



## Technical Memorandum

Project #: 1539	Project: Llanerch-y-coed Farm	Client: Paul Smolas
Document: 1539_r1	Author: Rob Low	Date: 17 <sup>th</sup> February 2013
Subject: <b>Hydrological impact assessment of proposed borehole abstraction</b>		

It is proposed to drill a water supply borehole close to the farm buildings at Llanerch-y-coed Farm. The peak anticipated groundwater abstraction rate is 5000 litres/day (5 m<sup>3</sup>/d). This is considered to be a small groundwater abstraction and is, for example, only 25% of the rate for which a groundwater abstraction licence would be required (20 m<sup>3</sup>/d).

Objections have been raised by local residents to the proposed developments, partly on the grounds of the potential impact of the groundwater abstraction on local water features, including a number of springs used for domestic and agricultural water supply.

Paul Smolas (Llanerch-y-coed Farm) commissioned Dr Rob Low (the author, Rigare Ltd) to carry out an assessment of the hydrological impact of the proposed groundwater abstraction on local water features. The results of this assessment are presented below.

Dr Rob Low has an MSc in Environmental Management and a PhD in groundwater hydrology. He has 20 years professional experience in academic research and consultancy, and has lived and worked in Wales for 13 years. He founded Rigare Ltd in September 2008.

A site visit was carried out on 15<sup>th</sup> February 2013, during which the features described below were viewed.

### Topography and geology

Figure 1 is an extract for the Ordnance Survey 1:25,000 scale mapping, and Figure 2 is a satellite image of the same area.

It shows that Llanerch-y-coed Farm is located towards the top of a north-west to south-east oriented valley. To the east of this valley the ground rises with undulations towards Little Mountain (303 maOD), on common ground. The common ground comprises wet and dry heath, with a number of spring-fed flushes and a perennial pond/wetland.

The closest water feature of concern is a spring (the *Common Spring* hereafter) which is used for water supply (NGR 327927 242630), and is protected by a small cover. Shallow ditches have been excavated around the spring to prevent flooding by water flowing down from the pond/wetland area. This Common Spring is located c. 400 m east of Llanerch-y-coed Farm, and around 9 m above it at 289 maOD.

The Common Spring and pond/wetland are located within a different surface water micro-catchment to Llanerch-y-coed Farm. The course of the divide between the two catchments was confirmed during the site visit, and is marked on Figure 1. An area of wet ground, probably a spring-fed flush, is found to the north-west of this catchment divide. This area drains to the north-east, and the stream (evident during

the site visit) joins the stream from the Common Spring further north; it is therefore a separate micro-catchment in this context.

The approximate eastern limit of the topographic catchment of the spring is also marked on Figures 1 and 2.

Springs and a water supply borehole (NGR 327692 242360) are found 250 m south-east of Llanerch-y-coed Farm.

### Geology

Figure 3 shows surface geology. The Lower Devonian St Maughans Formation is at the surface over the large majority of the area of interest. The Bishop's Frome Limestone crops out in a narrow band which is approximately coincident with the northern boundary of the common, and north of this the Raglan Mudstone Formation is at the surface.

The above formations consist of:

- St Maughans Formation. Red-brown mudstone and siltstone; red-brown, purple and green sandstone; some calcrete and intraformational conglomerate.
- Bishop's Frome Limestone. Small to large limestone nodules, coalescing to a compact limestone in the top metre.
- Raglan Mudstone. Red-brown mudstone and siltstone, some sandstone.

These formations are conformable and the structure is generally simple, with a gentle southerly regional dip.

No superficial (e.g. recent or glacial) deposits are mapped in the area.

### Hydrogeology

The lithology of the St Maughans Formation suggests that it will generally be poorly permeable, and that it will yield variable, but generally small amounts of water from sandstones and calcretes. It is interesting to note that the Common Spring, the spring-fed flush and the springs adjacent to the existing water supply borehole all occur at approximately the same elevation (290 maOD); it is possible that a more permeable horizon within the St Maughans Formation comes to the surface at this elevation.

Because the St Maughans Formation is poorly permeability, it can be assumed that groundwater catchments will be more-or-less coincident with surface water catchments.

The Bishops Frome Limestone is likely to be fractured, and therefore to have a very high bulk permeability. Assuming sufficient depth, the water supply borehole to the south-east of Llanerch-y-coed Farm probably intercepts the Bishops Frome Limestone; if so it is probably a productive horizon for groundwater.

A borehole drilled close to the farm buildings at Llanerch-y-coed Farm would probably similarly intercept the Bishop's Frome Limestone.

### Hydrological impact assessment

It is considered almost certain that the proposed abstraction at Llanerch-y-coed Farm would have no effect on the Common Spring for the following reasons:

1. The abstraction would take water from the ground c. 400 m to the west of, more than 10 m below, and in a separate groundwater catchment to the Common Spring. Whilst it is possible for a large groundwater abstraction to scavenge groundwater from neighbouring catchments (i.e. create an artificially large catchment), the proposed abstraction is small and the St Maughans Formation is

poorly permeable, meaning that the lateral extent of the impact of the abstraction would be small. It is therefore almost certain that the proposed abstraction would not reduce the flow of the Common Spring at any time.

2. To put the size of the proposed abstraction in perspective with the flow of the Common Spring, the approximate area of the groundwater catchment to the spring is 170,000 m<sup>2</sup>. Assuming that 300 mm/a of rainfall infiltrates the ground to become groundwater, which then emerges from the spring, the average flow rate of the spring will be around 1.6 litres/second. In comparison the average proposed rate of abstraction is 0.03 litres/second (5000 m<sup>3</sup>/d), or c. 3% of the flow of the spring. This is a very uncertain calculation, and the flow rates will vary around these averages through the year, but it serves to illustrate the relative size of the proposed abstraction.

In conclusion, the proposed groundwater abstraction at Llanerch-y-coed Farm is very small in comparison with the flow of the Common Spring, and the topographic and hydrogeological position of the proposed abstraction means that it is almost certain that it would not reduce the flow of the Common Spring at any time.

Since the other springs which are used for water supply in the area are to the north-east and east of the Common Spring, it is certain that the proposed abstraction would not reduce the flow of these springs.



Figure 1 Extract from 1:25,000 OS survey showing key features of site





