

Angus Housing Association

Proposed Development at Guthrie Street, Frioockheim

Geo-environmental and Geotechnical Preliminary Investigation

November 2022



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Executive Summary

A Geo-environmental and Geotechnical Preliminary Investigation has been undertaken at a site located on Guthrie Street, Friockheim, currently present on site is the Lunan Park (Elderly Persons Home). National Grid Reference NO 59667 50055. The main findings and conclusions of this preliminary investigation are summarised below.

Geo-environmental/Contaminated Land Assessment

This preliminary investigation has identified potential pollutant linkages to future receptors at the site from potential sources of contamination associated with historic onsite and offsite developments ([Table 6](#)). These potential sources and pollutant linkages require to be investigated further and are briefly summarised below:

ACM's in Structures

Due to the age of onsite structures there is the potential that Asbestos Containing Materials (ACMs) are present within the structures. An Asbestos Demolition and Refurbishment Survey is required for all structures which are proposed to be demolished on site. All identified ACMs require to be removed from the buildings by a suitably licensed contractor prior to any demolition works.

Fuel Storage Tank and Pipework

A fuel storage tank with an approximate capacity of 5,000 Litres and pipework is present within the site. The approximate location of the historic tank is presented in Drawing [150141/9002, Appendix 1](#). There is the potential that fuels/oils have historically leaked from below storage tanks, associated pipework and filling point at the site. The potential presence of hydrocarbon contamination within site soils and groundwater from the spillage and leaking of fuel oils presents a potential pollutant linkage to receptors and requires to be investigated.

Made Ground

Made ground will be present at the site due to the previous onsite development. Due to the unknown origin of made ground deposits they have the potential to contain contaminants which present a risk to future receptors at the site.

The proposed development requires the demolition of the existing buildings at the site to allow the erection a new residential housing which will include associated access roads, car parking, infrastructure and landscaping. Therefore based on the above it is anticipated that majority of the existing site soils will remain capped below the existing building footprint or below the existing hard standings at the site.

A targeted intrusive ground investigation will be required where new buildings/structures are proposed at the site in accordance with BS5930:2015+A1:2020 and BS10175:2011+A2:2017 to investigate the above potential sources of contamination and quantitatively assess the risk to end users of the proposed development from potentially contaminated soils and groundwater.

Preliminary Ground Gas and VOC Vapour Risk Assessment

Due to the potentially contaminated made ground at the site containing hazardous gas and VOC vapour generating materials and the risk of hazardous ground gases and VOC vapours, including migrating to the site from offsite sources, the investigation requires to include ground gas and VOC vapour monitoring in accordance with CIRIA C665 and BS 8576:2013. The proposed development is likely to be a '*Residential*' end-use, which CIRIA C665 identifies as being a '*High Sensitivity Development*' however an undercroft car parking is proposed beneath the flatted structures which will vent most of the structure and therefore the requirement for gas protection will be limited to areas of the building footprint where the walls are in contact with the ground such as the stairwells and the townhouses.

Based on this and the identified potential sources of contamination, the overall site is considered to represent a '*Low Ground Gas Generation Potential*', in accordance with CIRIA C665. The ground gas investigation should therefore be designed accordingly and reassessed, if required, based on preliminary results.

Water Environment

Made ground is suspected to be present onsite. Therefore, it is possible that leachable contaminants within the made ground have leached/leaked into the underlying Groundwater Environment which presents a significant risk of significant harm to the Groundwater environment and requires further investigation.

Due to the location of the site and the fact that the closest surface water features are located within 50m from the site these surface water features are considered to be at risk from the potential sources of contamination at the site. As such the risk to Surface Waters from the site also requires to be investigated.

Buried Concrete

Elevated Sulphate concentrations and low pH levels in site soils have the potential to degrade buried concrete overtime and therefore, if applicable, pH and Sulphate testing of site soils will be required to specify an appropriate Exposure Class of buried concrete at the site in accordance with BRE Special Digest 1 (2005).

Water Pipework Material

The proposed redevelopment of the site will require the installation of new water supply pipework. In accordance with current Scottish Water UKWIR guidance where supply pipes are installed within '*Brownfield*' land there is a requirement for intrusive investigation and chemical analysis to be undertaken in order to assess if upgraded pipe material is required. At the time of writing, there are no final water supply pipework layout plans available for assessment. Therefore, if any proposed supply pipework is required in these previously developed areas, a UKWIR ground investigation may be required. **This assessment must be approved by Scottish Water prior to the installation of supply pipework at the site.**

Geotechnical/Engineering Feasibility Assessment

A detailed Preliminary Geotechnical Assessment of the proposed development at the site including foundations, earthworks, and drainage infrastructure is presented in [Section 11.0](#).

Recommendations

An Asbestos Demolition and Refurbishment survey is required for all structures which are proposed to be demolished on site.

It is recommended that a pre demolition ground investigation should be carried out in accordance with the guidance set out in BS 10175:2011+A2:2017 (Investigation of Potentially Contaminated Sites), BS 5930:2015+A1:2020 (Code of Practice for Ground Investigations), BS EN 1997-2:2007 (Ground Investigation and Testing), BS 8004:2015 (Code of Practice for Foundations), CIRIA C665 (Assessing Risks Posed by Hazardous Ground Gases to Buildings) and BS 8576:2013 (Guidance on Investigations for Ground Gas).

Further Reporting

Further phases of Geotechnical reporting are considered to be required for the development:

- The findings of the intrusive ground investigation works will require to be reported in a **Ground Investigation Report (GIR)** which should be compiled in accordance with BS EN 1997-1:2004+A1:2013; and
- All geotechnical design elements of the development (including foundations, roads, retaining walls, slopes and earthworks) should be detailed in a **Geotechnical Design Report (GDR)** which should be compiled in accordance with BS EN 1997-1:2004+A1:2013.

Further phases of Geo-environmental reporting will be required if contamination is identified at the site:

- A **Remediation Statement** which will identify all complete pollutant linkages present at the site and the required remedial works; and
- A **Verification Report** following the remediation works.

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Appendix 1: Drawings

150141/9000	Site Location Plan
150141/9001	Preliminary Conceptual Model
150141/9002	Features Identified during Site Walkover
SK_002	Site Layout Sketch

Appendix 2: Previous Reporting/ Investigations

Envirocheck 298197036_1_1

Appendix 3: Principles of Environmental Risk Assessment

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Appendix 5: Statutory and Non-Statutory Consultations

Appendix 6: Public Utilities

1.0 Introduction

Fairhurst were appointed by 'Angus Housing Association' (The Client) to undertake a Preliminary Geo-environmental and Geotechnical Investigation at a site located on Guthrie Street, Friockheim, currently present on site is the Lunan Park (Elderly Persons Home). The site is centred at National Grid Reference NO 59667 50055 and the location of the site is presented in [Drawing 150141/9000](#), [Appendix 1](#).

The Client proposes to demolish the current structures and construct a new residential development. At the time of writing a proposed development plan is not available.

This report is being undertaken in order to characterise potential environmental constraints and will assess any potential historic land uses or activities that may have resulted in land contamination. The Report will also identify preliminary engineering or geotechnical constraints at the overall site which will allow a ground investigation to be designed in accordance with BS EN 1997-2:2007 and BS 8004:2015 and subsequently allow the geotechnical aspects of the development to be designed in accordance with BS EN 1997-1:2004+A1:2013.

At the time of preparation of this report, a Planning Application has not yet been lodged to Angus Council Planning Service in support of the proposed development site. It is likely that due to brownfield nature of the proposed development site that any future Planning Decision will be issued with a Planning Condition relating to Contaminated Land, which this and subsequent reports seek to address.

The information presented in this Report is based on observations made by examination of in-house and external records including historic maps ([Appendix 2](#)), public body consultations ([Appendix 5](#)), a walkover of the site ([Appendix 4](#)) and geological maps.

1.1. Objectives

The specific objectives of this Report are to:

- Establish historic and current site uses based on historic maps, a site walkover and other sources of information obtained from the Statutory Authorities;
- Construct a Preliminary Conceptual Model for the site based on the proposed use and the desk based data collected and derive a Qualitative Risk Assessment;
- Identify potential geotechnical and engineering constraints that could affect the proposed development; and
- Provide recommendations for appropriate geo-environmental and geotechnical ground investigation(s) in accordance with BS 10175:2011+A2:2017, CIRIA C665, BS 8576:2013, BS 5930:2015+A1:2020, BS 8004:2015 and BS EN 1997-2:2007.

2.0 Desk Based Information

Information from a number of sources has been consulted as part of this Geo-environmental and Geotechnical Preliminary Investigation Report.

i Ordnance Survey Maps

A selection of Ordnance Survey Maps has been consulted as part of the desk-based review to assess the historic development of the site and surrounding area.

ii British Geological Survey

Sheet	Scale	Date
BGS Online Superficial Geology Map	1:50,000	online
BGS Online Solid Geology Map	1:50,000	online
BGS Hydrogeological Map of Scotland	1:625,000	1988
Groundwater Vulnerability Map of Scotland	1:625,000	1995

iii Site Walkover and Photography

A site walkover was undertaken by Fairhurst Geotechnical and Geo-environmental Engineers on the 22nd July 2022. A summary of the walkover is presented in [Section 4.0](#) with the site walkover photographs presented in [Appendix 4](#).

iv Consultations

The following comprises a list of organisations which were consulted during this phase of investigation works. These are summarised in [Sections 6.0 & 7.0](#). A summary of the responses associated with the site are presented in [Appendix 5](#).

Organisation	Date	Method	Response Date
Angus Council Contaminated Land Officer	11/07/22	email	19/07/22
Angus Council Petroleum Officer	11/07/22	email	19/07/22
Angus Council Online Planning Portal	15/07/22	Online	n/a
Angus Council Tree Preservation Order (TPO) Mapping	15/07/22	Online	n/a
British Geological Survey online Geoindex	15/07/22	Online	n/a
SEPA online Flood Risk Mapping	15/07/22	Online	n/a
Scottish Natural Heritage (Sitelink)	15/07/22	Online	n/a
The Coal Authority	15/07/22	Online	n/a

3.0 Site Description

3.1. Site Overview

The site is located on Guthrie Street, Friockheim at National Grid Reference NO 59667 50055. The site covers an area of approximately 0.39Ha and is irregular in shape. The location of the site is presented in [Drawing 150141/9000](#), [Appendix 1](#).

The site currently consists of a large 2 storey L-shaped building which is the Lunan Park elderly person's home, the building is surrounded by an access road, car parking and small areas of previously maintained gardens.

3.1.1. Topography

The site is generally flat sloping gradually upwards from 44.72mAOD in the south to 45.25mAOD in the north, towards the river (Lunan Water) approximately 50m to the north-west of the site at its closest point. The majority of the site is surfaced in buildings or access roads and car parking hardstanding. There are no retaining walls or significant level changes such as embankments or slopes present at the site.

3.1.2. Boundaries and adjacent Land Uses

The land uses adjacent to the site are as follows:

Adjacent Land Uses:

North:	Guthrie Crescent beyond which is residential housing
East:	Guthrie Street beyond which is residential housing
South:	Residential housing beyond which is Kirkden Street
West:	Residential housing beyond which is Lunan Street

3.1.3. Surface Water Features

There are no surface water features present on site. The closest surface water feature to the site is the Lunan Water located approximately 50m to the north-west of the site, flowing in a easterly direction. The Lunan Water flows towards Lunan Bay approximately 11km to the east which flows in to the North Sea.

3.1.4. Vegetation

The site walkover has identified the majority of the site is surfaced in buildings or access roads and car parking. There is a small garden area to the west with large mature trees, overgrown plants and shrubs.

3.1.5. Invasive Species

There was no obvious visual evidence of Invasive Species (i.e. Japanese Knotweed, Giant Hogweed or Himalayan Balsam) during the site walkover. However it must be noted that the site walkover is not a comprehensive botanical survey and the Client should satisfy themselves with regard to the presence of Invasive Species by commissioning an Invasive Species Survey.

3.1.6. Utilities Information

A full set of public utilities plans have been obtained for the site and have identified that below ground services and infrastructure are present on and in close proximity to the site.

These are discussed in detail in [Section 11.2](#) and a full set of public utility plans for the site are included in [Appendix 6](#).

4.0 Site Walkover

A site walkover was undertaken by Fairhurst Geotechnical and Geo-environmental Engineers on the 22nd July 2022. The main findings of the walkover are summarised below;

The site is located on Guthrie Street and Guthrie Crescent in the village of Friockheim. The site can be accessed by foot and by vehicle from Guthrie Street through 1 no. access gate. Access by foot can also be gained from Guthrie Crescent to the north and Kirkden Street to the south between residential properties. The site is bound to the north by Guthrie Crescent, to the east by Guthrie Street and to the south and west by residential housing.

The majority of the site is covered in the main L shaped building, which was a former nursing home, access roads and car parking. The main building is two storey noted to be in 'fair' condition, with access from the south, east and within the internal corner of the L shape. There is a small garden area to the west with mature trees, overgrown plants and shrubs. Historically the garden looked to have been maintained, however the plants and shrubs have been allowed to grow and the whole area is overgrown. Large mature trees were also noted to be present along the western and northern boundaries.

There is a fuel tank present within a lowered enclosed building to the north east of the L shaped building with approximate dimensions of 4.0 x 2.0m. The tank has a capacity of approximately 5,000L. A fuel point and vent point were noted to be present during the site walkover. During the site walkover, there wasn't access to lift the manhole covers to see within the lowered building.

A stone boundary wall approximately 2m in height is present along the western boundary and during the site walkover it was noted to be in a severely dilapidated condition. A brick wall is present along a section of the northern boundary and during the site walkover it was also noted to be in a severely dilapidated condition.

Overall Site Observations

- There was no obvious visual olfactory evidence of contamination during the walkover.
- There was no obvious evidence of flooding or water logged ground etc. during the walkover.
- There were no invasive species such as Japanese Knotweed, Giant hogweed or Himalayan Balsam identified during the walkover. However it should be noted a full botanical survey was not undertaken.

Photographs taken during the walkover are presented in [Appendix 4](#).

5.0 Proposed Development

5.1. Proposal

The Client proposes to demolish the current structures and construct a new residential development. At the time of writing a proposed development plan is not available.

5.2. Eurocode Design Category

Based upon a preliminary assessment of the development proposals and likely ground conditions, it is anticipated that the developments will include only **Geotechnical Category 2** structures, which are defined in BS EN 1997-1:2004+A1:2013 as “*conventional types of structure and foundation with no exceptional risk or difficult ground or loading conditions*”. This assessment should be continuously reviewed as the project advances. In accordance with the National Annex to BS EN 1990:2002+A1:2005, the design life of the development is anticipated to be 50 years.

5.3. Planning Status

At the time of preparation of this report, a Planning Application has not yet been lodged to Angus Council Planning Service in support of the proposed development site. It is likely that due to brownfield nature of the proposed development site that any future Planning Decision will be issued with a Planning Condition relating to Contaminated Land, which this and subsequent reports seek to address.

6.0 Historical Development of the Site

The historic development of the site was established from a review of historic Ordnance Survey maps presented in the Envirocheck Report 298197036_1_1 ([Appendix 2](#)) and the recent site walkover ([Appendix 4](#)). A summary of the findings of these examinations is presented in [Table 1](#).

Table 1: Summary of the historic and current development of the site and surrounding area

Onsite	Remarks on the mapping	Date(s) (circa)	
Open Undeveloped Land	From the earliest available historic OS mapping c. 1861 shows the site remained undeveloped until c. 1967.	c. 1861 – 1967	
Lunan Park Elderly Persons Home	From historic OS mapping c. 1967 the site is occupied by Lunan Park Elderly Persons Home with associated access road and car parking. The site remains occupied by Lunan Park Elderly Persons Home although the building is currently vacant.	c. 1967 – Present	
Offsite	Date(s) (circa)	Distance	Orientation
Residential Housing	1894 – Present	0m	West
Residential Housing	1967 – Present	0m	North, East and South
Uncompleted Development	2007 – Present	50m	East
Glazed Roofed Building (Greenhouse)	1967	60m	West
Sewage Farm	1967 – Present	70m	North

7.0 Geology, Hydrology and Hydrogeology

7.1. Superficial Geology

The 1:50,000 BGS mapping notes the superficial deposits predominantly comprise Glaciofluvial Deposits consisting of Gravel, Sand and Silt.

7.2. Solid Geology

The BGS 1:50,000 mapping identify the underlying geology as the Dundee Flagstone Formation consisting of Sandstone, Siltstone and Mudstone.

The BGS mapping confirms there is no geological faulting within the site boundary or within close proximity of the site.

7.3. Mine workings

The Coal Authority GIS database identified that the site is not within an area of coal mining reporting or where coal outcrops are present. Based upon this information, the presence of historic coal mining in the area has been discounted as a potential risk at the site.

7.4. Quarry Activities

A review of historic mapping has confirmed that were no historic quarry activities undertaken at or in close proximity to the site.

7.5. Radon Potential

A review of UK Radon mapping has indicated that that the site is located within an area where 1-3% of homes are affected by Radon. Therefore, based upon this dataset and in accordance with BRE 211(2015), **Radon Protection is required for any future development at the site.**

7.6. Unexploded Ordnance (UXO)

According to the Zetica Regional Unexploded Bomb Risk Map, the overall site is within an area which is at '*low risk*' of unexploded ordnance being present.

There is noted to be 5 no. 'Luftwaffe Targets' approximately 1.5 – 2.0km to the north east of the site (disused Airfield).

7.7. Hydrology

There are no surface water features present on site. The closest surface water feature to the site is the Lunan Water located approximately 50m to the north west of the site, flowing in a easterly direction. The Lunan Water flows towards Lunan Bay approximately 11km to the east which flows in to the North Sea. The SEPA River Basin Management Plan (RBMP) online database classifies the Lunan Water (Friockheim to Estuary) as having an overall status of '*Moderate*' in 2014.

7.8. Hydrogeology

The BGS Hydrogeological Map of Scotland (1:625,000) (1988) states that the hydrogeology at the site is the Quaternary sands and gravels. The BGS identifies this as being a "*locally important aquifer*".

7.9. Private Water Supplies

The Angus Council Contaminated Land Officer has confirmed there are no known private water abstractions in the vicinity of the site.

7.10. Flooding

SEPA's flood risk maps (SEPA 2016) provide guidance on the possible extent, depth and velocity for different likelihoods (*High, Medium and Low*) of three different sources of flooding (River, Sea and Surface Water), alongside other associated information.

The resolution of the mapping does not provide site-specific detail. The flood maps do not consider the interaction between sources of flooding. The river flood map is based on a two dimensional flood modelling method applied across Scotland to all catchments greater than 3km² and includes hydraulic structures *'where appropriate information was available'*. Whilst the flood maps can be a useful tool for initially considering whether a site may be at risk of flooding, the following caveat is attached to their use:

"The Flood Maps are indicative and of a strategic nature. Whilst all reasonable effort has been made to ensure that the Flood Maps are accurate for their intended purpose, no warranty is given by SEPA in this regard... It is inappropriate for these Flood Maps to be used to assess flood risk to an individual property."

According to SEPA online flood risk mapping, the site is not at risk from flooding from Surface, River or Coastal Waters.

8.0 Environmental Information

Information in this Section relates to the published environmental information (incidents, legal determinations, waste transfer licences etc.) for the proposed development site, details of which have been obtained from Envirocheck Report (298197036_1_1). If a particular feature is identified as being potentially contaminative, it is taken forward to risk assessment stage. All information is presented within [Appendix 2](#).

8.1. Contaminated Land Register Entries and Notices

There are no Contaminated Land Entries and/or Notices located within 0.5km of the site.

8.2. Discharge Consents

There are no discharge consent entries within 0.5km of the site.

8.3. Enforcement and Prohibition Notices

There are no registered Enforcement and Prohibition Notices within 0.5km of the site

8.4. Integrated Pollution Controls

There are no registered Integrated Pollution Controls within 0.5km of the site.

8.5. Local Authority Integrated Pollution Prevention and Controls

There are no registered Local Authority Integrated Pollution Prevention and Controls within 0.5km of the site.

8.6. Registered Radioactive Substances

There are no Registered Radioactive Substances entries within 0.5km of the site.

8.7. Local Authority Recorded Landfill Sites

There are no Local Authority Recorded Landfill sites present within 0.5km of the site.

8.8. Registered Landfill Sites

There are no registered Landfill Sites within 0.5km of the site.

8.9. Registered Waste Transfer Sites

There is one registered Waste transfer sites within 0.5km of the site, details of which is summarised below in [Table 2](#).

Table 2: Registered Waste Transfer Sites within 0.5km of the Site

Name	Authorised Waste	Licence Reference	Status	Distance/Direction
Angus Council/Acrop	Household Waste	W/ML/E/20038	Licence has completion certificate surrendered	423m South

8.10. Registered Waste Treatment or Disposal Sites

There are no registered Waste Treatment or Disposal sites within 0.5km of the site.

8.11. Notifications of Installations Handling Hazardous Substances (NIHSS)

There are no registered Notifications of Installations Handling Hazardous Substances entries within 0.5km of the site.

8.12. Controls of Major Accident Hazard Sites

There are no registered Controls of Major Accident Hazard (COMAH) entries within 0.5km of the site.

8.13. Explosive Sites

There are no registered explosive sites within 0.5km of the site.

8.14. Planning Hazardous Substance Consents

There are no registered Planning Hazardous Substance Consents entries within 0.5km of the site.

8.15. Garage and Fuel Stations

There are no registered fuel station entries noted within 0.5km of the site.

8.16. Contemporary Trade Entries

There is one registered contemporary trade entry within 0.5km of the site, as summarised below in [Table 3](#).

Table 3: Registered Contemporary Trade entries within 500m of the site

Name	Classification	Status	Distance/Direction
L C Packaging	Packing Materials Manufacturers Suppliers	Active	159m South

9.0 Consultation Responses

9.1. Angus Council – Contaminated Land

A formal request for relevant information relating to the site was sent to Angus Council's Contaminated Land Officer on the 11th July 2022 of which a response was received on the 19th July 2022. The Contaminated Land Officer has confirmed the following:

- *There are no records of former uses of the site or the immediate surrounding land, which may have resulted in contamination of the site. The Friockfield Works Woollen Mill to the west of the site has previously been redeveloped as housing but I can confirm that land contamination issues were controlled by way of a planning condition.*
- *There are no records held regarding Private Water Abstractions in the vicinity of the site.*
- *There are no sites determined or investigated under Part IIA of the Environmental Protection Act 1990 within 0.5km of the site.*
- *There are no records of any nuisance associated with the site.*
- *There are no records regarding mine workings in the vicinity of the site.*
- *There are no records of any fuel storage at the site including underground or above fuel storage tanks on the site.*
- *No further information available.*

All correspondence and attachments received from the Contaminated Land Officer are included in [Appendix 5](#).

9.2. Angus Council Conservation Portal

The Angus Council Conservation Portal was accessed on the 18th July 2022 which identified the development site is not within an area of conservation.

9.3. Tree Preservation

The Angus Council Tree Preservation Order (TPO) online map was accessed on the 18th July 2022 which identified that there are no TPO's at the site.

9.4. Scottish Natural Heritage

The SNH online SiteLink Map was accessed on the 18th July 2022 and confirmed that the site is not within a designated area which encompasses Sites of Special Scientific Interest, Special Areas of Conservation, Special Protection Areas, RAMSAR, National Scenic Areas or National Nature Reserves or Local Nature Reserve.

9.5. Environment Scotland

The Environment Scotland online database was accessed on the 18th July 2022 which identified the following:

- The groundwater at the site, and in the surrounding area, is classified as being of 'poor quality'.

The consultation responses are included in [Appendix 5](#).

10.0 Conceptual Model and Qualitative Risk Assessment

A Conceptual Model is formed by assessing the likelihood and risk of all identified and suspected sources, pollutant pathways and receptors. Where a potentially significant source, pathway and receptor is identified, a pollutant linkage is considered to potentially exist that should be investigated through intrusive ground investigation, or where the pollutant linkage is known, remedial measures should be undertaken. This is presented in the following sections.

The Principles of Environmental Risk Assessment is presented in [Appendix 3](#).

The significance of the presence of these elements is considered by carrying out a risk assessment of all potential pollutant linkages in the context of the proposed development of the site.

The Preliminary Conceptual Model detailed in the following section is summarised in [Drawing 150141/9001](#), [Appendix 1](#).

10.1. Source Characterisation

All potential sources of contamination at the site have been established based on the site walkover, the historic map review, review of statutory and non-statutory consultations and the review of environmental information online.

These are considered further with regards to their potential significance and whether or not they should be progressed to the Qualitative Risk Assessment (QRA) stage.

An assessment of the potential sources of contamination is presented below in [Table 6](#) with the contaminants of concern presented in [Table 5](#).

Table 4: Assessment of potential sources of contamination

Potential Pollutant Source	Information Source	Location	Progress to Qualitative RA?	Comments
Onsite Pollutant Source(s)				
Existing Structures (Built prior to 2000)	Historical Mapping, Envirocheck Report and Satellite Imagery	Onsite	Yes	A review of historic mapping has identified historic structures built before 2000 are present on site and are proposed to be demolished. Therefore an Asbestos Demolition and Refurbishment Survey is required for the site and all identified Asbestos Containing Materials (ACMs) will require to be removed by a suitably licensed contractor during the re-development/ refurbishment of the site and will require to be disposed offsite to a suitably licensed waste facility.
Fuel Storage Tank (5,000L) and Pipework	Site Walkover	Onsite	Yes	A fuel storage tank with a capacity of 5,000L and pipework is present within the site. The approximate location of the historic tank is presented in Drawing 150141/9002, Appendix 1 . There is the potential that fuels/oils have historically leaked from below storage tanks, associated pipework and filling point at the site. The potential presence of hydrocarbon contamination within site soils and groundwater from the spillage and leaking of fuel oils presents a potential pollutant linkage to receptors and requires to be investigated. Ground Gas and Vapour Risk Due to the presence of historic fuel storage at the site, there is the potential that site soils and groundwater are contaminated with hydrocarbon fuel oils via the historic leakage and spillage of fuel. Hydrocarbon contaminated site soils and groundwater present a potential risk of generating hazardous ground gas and VOC vapour at the site which could accumulate in buildings. This potential pollutant linkage to receptors requires to be investigated at the site in accordance with BS8485 & CIRIA C655.
Potentially Contaminated Made Ground (Associated with existing structure)	Historical Mapping, Envirocheck Report, Site Walkover and Satellite Imagery	Onsite	Yes	Associated with the existing structure made ground deposits will likely be present at the site. Generally, due to the unknown origin of the made ground deposits they have the potential to be contaminated and therefore present a risk to receptors at the site. Due to the age of construction of the onsite structures some of which have been /altered at the site, there is also the potential that ACMs are present within the made ground deposits at the site presenting a potential risk of Asbestos fibre inhalation to end users of the site. The proposed development is to demolish the existing buildings at the site and construct a new residential development. The future development will likely include areas of landscaping and planting and therefore there is a potential risk of exposure to contaminated soils/groundwater to site end users in the final development. There is also the potential that made ground deposits could contain hazardous ground gas and vapour generating materials which could present a risk to future end users of the site by accumulating in buildings and service trenches. Therefore based on the above assessments the presence of made ground creates potential Pollutant Linkages to future receptors at the site and requires further intrusive investigation and monitoring.
Potentially Contaminated Made Ground and Superficial Deposits	n/a	Onsite	Yes	Elevated Sulphate concentrations and low pH levels in site soils have the potential to degrade buried concrete overtime and therefore, pH and Sulphate testing of site soils will be required to specify an appropriate Exposure Class of buried concrete at the site in accordance with BRE Special Digest 1 (2005).
Offsite Pollutant Source(s)				
See Table 1	Historical Mapping, Envirocheck Report	Offsite	No	There were no potential pollutant linkages identified within 100m of the site boundary and therefore further investigation is not required.

Table 5: Contaminants of Concern

SOURCE	CONTAMINANTS OF CONCERN														
	Heavy Metals	Fuels & Oils	BTEX	TPH	PCB	PAHs	SVOCs/ VOCs	Pesticides / Fungicides	Asbestos	SO ₃ SO ₄	Phenol	pH	Nitrate Nitrite	Detergents	Ground Gas/Vapour
Onsite Contaminants of Concern															
Existing Structures (ACM's)									✓						
Fuel Storage Tank (5,000L) and Pipework		✓	✓	✓			✓								✓
Made Ground	✓	✓	✓	✓		✓	✓		✓	✓		✓			✓

10.2. Pathway Characterisation

The potential pathways by which receptors may be exposed to contaminants (sources) at a site will vary depending on the proposed or current land use (i.e. residential properties, public open space, retail). A *Residential with plant up take* scenario is assumed to be applicable for the purposes of this Report based on the proposed end use for the development site.

For Humans (site end-users), the possible routes of exposure to contaminants are:

- Dermal (skin) contact with contaminated soils and waters and transfer of contaminants through the skin into the body (out with areas of hardstanding);
- Inhalation of ground gas/vapours;
- Inhalation of contaminated dusts (*potential Asbestos containing materials*);
- Ingress of contaminants into water-supply pipes contaminating drinking water supplies.
- Consumption of home grown vegetables;
- Ingestion of soils attached to home grown vegetables.

For Humans (construction & maintenance workers during potential maintenance/redevelopment works), the possible routes of exposure to contaminants are:

- Inhalation of ground gas/vapours;
- Inhalation of contaminated dusts (*potential Asbestos containing materials*);
- Dermal (skin) contact with contaminated soils and waters and transfer of contaminants through the skin into the body (out with areas of hardstanding).

Buildings and Utilities (Property) may be affected by contaminants in the following ways:

- Soil gas or vapour pooling in voids within or beneath structures;
- Direct contact of building fabric with contaminated soils;
- Service trenches acting as preferential migration pathways.

For potential risks associated with ground gases, the potential migration pathways and drivers are:

- Meteorological Conditions; most significantly rapidly falling atmospheric pressures;
- Rainfall/frozen ground causing a reduction in soil pore space and thus increasing ground gas concentrations and increase potential for the release of gases into the atmosphere;
- The level of groundwater or mine water level may affect the potential for ground gas migration as a shallow water level will reduce pore space and therefore potentially mobilise ground gases.
- Effects on solubility of ground gases caused by changes in temperature; ground gases are likely to become more mobile in higher temperatures;
- Wind; potential gradients can be formed between the gas and the ground caused by wind (the Venturi effect) which may result in gas release into the atmosphere;
- Geology; low permeability soils will to a certain extent restrict the flow of ground gases and conversely, permeable strata will allow gases to flow more freely,

- Construction techniques; the manner in which a building is constructed will affect the migration potential for ground gases, for example vibro-stone column foundations have high void space and therefore may create a preferential pathway for ground gases to migrate to surface;
- Utilities tracks may create preferential pathways for gas migration;
- Cracks within the solid geology member either inherent to the member i.e. Sandstone or caused by geological faulting may present a conduit for gas migration.

In respect to the Water Environment, the possible pollutant potential pathways are:

- Leaching of contaminants from the soil to on-site Groundwater;
- Migration of contaminated groundwater to off-site Groundwater;
- Migration of contaminated groundwater to Surface Waters

10.3. Receptor Characterisation

Potential receptors at the site are related to the development proposals (Residential). The location of the site relative to sensitive environmental receptors and the ground and groundwater conditions at and below the site has been considered. This Report has identified the following potential receptors:

- Humans: End Users
- Construction Workers (during maintenance and redevelopment works)¹
- Buildings: Building Fabric and Services
- The Water Environment

10.4. Pollutant Linkages

The significance of potential pollutant linkages at the site is qualitatively assessed by considering the likely magnitude of the hazard and the probability of the linkages occurring based on the information gathered. This is summarised in [Table 6](#).

¹ Potential pollutant linkages to construction and maintenance workers can be mitigated through the appropriate use of Personal Protective Equipment (PPE) and Safe Systems of Work.

Table 6: Preliminary Qualitative Risk Assessment for Potential Sources of Contamination

Source	CoCs	Potential Pathways	Potential Receptors	Assessment	Potential severity	Potential probability	Risk class	Further Investigation required (Y/N)
Onsite Sources: Existing Structures Fuel Storage Tank (5,000L) and Pipework Potentially Contaminated Made Ground Offsite Sources: n/a	Asbestos	Inhalation of Asbestos fibres	Humans: Site End Users	A review of historic mapping has identified historic structures built before 2000 are present on site and are proposed to be demolished. Due to the age of onsite structures there is the potential that Asbestos Containing Materials (ACMs) are present within structures. Therefore, this may present a potential risk to human end users at the site via the inhalation of Asbestos fibres. An Asbestos Demolition and Refurbishment Survey is required for all structures which are proposed to be demolished, redeveloped or refurbished on site.	High	Low	Moderate	Yes – Asbestos Demolition and Refurbishment Survey is required for all structures which are proposed to be demolished, redeveloped or refurbished. All identified ACMs require to be removed from the buildings by a suitably licensed contractor.
		Direct Contact, Inhalation & Ingestion Inhalation of Asbestos fibres	Humans: Site End Users	The only previously onsite development has been the elderly care home constructed in the c.1960s. There are no former industrial uses of the site and therefore the overall risk of significant contamination being present at the site presenting a significant harm to end users is considered to be low. However due to the existing onsite development works, made ground deposits will likely be present at the site including the potential presence of asbestos fibres. The site walkover has also identified a fuel storage tank and associated pipework, which could have leaked and spilled fuels into the site soils and groundwater The proposed development are to demolish the existing buildings at the site and erect a new residential housing development which will include associated access roads, infrastructure and landscaping A targeted intrusive investigation and chemical analysis of the site soils will be required where new buildings/structures are proposed at the site in accordance with BS5930:2015+A1:2020 and BS10175:2011+A2:2017 to investigate the above potential sources of contamination and quantitatively assess the risk to end users of the proposed development from potentially contaminated soils and groundwater.	High	Low	Moderate	Yes – Ground Investigation and sampling in accordance with BS BS5930:2015+A1:2020 and BS 10175:2011+A2:2017; and ground gas/VOC investigation in accordance with CIRIA C665 and BS 8576:2013. The ground gas investigation should consist of 6 monitoring visits over a 3 month monitoring period in accordance with CIRIA 665.
	Heavy Metals	Accumulation of ground gas within buildings and service conduits	Humans: Site End Users	Due to the potential presence of made ground containing hazardous gas and VOC vapour generating materials, the investigation requires ground gas and VOC vapour monitoring in accordance with CIRIA C665 and BS 8576:2013. The proposed development is likely to be a 'Residential' end-use, which CIRIA C665 identifies as being a 'High Sensitivity Development' Based on this and the identified potential sources of contamination, the overall site is considered to represent a 'Low Ground Gas Generation Potential', in accordance with CIRIA C665. The ground gas investigation should therefore be designed accordingly and reassessed, if required, based on preliminary results.	High	Low	Moderate	No – Potential pollutant linkages to construction and maintenance workers can be mitigated through the appropriate use of Personal Protective Equipment (PPE) and Safe Systems of Work.
	Petroleum Hydrocarbons/Fuel Oils	Direct Contact, Inhalation & Ingestion	Humans: Construction and Maintenance Workers	Potential pollutant linkages to construction and maintenance workers can be mitigated through the appropriate use of Personal Protective Equipment (PPE) and Safe Systems of Work.	n/a	n/a	n/a	
	PAH							
	BTEX	Leaching Migration to Groundwater and Surface Water Environment	Water Environment	There is made ground and a suspected fuel storage tank and pipework present onsite. Therefore, it is possible that leachable contaminants within the made ground have leached/leaked into the underlying Groundwater Environment which presents a significant risk of significant harm to the Groundwater environment and requires further investigation. There are no surface water features present on site. The closest surface water feature to the site is the Lunan Water located approximately 50m to the north west of the site, flowing in an easterly direction. The Lunan Water flows towards Lunan Bay approximately 11km to the east which flows in to the North Sea. Due to the location of the site and the fact that the closest surface water features are located within 50m from the site these surface water features are considered to be at risk from the potential sources of contamination at the site. As such the risk to Surface Waters from the site requires to be investigated.	Low	Moderate	Moderate	Yes – Ground Investigation and sampling in accordance with BS5930:2015+A1:2020 and BS 10175:2011+A2:2017.
	TPH							
	SVOCs/VOCs							
Ground Gas/Vapours	Accumulation of ground gas within buildings and service conduits	Buildings and Utilities	Due to the presence of made ground there is the potential that explosive ground gases (Methane) exist at the site which could accumulate within buildings and present an explosion risk to structures. This requires to be investigated and risk assessed in accordance with CIRIA C665 and BS 8576:2013.	High	Very Low	Moderate	Yes – Ground Investigation and sampling in accordance with BS5930:2015+A1:2020 and BS 10175:2011+A2:2017; and ground gas/VOC investigation in accordance with CIRIA C665 and BS 8576:2013.	
	Direct Contact	Buildings and Utilities (Buried Concrete)	Elevated Sulphate concentrations and low pH levels in site soils have the potential to degrade buried concrete overtime and therefore, if applicable, pH and Sulphate testing of site soils will be required to specify an appropriate Exposure Class of buried concrete at the site in accordance with BRE Special Digest 1 (2005).	Moderate	Moderate	Moderate	Yes – If applicable, pH and Sulphate testing of site soils will be required to specify the Exposure Class of buried concrete within the proposed development in accordance with BRE Special Digest 1.	
	Direct Contact (Permeation of Water Supply Pipes)	Humans: Site End Users	The proposed redevelopment of the site may require the installation of new water supply pipework. In accordance with current Scottish Water UKWIR guidance where supply pipes are installed within 'Brownfield' land there is a requirement for intrusive investigation and chemical analysis to be undertaken in order to assess if upgraded pipe material is required. At the time of writing, there are no final water supply pipework layout plans available for assessment. Therefore, if any proposed supply pipework is required in these previously developed areas, a UKWIR ground investigation may be required. This assessment must be approved by Scottish Water prior to the installation of supply pipework at the site.	High	Moderate	Moderate	Yes – Chemical analysis of site soils along proposed water supply pipework route at 500mm below proposed pipe invert level at 25m centres in accordance with current UKWIR Guidance Report (Ref No. 10/MW/03/21)	

Risk Ratings key for Table 6:

- High: The available information indicates a significant possibility of harm to a receptor requiring further investigation, assessment or treatment.
- Moderate: The available information indicates a potential for significant harm to a receptor requiring further investigation or assessment.
- Low: The available information does not indicate a significant potential for harm to a receptor requiring further investigation. This does not indicate a zero risk

11.0 Preliminary Engineering Assessment

The following geotechnical/engineering constraints may be present at the site. These constraints have the potential to present abnormal costs to the future development of the site:

- Made Ground
- Historic Substructures & Infrastructure
- Groundwater
- Foundations
- Surface Water Drainage
- Roads & Pavements
- Buried Concrete
- Water Supply Pipe Material
- Material Re-Use/Waste
- Public Utilities

11.1. Made Ground

Due to the existing development at the site, made ground deposits will likely be present beneath the existing buildings, access road and car parking at the site although given the limited historic development which has occurred onsite there is not anticipated to be significant depth of made ground deposits present.

Due to the unverifiable origin of made ground deposits and their varying composition, assumed low/variable shear strength and high susceptibility to settlement and differential settlement they are considered an unsuitable bearing stratum for the placement of new foundations. Therefore the presence, depth and nature of made ground deposits at the site should be investigated by intrusive means in accordance with BS EN 1997-2:2007, BS 5930:2015+A1:2020, BS 8004:2015 and BS 10175:2011+A2:2017.

11.2. Historic Substructures and Infrastructure

Substructures including buried foundations and other infrastructure outwith the existing car home building are unlikely to be present. However the site walkover identified a suspected former floor slab at surface in the north-west corner.

The presence of substructures and infrastructure can present significant abnormal costs to the development of a site and if present an appropriate budget should be allowed for their removal.

11.3. Groundwater

The groundwater regime below the site is unknown. It is therefore recommended that the groundwater level at the site is investigated to determine any potential constraints to the proposed development at the site such as drainage, earthworks and foundation design.

It is recommended that the groundwater regime at the site is established via intrusive investigation and post fieldwork groundwater level monitoring. Cognisance must be taken of the recorded groundwater levels across the site in relation to the proposed earthworks, foundations and the proposed final development levels.

11.4. Earthworks/Site Levels

At the time of writing there are no proposed development layouts available, however the site is thought to become a residential development with associated roads and infrastructure. Based on the surrounding topography, road network and drainage infrastructure which the development will require to tie into, it is concluded that limited earthworks would be required to achieve final development levels at the site.

The installation/construction of foundations and infrastructure for the future development will necessitate the excavation of topsoil, made ground and possibly natural superficial soils; therefore it is recommended that a preliminary stage of intrusive investigation to ascertain the ground conditions at the site including the depth of groundwater and bedrock throughout the site to assess the feasibility and potential constraints of earthworks at the site. This should be followed by targeted geotechnical testing to classify and determine the reusability potential of site soils in earthworks, in a second phase of targeted design investigation.

11.5. Foundation Design

At the time of writing there are no proposed development layouts available, the foundation design solution for the structure would be dependent on the ground and groundwater conditions at the site and the geotechnical characteristics of the natural superficial soils or potential bedrock underlying topsoil and made ground at the site.

Ground investigation works should be undertaken in accordance with BS EN 1997-2:2007, BS 8004:2015 and BS 5930:2015+A1:2020 which will identify the general geological conditions at the site following which recommendations can be made regarding likely foundation solutions. These works should identify the shear strength and settlement characteristics of the superficial materials. If the ground investigation works are to be undertaken prior to the demolition works it is recommended an intrusive foundation inspection of the existing structure is undertaken to identify the existing foundation type and depth at the site.

11.6. Surface Water Drainage Design

It is likely that the surface water drainage infrastructure for the proposed development will be required to tie into the existing surface water drainage system for the existing site. Currently it is thought the site uses a private system, however it is recommended that at an early development stage consultation is made with Scottish Water (if required) to determine if there is capacity within the network to adopt the additional runoff from the proposed development.

It is recommended that a drainage specialist is appointed to assess the drainage requirements for the site and undertake discussions with the relevant authority/asset owner at an early stage.

11.7. Roads and Pavements

It is anticipated that the surrounding existing car parking spaces and the site access roads which connect to the main road will remain at existing levels. Any future roads or pavement design will require ground investigation works to confirm ground conditions and assist in road and drainage design.

11.8. Buried Concrete

There is the possibility that naturally elevated sulphate concentrations and low pH levels may be present within the natural superficial deposits at the site. Elevated sulphate and low pH levels have the potential to degrade buried concrete over time and therefore the Sulphate and pH levels of site soils should be investigated via chemical analysis to allow the specification of buried concrete for the proposed development in accordance with BRE Special Digest 1 (Concrete in aggressive ground 2005).

11.9. Water Supply Pipe Material

The installation of new water pipework must conform to the guidance produced by Scottish Water. Currently, this is the Scottish Water UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (10/WM/03/21). These guidelines indicate that a desk study and specific chemical testing is undertaken along the proposed location and depth of the new water supply pipework. Therefore it is recommended that an intrusive investigation is undertaken along the line of any proposed new water supply pipework.

11.10. Material Re-use/Waste

During development works at the site it is likely that some site preparation activities will necessitate excavation of materials. If suitable for re-use (chemically and geotechnically) the materials can be re-used on site without a waste management exemption as there would be no intention to discard the material. If the material is not suitable for re-use or required treatment prior to re-use this introduces waste management issues.

Due to the nature of the site and review of historic mapping, it is anticipated that there will be made ground deposits encountered at the site associated with previous development and proposed demolition works. If these materials cannot be re-used onsite, they may require offsite disposal.

If the excavated material is deemed unsuitable for re-use and is destined for off-site disposal the waste status of the material will require to be determined and Waste Acceptance Criteria Testing carried out. All wastes destined for landfill must undergo some form of treatment. This can be as simple as sorting and segregation, which occurs in the case of most excavated wastes on construction sites anyway, but the fact that this has been done needs to be recorded. Sorting and segregation of the waste requires to be carried out under a mobile plant licence and therefore it is essential to ensure that the earthworks contractor is licensed for such activity.

If the intention is to treat excavated material to render it suitable for re-use this needs to be done under a mobile plant licence and the material that results from the treatment should conform to an appropriate recognised fill Specification. If the resulting material does conform to such a specification it is deemed to be a product and no longer a waste and can be re-used on site without the need for an exemption from waste management licensing.

If however the material does not conform to a recognised specification but is to be used anyway then an exemption from waste management licensing will be required prior to emplacement taking place.

11.11. Public Utilities

A full set of public utility plans were obtained for the site to identify the presence of any existing onsite services which could cause a constraint to the ground investigation works and future development works. Public utility provider BT identified overhead services within the site boundary. It should be noted public utility providers Scottish Water, SSE and SGN identified services within close proximity of the site boundary. A full set of public utility plans obtained for the site are included in [Appendix 6](#).

12.0 Conclusions

A Geo-environmental and Geotechnical Preliminary Investigation has been undertaken at a site located on Guthrie Street, Friockheim, currently present on site is the Lunan Park (Elderly Persons Home). National Grid Reference NO 59667 50055. The main findings and conclusions of this preliminary investigation are summarised below.

Geo-environmental/Contaminated Land Assessment

This preliminary investigation has identified potential pollutant linkages to future receptors at the site from potential sources of contamination associated with historic onsite and offsite developments ([Table 6](#)). These potential sources and pollutant linkages require to be investigated further and are briefly summarised below:

12.1. ACM's in Structures

Due to the age of onsite structures there is the potential that Asbestos Containing Materials (ACMs) are present within the structures. An Asbestos Demolition and Refurbishment Survey is required for all structures which are proposed to be demolished on site. All identified ACMs require to be removed from the buildings by a suitably licensed contractor prior to any demolition works.

12.2. Fuel Storage Tank and Pipework

A fuel storage tank with an approximate capacity of 5,000 Litres and pipework is present within the site. The approximate location of the historic tank is presented in Drawing [150141/9002, Appendix 1](#). There is the potential that fuels/oils have historically leaked from below storage tanks, associated pipework and filling point at the site. The potential presence of hydrocarbon contamination within site soils and groundwater from the spillage and leaking of fuel oils presents a potential pollutant linkage to receptors and requires to be investigated.

12.3. Made Ground

Made ground will be present at the site due to the previous onsite development. Due to the unknown origin of made ground deposits they have the potential to contain contaminants which present a risk to future receptors at the site.

The proposed development requires the demolition of the existing buildings at the site to allow the erection a new residential housing which will include associated access roads, car parking, infrastructure and landscaping. Therefore based on the above it is anticipated that majority of the existing site soils will remain capped below the existing building footprint or below the existing hard standings at the site.

A targeted intrusive ground investigation will be required where new buildings/structures are proposed at the site in accordance with BS5930:2015+A1:2020 and BS10175:2011+A2:2017 to investigate the above potential sources of contamination and quantitatively assess the risk to end users of the proposed development from potentially contaminated soils and groundwater.

12.4. Preliminary Ground Gas and VOC Vapour Risk Assessment

Due to the potentially contaminated made ground at the site containing hazardous gas and VOC vapour generating materials and the risk of hazardous ground gases and VOC vapours, including migrating to the site from offsite sources, the investigation requires to include ground gas and VOC vapour monitoring in accordance with CIRIA C665 and BS 8576:2013. The proposed development is likely to be a '*Residential*' end-use, which CIRIA C665 identifies as being a '*High Sensitivity Development*' however an undercroft car parking is proposed beneath the flatted structures which will vent most of the structure and therefore the requirement for gas protection will be limited to areas of the building footprint where the walls are in contact with the ground such as the stairwells and the townhouses.

Based on this and the identified potential sources of contamination, the overall site is considered to represent a '*Low Ground Gas Generation Potential*', in accordance with CIRIA C665. The ground gas investigation should therefore be designed accordingly and reassessed, if required, based on preliminary results.

12.5. Water Environment

Made ground is suspected to be present onsite. Therefore, it is possible that leachable contaminants within the made ground have leached/leaked into the underlying Groundwater Environment which presents a significant risk of significant harm to the Groundwater environment and requires further investigation.

Due to the location of the site and the fact that the closest surface water features are located within 50m from the site these surface water features are considered to be at risk from the potential sources of contamination at the site. As such the risk to Surface Waters from the site also requires to be investigated.

12.6. Buried Concrete

Elevated Sulphate concentrations and low pH levels in site soils have the potential to degrade buried concrete overtime and therefore, if applicable, pH and Sulphate testing of site soils will be required to specify an appropriate Exposure Class of buried concrete at the site in accordance with BRE Special Digest 1 (2005).

12.7. Water Pipework Material

The proposed redevelopment of the site will require the installation of new water supply pipework. In accordance with current Scottish Water UKWIR guidance where supply pipes are installed within '*Brownfield*' land there is a requirement for intrusive investigation and chemical analysis to be undertaken in order to assess if upgraded pipe material is required. At the time of writing, there are no final water supply pipework layout plans available for assessment. Therefore, if any proposed supply pipework is required in these previously developed areas, a UKWIR ground investigation may be required. **This assessment must be approved by Scottish Water prior to the installation of supply pipework at the site.**

Geotechnical/Engineering Feasibility Assessment

A detailed Preliminary Geotechnical Assessment of the proposed development at the site including foundations, earthworks, and drainage infrastructure is presented in [Section 11.0](#).

Recommendations

An Asbestos Demolition and Refurbishment survey is required for all structures which are proposed to be demolished on site.

It is recommended that a pre demolition ground investigation should be carried out in accordance with the guidance set out in BS 10175:2011+A2:2017 (Investigation of Potentially Contaminated Sites), BS 5930:2015+A1:2020 (Code of Practice for Ground Investigations), BS EN 1997-2:2007 (Ground Investigation and Testing), BS 8004:2015 (Code of Practice for Foundations), CIRIA C665 (Assessing Risks Posed by Hazardous Ground Gases to Buildings) and BS 8576:2013 (Guidance on Investigations for Ground Gas).

Further Reporting

Further phases of Geotechnical reporting are considered to be required for the development:

- The findings of the intrusive ground investigation works will require to be reported in a **Ground Investigation Report (GIR)** which should be compiled in accordance with BS EN 1997-1:2004+A1:2013; and
- All geotechnical design elements of the development (including foundations, roads, retaining walls, slopes and earthworks) should be detailed in a **Geotechnical Design Report (GDR)** which should be compiled in accordance with BS EN 1997-1:2004+A1:2013.

Further phases of Geo-environmental reporting will be required if contamination is identified at the site:

- A **Remediation Statement** which will identify all complete pollutant linkages present at the site and the required remedial works; and
- A **Verification Report** following the remediation works.

Appendix 1

Drawings

150141/9000	Site Location Plan
150141/9001	Preliminary Conceptual Model
150141/9002	Features Identified during Site Walkover
SK_002	Site Layout Sketch

Appendix 2

Desk Based Information

Envirocheck 298197036_1_1

Appendix 3

Principles of Environmental Risk Assessment

Principles of Environmental Risk Assessment

The Environmental Protection Act (1990), Part II A Contaminated Land (Section 57 of the Environment Act 1995), revised by Scottish Statutory Instrument No.658 (2005), and the Contaminated Land Regulations (1999) provide a basis on which to determine the risks and liabilities presented by a contaminated site. Contaminated Land is defined within Annex 3, Chapter A Part 1- Scope of Chapter and in all those Sections mentioned as:

“Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land that-

- (a) Significant harm is being caused or there is significant possibility of such harm being caused; or*
- (b) Significant pollution of the water environment is being caused or there is a significant possibility of such pollution being caused.”*

Section 57 of the Environment Act 1995 requires that any site identified as being “contaminated” by the Local Authority will be registered by them and remediation will be required to render the site fit for use.

The presence of contamination is not the sole factor for deciding whether a site is contaminated. Relevant parties should identify site-specific risks and provide objective, cost-effective methods to manage the contamination in a manner that satisfies the proposed end-use.

A risk-based approach, which takes both technical and non-technical aspects into consideration when making decisions on contamination resulting from past, present or future human activities, is advocated. The assessment of environmental risks generally relies on the identification of three principal elements forming a ‘pollutant linkage’:

- SOURCE:** the contaminant
- PATHWAY:** the route through which the contaminant can migrate, and
- RECEPTOR:** any human, animal, plant, water environment or property that may be adversely affected (harmed) by the contaminant

In the absence of any one of these elements, on any given site, there is no risk. Where all three elements are present, risk assessment is required to determine the significance of the harm that is being or may be caused. As outlined above, the terms of the Contaminated Land regime specify that remediation need only be implemented where a site is causing, or there is a significant possibility that it will cause, significant harm, or significant pollution to the water environment.

Development of contaminated land is usually addressed through the application of planning and development legislation and guidance (i.e. Planning Advice Note 33). The suitable for use approach is seen as the most appropriate to deal with contaminated land, taking account of environmental, social and economic objectives. The assessment is made in the context of the proposed land use (i.e. residential, retail, open-space and tourist developments).

Appendix 4

Site Walkover Photographs

Appendix 5

Statutory Consultations and Responses

Appendix 6

Public Utilities

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