

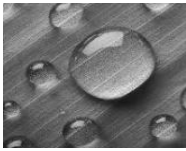
ELEMENTS ENERGY

**Plas Farm Hydro
Scheme**

**Design & Access
Statement**

March 2024

**Hydropower Consultancy &
Development**



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Client Address: Cilybebyll, Swansea

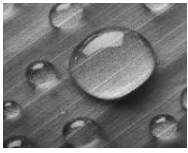
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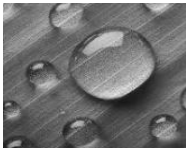


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1. INTRODUCTION

This Design and Access Statement (DAS) outlines the design principles and access issues that have been applied in the selection, scaling and sizing of the proposed hydro power scheme on the unnamed watercourse at Plas Farm, Cilybebyll, Swansea.

This DAS has been prepared to accompany the planning application for a micro hydro power scheme. It has also been prepared to accompany the abstraction and impoundment licence applications with Natural Resources Wales.

This statement refers to the objectives of good design as set out in The Town and Country Planning (Development Management Procedure) Order 2012 and explains how they have informed the design process. The particular relevance and weight attached to each of the objectives may depend on local policy, circumstances and the nature of the proposed development.

The objectives are outlined under five headings:

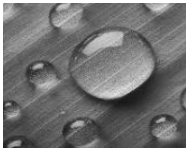
- Context;
- Environmental Sustainability.
- Community;
- Access;
- Movement;

2. CONTEXT

A proposed 11 kW micro hydro scheme for the generation of electricity from a renewable source, water. The applicant is the landowner of the project. The applicant owns the farm and holiday cottages beside the powerhouse location and the electricity will be connected to this demand as well as the National Grid network. The applicant support efforts to address and seek solutions to climate change and is therefore making an effort to contribute towards National and regional requirements for clean energy.

2.1 Location

The watercourse originates at on western flanks of Mynydd Marchwel. Mynydd Marchywel (Hywel's Stallion) is one of a series of stepped escarpments that rise to heights of over a 1,000 feet across the region. It lies on the eastern side of the Swansea Valley, carved out by enormous glaciers during the last ice age.



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A Location Plan has been included with the application, and the layout of scheme is shown in the General Layout drawing.

2.2 Works Overview

The works will include:

- A small intake structure across the watercourse on the face of a waterfall, incorporating a Coanda screen with 1.3mm apertures and stilling chamber.
- A pipeline of HDPE plastic pipe (200mm outside dia.) running from the intake down to the turbine house on the West side of the watercourse. (Burial depth 400mm to crown) The pipeline is 600m long. The pipeline is mainly buried with the one section overground where trees are present as detailed in General Layout.
- A wood clad turbine house building with a pitched roof, enclosing the hydroelectric turbine, generator, and control panel.
- A 10m long, 225mm diameter discharge pipe with a screen with 25mm spacing, and an outfall, in the form of a mortared stone cascade, to return water to the beck at the rear of the powerhouse.
- A buried electrical cable from the turbine enclosure to the Cilybebyll Manor connection point. (Burial Depth 600mm)

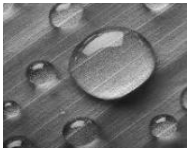
2.3 Landscaping and Appearance

All visible elements of the scheme will not constitute a dominating factor to the local environment by appropriate sizing and conforming to the local characteristics of the landscape.

The powerhouse will be a timber frame clad in natural-edge larch boards. In appearance the building will look like a small barn/shed such as are found throughout farms and gardens in the local area.

The intake weir is a very low structure on visible from close by and will be partly clad in stone and boulders which will disguise much of the metal structure.

The pipeline is mostly out of any lines of sight from the intake down to the powerhouse. The pipeline will be mostly buried with a minimum cover of 300mm. In one section the pipe is overground through shrub and trees (about a quarter of the way down from the intake as shown in the general layout drawing, length of pipe through these trees and shrub is approx. 20 meters). Vegetation will be encouraged to grow over the pipe and the tree cover that will cover this section of the pipeline will hide the pipeline from view. The overground pipe is then along a ridge line and ditch so will only be visible when stood next to it, from afar it will be out of sight. The pipeline here will be dragged in one end (my excavator from afar (on a



rope) and therefore no machinery will need to enter boggy or woodland area. This method has proved effective elsewhere on similar hydro pipelines.

2.5 General Design Principles

Hydro power is a non-consumptive technology that utilises the potential energy available in flowing water dropping from one point to another. Water is abstracted from a watercourse through a dedicated weir structure with an intake screen, and passed into a pipeline which minimise frictional losses. Water then passes through a control valve, which regulates the amount of flow, to a turbine that is coupled, either directly or by belt, to a generator. A control system regulates the control valve depending on the water available to abstract, and also connects the generator to the distribution network to export electricity.

2.5.1 Physical Layout & Siting

The locations and pipeline have been checked to ensure minimal interference and disturbance is caused to known environmental resources such as ecology and hydrology. A new intake weir of watercourses can have a small impact to the the hydromorphology of a watercourse (sediment transfer) this has been avoided on this project due to the location of the Intake being position at a nature waterfall in the watercourse, minimising the impoundment of water and not creating an upstream weir pool. This means that sediment passes over the Intake.

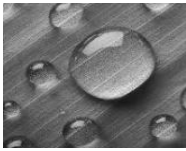
No SSSIs, SACs, or Ancient Woodlands are located within the boundaries of the site.

The nature of the site dictates that the construction of the scheme is to be soft and progressive working in good weather with small machinery that does not require significant working corridors or large construction compounds. The pipe installation works are planned to be moved into place using mainly a winches and, a 5-8tonne excavator will be used but only for the construction of the powerhouse foundation.

Over the long term the visual aspect of the construction works and will fade as areas grow over; the powerhouse timber cladding will weather and become more natural looking, grass growth increases over pipeline areas, and the intake construction will weather and be colonised by mosses and so on.

2.5.2 Noise Emission

During the design phase, careful attention has been given to the mitigation of noise. Concerns are often raised during the planning stage of a hydro scheme about potential noise impacts, though in practice, it has been proven that they can be minimised via design. The nearest dwelling is over several hundred metres away and the scheme will be inaudible from there. Nevertheless the ambient noise of the scheme will be limited by the following:



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- Proximity of the powerhouse and outfall to running, cascading water
- Small turbine and generator – very little noise generated
- Ventilation vents will be baffled on the inside to control noise emissions
- This scheme is of a similar size and design as other schemes EGH have built, where these measures have been utilised and proven to absorb noise to effectively ensure that there is not an issue of noise emitted from the powerhouse.

2.5.3 Hydrology

The stream is not gauged by the Environment Agency. The LowFlows Enterprise (LFE) model from the Institute of Hydrology was commissioned to develop the flow characteristic of the site, estimating the mean annual flow to be $0.021\text{m}^3/\text{s}$, with a catchment area of 0.510 km^2 .

Qmean	Average Flow	21	Litres/sec
Q95	Flow exceeded 95% of the time	2.3	Litres/sec
Q50	Median Flow – flow exceeded 50% of the time	11.8	Litres/sec
Q10	Flow exceeded 10% of the time	48.9	Litres/sec

The hydrological report is enclosed with the consenting applications.

2.5.4 Abstracted Flow

Hydropower is a non-consumptive abstraction. The turbine will draw a flow not exceeding $0.021\text{m}^3/\text{sec}$.

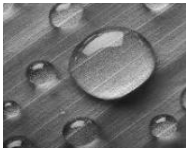
As per the NRW Pre app feedback, the HEP scheme will be based on an abstraction percentage of 70% take above the hands off flow, with 30% remaining within the reach in addition to the hands off flow. This ratio is secured by two open rectangular notches of calculated dimensions. Please see the intake drawing for more details.

2.5.5 Residual Flow and the Deprived Reach

Following EA good practice guidelines, a figure of Q95 has been allocated for the Hands Off Flow which is 2.3 litres/sec. This will be guaranteed by a V-notch built into the weir, which will be sized to discharge 2.3 litres/sec before any flow enters the pipeline to the turbine.

It should be also noted that additional flow enters the watercourse from runoff down the derogated reach and provides a variance of flows as well as extra flow on top of the hands off flow provision.

2.5.6 Start-up flow



It is worthwhile to note that before the scheme can start to abstract, there needs to be a quantity of water in the stream significantly greater than the residual flow. This is because:

- (a) The turbine only achieves a worthwhile efficiency when it can pass at least 10% of its design flow – 2 litres/sec in this case. It will not pass any flow until at least this flow is available over and above the residual flow.
- (b) The turbine control system needs to add an additional margin to be sure that the turbine will not shutdown as soon as it starts up, and then 'hunt' around the start-up condition, switching on and off.

Therefore, in practice, the flow required in the river before the hydro scheme will start drawing any water will be the Residual Flow plus 15% of the Design Flow, i.e. a total of 5.45 litres/sec, approximately Q75. It is likely this condition will not be met throughout the dry summer months, and other extended dry periods, and at these times the stream will experience its normal low-flow variability with no abstraction taking place.

2.5.7 Flow measurement

Because the turbines have a very flat efficiency curve against flow rate, the total flow passing through the turbine is directly proportional to the units of energy generated, as recorded on the kilowatthour meter in the powerhouse. Hence the annual kWh reading, multiplied by the appropriate factor of proportionality, will provide an accurate figure for the annual flow abstracted. This method is used satisfactorily on other small hydro schemes around the UK and will be used to provide the annual abstraction submission to the Natural Resources Wales.

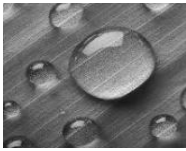
2.5.8 Output

The installation will produce a maximum electrical output of 11 kW and is projected to provide up to 33.5 MWh of renewable electricity per year, equivalent to the consumption of 10 average homes, and preventing the emission of 15 tonnes of CO₂ annually.

3. ENVIRONMENTAL SUSTAINABILITY

The purpose of the proposed hydro power scheme is to contribute towards the energy requirements of broader National requirements for sustainable electricity generation.

Via a small construction time period and no long term effect on the local ecology, the scheme will generate the equivalent energy of the demand of 10 average homes, and with regular maintenance and care could operate in excess of 50 years.



As noted above, the annual prevention of the emission 15t of CO₂ is a small but important step in mitigating the effects of climate change.

4. COMMUNITY

4.1 Safety

It has been established that there is no threat to community safety from the operation of the hydro power scheme. All access points to the water flow, and generation equipment, are either screened or locked to protect the members of the community and to protect the scheme from vandalism. Furthermore, the limited moving parts of the scheme, i.e. the turbine and generator, are contained within their own casings and are also locked against entry.

4.2 Social

Renewable energy schemes such as that proposed are often the focal point of social interest. There is can be concern over the general welfare of the community and the schemes effect on it. With appropriate responses from land owner and developer, concerns can be alleviated and the community made more aware of the potential of renewable energy and its benefits for rural areas. The applicant, Coetir Mynydd, has been actively engaging with the community and nearby landowners in the vicinity of the scheme and their opinions have fed into the overall design of the scheme.

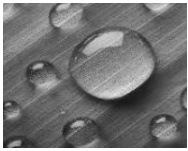
The long term social effect of the scheme, as experienced with previously constructed schemes of this scale, will be that of a positive awareness of renewable energy, particularly hydro, whereby locals will discuss the technology in the wider community, further alleviating concerns in other areas and generally increasing support.

Additionally during construction the project will use local labour, from the Pontardawe or and Neath Port Talbot area.

4.3 Economic

The scheme will provide income (eventually in the long term when the scheme capital is paid off - projects of this nature typically take around 30 years to pay back) to the landowner. This income will enable continued stewardship of the land allowing a diversified income from the farm land. The reduced electricity costs will also help retain the viability of Swansea Valley holiday cottages and help continue the increased tourism input to the area.

4.4 Flood Risk



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The power house is designed with all electronics suitably above ground level and with automatic safety shut down incorporated into the electrical connections. Furthermore, the intake structure will have a very low profile (designed to be submerged). Further information is contained with the project flood risk assessment included with applications.

5. ACCESS

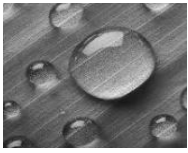
5.1 Proposed Access Arrangement

The powerhouse will have temporary access which runs alongside the farm house, this temporary construction access is already existing due to the National Grid works underway for a separate project (3 phase grid upgrade at the site).

A thin working corridor for the pipe route, is sufficient area of access and material set aside during pipeline burial. Most of the pipe route has an existing track nearby which provides good access to the route and up to the intake.

5.2 Rights of Way

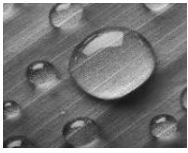
There are no public right of way within the vicinity of the project.



6. PHOTOS



Intake Location Photo

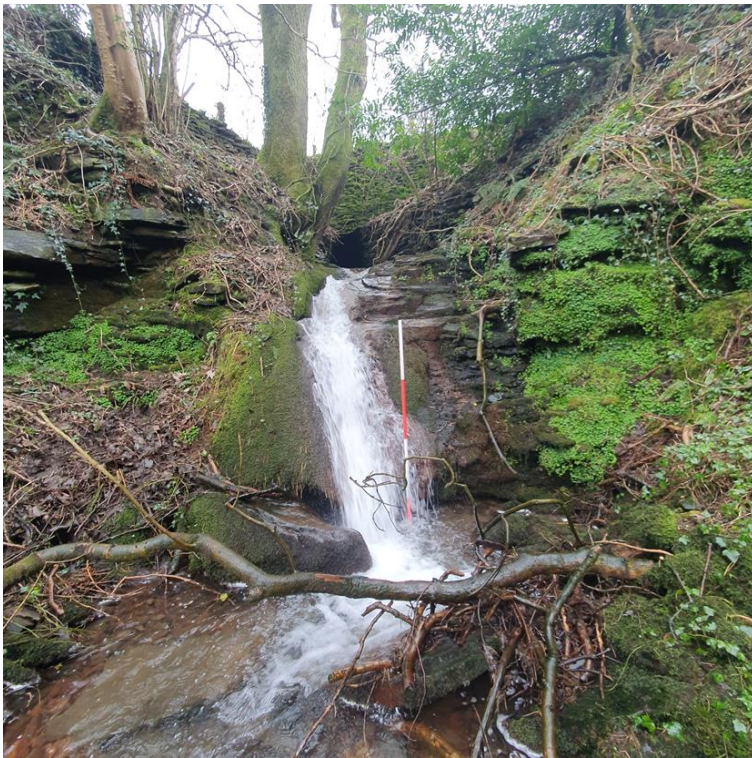


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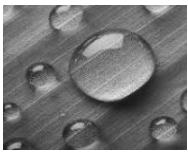
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Plas Farm Hydro – whole site from above



Intake Location



Outfall Location



Powerhouse Location (photo taken looking West)