

Hydrobot Pre-feasibility Report

Reference: 1061v1

1 Background

On 30/09/2008 a Hydrobot survey was commissioned to identify potential hydropower sites within the selected area. Using the client's chosen input values, Hydrobot identified 1 sites where a hydropower scheme could be developed with appropriate financial returns.

This report summarises the sites identified, as well as the approach taken by Hydrobot, guidance regarding use of this information and steps to take the project forward. The report comprises the following sections:

- Summary of the order placed
- Results
- Description of Hydrobot
- Notes regarding accuracy of results
- Next steps
- Terms and conditions

2 Summary of order

- Project name: 1061v1
- Date: 30/09/2008
- Discount on future cashflows: 0%
- Grid connected: Yes
- Importance of maximising power output: 0.1
- Importance of minimising cost of energy: 0.1
- Importance of minimising capital cost: 0.1
- 25km² tiles: NH55NE

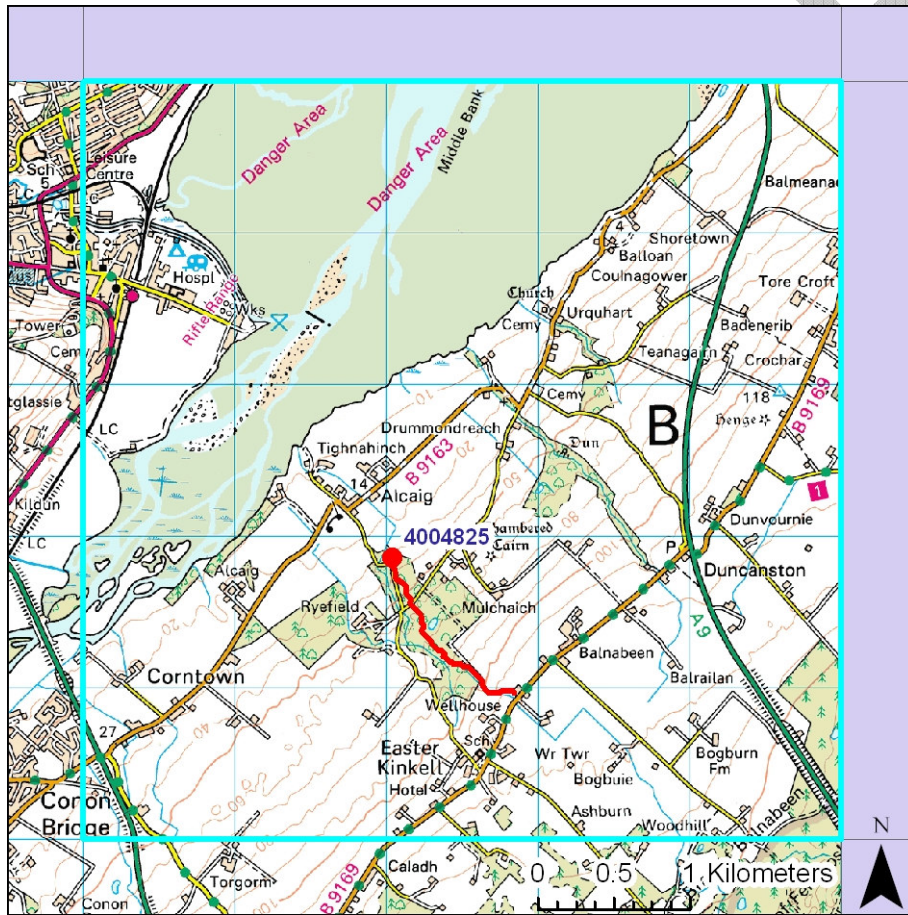
3 Results

Hydrobot's results for the selected area are presented in two forms: a table and maps. If valid solutions were found, Table 1 lists physical details and a financial breakdown of each viable scheme identified. The maps of the areas in the figures below show the approximate position of each scheme where valid schemes were identified; otherwise the maps will be blank.

The reported results only address projects that are financially viable. This is determined by whether they pay back within a reasonable time so that they can generate sufficient profit to be worthwhile. Because hydro schemes should last at least 25 years, anything less than this is regarded as a reasonable payback time. Financially viable schemes in this report show a positive balance within 25 years, discounting income at the rate selected by the client at the time of ordering the report.

Table 1. Solutions within the selected areas, with size, costs and payback details. Turbine numbers relate to the illustrated solutions in the maps.

Turbine number	Design flow (m3/s)	Gross head (m)	Power (kW)	Annual energy (MWh)	Capital cost (£)	Operating cost (£/yr)	Annual revenue (£/yr)	Net present value (£)
4004825	0.xxx	xx.x	xx	xxx,xxx	xxx,xxx	x,xxx	xx,xxx	xxx,xxx



Map 1. Schemes intersecting selected tiles within NH55NE. If valid solutions were found, red dots mark turbine sites, red lines show suggested penstock route, and blue numbers correspond to turbine numbers in Table 1.

4 Hydrobot

Hydrobot is a geographical model using data from many different sources to survey an area for hydropower potential. It does this by mapping the river paths and calculating the flows throughout the year, then testing many different layouts in all potential sites. Hydrobot selects the best solution in each place, according to the user's preferences. The model was developed and calibrated with support from Black & Veatch Ltd. Previously, Hydrobot has been used to survey the whole of Scotland in a report for the Scottish Government, but it can also work on small areas of 1 km² or more.

Because Hydrobot is automated, it can generate results more easily and quickly than a person visiting the site. The output is a pre-feasibility study: the first investigation of any hydro project. A pre-feasibility study assists the client and developer to decide whether a full feasibility study is warranted at that site, since a feasibility study requires considerable time and investment. The pre-feasibility study is not an exact quote for a project, but aims to be a reasonable estimate of the most suitably sized scheme at each site.

Two types of hydro scheme are currently modelled by Hydrobot:

- those with a new weir and penstock (pipe); and
- existing weirs, without a penstock or storage pond, but with some existing structures such as a lade.

Hydrobot takes into account the reduction in costs where a weir already exists. It also takes into account the fact that on micro-hydro projects (less than 100 kW), the site owner is often able to reduce costs further by doing some of the civils, ground works, and even some project management themselves. Every scheme is different and these factors can only become clear during the full feasibility study.

Currently the modelled schemes are "run-of-river" rather than storage schemes, which means the flow will vary throughout the year, heavily influenced by rainfall.

5 Accuracy and application

Because the course of the river network has been modified in places, Hydrobot may occasionally position a turbine and penstock a short distance from the actual location of the watercourse. This can also occur in very flat places, but unless there is an existing weir, these are not likely to be the site of a hydro scheme.

Please note that only weirs registered under the Controlled Activities Regulations are included. The facility to add your own weir online will be available soon. If there is no valid result where you know there is a good existing weir, it may not be registered and so will not be part of Hydrobot's input dataset. If you supply coordinates and the height of the drop through which the water falls, we will be happy to re-run Hydrobot for that site once for only £10 + VAT, providing your request comes within two weeks of you receiving the original report. The information would not be used for any other purpose than Hydrobot surveys.

Water is abstracted from the river network at various points and the major abstractions are taken into account by Hydrobot. Similarly, existing hydro schemes are excluded from the results. Hydrobot uses a series of equations to determine the best point to place a turbine and intake. While an engineer onsite may propose a slightly different layout or size, the schemes proposed by Hydrobot will be financially viable. The level of accuracy will be suitable to allow the user to choose whether to take the project further.

6 Next steps

The next step is to select which if any of the modelled schemes are appropriate for further investigation. This will depend on your required investment preferences. If you require further information about the identified solutions, a more detailed version of Hydrobot's outputs is available for a further £92 per scheme. Please contact us to discuss this.

If you decide to proceed with a hydro project, the stages are as follows:

- Feasibility study, including flow metering with technical, financial and environmental assessments
- Development of an Environmental Statement
- Planning application
- Detailed design and engineering
- Contract development and tendering
- Construction and installation
- Commissioning and operation

Because flow measurement must be conducted for a year on any sizeable scheme, it normally takes place at the same time as the other elements of the feasibility study. To ensure availability of equipment, it is worth discussing flow measurement as soon as possible. The cost of the feasibility study is included in Hydrobot's capital costing, and can range from £1,500 to well over £5,000 depending on scheme size and site sensitivity. We will be happy to give an opinion on whether your site appears worthy of a feasibility study.

The impacts of hydropower schemes upon the environment must be predicted as part of the feasibility study. Environmentally sensitive areas may be designated for their natural heritage value and it may be more difficult to obtain planning permission for schemes in these areas. For further details on what each designation means and where they are, visit [SiteLink](#) on the Scottish Natural Heritage (SNH) website. The Scottish Environmental Protection Agency (SEPA), SNH and local salmon fisheries boards can provide further information on the mitigation measures that are required to minimise impacts of hydro schemes upon fish.

7 Contacts

Various sources of funding and useful contacts are applicable to hydropower installations, and a selection are given below.

7.1 Sources of funding

Name	Technologies Eligible	Description	Funding Level
Scottish Community and Householder's Renewable Initiative	Most renewable technologies (excluding solar PV)	Funding is available for householders or communities in Scotland. Can be used to buy equipment, or to commission feasibility studies etc. Free advice is also available	Householder: 30% up to a maximum of £4,000 Community: up to a maximum of £10,000
Low Carbon Buildings Programme	Most renewables	Mainly for England and Wales, since cannot be used in conjunction with SCHRI grants. Will provide funding for solar PV (unlike SCHRI)	Depends on technology. Typically around 30% of total cost for individual projects.
Scottish Rural Development Programme	Most renewables	Funding for rural businesses in Scotland developing small-scale renewable energy capacity.	Up to 50% of capital costs
Community Action for Energy	Most renewable technologies	Provides up to two days free consultancy for community groups interested in renewable energy. Travel bursaries also available to visit case studies. Will provide free training courses, provided sufficient numbers and venue	Free consultancy for community groups Travel bursaries available for case study visits. No capital support
Loan Action Scotland	Energy saving measures - new boilers, controls, efficient lighting	Provides interest free loans for small businesses in Scotland. Farms not eligible, but connected businesses may be e.g. food, B&B etc	Interest free 5 yr loans. £5,000 - £50,000
Enhanced Capital Allowances	Efficient boilers, lighting, motors. Heat pumps, CHP, solar thermal systems	Tax relief on the cost of efficient equipment.	Tax offset on the capital cost. E.g if equipment costs £1,000, tax can be reclaimed on £1,000 of profits.

7.2 Further information

Details of all accredited installers of renewable energy technologies are available from the Energy Savings Trust. For a list, call EST on 0800 512 012.

British Hydropower Association: www.british-hydro.org

Energy Savings Trust factsheet:

http://www.savenergy.org/pdf/EST_RE_Factsheets_05/Microhydro.pdf

Scottish Community and Householders Renewables Initiative: <http://www.energysavingtrust.org.uk/schri>

Renewable Obligation Certificates:

[http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/18293 Questions and A nswers FINAL.pdf](http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/18293_Questions_and_Ans wers_FINAL.pdf)

Scottish Rural Development Programme, agricultural:

[http://www.scotland.gov.uk/Topics/Rural/SRDP/RuralPriorities/Options/Supportfor RenewableEnergy](http://www.scotland.gov.uk/Topics/Rural/SRDP/RuralPriorities/Options/SupportforRenewableEnergy)

Scottish Rural Development Programme, non-agricultural:
<http://www.scotland.gov.uk/Topics/Rural/SRDP/RuralPriorities/Packages/renewableenergy/SupportforRenewableEnergy>

7.3 Companies that conduct feasibility studies

Please contact us for details.

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