PROPOSED RESIDENTIAL DEVELOPMENT
MAES-Y-GWILOG FARM, SKEWEN

Mr KEITH MILLER

PHASE ONE HYDROGEOLOGICAL ASSESSMENT

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FIGURE 1 Site Location Plan

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GENERAL NOTES

1.0 INTRODUCTION AND OBJECTIVES

1.1 Background and Objectives

Mr Keith Miller (hereafter known as the Client) is proposing to redevelop the subject site as a residential development. The site is included on the Neath Port Talbot County Council Unitary Development Plan as open countryside, so is not planned for development by the Authority. We understand that an application for housing on the site was refused in 2008, fundamentally on principle, rather than for any technical reason.

One of the objections was raised by Natural Resources Wales (NRW) who identified that the site lies some 460m from the Crymlyn Bog SSSI (to the south). NRW recommended that the Local Development Plan (LDP) should:

> *'clearly specify that the impact of site drainage on the designated site (Crymlyn Bog) will need to be considered in detail in consultation with NRW, as it is likely that drainage from this site will be towards the SAC (Special Area of Conservation)'.*

CDN Planning are acting on the Client's behalf at examination hearings by the Welsh Government for the proposed development. In order to assist in these hearings, the Earth Science Partnership Ltd (ESP), Consulting Engineers, Geologists and Environmental Scientists, were instructed by CDN Planning (Wales) Ltd, acting on behalf of the Client to undertake a Phase One (desk study) assessment of the potential impact of drainage at the development site on the Crymlyn Bog SSSI (as requested by NRW).

The site location is shown on Figure 1, and we understand that, if successful, the development will comprise around 15 self-build plots for conventional dwellings, with associated access roads, vehicle hardstandings and gardens. We are not aware of any proposed site layout at this stage.

1.2 Scope of Works

The scope of works for the assessment was mutually developed with the Client by ESP within an agreed budget, and comprised a desk study hydrogeological review of available historical Ordnance Survey maps, geological maps, memoirs, and further desk study information. It should be noted that no intrusive investigations have been undertaken at this stage.

The contract was awarded on the basis of a competitive tender quotation. The terms of reference for the assessment are as laid down in the Earth Science Partnership e-mailed proposal of 7th November 2014. The investigation and assessment was undertaken in March 2015.

1.3 Limitations of Report

This report comprises an assessment of the potential impact on the Crymlyn Bog SSSI by drainage on the site if it were to be development in line with the proposals summarised in Section 1.1. The report is not a comprehensive site characterisation and should not be construed as such. Should an alternative end use be considered, the findings of the assessment should be re-examined relating to this use.

This report represents the findings and opinions of experienced geo-environmental specialists. Earth Science Partnership does not provide legal advice and the advice of lawyers may also be required.

1.5 Digital Copy of Report

A digital copy of this report (in pdf format) is included on a CD in Appendix B.

2.0 DESK STUDY, WALKOVER SURVEY AND PRELIMINARY RISK ASSESSMENT

The information presented in this section was obtained from desk-based research of sources detailed in the text. The site description is largely based on a site inspection made from Crymlyn Road on 11th March, during wet and misty weather conditions. No access into the site was made. General views of the site and its environs are included as a series of photographs within the Plates section of this report.

2.1 Site Location and Description

The site is located on the southern side of Crymlyn Road, on the western margins of Skewen in the County Borough of Neath Port Talbot. The National Grid Reference of the centre of the site is (SS) 271000 196570 and the postcode is SA10 6NL. A Site Location Plan is presented as Figure 1.

The site comprises an irregular (but approximately rectangular) parcel of land some 160m in length (east-west) and 125m in width (north-south), occupying an area of around 2ha. It is presently occupied by Maes-y-Gwilog Farm, with the farm house and outbuildings in the eastern area and the remainder comprising open arable farmland (Plate 5). An area in the north-west is occupied by woodland (Plate 6).

It is bounded by:

- To the north: Crymlyn Road, followed by residential properties on Crymlyn Gardens (Plate 4);
- To the east and south: open farmland; and
- To the west: an active railway line.

Vehicular access to the site is currently gained from Crymlyn Road, via a drive to the farmhouse on the north-eastern margins (Plate 1). The northern boundary with Crymlyn Road comprises a tree-lined hedgerow and a wooden fence, and the western boundary with the railway appears to be open (Plate 3). The remaining site boundaries were not visible. Field boundaries within the site appeared to comprise hedgerows with mature trees.

The general topography in the area slopes to the south, i.e. towards Crymlyn Bog. Crymlyn Road alongside the site falls from east to west, and the site surface appears to slope gently towards the south/south-west.

We are not aware of a topographic survey for the site at this time, however, recent Ordnance Survey maps (Appendix A) indicate a bench mark of 37.2m OD on the railway bridge immediately to the north-west of the site, and spot heights of 34.7m OD on Crymlyn Road alongside the site and 42.2m OD at the entrance to a graveyard some 60m to the east. Therefore, based on this, we visually estimate that alongside the site the road falls from around 39 to 34m OD, then back to 37m OD at Crymlyn Road railway bridge.

The elevations of the remainder of the open fields at the site are not known but are visually estimated to be similar to the above, i.e. around 30 to 40m OD.

The railway to the west of the site is located within a cutting to the north of the railway bridge, and at a lower level alongside the site (Plate 3). A spot height to the west of the railway of 27.4m OD suggests the natural ground falls away to the south-west, with the railway having been constructed on a platform, possibly partly in cut and partly on embankment on the side of the hill. At the bridge, the railway tracks are estimated to be around 6m below road level.

The wooded north-western margins of the site are lower than the adjacent area, by around 3 to 4m, falling gently towards the railway to the west. During the site visit, this area was observed to be very wet, with surface water – see Section 2.4 and Plate 6.

2.2 Site History

2.2.1 Published Historical Maps

The site history has been assessed from a review of available historical Ordnance Survey County Series and National Grid maps. Extracts from the historical maps are presented in Appendix A, and the salient features are summarised in Table 1 below.

Table 1: Review of Historical Maps

Date	On-Site	In Vicinity of Site
1877 – 1899	The site comprised open farmland (a series of fields) to the south of Crymlyn Road. A small farm is shown in the east, with a well.	A spring feeds a pond in the field to the north of the road, and a further farm, Cae-yr-Hendy lies to the north of the road. The railway has yet to be constructed to the west.
1914 - 1921	The farm buildings had been expanded in the east of the site. Some minor changes in field layout are evident.	The railway is shown to the west of the site partly on embankment (on the western margins, just south of the Crymlyn Road bridge) and partly in cutting (alongside the south-western margins of the site). steep slopes are shown on the southern side of Crymlyn Road on the western part of the northern boundary, suggesting that the road had been raised to allow it to cross over the railway bridge.
1940 - present day	A 'gravel pit' is shown to the east of the site, which appears to extend into the eastern most field. It appears to have become potentially disused by the 1960s.	A large reservoir is shown some 120m to the east on editions from 1948. Further railways are shown to the south of the site from the 1960s, probably associated with the development of the former Llandarcy oil refinery.

2.2.2 Other Sources

No further relevant information on the site history has been identified as part of this assessment.

2.3 Previous Investigations and Assessments

We are not aware of any previous geotechnical or geo-environmental investigations or assessments at the site.

2.4 Hydrology

2.4.1 Surface Water Features

The major surface water features in the area are presented on Figure 2.

The nearest major surface water feature to the site is the Crymlyn Brook, which flows from north to south in Cwm Crymlyn (a steep sided valley), some 500m to the west. The Crymlyn Brook appears to be a major contributor of water to the northern end of the Crymlyn Bog.

A number of reservoirs are located in the area, including a large elongate reservoir supported behind a dam some 120m to the south-east and a smaller reservoir some 140m to the south-west – both of these appear to be associated with the former oil refinery at Llandarcy. A stream is shown emanating from the reservoir to the south-east flowing towards Crymlyn Bog.

Historical maps show a number of streams and springs in the area of the site, including one within a former field to the north of Crymlyn Road (broadly opposite the site entrance). This spring formerly fed a pond and then a sink on the northern side of Crymlyn Road. It appears that the water ran alongside Crymlyn Road, and may now be the source of the surface water on the lower-lying, wooded, north-western margins of the site. Further springs are located to the west of the site alongside Crymlyn Road.

The mapping available on the Environment Agency website (EA, 2015) indicates that the site lies within the surface water catchment of the Crymlyn Bog.

2.4.2 Flooding

From a review of topographical plans and flooding maps presented on the Environment Agency website (EA, 2015), the site is not generally indicated to be at risk from flooding. Depending on its elevation, the lower-lying southern margins may be impacted by the rare occurrence of a flood event caused by the failure of the reservoir to the south-east. The northern and western margins, alongside Crymlyn Road and the railway, are indicated to be at potential risk of flooding from surface water. The observed surface water on the lower-lying, wooded north-western margins of the site could be evidence of this.

2.5 The Crymlyn Bog

The Crymlyn Bog lies some 460m (after NRW, see Section 1.1) to the south of the site at its closest point and is classified as a Site of Special Scientific Interest (SSSI), a Ramsar site, and a Special Area of Conservation (SAC). Information on the Countryside Commission for Wales website (CCW, 2015 - now part of NRW) indicates that the bog is the largest area of lowland fen in South Wales (280 ha) and is of special interest for its fen communities, wet woodland, associated insects and rare fauna including the hornet robberfly and fen raft spider.

Recent Ordnance Survey maps indicate the 10m OD contour to run along the margins of the bog, suggesting that this is the general elevation of the fenland, i.e. at least 20m below site level. Given its low elevation, the bog appears to be the discharge point for most water courses in the area.

The Management Plan for the Crymlyn Bog (CCW, undated) identifies water levels and quality to be a major controlling factor in maintaining the bog, with key hydrological features listed as the Tennant and Glan y Wern Canals (both located at the southern part of the bog, over 2km from the site), and the Crymlyn Brook. The plan states that: '*the wider catchment area for water drainage to the site requires consideration in land use decisions'.*

2.6 Geology

2.6.1 Published Geology

The published geological map for the area of the site (1:10,560 scale, SS79NW) indicates the site to be underlain by Boulder Clay of glacial origin, over bedrock of the Hughes Sandstone of the Upper Coal Measures. The higher land to the north of Crymlyn Road is shown to be underlain by the sandstone bedrock without any superficial deposits. Sandstone outcrops are shown in the railway cuttings to the north-west, and to the south-east (north of the Coed Darcy development site). Further sandstone outcrops are shown in the field immediately to the east of the site.

The north of the site is crossed by an unnamed, east-west trending fault which appears to terminate on the major, north-south trending Gardeners Fault, which forms the valley of the Crymlyn Brook to the west.

The northern part of the Crymlyn Bog are also crossed by the Gardeners Fault, with the north-eastern margins of the bog shown to be underlain by peat over the Hughes Sandstone, and the majority of the bog underlain by peat over the Swansea Beds (which overlie the Hughes Beds in the succession).

Reference to the up-to-date mapping available on the website of the British Geological Survey (BGS, 2015) indicates a similar succession, but the Glacial Till has been renamed Diamicton.

The glacial Diamicton (Boulder Clay) soils would normally be expected to be fine-grained in nature with some gravel, and possibly cobbles and boulders. However, historical maps indicate a former gravel pit immediately to the east of the site (and encroaching into the eastern site margins) – therefore, the superficial glacial soils may be coarse-grained rather than fine-grained in nature. The Hughes Beds comprise predominantly sandstones, but with subordinate bands of siltstone and mudstone. No coal outcrops are shown in the vicinity of the site.

2.6.2 Available BGS Borehole Records

Reference to the website of the British Geological Survey (BGS, 2015) indicates no available records in the vicinity of the site or the northern end of Crymlyn Bog.

2.7 Hydrogeology

2.7.1 Aquifer Classification

Reference to the aquifer maps published on the Environment Agency website (EA, 2015) indicates that the Coal Measures bedrock beneath the site is classed as a Secondary A Aquifer. The superficial glacial deposits are not classified but, if coarse-grained as suspected from the presence of historical gravel pits immediately to the east of the site, they could also be classed as a Secondary A aquifer.

Secondary A Aquifers generally correspond with the previously classified minor aquifers, and comprise permeable layers capable of supporting water at a local, rather than strategic, scale and in some cases form an important base flow to rivers. Secondary A Aquifers are sensitive to pollution.

2.7.2 Abstractions and Groundwater Vulnerability

The groundwater resource maps on the EA website (EA, 2015) indicate that there are no groundwater abstractions or Source Protection Zones within 1km of the site.

The groundwater vulnerability is shown by the Environment Agency (EA, 2015) to be 'minor aquifer low'

2.7.3 Groundwater Movement

Groundwater movement within the Hughes Sandstone bedrock will be fundamentally controlled by fracture flow, whilst that in the overlying glacial soils will be intergranular in nature. However, the flow of groundwater within the Hughes Sandstone may be controlled to a large degree by the presence of the east-west trending fault beneath the north of the site which is likely to provide a preferential flow pathway towards the Gardeners Fault to the west.

3.0 PRELIMINARY ASSESSMENT OF POTENTIAL IMPACT OF DEVELOPMENT

3.1 Change in Infiltration after Development

The current site comprises predominantly open fields which slope to the south/south-west, so any rainfall is currently likely to either infiltrate into the upper soils, or run across the ground as surface flow.

We understand that the proposed development will comprise 15 new dwellings which will have associated gardens, access roads and vehicle hardstandings. In garden areas, infiltration rates into the site surface are likely to be the same as at present. However, rain falling on areas of hard surfacing (e.g. access roads, vehicle hardstanding and building roofs) will be collected as surface water drainage. The surface water runoff would need to be either discharged into the ground via soakaways, or discharged off site via the sewerage system.

The feasibility of conventional shallow soakaways at the site will depend on the nature of the shallow glacial soils. As discussed in Section 2.6.1, these would normally be expected to be fine-grained in nature and may have insufficient infiltration characteristics to allow conventional soakaways to be successful. However, given the presence of the historical gravel pits to the east, they may be coarse-grained, and therefore, shallow soakaways may work successfully. This would need to be confirmed by infiltration testing (to the BRE recommended method).

The land to the north of Crymlyn Road is indicated on the geological map to be underlain directly by bedrock, and this is evident from the presence of the railway cutting within sandstone just north of the Crymlyn Road bridge. Given this, the thickness of superficial deposits may only be limited, and if these are found to be fine-grained, deep conventional or borehole soakaways could be adopted to allow the discharge of water to the ground, rather than disposal via the sewerage network.

Roof run-off water will be clean and will be suitable for discharge into the ground without further treatment. However, surface run-off may contain contaminants such as silt or petroleum hydrocarbons (from where vehicles may have leaked). Oil interceptors would be required to treat the surface run-off prior to discharge via soakaways.

Given the above, provided that the surface water drainage system is designed appropriately, we consider that there is unlikely to be any significant change in the quantity of infiltration following development. The use of oil interceptors should also ensure that the water quality of the infiltration is also likely to be similar following development.

3.2 Pathway of Infiltration Flow between Site and Crymlyn Bog

The Crymlyn Bog lies some 460m to the south of and some 20m below the proposed development site. The site lies within the surface water, and probable groundwater, catchments of the bog, and so surface and shallow ground water would be expected to flow south/south-west towards the bog. As discussed in Section 2.6.1, deeper groundwater flows may be controlled by the presence of faulting, directing it to the Gardener Fault, which runs under the northern part of the bog.

Surface water across the site is likely to follow the topography and flow towards the south or south-west. These flows will be intercepted by a major railway line (Plate 5) which is estimated to be at least 10m in width, and is likely to form a hydrological barrier diverting surface water flows along it rather than across it.

Similarly, shallow groundwater beneath the site is likely to flow towards the south or south-west, i.e. also towards the railway line. The railway has been constructed in cutting (on the eastern site side) at a level significantly below the general site level, with the difference around 6m at the Crymlyn Road bridge. At this depth, the railway cutting is likely act as a cut-off and, therefore, also intercept shallow groundwater flows. The railway would be expected to have lateral drains which are likely to carry the water away from the area.

Deeper groundwater may flow along the east-west fault to the Gardeners Fault whereby it may then flow south to the bedrock beneath the Crymlyn Bog. However, at this depth ,we consider that it is unlikely to form any significant contribution to the recharge of the bog.

Therefore, given the above, we consider that it is unlikely that surface water or groundwater flows from the site have been contributing any significant recharge flow to the Crymlyn Bog since the early twentieth century when the railway was built. Therefore, any change to the drainage at the site is very unlikely to have any significant effect on the water quality or flow at the Crymlyn Bog.

In our opinion, regardless of the presence of the railway immediate to the west of the site, it is sufficiently distant from the Crymlyn Bog (over 450m at its closest point) that the contribution of water flows entering the bog which originate at the site is likely to be small. Provided that the surface water drainage in designed to the SUDS principles discussed in Section 3.1 above, the change in site use is unlikely to have any significant impact on the Crymlyn Bog.

3.3 Uncertainties

The above assessment is based on the available desk study information, with no intrusive investigation undertaken. The former Llandarcy oil refinery site is currently being developed as a mixed, mainly residential development.

We are aware that the refinery was a significant source of contamination in the area (particularly by hydrocarbons) and we understand that the bog was impacted by such contamination. Therefore, prior to redevelopment of the Llandarcy site, we would anticipate that Natural Resources Wales (in their previous form of the Environment Agency Wales) would have required a full hydrogeological assessment of the Crymlyn Bog area to identify the hydrogeological flows within the catchment. This assessment is likely to have included investigation/survey information which may provide support to the above conclusions.

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