

**Development at
261 Graig Road
Godre'r-graig**

Land Quality Assessment

Report Number 1642r1v1d1116

Commissioned by

Mr & Mrs Jones
7 Railway Terrace
Cwmllynfell
Swansea
SA9 2GP

Prepared by

Geotechnology Ltd
Ty Coed
Cefn-yr-Allt
Aberdulais
Neath
SA10 8HE



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1 INTRODUCTION

Mr & Mrs Jones are currently seeking a planning consent for the construction of a single detached residential property adjacent to 261 Graig Road, Godre'r-graig. As part of pre-application discussions with the Local Planning Authority (Neath Port Talbot County Borough Council) two specific aspects have been identified as requiring consideration; land quality and land stability. Within this context, Mr & Mrs Jones have requested Geotechnology Ltd to prepare a report to deal with each of these aspects. This report deals solely with the land quality aspects as a Technical Note on the ground stability has already been prepared and submitted to the LPA.

Summary details of the proposed development are provide in Table 1-1. Figure 1 shows the site location.

Table 1-1 Summary of Proposal

Name of Applicant	Mr and Mrs H Jones
Location of Development	Adjacent to 261 Graig Road, Godre'r-graig
Description of Current Proposals	Single detached residential dwellings
Grid Reference at centre of site	274839 206677

1.1 Scope of Work

The Local Planning Authority expects a phased approach towards land quality to be adopted with the first stage comprising a Phase I Desk Study, development of Conceptual Site Model (CSM) and Preliminary Risk Assessment (PRA). The objective of this initial report is therefore to identify and assess potential site hazards and to determine what actions are required, if any, for a subsequent Phase II investigative phase of work. This Phase I report has been compiled through desk study review of selected third party information and a site walkover. Prior to undertaking any Phase II intrusive work or monitoring, the Local Planning Authority should be consulted and the approach agreed.

2 DEVELOPMENT PROPOSALS

Mr and Mrs Jones are planning to construct a two storey property, though because the ground is sloping the rear of the ground floor will be cut into the hillside such that the rear of the property appears to be single story whilst the front elevation is double storey. The ground floor will include a garage and will be built with a retaining wall to the rear; this could be either a freestanding retaining wall with an offset to the rear wall of the property or it could be a single wall designed with the capability to be both a retaining wall and the rear wall of the property. This decision will be deferred to the technical design stage prior to Building Regs submissions.

Foundations are likely to comprise a raft which incorporates the rear retaining wall and therefore the detailing of the damp/gas proof membranes will be straightforward.

3 THE SITE

3.1 Location

The site is located in an established residential area of the Upper Swansea Valley, between Pontardawe and Ystalyfera. Located on the western side of the valley, the site is located on the northern side of Graig road.

3.2 Environmental Setting

The site slopes to the east, towards the base of the valley where the River Tawe flows from northeast to southwest.

Reference to the Geological Map for the site, SN 70 NW, shows the site to be surrounded by superficial material that are glacial in origin (see Figure 2). This material comprises Glacial Sands and Gravels which may be overlain by Glacial Head Material (Colluvium). The boundary showing the extent of the Colluvium is close to the site but indefinite and this material may or may not be present beneath the site. The Glacial Deposits are indicated to overlie bedrock comprising Llynfi Sandstones, Llynfi Beds, Lower Penant Measures, Upper Coal Measures in Age.

The conjectured subcrop position (proven in parts) of the Upper Welsh Coal Seam is shown to crop directly upslope of the site and will not, therefore, underlie the site at shallow depth. Mine entries are positioned along a proven section of the crop of this seam southwest and upslope of the site. No other coal seams are anticipated to underlie the site at shallow depth.

A deposit of waste referred to as Cilmaengwyn Waste Tip is recorded by the Environment Agency on the 'What's in Your Backyard' website. Unfortunately, no details are available on the website regarding the age of the tip or the type of waste deposited. All that is known is the the tip is approximately 240m to the northeast of the site and some 50m higher in elevation. The tip ceased operation in the 1960s. Interestingly, on the geological plan published in 1962 the same tip is indicated as a coal tip, as shown on Figure 2.

3.3 Current Land Use

The site is currently undeveloped land partly under tree cover: it is a greenfield site, though it is bounded on both sides by existing houses.

3.4 Surrounding Land Use

The site is located in a well-established residential settlement that straddles either side of Graig Road.

3.5 Previous Land Use

Early edition Ordnance Survey maps confirm that there have been no previous site uses and that the site has been wooded undeveloped land since published records have been provided.

3.6 Site Walkover

Geotechnology has carried out a site walkover on 10 October 2016.

At the time of the site inspection (10 October 2016) weather conditions had been dry for approximately 2 weeks. Despite this, a small flow of water (0.5 litres/second) was seen running into the site from the north. It appears that water which flows over the ground to the northeast and upslope of the site has been entrained and discharges through a pipe onto the land. This does not appear to be an established water course on historic mapping.

During the site inspection, the soils beneath the site were examined in a series of excavated faces that are present across the site at various locations. The in-situ soils appear to be a mixture of colluvium (finer grained soils near the ground surface caused by hill-wash processes and underlying Glacial Till). The Till is colloquially referred to as boulder clay and its characteristics at this site are consistent with this description, a stony clay with increasing stone content with depth. The finer grained near surface soils seem more permeable as seepages can be seen at the base of the finer deposits above the boulder clay. There were no visual or olfactory signs of contamination or previous land development.

There were, during the inspection, a series of excavations onto the ground and a detailed examination revealed that the soil beneath the site comprises natural in-situ Glacial Till.

The vegetation was seen to be in good health and was not exhibiting any evidence of die back as might be expected if the ground was subjected to migrating landfill gas.

3.7 Implications for Assessment

- There are no identified sources of historical land contamination on site. The exposed ground at the site shows no obvious visual or olfactory signs of anthropogenic activity and is considered greenfield.
- There is one potential source of ground gas in the area; Cilmaengwyn tip some 240m to the northeast and at a higher elevation. From the information reviewed there is some uncertainty over the nature of the material placed in the tip. For the purposes of this assessment the tip has been prudently assumed to contain materials that could produce landfill gas and that the waste was deposited until the 1960s.
- The site is underlain by a sequence of low permeability strata and their presence at surface has been confirmed.

4 CONCEPTUAL SITE MODEL AND PRELIMINARY RISK ASSESSMENT

The information gathered and reviewed during the desk study has been used to develop a preliminary conceptual site model. The conceptual model shows the possible relationship between site receptors and the pathways via which they may be exposed to identify on-site and off-site hazards. The conceptual model and preliminary risk assessment is used to determine if further Phase II site investigation of the exposure pathways is required at a later date.

4.1 Methodology

The preliminary assessment is based on identifying plausible exposure pathways through the use of a tabulated conceptual model based upon the standard source (hazard)–pathway–receptor model. The approach enables the pathways via which human, environmental and infrastructure receptors may be exposed to hazards. If one element of the source – pathway – model does not exist there is no risk. If a pathway exists that potentially links the hazard to the receptor then there is a risk that requires evaluation, management and potentially mitigation.

For each plausible exposure pathway identified, the probability and consequence of the event occurring has been qualitatively evaluated. The magnitude of probability (i.e. likelihood) takes into account both the presence of the hazard and receptor and the integrity of the pathway. The magnitude of the potential consequence (i.e. severity) takes into account both the potential severity of the hazard and the sensitivity of the receptor. The overall magnitude of risk associated with an exposure pathway is the product of the probability and the consequence associated with the event. Therefore, the overall magnitude of risk can be summarised as follows:

$$\text{Magnitude of Risk} = \text{Probability} \times \text{Consequence}$$

In order to assess each pathway the magnitude of the consequence (i.e. severity) and the magnitude of the probability (i.e. likelihood) has been determined. To ensure this process is transparent and repeatable the terms used to define the magnitude of the consequence and probability is defined in Table 4-1 and Table 4-2. These terms are based on those used to describe the risks potentially posed by land contamination and have been adapted from those presented in the document *NHBC and Environment Agency 2008. Guidance for the Safe Development of Housing on Land Affected by Contamination*.

Table 4-1 Classification of Consequence

Classification	Definition
Severe	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Catastrophic damage to crops, buildings or property.
Medium	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.
Mild	Exposure to human health unlikely to lead to "significant harm". Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce. Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population. Minor damage to crops, buildings or property.
Minor	No measurable effect on humans. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.
Uncertain	Further assessment potentially required to evaluate exposure pathway.

Table 4-2 Classification of Probability

Category	Definition
High likelihood	There is pollutant linkage and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.
Likely	There is pollutant linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low likelihood	There is pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place, and is less likely in the shorter term.
Unlikely	There is pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.
Uncertain	Further assessment potentially required to evaluate exposure pathway.

For each exposure pathway the overall magnitude of risk is defined by the product of the probability and consequence as shown in Table 4-3. The risk categories are defined in Table 4-4.

Table 4-3 Classification of Risk

		CONSEQUENCE			
		Severe	Medium	Mild	Minor
PROBABILITY	High likelihood	Very high risk	High risk		Low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low Likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Table 4-4 Description of Risk Classes

Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action OR there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to be site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.
High risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realisation of the risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term.
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term.
Low risk	It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst, that this harm if realised would normally be mild. It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.
Very low risk	It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.
No potential risk	There is no potential risk if no pollution linkage has been established.

4.2 Source Characterisation

The desk study has identified that the site has not been subject to previous development and is located in a well-established residential setting. Based on this study and walkover there are several lines of evidence which indicate that the existing land quality is not likely to be impacted. Based on the available information the only following credible on or off-site hazard currently identified from the information available is:

- Potential migration of ground gas from Cilmaengwyn tip

This hazard is prudently included in the preliminary risk assessment.

4.3 Receptor Characterisation

Based upon the current site development plans three distinct potential receptor groups are identified:

- Future site users, visitors and construction workers.
- Flora and Fauna in proposed landscaped areas.
- Building materials and site development infrastructure.

The potential pathways connecting the identified sources and receptors are discussed further in the CSM and PRA.

4.4 Conceptual Site Model

Based upon the information gathered to date an initial conceptual site model, identifying the source-pathway-receptor linkages, has been produced. At this stage, the model is in the form of a table that summarises the potential risks (exposure pathways) that may be present at the site. The current conceptual site model is summarised in Table 3-5.

4.5 Preliminary Risk Assessment

Based upon the potential exposure pathways identified in the conceptual site model, a preliminary risk assessment has been completed that assesses each pathway in terms of its credibility, the likelihood of the exposure occurring and the consequence of the exposure to the identified receptor. The assessment also considers where there is uncertainty that should be addressed by further investigation. This preliminary risk assessment is also presented in Tables 3-5 for each identified exposure pathway.

Geotechnology considers that there are no credible pathways linking the potential source of ground gas at Cilmaengwyn Tip and the identified receptors at the site. This conclusion has been reached by consideration of each element of the risk assessment and several direct and indirect lines of evidence.

4.5.1 Gas source

The migration of ground gas and vapour from a ground source is primarily controlled by pressure gradients. Diffusive transport is typically much lower than pressure-driven flow. Driven by pressure gradients, flow will principally migrate along paths of least resistance. Within a landfill or area of infilled land, gas generation and migration pathways will be determined by various factors such as the age of the waste, moisture content, type of waste, degree of compaction, and presence of infrastructure such as monitoring wells.

The gassing potential of the original and remaining waste at Cilmaengwyn tip is uncertain as two reliable sources suggest two alternate wastes have been placed. Irrespective of the nature of the that is actually present, the available information indicates that the waste has been in place for some 50 years. Therefore, as biodegradation potential diminishes with time, if gas evolution is still ongoing it is likely to have a very low flux. Also, as the tip was primarily developed as a landraise at a higher elevation than the site, any gas present may potentially escape to the atmosphere. Given an easier route of venting to atmosphere there is little prospect of subterranean migration from the off-site sources identified.

4.5.2 Gas Migration

Should gas or vapours be generated from Cilmaengwyn tip, there is little prospect that these would migrate to the proposed development as the ground at the site, and between the site and the tip, comprises low permeability geological deposits. As a consequence there are easier ways for any gas to vent to atmosphere.

Table 4-5 Conceptual Model of Potential Linkages between Human Receptors and Hazards

Conceptual Site Model			Preliminary Risk Assessment			
Receptor	Source Hazards	Hazard Exposure Pathway	Probability of event occurring	Consequence of event occurring	Overall Risk	Recommendations for Subsequent Phase II Investigation
Human Health (future users, visitors and maintenance workers)	Migration of ground gas from Cilmaengwyn Tip into residential property	Indoor inhalation of gases leading to asphyxiation	Pathway not considered credible			No further investigation considered necessary
Flora and Fauna	Migration of ground gas from Cilmaengwyn Tip into rooting zone of landscaped areas	Potential adverse impact on landscape plants	Pathway not considered credible			
Built Environment	Migration of ground gas from Cilmaengwyn Tip into poorly ventilated parts of residential property	Accumulation of ground gases above explosive limits	Pathway not considered credible			

The property is to be constructed such that the over ground structural elements are protected from capillary water by a damp-proof membrane linked to a damp proof course. In this case however, the upgrading and redetailing of the DPC/DPM can make the layer gas-tight as well as water tight. To address any small residual risks to the property and its occupants, a DPM of 2000 gauge will be used. The membrane will be carefully jointed with a proprietary taped jointing system to produce gas-tight joints between sections of DPM and between the DPM and pipe penetrations.

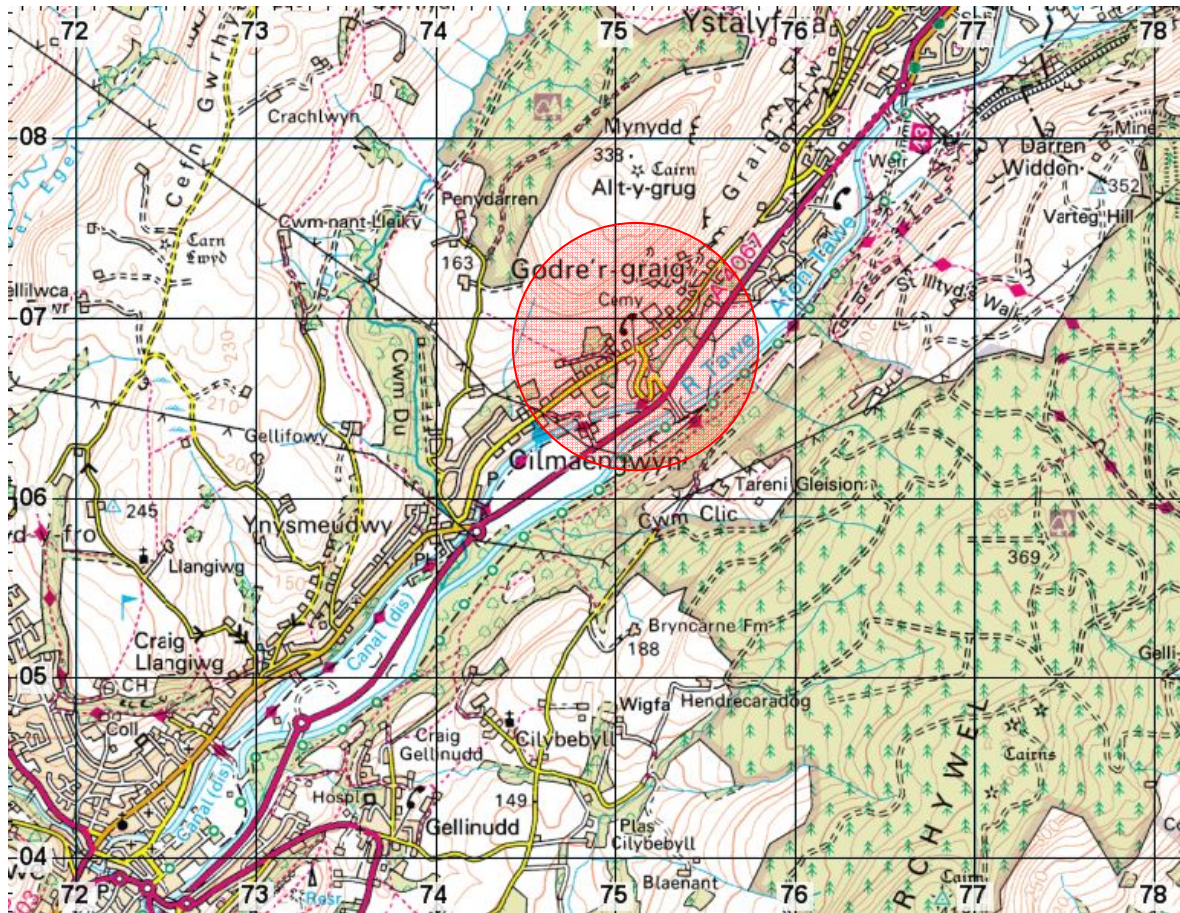
5 SUMMARY AND CONCLUSIONS

5.1 Land Quality

Potential concerns over ground gas migration from Cilmaengwyn tip have been evaluated. The assessment has concluded that there is no credible pathway. On this basis, no specific ground gas protective measures are required although the development will be utilising 2000g DPM during foundation construction. Based on the available information there are not likely to be any credible land quality concerns that should impact the proposed development.

This assessment should be reviewed if information becomes available that could alter this conclusion.

Figure 1 Site Location Plan



Reproduced from the Ordnance Survey Land Ranger Map
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1642r1v1d1116 Figure 2 **Scale As Shown**





Geotechnical &
Environmental Services

Ty Coed
Cefn-yr-Allt
Aberdulais
Neath SA10 8HE

T 01639 775293
F 01639 779173

enquiries@geotechnology.net
www.geotechnology.net