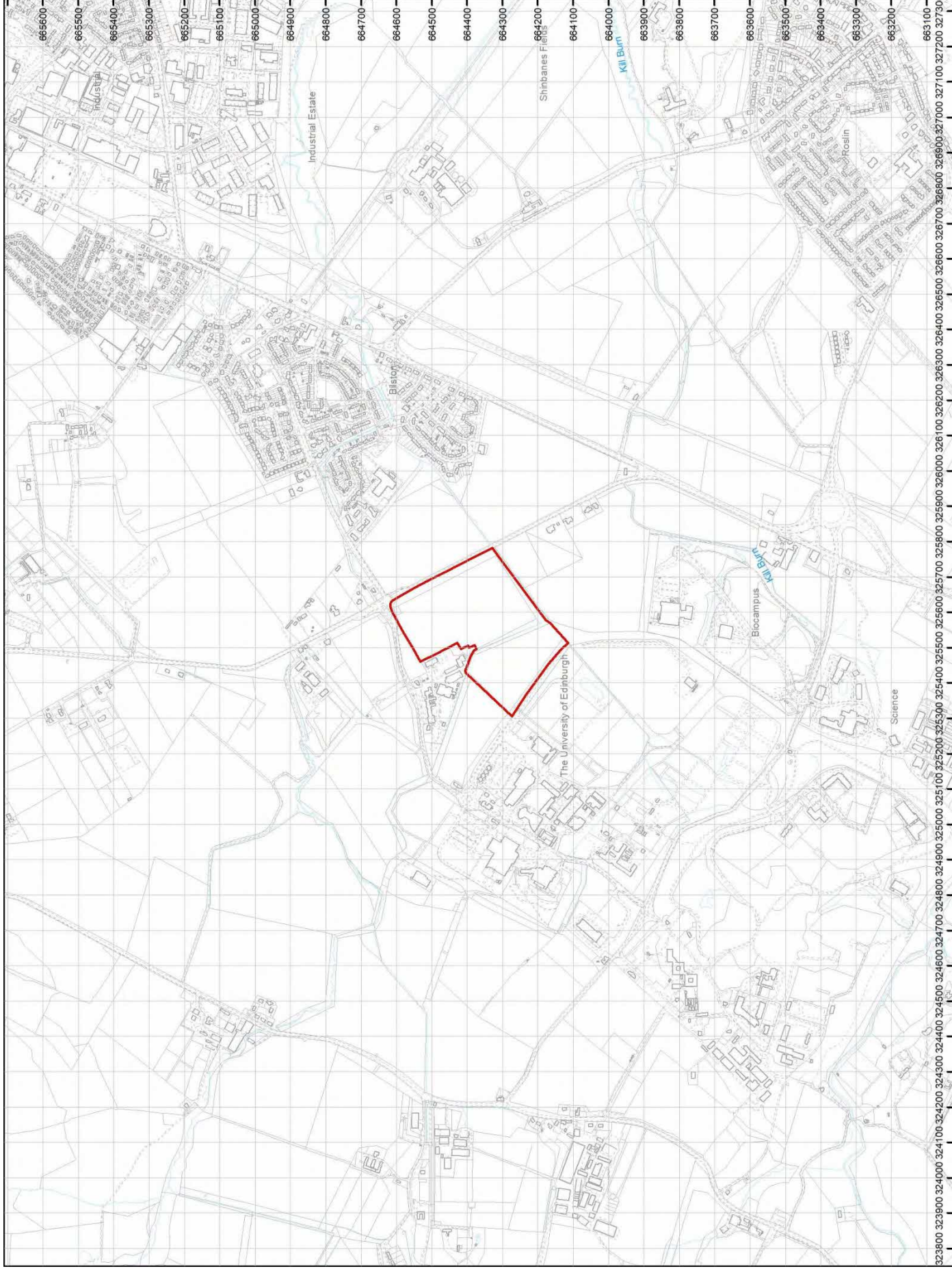
Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.



# Summary of findings

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The map highlights any specific surface or subsurface features within or near to the boundary of the site.



## Key

Approximate position of the enquiry  
boundary shown

## How to contact us

0345 762 6848 (UK)  
+44 (0)1623 637 000 (International)  
[www.groundstability.com](http://www.groundstability.com)

## Appendix E – Copy of Unexploded Bomb Risk Map



## **Appendix 5      Previous Investigation Data - Pick Everard Phase 1 Geoenvironmental Desk Study Report**



Seafield Moor Road - Option 1  
Phase 1 Geo-Environmental Desk Study Report  
Midlothian Council

Issue Number 01  
May 2021



## Document History

Issue	Date	Comment	Author	Chk'd
01	24/05/2021	First Issue	CDK	TJG

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#### [Appendix A - Site Walk over](#)

#### [Appendix B – Review of Publicly Available Information \(SEPA\)](#)

#### [Appendix C – Envirocheck Report \(with Historical Ordnance Survey Maps\)](#)

#### [Appendix D – Coal Authority Information](#)

#### [Appendix E – Copy of Unexploded Bomb Risk Map](#)

#### [Appendix F – Utility Information](#)

#### [Appendix G – Historic Borehole Logs](#)

## 1.0 INTRODUCTION

### 1.1 Brief

I.1.1 Pick Everard with the assistance of their local geo environmental specialist Mason Evans have undertaken a Geo-Environmental Desk Study for a site titled 'Site 01, Seafield Moor Road, near Bilston' (Drawing Nos. DS/R/F/01). It is understood that the site is being considered for a school development with associated infrastructure and landscaping.

I.1.2 The objectives of the study were:

- a) To clarify the historical background of the site with particular regard to any former contaminative usages or development.
- b) To provide information on nearby groundwater and surface water courses surrounding the site.
- c) To provide an indication of the geological conditions beneath the site and its environs.
- d) To recognise any nearby historical pollution incidents which may have resulted in contamination issued to the soils or water environment on site.
- e) To identify the possible presence and assess potential risks associated with chemical and ground gas contamination.
- f) To identify the possible presence and assess potential risks associated with historical underground mine workings and quarrying activities.

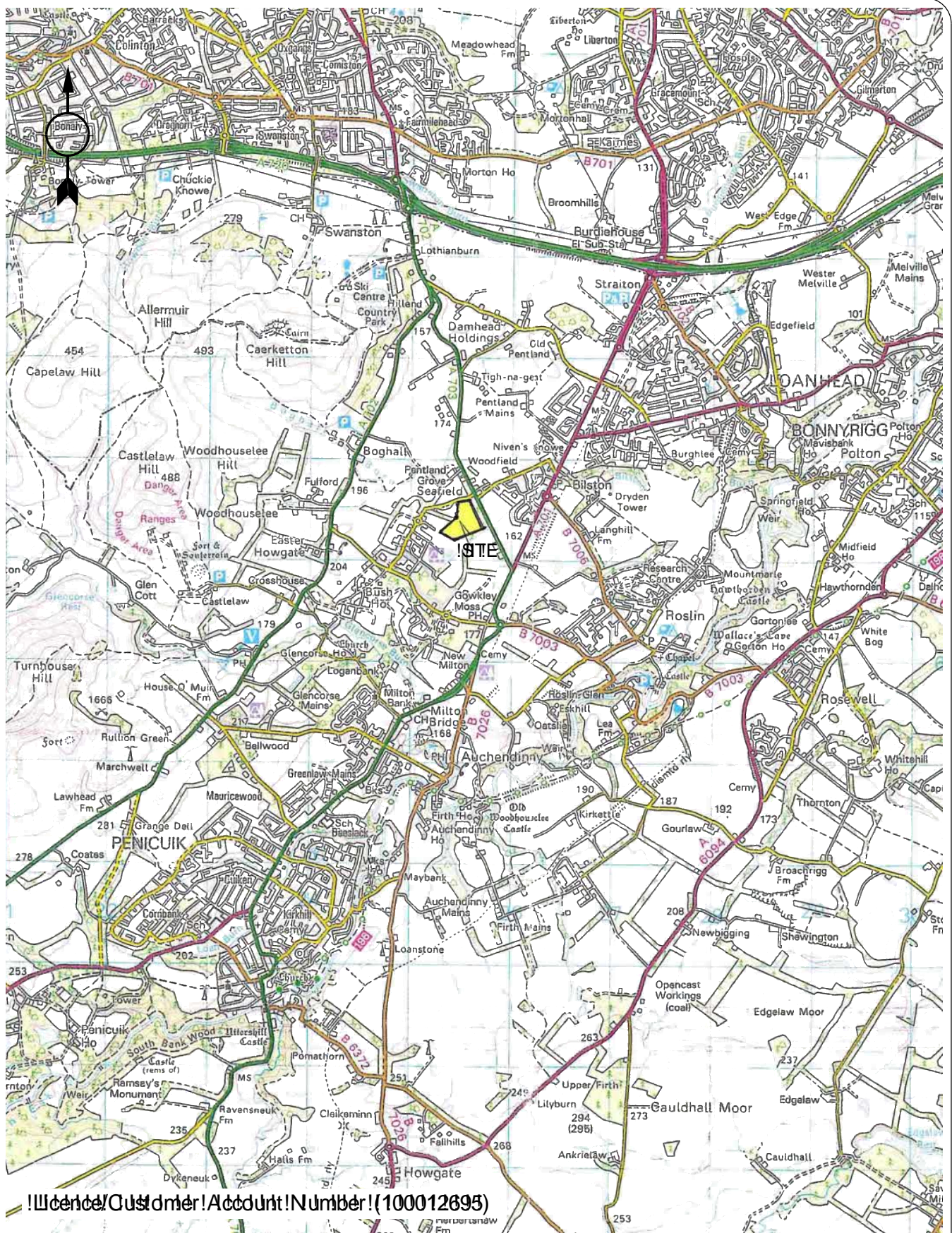
I.1.3 Please note that no topographic survey or proposed development layout has been provided.

### 1.2 Information Sources

I.1.1 The following sources of information have been utilised in the compilation of this report:

- Site Walkover Record (April 2021) (Appendix A)
- Review of Publicly Available Information (SEPA) (Appendix B)
- Envirocheck Report (with Historical OS Maps) (Appendix C)
- Coal Authority Report (Appendix D)
- Copy of Unexploded Bomb Risk Map (Appendix E)
- Utility Information (Appendix F)
- Historic Borehole Logs Located immediately east of site (Appendix G)





**PICK  
EVERARD**

!project title:  
**!SITE 1, !SEAFIELD MOOR ROAD  
 !NEAR !BILSTON**

!drawing id:  
**!DSR/001**

!drawing title:  
**!SITE LOCATION !PLAN**

!date:  
**!13/03/21**

!drawn by:  
**!MB**

!approved by:  
**!PB**

!scale:  
**!1:50,000! @ 1/A4**

### 1.3 General Methodology

- I.1.1 The studies involved documentary researches of available information on the historical background and the geological conditions at the site. This included examination of past and present Ordnance Survey maps, British Geological Survey records and other available information.
- I.1.2 These researches have provided a valuable insight into the historical site development and development within the surrounding area. Consequently, an indication of potential constraints related to processes associated with its previous land use or the geological conditions has been attained.



## 2.0 SITE LOCATION AND DESCRIPTION

### 2.1 Site Details

I.1.2 The summary details of the site as understood from supplied information and following a site visit (refer to Appendix A) were as follows:

Site Name:	-	Site 01, Seafield Moor Road, near Bilston.
Address:	-	Midlothian Innovation Centre, Roslin EH25 9RE.
National Grid Reference	-	325550 664360.
Total Site Area:	-	11.58 Ha.
Local Authority	-	Midlothian Council.
Current Usage	-	Agricultural land.
Access	-	Site access from the north via an unnamed road and from the east via an unnamed road.
Topography	-	The site was generally noted as flat lying.
Surface Conditions	-	The majority of the site was surfaced by short grasses within agricultural land. Dense vegetation and tree cover surfaced a small section within the central and southern site areas in close proximity to the burn.

### 2.2 Neighbouring Land Uses (within the immediate surrounding area)

North	-	Midlothian Innovation Centre with farmland beyond.
South	-	Boghall Burn with farmland beyond.
East	-	Seafield Moor Road with farmland beyond.
West	-	Unnamed road with University of Edinburgh Easter Bush Campus beyond.

Plate 01 - Aerial view of the site (Courtesy of Google Maps, 2021)



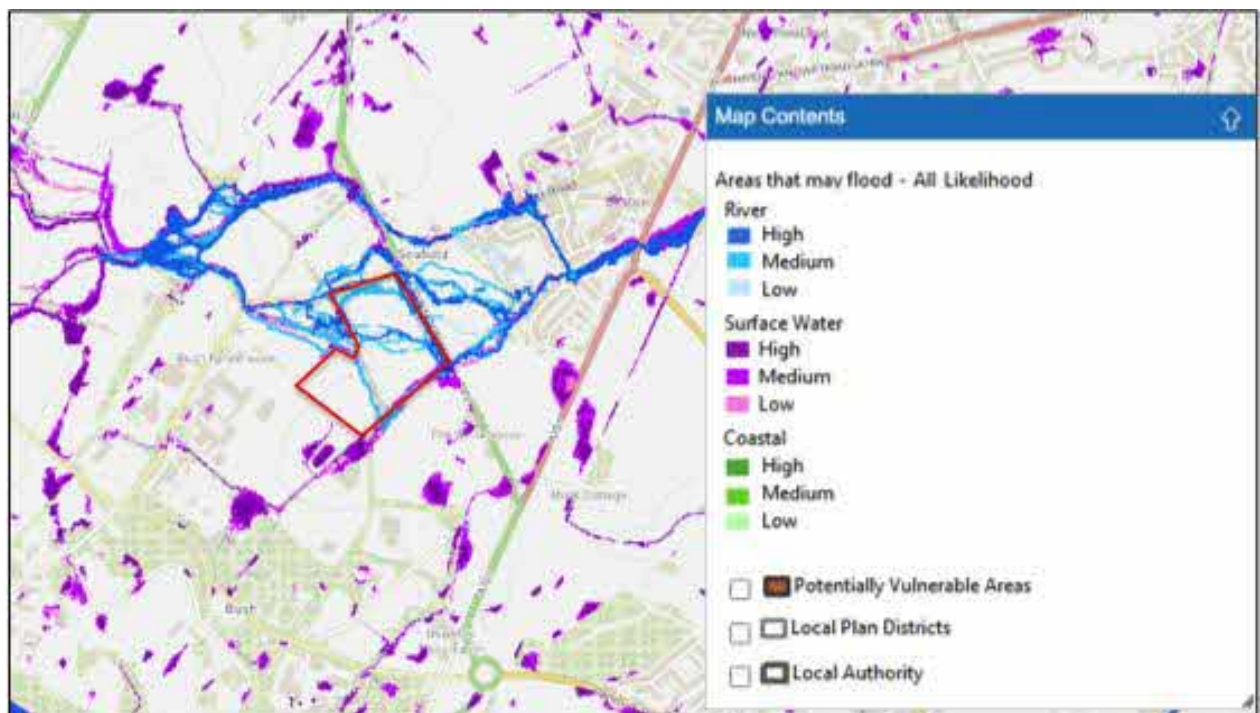
## 2.3 Watercourses

- I.1.2 The nearest surface water body was the Boghall Burn recorded during the site walkover flowing north to south through the central site area and south-west to north-east immediately south of the site. As such, we consider this to be a sensitive receptor in relation to the proposed school development.
- 2.3.2 SEPA record groundwater beneath the site to be associated with the 'Penicuik' Bedrock Aquifer. The most recent water quality information (dated 2018), shows the water body was indicated to have an overall status of 'Poor' based on the water quality (Refer to Appendix B).

## 2.4 Flooding

- I.1.2 The SEPA Flood Map (Plate 02) indicated that the site area is at a moderate to high risk from flooding in areas around the Boghall Burn and within the central and northern site areas. An area immediately south of the site is indicated to have a moderate to high risk of surface water flooding. If more detail is required, we would recommend a detailed flood risk assessment be undertaken..

Plate 02 - Ariel view indicating surrounding areas of flooding



\* Image courtesy of Scottish Environmental Protection Agency (SEPA) with site indicated in red.

## 2.5 Public Register Information

**I.1.2** Our desk study researches involved data acquisition and the examination of various documents on the geological and historical background of the site. The general findings were as follows: -

Waste Disposal Sites	- One registered landfill site were recorded within 500 m of the site (Appendix C).
Contemporary Trade Entries	- Active trade entries were recorded within the site. Four active trade entries were recorded within 500 m of the site including Laboratories, Garage Services and Commercial Vehicle Dealers (Appendix C).
Flooding	- The SEPA Flood Map records a medium to high risk of river and surface water flooding (Plate 02).
Water Environment	- There were no historical abstraction wells recorded within 500 m of the site.
Pollution	- Two discharge consents were recorded within 500 m of the site (refer to Table 01).
Mining	- The site is within a Coal Authority defined 'Coal Mining Reporting Area'. However, the site lies outwith a 'Development High Risk Area' (Appendix D). The mining condition is discussed further in section 4.4.
Radon Potential	- Radon gas protection measures are not considered to be applicable for the site and surrounding area as less than 1% of homes are considered to be above the action level (Refer to Appendix C).
Invasive Plant Species	- No evidence of invasive plant species were noted during the site walkover survey (May 2021) (Appendix A).
Unexploded Ordnance Risk Assessment	- The site is considered to have a low risk of unexploded bombs within its boundaries (Appendix E).

**2.3.2** As described, the researches included consultations with public bodies and regulators, supplemented with researches of various documents and related website sources on the geological and environmental context of the site. Much of the information was summarised in the Landmark Envirocheck Report, which is included in Appendix C, with the findings outlined in Table 01 overleaf.

**2.5.3** In the compilation of the table, we have listed the key geo-environmental impact sources identified within the Envirocheck report. In each of these cases, we have assigned a notional risk level based on a qualitative assessment of the potential for a defined hazard to impact on the site and its users. Where the risk is

estimated to be 'low', we consider that there is sufficient information available to suggest that the indicated source is unlikely to have any material effect on the site and its intended usage. Where a 'moderate' risk is shown, we consider that circumstances could reasonably arise where the site and its users could be impacted by the identified source. In the case of an assigned 'high' risk, we consider that there is sufficient information to indicate that the site will be impacted by the defined source.

**Table 01 - Summary of Envirocheck Records of Potential Impact Sources within 500 m of the Site**

Potential Impact Source	Distance (m)	Details	Impact Risk
Mineral Sites	-	None recorded.	Low
Discharge	217	Septic Tank	Low
Consents	246	Septic Tank	
Radon	-	No radon protective measures are required as the site resides in a lower probability area where less than 1% of homes are above the action level.	Low
Flooding (SEPA Flood Map)	-	The SEPA Flood Map indicates that the site is at a moderate to high risk from river and surface water flooding.	Moderate
Current Offsite Contamination Sources (Active Trade Entries)	16 82 293 467	Laboratories. Garage Services. Laboratories. Commercial Vehicle Dealers.	Low
Registered Landfills	-	None recorded.	
Fuel Station Entries	298	Abercromby Vauxhall Status: Obsolete.	

\* Refer to site sensitivity datasheets and historical maps included in Appendix C.

## 2.6 Invasive Plant Species

I.1.2 No invasive plants were noted during the walkover survey (Appendix A).

## 2.7 Utility Information

I.1.2 Utility information (retrieved May 2021) recorded fresh and waste water in the central and northern site areas. Underground BT and powerlines are recorded immediately north of the site. A copy of the utilities is included in Appendix F.

### 3.0 HISTORICAL BACKGROUND

#### 3.1 General

**1.1.3** An examination of the history of a site can often provide valuable information relating to potential constraints to its development. To facilitate these investigations, copies of historical Ordnance Survey maps contained within the Envirocheck report (Appendix C) and other historical data were examined, with particular attention being focused on former site uses and the presence of any industrial processes in the vicinity of the study area. It should be noted that considerable periods of time have elapsed between successive Ordnance Survey map editions and the possibility that further land uses occurred in the intervening years, which were not recorded on the maps, cannot be discounted.

#### 3.2 Historical Background

**Table 02 - Summary of History (Ordnance Survey Map Records)**

Ordnance Survey Map Edition (Scale)	The Site	The Surrounding Area
1854 (1:10,560)	Site noted to consist of agricultural land.	Road was recorded immediately north-east of the site. Seafield Muir was recorded approximately 40 m north of the site.
1894 (1:2,500) 1895 (1:10,560)	No significant changes were recorded.	Sand Pit was recorded 600 m east of the site. Old shaft recorded in Bilston approximately 950 m north-east of the site.
1907 (1:2,500) 1908 (1:10,560)	No significant changes were recorded.	A well was recorded approximately 200 m north of the site. Roslin Colliery was recorded approximately 900 m south-east of the site.
1914 (1:2,500) 1915 (1:10,560)	No significant changes were recorded.	Smithy recorded approximately 900 m south-east of the site, associated with the Roslin colliery.
1938 (1:10,560)	No significant changes were recorded.	Residential expansion was recorded approximately 350 m north east of the site, in the town of Bilston.
1957 -1958 (1:10,000)	No significant changes were recorded.	Midlothian innovation centre was recorded immediately north of the site. Further expansion of residential developments to within 250 m north-east of site. Expansion of sand pit 500 m east of the site.

1972 (1:2,500) 1970 – 1979 (1: 10,000)	No significant changes were recorded.	Road to the immediate north-east recorded as Seafeld Moor Road. Expansion of Midlothian innovation centre, including the Pentlandfield plant breeding station) was recorded immediately north of the site. Expansion of commercial buildings named Easter Bush within 100 m west of the site. Further expansion of residential developments to within 250 m north-east of site within town of Bilston.
1986 (1:2,500) 1980 – 1988 (1:10,000)	No significant changes were recorded.	Easter Bush buildings recorded as veterinary field station.
1993 (1:2,500)	No significant changes were recorded.	Electricity substation recorded 50 m west of the site.
1999 (1:10,000)	No significant changes were recorded.	No significant changes were recorded.
2021 (1:10,000)	No significant changes were recorded.	Expansion of education facility 50 m south of the site.

- 1.1.3** A review of the site history indicates that the site has remained as unoccupied agricultural land from 1854 to 2021.
- 2.5.3** During our site walkover (dated April 2021), we noted the site to be unoccupied, with short grasses covering the majority of the site, with small areas of dense vegetation and trees in the southern and central site areas (see Appendix A). The site was generally noted to be flat lying. The immediate surrounding area was noted to consist of agricultural farmland to the south and east, with commercial buildings to the north and the University of Edinburgh campus to the west. The Boghall burn was recorded within the central site area, flowing north to south and immediately south of the site flowing south-west to north-east.
- 3.2.3** Development to the surrounding area underwent significant expansion during the mid to late 1900's comprising residential developments (within the town of Bilston), commercial developments, education facilities and road infrastructure.
- 2.3.2** Following these researches, we conclude that the site would be classified as 'greenfield' in nature, whereby significant contamination across the site is considered unlikely.



## 4.0 DOCUMENTED GROUND CONDITIONS

### 4.1 General

- 4.1.1 The conjectured ground conditions at the site have been assessed utilising documentary information sources such as British Geological Survey maps and historic bores/pits.

### 4.2 Published Superficial Soils

- 4.1.1 It is not considered likely that significant made ground soils will be encountered below the site. However, there is potential for localised made ground to exist in the northern site area associated with the commercial developments immediately north of the site.
- 4.2.2 The British Geological Survey (BGS) recording superficial and solid geology (Drawing No. DS/R/F/02) records the majority of the site to be underlain by glacial till comprising of boulder CLAY, and alluvium deposits in the southern site area (i.e. bordering the Boghall Burn) comprising of SAND and GRAVEL.
- 2.5.3 Historic Site Investigations (Appendix G) located immediately east of the site recorded TOPSOIL from ground level to 0.30 m bgl underlain by localised MADE GROUND (proven to 0.40 m bgl) described as brown very clayey, fine to coarse sand, with occasional pottery fragments, further underlain by localised granular alluvium (proven to between 1.60 m and 2.75 m bgl) described as medium dense to dense, orange mottled brown, slightly clayey SAND and GRAVEL, further underlain by glacial till consisting of boulder CLAY (proven to depths of 12.00 m bgl) and described as soft to stiff, greyish brown, sandy, gravelly CLAY.

### 4.3 Published Solid Geology

- 4.1.1 The solid strata beneath the north-western site area is indicated to belong to the Upper Oil Shale Group consisting of sedimentary rock comprising SANDSTONE, MUDSTONE and LIMESTONE with seams of OIL SHALE (Drawing No. DS/R/F/02).
- 4.2.2 Historic MEP site investigations (Appendix G) located within 100 m east of the site did not record rockhead.

### 4.4 Mining and Quarrying

- 4.1.1 The Coal Authority states that the site is located within a Coal Mining Reporting Area meaning that it lies within a surface area that could be affected by past underground mining. However, the Coal Authority have record the site outwith a 'Development High Risk Area' (refer to Appendix D).
- 4.2.2 The Coal Authority Report (provided in Appendix D) records no historic recorded underground mining below the site.
- 2.5.3 Additionally, the report indicates that no 'probable unrecorded shallow mine workings' exist below the site.



- 4.2.2 The Coal Authority has no records of mine entries within the site area, or within 100 m of the site boundary.
- 2.3.2 The Non-Coal Mining Map (Appendix D) records sand and gravel and oil shale related historic quarrying/mining activity within close proximity of the site.
- 4.2.2 However, a review of the available historical Ordnance Survey maps (Appendix C) has not indicated the presence of historical quarrying activities both within the site or within the immediate surrounding area.
- 4.4.7 With cognisance to the above we do not consider the site to be at risk of ground instability as a result of historic shallow mining, mine entries and/or quarrying activities.



## 4.5 Hydrology and Hydrogeology

- 4.1.1 Interpretation of the site hydrogeology required consideration of the general geological conditions. In this instance the available information indicates the ground conditions to be comprised of five geological units: topsoil, potential localised made ground, granular subsoil (i.e alluvium deposits) , cohesive subsoil (i.e. boulder clay) and sedimentary bedrock. The typical permeabilities of each of these strata are recorded in Table 03.

**Table 03 - Typical Material Permeability**

Material	Permeability
Topsoil	Variable
Made Ground	Variable
Granular Subsoil (Sand and Gravels)	$10^{-5} - 10^0$
Cohesive Subsoil (Boulder Clay)	$10^{-12} - 10^{-6}$
Sedimentary Bedrock	Variable

- 4.2.2 It is considered unlikely that a shallow groundwater body exists within the cohesive clay deposits, due to the low permeability range of cohesive deposits. Groundwater may still be encountered within the cohesive soils underlying the site, though will likely be localised and perched, the result of surface water infiltration.
- 2.5.3 It is considered likely that a shallow groundwater body exists within the granular sand and gravel deposits, due to the high permeability range of granular deposits.
- 4.2.2 At present, surface run-off below the site would be relatively low as the site is predominantly surfaced by grass/vegetation. Infiltration of surface water is therefore expected to be high.
- 2.3.2 The nearest surface water body is the Boghall Burn located within the central site area, flowing north to south, and immediately south of the site, flowing south-west to north-east. As such, we consider this to be a sensitive receptor in relation to the proposed development.
- 4.2.2 SEPA indicated the 'Penicuik' bedrock aquifer to exist below the site area. In 2018 the aquifer was recorded to have a status of 'Poor' in relation to its water quality (Appendix B).
- 4.4.7 The British Geological Survey Database did not record the presence of any groundwater abstraction wells within the site or the immediate surrounding area.
- 4.2.2 In consideration of the available information regarding groundwater, the following general comments are made.

**Table 04 - Surface Water and Groundwater Pathways**

<b>Surface water run-off</b>	Surface water run-off below the site is relatively low as the site is surfaced in predominantly short grasses and vegetation. Consequently, the infiltration of surface water is high.
<b>Groundwater migration through superficial materials</b>	The underlying cohesive clay deposits are expected to be prohibitive to vertical groundwater flow to greater depths. Consequently we would generally expect groundwater to be localised, perched and of low volume within the shallow soils. The underlying granular sand and gravel deposits are expected to facilitate vertical groundwater flow to greater depths. Consequently it is considered likely that a shallow groundwater table exists within these permeable soils. Deeper groundwater bodies are considered to be present at or below the bedrock level associated with the Penicuik Bedrock Aquifer.

#### 4.6 Correspondence with Midlothian Council

- 4.1.1 As part of our desk study researches, we contacted Midlothian Council to obtain any available historical site information, including any knowledge of contaminated land uses, historic mine workings and buried fuel tanks below the site.
- 4.2.2 We currently await a response, and this will be issued upon receipt.
- 2.5.3 The Notwithstanding the above, we do not consider any significant contamination source and/or buried fuel tanks to exist on site.

## 5.0 CONCEPTUAL SITE MODEL

### 5.1 General

- 1.1.2 In order to fully evaluate the potential presence and impact of contamination at the site, the area must be considered in an environmental context taking account of its geology, topography, past and present land-use. From this review, the current guidance requires the development of a 'Conceptual Site Model' as defined in the R & D Publication CLR10 published by the Department for the Environment and Rural Affairs (DEFRA). The model then forms an integral part of the contamination assessment for the proposed development site, looking at conventional source-pathway-receptor linkages.
- 2.3.2 The key parameters of the model are the conjectured ground conditions at the site, the potential sources of contamination, migration pathways and possible receptors in the vicinity. During the initial stages of the investigation, a preliminary conceptual model can be developed using information obtained during the desk study phase, prior to site investigations being carried out. This should then be revised during a subsequent phase of investigation.

### 5.2 Environmental Qualitative Risk Assessment

- 1.1.2 Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) has created a new regime for the identification and remediation of contaminated land. A revised Statutory Guidance Edition 2 (Paper SE/2006/44) to the Act was published by the Scottish Executive in May 2006.
- 2.3.2 Both Part IIA and the planning regulations it impacts on, embrace the "suitable for use" approach, with remedial actions only required where there are unacceptable risks to health or the environment, taking into account the current and proposed land uses and its environmental setting.
- 3.2.3 It is based on the principles of risk assessment, including the concept of a ***pollutant linkage*** between a ***source*** contaminant and a ***receptor***, by means of a ***pathway***. We would highlight that the approach, while perhaps rendering the site suitable for its current use, may prove inappropriate to a change in site designation or specific land use, arising from existing site conditions.
- 2.3.2 The presence of all three elements identifies a plausible pollutant linkage. An assessment of the potential sources, pathways and receptors constitutes a conceptual model for the site.

### 5.3 Receptor Characterisation

- 1.1.2** Potential receptors at the site are defined on the basis of the site proposals, which are understood to include the development of a school and associated landscaping and infrastructure. The location of the site relative to any off site receptors has also been considered. The following receptors are considered relevant to this project:

- Humans – site end users and construction workers (outdoor),
- Humans – site end users (indoor),
- Buildings and services,
- Water Environment (Boghall Burn surface water),
- Vegetation/fauna.

### 5.4 Source Characterisation

- 1.1.2** The potential on-site sources of contamination identified by this desk study are:

- Spillage of fuel from agricultural plant operation on site.

- Deposition of herbicides and pesticides associated with agricultural land use.

- 2.3.2** The potential off-site sources of contamination identified by this desk study are:

- Generation and accumulation of ground gases associated with made ground soils.

- Spillages and leakages of contaminants during construction of surrounding commercial developments and road infrastructure.

- 3.2.3** The following table summarises the typical contaminants which we would anticipate at the site, although any testing schedule should be developed in cognisance of the materials encountered.

TABLE 05 - Contaminants of Concern

THE SITE	Industrial Activity/ Site Use	Potential Pathways	Associated Potential Contaminants
CURRENT	Agricultural Land	Spillages and leakages of fuel and oil from farm vehicles. Spillages and leakages of contaminants. Generation of ground gases.	Metals: As, Cd, Cr, Ni, Zn, Cu, Hg, Pb Organics: Fuel oils, PAH, Phenol Ground Gases: CO <sub>2</sub> , CH <sub>4</sub> , H <sub>2</sub> S Asbestos Herbicides and Pesticides
PREVIOUS	Agricultural Land	Spillages and leakages of fuel and oil from farm vehicles. Spillages and leakages of contaminants. Generation of ground gases.	Metals: As, Cd, Cr, Ni, Zn, Cu, Hg, Pb Organics: Fuel oils, PAH, Phenol Ground Gases: CO <sub>2</sub> , CH <sub>4</sub> , H <sub>2</sub> S Asbestos Herbicides and Pesticides
IMMEDIATE SURROUNDING AREA	Industrial Activity/ Site Use	Potential Pathways	Associated Potential Contaminants
CURRENT	Education facility Commercial developments Road infrastructure	Deposition of waste materials during construction. Spillages and leakages of contaminants. Generation of ground gases.	Metals: As, Cd, Cr, Ni, Zn, Cu, Hg, Pb Organics: Fuel oils, PAH, Phenol Ground Gases: CO <sub>2</sub> , CH <sub>4</sub> , Asbestos
PREVIOUS	Commercial Development Road Infrastructure	Deposition of waste materials during construction. Spillages and leakages of contaminants. Generation of ground gases.	Metals: As, Cd, Cr, Ni, Zn, Cu, Hg, Pb Organics: Fuel oils, PAH, Phenol Ground Gases: CO <sub>2</sub> , CH <sub>4</sub> , H <sub>2</sub> S Asbestos

## 5.5 Pathway Characterisation (Pollutant Linkages)



I.1.2 The pathways by which sensitive receptors may be exposed to potential sources of contamination, as determined by the proposed end use for the site are as follows.

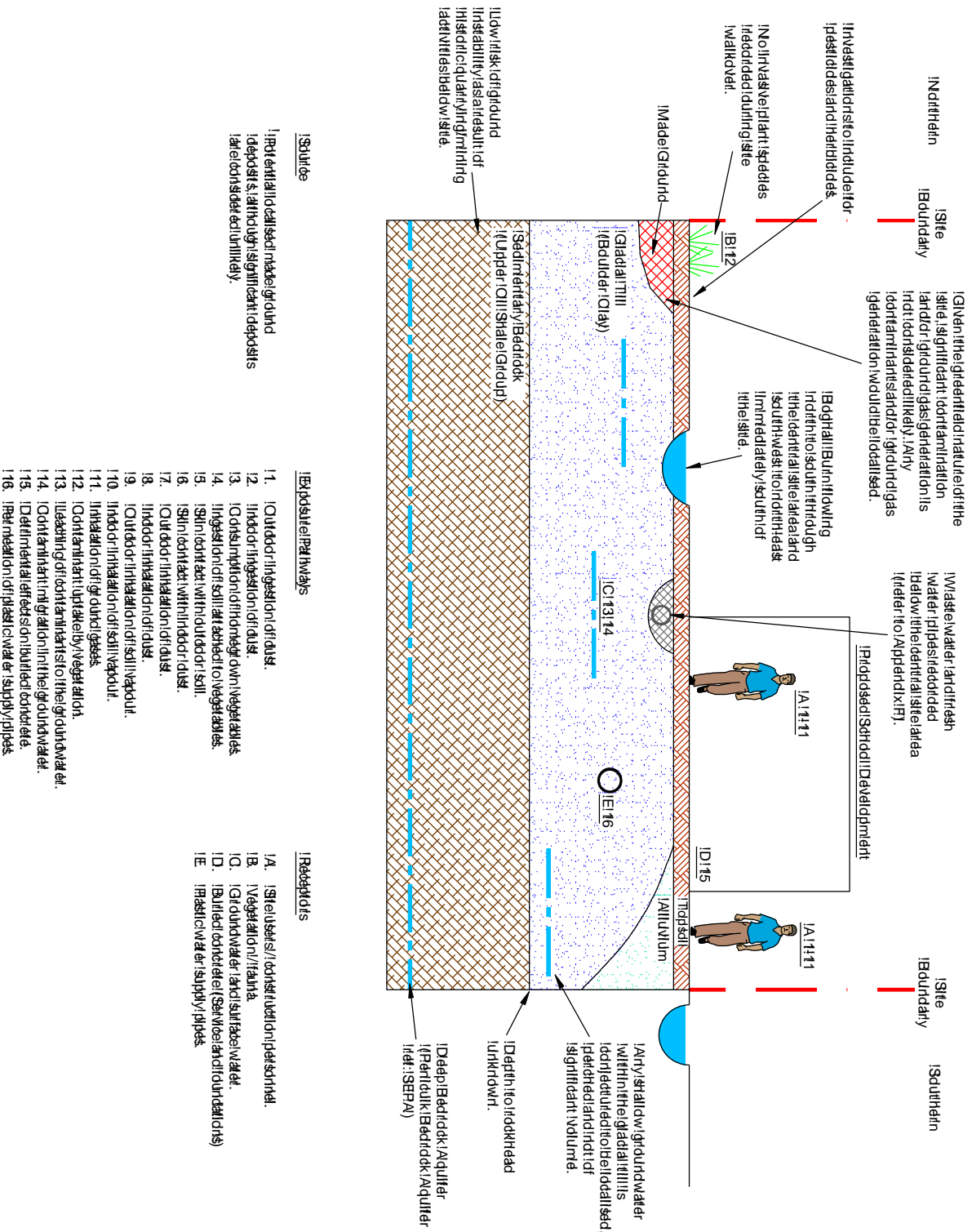
1. Humans – site end users and construction workers (outdoor)
  - Derma (skin) contact with contaminated soil, fugitive dust and the absorption of any contaminants through the skin into the body.
  - Inhalation of fugitive soil dust or vapour.
  - Ingestion of soil by hand to mouth activity
2. Humans – site end users (indoor)
  - Inhalation of any ground gas migrating into buildings.
  - Inhalation of soil derived dust.
3. Buildings
  - Potential soil gas generated in the ground vertically migrating and pooling within the structure.
  - Contact with aggressive or acidic soils will affect the concrete design of the foundations.
4. Services
  - Direct contact with contaminated soil or groundwater.
  - Leaching of contaminants through the soil.
  - Service trenches acting as preferential migration pathways for contamination.
  - Permeation of plastic water supply pipes.
5. Water Environment
  - Leaching of contaminants from the soil to groundwater.
  - Contaminant migration beyond the site boundary.
6. Vegetation
  - Uptake of contamination in plant roots.
  - Direct contact with contaminated soil or groundwater.

2.3.2 On the basis of the above, a qualitative risk assessment is described in Table 06 below and the potential source-pathway-receptor relationships identified at the site, based on the preliminary qualitative risk assessment, are summarised in Drawing No. DS/R/F/04 - Preliminary Conceptual Site Model (CSM).

Table 06 - Preliminary Qualitative Risk Assessment – On Site

Source	COCs	Pathway	Receptors (s)	Assessment	Further Investigation Required
On site: Possible	Metals: As, Cd, Cr, Ni,	Dermal contact, ingestion,	Human – site workers	Made ground materials may have been deposited within	Yes

localised areas of contaminated made ground and potential localised ground gas generation	Zn, Cu, Hg, Pb  Organics : Fuel oils, PAH, Phenol  Ground Gases: CO <sub>2</sub> , CH <sub>4</sub> ,  Asbestos	inhalation	Humans – end users (outdoor)	the site associated with previous development/demolition works in the surrounding area.	
		Leaching through soil or direct migration	The water environment - groundwater	Contaminants may be leached and potentially mobilised from the soil by the infiltration of rainwater and possibly by shallow groundwater movement.	Yes
		Direct contact, leaching through soil, groundwater migration	Buildings and services	Potential for aggressive chemical environments for concrete due to sulphate and acidic conditions. Presence of contaminants in soil that may permeate water supply pipes.	Yes
		Gas/vapour inhalation, vertical/lateral migration	Buildings and services	Contamination may include gas/vapour producing materials or compounds that could vertically migrate into overlying buildings producing a potentially asphyxiating or explosive environment.	Yes
			Humans – end users (indoor)		
		Migration in the groundwater	The water environment	Contaminated soils/ groundwater within the site could migrate in the groundwater beyond the site boundary.	Yes
		Direct Contact/ Plant Uptake	Vegetation	Direct contact with, or uptake of contaminated soils or groundwater could adversely affect plant growth.	Yes



NOTES

Important for local seed contamination is soil in the  
industrial site area associated with the  
industrial development immediately north of  
the site

in a topographic survey provided

IREV	IDATE	IDET/ANUS
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PROJECT TIME

SITE 1, SEAFIELD MOOR ROAD  
 IN EARILSTON

DRAWING TITLE	ICONCEPTUAL SYSTEM MODEL						
DRAWN BY	JMB	CHECKED BY	JCM	APPROVED BY	JRB	DATE	1/14/92
DRAWING NO.	IDSRJ003						
	SHEET(S)						INDICATED
							1 OF 1
	REVISION						



## 6.0 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

### 6.1 General

- 1.1.2 Phase 1 desk study researches have indicated the site to be greenfield in nature. Therefore significant contamination across the site is not considered likely. However, there is a potential risk that the site is impacted by localised soil contamination relating to historic development immediately north of the site. This would require evaluation through Phase II investigations, including the testing of soil/water samples, and examining the characterisation of the soils and groundwater beneath the site. In addition, potential localised ground gas emissions associated with these localised deposits require to be assessed through monitoring. Foundation options for any new development will be influenced by the thickness and condition of any made ground soils as well as the condition of the natural superficial deposits and underlying bedrock.

### 6.2 Historical Site Usage

A review of the site history indicates that the site has remained as unoccupied agricultural land from 1854 to 2021. Development to the immediate surrounding area underwent significant expansion during the mid to late 1900's comprising residential developments (within the town of Bilston), commercial developments, education facilities and road infrastructure.

### 6.3 Conjectured Ground Conditions

Our researches have indicated the site to be underlain by topsoil, underlain by potential localised MADE GROUND, underlain by granular SAND and GRAVEL, further underlain by glacial till deposits consisting of boulder CLAY and further underlain by sedimentary bedrock (Upper Oil Shale Group). Depth to rockhead is unknown.

### 6.4 Chemical Contamination

- 1.1.2 The historical appraisal indicated the site to be generally greenfield in nature. However, there is potential for localised made ground materials to be present below the northern site area associated with the commercial development immediately north of the site. However, significant contamination is not considered likely and any contaminants would likely be localised.
- 2.3.2 Intrusive site investigations to assess the presence of made ground soils, supplemented by detailed chemical analyses and risk assessments will be required to assess the potential risks to sensitive receptors such as construction workers, site users, vegetation and the water environment.

### 6.5 Gas Emissions

- 1.1.2 Our researches suggest that potential localised made ground exists below the northern site area associated with the commercial developments immediately north of the site. As a result, there is the potential for

elevated ground gas emissions. However, given the greenfield nature of the site significant gas generation is not considered likely.

- 2.3.2** In order to identify, a detailed ground gas risk assessment, including a programme of gas monitoring from standpipes installed in boreholes, may be required if significant ground gas sources are identified.
- 3.2.3** The site is not at risk from radon gas generation and migration.

## 6.6 Foundations

- 6.6.1** Our initial assessments have indicated that the site is underlain by TOPSOIL, underlain by potential localised MADE GROUND, underlain by granular alluvium (i.e. SAND and GRAVEL), further underlain by natural cohesive glacial till (i.e. 'boulder CLAY') and further underlain by sedimentary bedrock (Upper Oil Shale Group).
- 6.6.2** Investigations are therefore required to determine whether the natural soils and/or shallow bedrock will form a suitable bearing horizon for the proposed school development.
- 6.6.3** Investigations should aim to assess the ground conditions by exploratory excavations and in-situ testing, augmented by laboratory testing of samples, to determine a practical and economic foundation solution for the development.

## 6.7 Mining and Quarrying

- 1.1.2** The Coal Authority states that the site is located outwith a Development High Risk Area meaning that it lies outwith a surface area that is likely affected by past underground mining.
- 2.3.2** A review of the available historical Ordnance Survey maps has not indicated the presence of historical quarrying activities both within the site and the within the immediate surrounding area.
- 3.2.3** With cognisance to the above we do not consider the site to be at risk of ground instability as a result of historic shallow mining, mine entries and/or quarrying activities.

## 6.8 Invasive Plants

No invasive plants were noted during the site walkover (May 2021).

## 6.9 Utility Information

A utility search indicated fresh and waste water in the central and northern site areas. Underground BT and power lines are also recorded immediately north of the site.

## 6.10 Development Considerations

**6.10.1** A number of development geo-environmental considerations could arise from the recommended Phase II investigations. These include:

- Possible remediation of contaminated land.
- Off-site disposal of excess soils.
- Ground Gas preclusion measures.
- Foundations designs will be determined by the thickness of made ground deposits and the thickness/condition of the underlying natural soils, plus depth to bedrock.

We highlight that these considerations are speculative without the more detailed information that would arise following Phase II investigations, following which the impact of each should be re-assessed. The advised scope of these investigations may include:

- Trial pits to assess the shallow soils and ground conditions.
- Soil boreholes (to assess the shallow soils and ground conditions) with installations for gas and groundwater monitoring.
- Geo-environmental testing of soil and water samples.
- Monitoring of ground/mine gas concentrations and groundwater depths.
- Phase II Geo-environmental Investigation Report.

## Appendix A - Site Walk over



WALKOVER SURVEY RECORD

Project Name: SITE 01 Seafield Moor Road, near Bilston  
Date of Survey: 28/04/2021  
Weather: Sunny spells, dry

Project Number : P21/019  
Surveyed By: CMcD

VICINITY OF THE SITE		DESCRIPTION	
Are there any street/house/locality/pub names indicating current or former land use?	N/A	-	
What are the neighbouring land uses?	NORTH	Unnamed road and commercial properties indicated to be part of Midlothian Innovation Centre.	
	EAST	Seafield Moor road with farmland beyond	
	SOUTH	Boghead Burn with farmland beyond.	
	WEST	Unnamed road with University of Edinburgh Easter Bush campus beyond	
Potential off-site receptors		Boghead Burn flowing north to south through central site area and flowing south-west to north-east immediately south of the site.	

ACCESS		
Describe the site accesses - type, width and headroom.		Access off of unnamed road from north and from the west off of unnamed road. Width around 3.0 m no height restrictions.
Describe any access difficulties for SI plant		None recorded.

**SITE DESCRIPTION - GENERAL**

What is the current land use?		Site currently used as agricultural fields.
What is the topography?		Site is flat lying throughout
What is the surface cover?		Predominantly short grasses with some dense vegetation and trees in the central and southern site areas.
Are there any water logged areas?	NO	-
How are the boundaries for med?		Fenced off around the site.
Does the topography suggest filling or platforming?	No	-
Are there any subsidence features?	NO	-

**EXISTING BUILDINGS**

What proportion of the site do the buildings cover?		No buildings present on site.
Do the building(s) show any evidence of distress?	NO	-
Indicate building usage on available site plan.		-
Indicate nature and location of materials in storage.		-
What processes are evident in the facility?		-

**TANKS AND WASTE STORAGE**

Are there any fuel or chemical storage tanks (surface and underground)? For each tank record whether it is above/under ground, nature of contents, whether full or empty, banded/unbanded/leaking band, presence of staining Mark locations on plan.	NO	-
Is there any evidence of waste storage or disposal?	NO	-
Are there any chemical drums or other containers?	NO	-
Are there any discharges to surface water?	NO	-

**HYDROLOGY**

Describe any groundwater sources - including flow rate.		No significant water sources noted.
Record positions all springs, ponds and other water on site.		Boghead Burn flowing north to south in the central site area and flowing south-west to north-east immediately south of the site.

**PUBLIC UTILITIES**

Are there any overhead cables - indicate type and location?	No	None noted.
Are there any manholes - describe?	NO	None noted.
Are there other indications of utilities?	NO	-
Are there any electricity transformers	NO	-

**HAZARDS**

Describe any obvious public health hazards.		-
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**SPILLAGES AND CONTAMINATION**

Are there any indications of oil or other spillages?	NO	-
Is there evidence of contaminated soils?	NO	-
Is there evidence of distress to vegetation?	NO	-
Describe constituents of any flytipping.		-
Is there surface evidence of asbestos contaminated soil?	NO	-
Are there any noxious smells?	NO	-

**GEOLOGY**

Soil and rock – record and describe any exposed soils or rocks that are present.		-
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**MINING AND QUARRYING**

Are there any signs of mineral extraction in the area, such as old mine buildings, derelict or hummocky land, surface depressions, evidence of infilling or spoil heaps.	NO	-
Is there evidence of any quarrying?	NO	-

**SLOPE STABILITY**

Are there any risks of slope instability?	NO	-
Is there evidence of previous land slipping?	NO	-

**INVASIVE PLANTS**

Are there any obvious invasive plants?	NO	None recorded.
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## Walkover Photographs



Photograph 01



Photograph 02





Photograph 03



Photograph 04



Photograph 83



Photograph 84



Photograph 87



Photograph 88





Photograph 01



Photograph 02



Photograph 11



Photograph 12



Photograph 12



## Appendix B – Review of Publicly Available Information (SEPA)

