

Contaminant	Effect	Measured Concentrations in Excess of SGV/GSV/SSL (mg/kg)	Measured Exceedence Concentrations (mg/kg)	SGV/GSV/SSV (mg/kg)	Source
		Made Ground	Made Ground		
Chrysene	Toxic	0 out of 3	-	585	ATRISK
Benzo(b)fluoranthene	Toxic	0 out of 3	-	7.72	ATRISK
Benzo(k)fluoranthene	Toxic	0 out of 3	-	84.4	ATRISK
Benzo-a-pyrene	Toxic	0 out of 3	-	0.818	ATRISK
Dibenz(a,h)anthracene	Toxic	0 out of 3	-	0.838	ATRISK
Indeno(1,2,3-CD) Pyrene	Toxic	0 out of 3	-	7.31	ATRISK
Benzo(g,h)perylene	Toxic	0 out of 3	-	96.1	ATRISK
Asbestos	Toxic	0 out of 3	-	Detection	HSE

6.1.2 The GORA has identified the no contamination exceedences within the made ground samples analysed from the site.

## 7.0 WATER ENVIRONMENT RISK ASSESSMENT

### 7.1 WATER ENVIRONMENT SENSITIVITY SETTING

- 7.1.1 Based on the desk study information, the main water environment receptors with regards to the subject site are considered to be the underlying drift and solid aquifers.

### 7.2 GROUNDWATER CONTAMINATION

- 7.2.1 No samples could be retrieved from the boreholes due to lack of recharge. This further indicates that the boreholes recorded localised perched or flooded conditions. In such circumstances a shallow groundwater table is not considered to be present at the site.

### 7.3 GROUNDWATER ASSESSMENT

- 7.3.1 Following SEPA Position Statement WAT-PS-10-01, Assigning Groundwater Assessment Criteria for Pollutant Inputs (2010), the following assessment should be carried out for potential pollutant linkages to the water environment:
- 1) Assess which receptors (including surface / coastal waters, wetlands, potable water extractions, and future drinking water potential) may be affected by contamination sources.
  - 2) For potential pollutant linkages, assess contaminant concentrations against relevant screening values at the recommended assessment point, taking into consideration mixing and upstream/upgradient concentrations, where appropriate.
  - 3) Evaluate whether remedial measures would be either disproportionately costly, a risk to other receptors, or cause deterioration of the natural environment.
- 7.3.2 In this case the presence of due to the absence of a shallow groundwater body the potential risk to the wider water environment is considered to be low.

## 8.0 GROUND GAS EMISSIONS

### 8.1 GENERAL

8.1.1 A ground gas assessment has been undertaken to assess risks associated with carbon dioxide and methane to new buildings and their users. The results obtained have been compared with relevant guidance that includes the following:

- Assessing risks posed by hazardous gases to buildings, CIRIA Report C665, 2007;
- Guidance on Evaluation of Development proposals on sites where methane and carbon dioxide is present NHBC/RSK-2007

### 8.2 GROUND GAS – RESULTS

8.2.1 Ground gas monitoring was undertaken at the site on five occasions. The monitoring was undertaken using a portable gas meter.

8.2.2 Measurements were taken over a variety of atmospheric conditions, including falling pressure conditions, with barometric pressure ranging from 975 to 1006 mB. No elevated concentrations of methane or carbon dioxide gas were recorded at the site. No positive flows were recorded the boreholes.

8.2.3 It should be noted however that shallow water was observed at levels that may have interfered with the flow of ground gas in the boreholes during the monitoring period.

### 8.3 GROUND GAS – ASSESSMENT

8.3.1 Gas Screening Values (calculated as the maximum gas concentration (% v/v) multiplied by the borehole flow rate (l/h)) have been calculated in line with CIRIA 665 guidance. A maximum GSV of 0.01% was calculated. This does not exceed the 0.07% limit for Characteristic Situation 1. However it is noted that the made ground was relatively thick in placers and did contain organic material which could potentially produce ground gas in the future. Hence it is considered prudent to move the Characteristic Situation up one class to Characteristic Situation 2.

Characteristic Situation (CIRIA 149)	Partners in Technology Gas Regime (DETR 1997)	Limiting Borehole Gas Volume Flow (CH <sub>4</sub> or CO <sub>2</sub> (l/hr))	Additional Limiting Factors	Typical Source of Generation
1	A	<0.07	Methane not to exceed 1% by volume and carbon dioxide not to exceed 5% by volume	Natural soils with low organic content. 'Typical Made Ground'
2	B	<0.7	Borehole air flow rate not to exceed 70 l/hr, otherwise increase to CS3.	Natural soils with high peat/ organic content. 'Typical Made Ground'
3	C	<3.5	None	Old landfill site, inert waste or flooded mineworkings.
4	D	<15	Quantitative risk assessment required to evaluate scope of protection measures.	Mineworking (susceptible to flooding), completed landfill, inert waste (WMP266B criteria).
5	E	<70	None	Flooded mineworkings.
6	F	>70	None	Recent landfill site.

- 8.3.2 In such circumstances a 2000 gauge DPM with sub-floor venting should be installed within the proposed buildings.
- 8.3.3 Radon is not considered a risk at the site and no protection measures are required in this regard.



## 10.0 REVISED CONCEPTUAL SITE MODEL

### 10.1 CONTAMINATION SOURCES

<b>Human Health:</b>	No exceedences were observed in relation to the proposed future use with respect to contamination at the site.
<b>Water Environment:</b>	No pervasive shallow groundwater was recorded at the site.
<b>Ground Gas:</b>	Gas protection measures will be required at the site.
<b>Built Environment:</b>	Representative samples analysed for pH and sulphate are below BRE thresholds.
<b>Plant Life:</b>	Phytotoxic contaminants have not been noted at concentrations above MAFF guidance.

### 10.2 POLLUTANT LINKAGE ASSESSMENT

- 10.2.1 Based on the ground and groundwater contamination conditions noted at the site, viable source-pathway-receptor pollutant linkages have been identified and the conceptual site model can be revised as indicated in Drawing No G2012/356/SI/R/F/10.

### 10.3 MITIGATION MEASURES

#### Ground Gas

- 10.3.1 Remedial measures are required possible future gas emissions at the site. These will include the following:

- Inclusion of a 2000 gauge DPM and sub-floor venting within the buildings at the site.

#### Construction/Maintenance Workers

- 10.3.2 No contamination was recorded which would represent a specific risk to groundworkers. Should potentially contaminated material be encountered during site works, further testing may be required to assess the risk to health and safety of the site workers and the environment.

- 10.3.3 Good site working practices should be followed, including:

- Use of appropriately qualified personnel for the task;
- Use of appropriate PPE;
- Provision of on-site washing facilities;
- Maintenance of a high standard of basic hygiene; and
- Implementation of a non-smoking and eating policy within the working area, with designated clean areas set aside for these activities.

### 10.4 WASTE MANAGEMENT LEGISLATION

- 10.4.1 Should materials be removed and disposed off-site, the developer has a statutory responsibility under the Duty of Care Regulations of the Environmental Protection Act 1990 to ensure that contaminated soil and water is disposed of off-site to a suitably licensed waste management facility in a safe and approved manner.
- 10.4.2 Waste Acceptance Criteria (WAC) testing should be required to determine the limit values for waste destined to various classes of landfill.

NOTES

REV DATE DETAILS

PRO-CONSTRUCTION LIMITED  
4 MOUNTBATTEN PLACE  
ROSYTH  
KY11 2HL

PROJECT TITLE

GREYRIGGS  
CALIFORNIA, FALKIRK

DRAWING TITLE

REVISED CONCEPTUAL  
SITE MODEL

DRAWN BY

PM

CHECKED BY

DATE

06.05.13

X-SHALES

Not to Scale

PROJECT NO

G2012/156

DRAWING NO

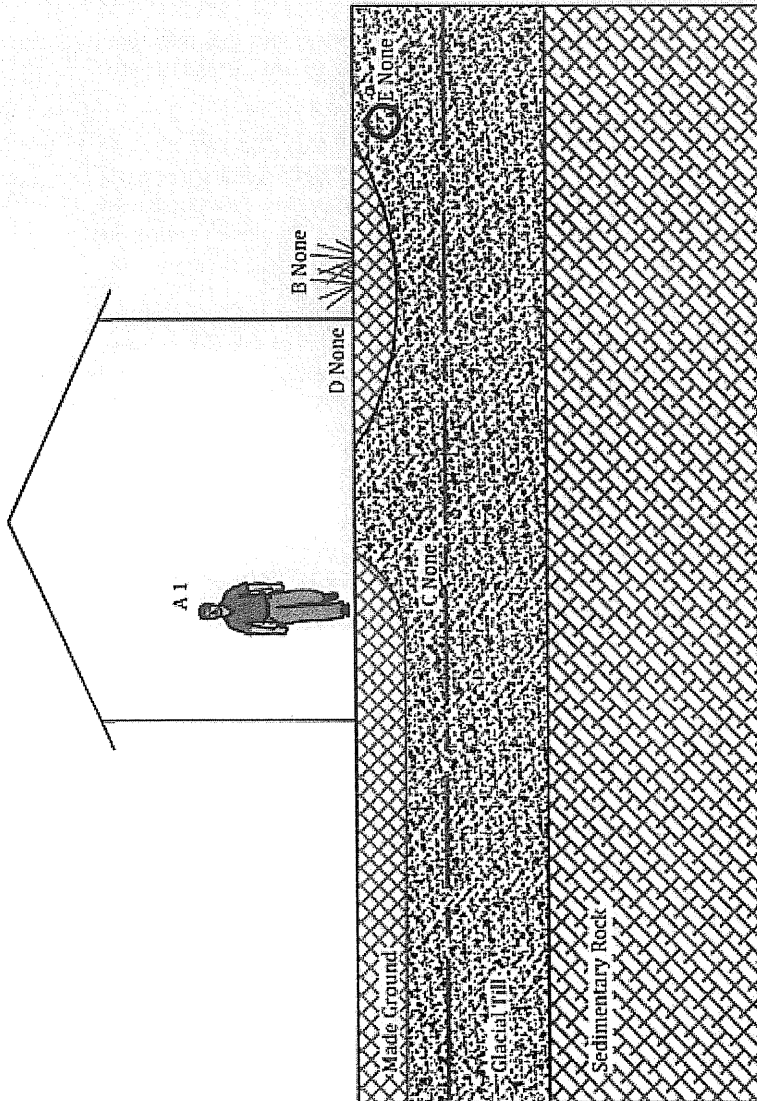
G2012/156/SU/R/F/10

REVISION

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#### Receptors

- Site users / construction personnel.
- Vegetation / fauna.
- Groundwater / surface water.
- Buried concrete (Service and foundations)
- Plastic water supply pipes.

#### Exposure Pathways

- Inhalation of ground gases.

#### Source

- Made ground.  
(Possible gas from organic material).

- 10.4.3 To comply with the Duty of Care all wastes taken off site, in solid or liquid form, must be handled by a registered waste carrier and be accompanied by a consignment note which describes the waste.
- 10.4.4 Should development plans include the removal of materials, the proposed remedial strategy plan should include details of proposed frequency and assessment standards for the waste disposal strategy.
- 10.4.5 In the event that material, uncharacteristic to that which has been previously identified within the site is encountered, we would recommend that a suitably qualified engineer/scientist obtain samples of the suspect material for chemical analysis, thus determining how the material should be managed.

#### 10.5 CONTINGENT LIABILITIES

- 10.5.1 Assessments of the site include the determination of contingent liabilities in respect of current and future ownerships subsequent to remedial measures. These consider the impact of the environmental conditions on the study area and surrounding areas on users and properties and the liability of the site owners.
- 10.5.2 With regard to site users, considerations in relation to liability are inherent in the development of a suitable remedial strategy. In the site-specific circumstances presented by the identified conditions, the risk levels suggest minimal liability on ownership due to the environmental conditions, subsequent to development.
- 10.5.3 The potential for liability arising from site conditions impacting on the surrounding environment largely considers the potential for migration of pollutants beyond the site boundary normally associated with groundwater. No significant or pervasive shallow groundwater was encountered and therefore the potential for contaminants to migrate beyond the site boundary was considered to be low. Therefore, the potential for liability arising from the site conditions is considered to be low following development of the site.
- 10.5.4 In the event that more definitive advice is required, we would recommend that the Client seeks specific advice on the liabilities incumbent on ownership from their legal advisors.

## **11.0 FOUNDATION RECOMMENDATIONS**

### **11.1 DETAILS OF THE DEVELOPMENT**

- 11.1.1** It is understood that the proposed development will comprise of one and a half storey buildings.

### **11.2 FOUNDATIONS**

- 11.2.1** It is recommended that foundation loads be transferred to depths in the region of 1m to 2.5m to the firm or better quality glacial till is present from current ground level where a bearing capacity of 75kN/m<sup>2</sup> to 100kN/m<sup>2</sup> could be achieved.
- 11.2.2** Consideration to the possible presence of shallow water should be considered. In addition the possible presence of large boulder obstructions should be noted.
- 11.2.3** All foundation excavations should be inspected by a suitably qualified geotechnical engineer or engineering geologist to ensure the recommendations provided are followed.