

**Elsick Development Company
Limited**

**Proposed Residential Development at
Chapelton, Aberdeenshire**

**Phase 1A Geo-environmental
Interpretative Report**



FAIRHURST

CONTROL SHEET




CLIENT: Elsick Development Company Ltd.

PROJECT TITLE: Proposed New Community at Chapelton, Aberdeenshire

REPORT TITLE: Phase 1A Geo-environmental Interpretative Report

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This document has been prepared in accordance with procedure OP/P02 of the *Fairhurst Quality and Environmental Management System*

Executive Summary

This Report is a revision to the Report '72054- Phase 1A Geo-environmental Interpretative Report Issue 2' which was previously agreed to, in writing by Aberdeenshire Council. The Report is being updated in light of minor alterations to the development boundary and proposals.

Environmental

No contaminants were identified above recognised thresholds and therefore no envisaged Source-Pathway-Receptor relationships in the completed residential development from site soils.

No Gas Defence System is required for the development.

New dwellings must include '**Stage 1 Radon Protection Measures**' in accordance with BRE 376.

A low Oxygen environment has been identified at the site. Trenches and sub-surface excavations should be treated as a low Oxygen environment.

No upgrading of the water pipework will be required based on the analysis and the Desk Study which identifies that the site is '*Greenfield*'. Scottish Water should confirm this assessment.

Geotechnical

Shallow rockhead was encountered across the northern and central sections of the site. There may be a requirement for excavation into rock to allow installation of infrastructure.

Northern and Central Section Foundations

Conventional nominal reinforced concrete strip and pad footings of normal proportions bearing would be the preferred foundation solution.

Southern Section Foundations

Foundations in the Southern Section of the site should be set as high as possible. The bearing capacity of the natural materials should be improved and incorporation of a 300mm thick layer of compacted imported fill below the foundation. **Further investigation is required in this area by a suitably qualified engineer on a plot by plot basis.**

If the final development levels are raised above current levels the increased load may induce settlement within the silt/cohesive deposits. This should be assessed by a suitably qualified engineer following finalisation of the development levels.

The granular deposits are suitable for re-use as an engineering material with appropriate treatment. The silt/cohesive deposits are unlikely to be suitable for re-use as an engineering fill; however, they may be suitable in non-structural areas.

Buried concrete should be designed to **AC-2z, DS-1**.

In-situ CBR testing indicates low to moderate values (0.2%- 38.0%).

Materials removed from site must be disposed of at an appropriately licensed facility.

Groundwater was present at surface in the area adjacent to the Pheppie Burn. Surface water drainage in the area may be insufficient to allow these areas to drain. This may present a constraint both to the final development, if it is to remain at its current level and during construction excavations/development works.

The infiltration rates are generally '*very low*'.

There are additional potential geotechnical/engineering constraints that require cognisance in the future development of the site; these are identified in [Section 15.0](#) of the Report.

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Appendix 1:

Drawings

72054/9005	Preliminary Conceptual Site Model
72054/9014	Site Location Plan
72054/9027	Ground Investigation Location Plan
72054/9030	Surfer Plot of Depth to Rockhead
72054/9033	Geological Cross Sections
72054/9035	CBR Test Results
72054/9037	Updated Conceptual Site Model
72054/9038	Infiltration Test Results
72054/9039	Cohesive and Granular Superficial Deposits
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Figures

Figure 1	SPT 'N' Values vs. Level
Figure 2	'A-Line' Plasticity Chart

Appendix 2:

Fairhurst Geo-environmental Desk Study Report: Phase 1A Development Site Issue 1 (August 2011)

ERS Factual Report - Ground Investigation at Chapelton, Aberdeenshire (Phase 1A)

Fairhurst Phase II Ground Investigation Factual Report

Appendix 3:

Principles of Environmental Risk Assessment

Appendix 4:

Tier 1 Special Digest 1 – Concrete Specification (Table 17)

Appendix 5:

SEPA Guidance on the decommissioning of boreholes

Appendix 6:

Depth and Description of Obstructions (Table 6)

Appendix 7:

Fairhurst Report '72054- Phase 1A Geo-environmental Interpretative Report, Issue 2'

1.0 Introduction

Fairhurst were appointed by Elsie Development Company Limited (The Client) to prepare a Geo-environmental Interpretative Report for the Phase 1A site located at Elsie, Aberdeenshire (Centred at NO 8963 9366). A site location plan is presented in [Drawing 72054/9014](#), [Appendix 1](#).

This Report is being undertaken to assess the suitability of the site for the proposed Phase 1A development works ([Drawing 72054/9027](#), [Appendix 1](#)). In addition, this Report is being produced to support the Planning Application submitted (Ref: APP/2011/3103) relating to the proposed development works at the site.

This Report follows the Fairhurst Geo Environmental Desk Study Report: Phase 1A Development Site Issue 1 (August 2011) presented in [Appendix 2](#) where the requirement for further geotechnical and environmental investigation was identified.

This Report is a revision to the Report '72054- Phase 1A Geo-environmental Interpretative Report Issue 2' which was previously agreed to, in writing by Aberdeenshire Council. The Report is being updated in light of minor alterations to the development boundary and proposals.

1.1. Objectives

The specific objectives of this Report are as follows:

- A Summary of the site works undertaken;
- A Summary of the chemical and geotechnical laboratory testing undertaken;
- A Tier 1 Quantitative Risk Assessment of soil samples;
- A UKWIR Assessment of Water Pipework
- A Summary of in-situ CBR testing
- A Summary of Infiltration potential of the site soils
- A Summary of geotechnical and engineering constraints which could affect the proposed development;

This Report must be read in conjunction with the following Report which is presented in [Appendix 2](#):

- Fairhurst Geo-environmental Desk Study: Phase 1A Development Site Issue 1 (August 2011)

2.0 Proposed Development

It is proposed to develop the Phase 1A development site into a new settlement comprising 802 residential units, retail and commercial floorspace, civic buildings and associated landscaping, public open space, drainage and roads infrastructure and services. At the time of preparation of this document, the exact structural loadings of the proposed residential units are unknown, however based upon their proposed structural composition, are considered likely to exhibit low to moderate loadings. The proposed development layout is presented in [Drawing 72054/9027](#), [Appendix 1](#).

Outline Planning Permission for the Phase 1A development has been granted by the Aberdeenshire Council Planning Authority under Planning Reference APP/2011/3103, however it is noted that for detailed Planning Permission, the site is being split into smaller areas.

It is noted that the Phase 1A development comprises one phase of the overall Elsieck development which comprises eight development phases in total, comprising approximately 4050 residential units with public amenities.

3.0 Summary of Phase I Intrusive Investigation Works

3.1. Design Objectives

The Geo-environmental site investigation was designed in accordance with BS 5930 (Code of Practice for Site Investigation) and BS 10175:2011 (Investigation of Potentially Contaminated Sites).

- Table 1 identifies the '*environmental*' rationale of the ground investigation and;
- Tables 2a and 2b indicate the '*geotechnical*' rationale of the ground investigation.

Drawing 72054/9027, Appendix 1 presents the surveyed ground investigation positions.

Unfortunately access could still not be gained to the various properties which could not be accessed during the Desk Study.

Suites of chemical testing were undertaken on soils to assess the soil concentrations for the likely contaminants of the soil mass (based on historic reporting and likely contaminants of concern) and requirements associated with the proposed development. In addition, geotechnical testing (earthworks tests) was undertaken to confirm soil descriptions and assess the suitability for re-use in earthworks.

Table 1: Ground Investigation Rationale for Environmental Purposes

Position no.	Approximate Spacing	Contaminant Source	Pollutant Linkage	Receptor
WBH07-09	WBH07-09 targeted to location of Fuel Tanks	Onsite Fuel Tanks/ Pipework associated with Properties	Generation of ground gases from biological breakdown of spilled fuels. Inhalation of Ground Gas/ Vapours and accumulation of Ground Gas/Vapours within buildings and service conduits in buildings.	Humans (end users) Buildings/Services/ Utilities
WBH07-09 and TP21	WBH07-09 and TP20 targeted to location of Fuel Tanks	Onsite Fuel Tanks/ Pipework associated with Properties	Direct contact with aggressive soils	Buildings/Services/ Utilities
WBH07-09 and TP21	WBH07-09 targeted to location of Fuel Tanks	Onsite Fuel Tanks/ Pipework associated with Properties	Leaching/movement in pore space/ migration	The Water Environment
WBH01-06 and WBH14	WBH01-06 targeted to development boundary	Offsite Sources of Ground gas (Tank Farm*, Substation, Telephone Exchange, Garages, and adjacent residential properties)	Generation of ground gases from biological breakdown of spilled fuels. Inhalation of Ground Gas/ Vapours and accumulation of Ground Gas/Vapours within buildings and service conduits in buildings.	Humans (end users) Buildings/Services/ Utilities
WBH010-12	WBH10-12 targeted to natural alluvial material	Natural alluvial material	Generation of ground gases from biological breakdown of natural alluvial material. Inhalation of Ground Gas and accumulation of Ground Gas within buildings and service	Humans (end users) Buildings/Services/ Utilities

			conduits in buildings.	
WBH06 and TP01, 02	Targeted to infilled Dam	Made Ground	Dermal contact/ inhalation/ ingestion of contaminated soils	Humans (end users)
WBH06	Targeted to infilled Dam	Made Ground	Generation of ground gases from Made Ground. Inhalation of Ground Gas/ Vapours and accumulation of Ground Gas/Vapours within buildings and service conduits in buildings	Humans (end users) Buildings/Services/ Utilities
TP01, 02 and WBH06	Targeted to infilled Dam	Made Ground	Direct contact with aggressive soils	Buildings/Services/ Utilities
WBH06**	Targeted to infilled Dam	Made Ground	Leaching/movement in pore space/ migration	The Water Environment
CBR01, 05, 09, 13, 17, 21, 25, 29	Along road and service line at the depths below existing ground level identified in Drawing 72054-9035	Made Ground	Direct contact with contaminated soils/ aggressive soils	Water Supply Pipe

*The Tank Farm (1977-1980) was incorrectly identified in the Desk Study as an onsite source due to a change in boundary

**WBH06 was located as close to the adjacent offsite Dam structure as possible. No borehole could be positioned closer than this to the Dam or positioned down groundwater gradient due to land ownership.

Table 2a: Ground Investigation Rationale for Geotechnical/Engineering Purposes (Positions within Red Line boundary)

Position no.	Approximate Spacing	Rationale
WBH01 - 18	Phase 1A site to 5mbgl	Gather information relating to ground conditions. Assist with design of proposed development. Allow in-situ testing (SPT's at 1.0m intervals) and obtain samples of the underlying deposits. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess settlement potential of the materials. Obtain information of the groundwater regime. Assess depth to rockhead.
TP01 – 20 TP22 – 61	75m offset Herringbone Grid 235 Development to 4mbgl	Gather information relating to ground conditions. Assist with design of proposed development. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess settlement potential of the materials. Assess depth to rockhead.
TP62 – 64	Proposed Access Road to 4mbgl	Gather information relating to ground conditions. Assist with design of proposed access road. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess settlement potential of the materials. Assess depth to rockhead.
TP01, 02 and WBH06	Targeted to Infilled Dam 4mbgl and 5mbgl	Gather information relating to ground conditions. Assist with design of proposed development. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess settlement potential of the materials. Assess depth to rockhead.
TP03 – 15 and WBH10, 11, 12	Targeted to Area of Alluvium 4mbgl and 5mbgl	Gather information relating to ground conditions. Assist with design of proposed development. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess settlement potential of the materials Assess depth to rockhead.
TP15 – 17 WBH05	Targeted to Area of material to be excavated for SUDS system	Gather information relating to ground conditions. Assist with design of proposed development. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials

	4mbgl and 5mbgl	Assess the 'reusability' of the underlying materials Assess settlement potential of the materials. Assess depth to rockhead.
SA01 to SA13	In areas for proposed infiltration	Undertake BRE 365 Infiltration Testing to assess permeability of underlying deposits Gather information relating to ground conditions. Assist with design of proposed development. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess settlement potential of the materials Assess depth to rockhead.
CBR01-51	Along potentially adopted roads	Allow in-situ and ex-situ testing (CBR's at a depth of 0.3mbgl or immediately below topsoil and at 0.6mbgl) and obtain samples of the underlying deposits.

Table 2b: Ground Investigation Rationale for Geotechnical/Engineering Purposes (Positions Outwith Red Line boundary)

TP58 – 60 TP65 – 84	Line of Proposed Rising Main to 4mbgl	Gather information relating to ground conditions. Assist with design of proposed rising main. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess depth to rockhead.
TP85-87	Initial Proposed Water Pumping Station	Gather information relating to ground conditions. Assist with design of initial proposed water pumping station. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess depth to rockhead.
TP88-90	Proposed Water Pumping Station	Gather information relating to ground conditions. Assist with design of proposed water pumping station. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess depth to rockhead.
QTP01-07	Proposed Borrow Pit	Gather information relating to ground conditions. Assist with design of proposed borrow pit. Characterise in-situ density and strength of the natural deposits. Assess the 'digability' of the underlying materials Assess the 'reusability' of the underlying materials Assess depth to rockhead.

4.0 Summary of Phase II Intrusive Investigation Works

4.1. Design Objectives

The Geotechnical site investigation was designed in accordance with BS 5930 (Code of Practice for Site Investigation) and the Scots National Roads Development Guide (NRDG). The primary focus of the investigation was to identify the site geology and obtain CBR values along the route of proposed roads to permit roads construction design.

- Table 3 indicates the '*geotechnical*' rationale of the ground investigation.

Drawing 72054/9027, Appendix 1 presents the surveyed ground investigation positions.

Table 3: Ground Investigation Rationale for Geotechnical/Engineering Purposes

Position no.	Approximate Spacing	Rationale
TP01 – 49	25m centres along routes of proposed roads	Gather information relating to ground conditions. Assist with design of proposed access roads (in accordance with NRDG). Characterise in-situ density and strength of the natural deposits. Assess the ' <i>digability</i> ' of the underlying materials Assess depth to rockhead.

5.0 Intrusive Investigation Works Undertaken (Phase I Investigation)

5.1. Intrusive Investigation

The intrusive investigation was undertaken by ERS Land Regeneration Ltd ('The Contractor') between the 9th January and 6th of February 2013.

A summary of the works undertaken is provided below. The contractors Factual Report is presented in [Appendix 2](#).

An exploratory location plan is presented in [Appendix 1](#) (Drawing 72054/9027, [Appendix 1](#)).

5.1.1. Boreholes

Eighteen (WBH01-WBH18) light hydraulic percussion boreholes were formed to depths of 0.50mbgl and 3.80mbgl employing a Dando Terrier Rig and temporary steel casing. None of the boreholes reached their intended depths of 5.00mbgl due to encountering obstructions (described by the contractor as '*probable weathered bedrock*'). WBH04-WBH15 were installed with groundwater level monitoring standpipes (50mm HDPE). WBH01-03 and WBH16-18 were not installed with groundwater level monitoring standpipes due to shallow rockhead being present. WBH06 was located approximately 10m north of the proposed position, adjacent to the offsite Dam structure, due to waterlogged ground conditions encountered during the investigation in this area. No borehole could be positioned closer than this to the Dam or be positioned down groundwater gradient due to land ownership. Exploratory borehole logs are presented in [Appendix 2](#).

5.1.2. Trial Pits

Ninety-seven trial pits (TP01-TP90 + QTP01-QTP07) were mechanically excavated employing a 13T Tracked Excavator to depths between 0.30mbgl and 3.40mbgl. The trial pits did not reach their scheduled depth (maximum reach at 4.00mbgl) due to encountering obstructions (described by the contractor as '*probable boulder or bedrock*'). TP01 and TP02 were located approximately 10m north of the proposed position, adjacent to the offsite Dam structure, due to waterlogged ground conditions encountered during the investigation in this area. Exploratory trial pit logs are presented in [Appendix 2](#).

5.1.3. Infiltration Testing

Thirteen infiltration tests (SA01-SA13) were undertaken in accordance with BRE 365. The Results are summarised in [Table 9](#) and discussed in [Section 7.0](#). The infiltration test logs and result of the tests are presented in [Appendix 2](#).

5.1.4. In situ CBR testing

Forty-six in-situ California Bearing Ratio tests were undertaken at depths between 0.30mbgl and 0.60mbgl in CBR02, CBR04, CBR06, CBR08, CBR10, CBR12, CBR14, CBR16, CBR18, CBR20, CBR22, CBR24, CBR26, CBR28 & CBR30-CBR51. The Results are summarised in [Tables 26](#) and [31](#) and discussed in [Section 15.0](#). The results of each test are presented in [Appendix 2](#).