Abergwynant Hydro Scheme Refurbishment
Supporting Information for Abstraction and Impoundment Licence Application
Document AHD01

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NEW NRW Ref: WROWENRENEWABLES2403

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1) General Overview

It is proposed to repair, upgrade and recommission this existing hydro project which was originally built sometime in the 1920's, but has not been operational now for several decades. The original intake weir, pipeline and powerhouse remain in place and require varying amounts of work to repair and upgrade them.

The original project had a power output of around 35kW, and was sized for the electrical requirements of Abergwynant Hall at the time, rather than what the water resource could optimally deliver. A pre-application response from NRW in 2014 identified an abstraction rate of 50% af available flow above a Q95 Hand off Flow (111 l/s) would be permitted, with a maximum abstraction up to the mean flow of 1184 l/s. We now propose a scheme with a slightly reduced maximum flow of 1100 l/s, which would generate a maximum electrical power output of 168 kW, generating an annual average of 510 MWh of renewable energy.

An application for abstraction and impoundment licences, based on the NRW 2014 pre-app response, was submitted by Owen Renewables in March 2023. NRW objected to this application on the basis that they had discovered they had records of a bryophyte survey carried out in 2011, that showed flow sensitive species present in the depleted reach. This survey had not been referred to by NRW in their 2014 pre-application response.

As a result, over the last three years, we have worked with the NRW bryophyte specialist Sam Bosanquet. After identifying a scope of works with Sam, we commissioned a bryophyte survey (report included with this application, and brief summary of its findings shown below), and undertook flow monitoring and videos of river conditions at various flows. On the basis of these surveys, an appropriate abstraction regime to protect the bryophytes was subsequently agreed with Sam. This abstraction regime was then discussed and agreed with Katrina Marshall in NRW fisheries team.

Drawing AH01 shows the scheme layout of intake, pipeline, powerhouse and outfall.

2) 2023 Bryophyte Survey

The survey was undertaken by Gritten Ecology at the river in October 2023, and reviewed the important bryophyte locations identified in the 2011 report. The survey concluded there had been a dramatic decline in abundance of all 6 notable species:
a) Two of the species (Jubula hutchinsiae and Aphalonajeunea microscopica) found in 2011 could not be found at their original locations, or elsewhere in the affected reach.
b) The other 4 notable species had declined in abundance and were now confined to a single boulder. In particular, Radula voluta had been found at two sites in 2011, but in 2023 was now only found on this one boulder, and now only occupying an area of 1.8 cm^2, compared to the 20cm^2 recorded in 2011. The report speculates that the reduction in abundance could be due to being out-competed by more robust species, and increased number of scour events.

The report also suggests that reinstating the hydro abstraction may help reduce the severity of the scour events, by reducing flood flows in the affected reach. In large flood events (mean annual

flood or higher), an abstraction of 1100 l/s is likely to have only a very minor impact on flood flows. In smaller spate flows, the hydro abstraction may have some beneficial effect.

3) Description of Scheme Elements

Intake Weir

This appears in reasonable condition for its age. Since the scheme ceased to operate, it seems that an original sluice opening and channel in the wing wall was enlarged to form a breach to lower water levels behind the weir, with the intention of improving fish passage around the weir. Whilst this has been an improvement, fish passage is still hindered, and there is an opportunity to improve fish passage as part of the hydro refurbishment. On site meetings, and discussions and development of proposals have been ongoing over the last 4 years with NRW fisheries officers at Bangor.

The proposal we have agreed is to modify the existing weir and wing wall as follows:
a) Construct an extended fish bypass channel, in a rock ramp style with cobbles and perturbation boulders that will improve fish and eel passage.
b) Construct a fixed residual notch to provide appropriate river residual flows, which also supply the fish bypass channel to provide the high fish attraction flows required.
c) Install a new 2mm spacing coanda screen intake to supply screened water to the turbine.

Drawings AH03 – 06 detail the proposed weir modifications.

Pipeline

The existing steel pipeline that connects the intake to the powerhouse is 500m long and 450mm diameter. The majority is above ground and supported on pedestals along the river bank. We propose to install a new larger 900mm diameter polyethylene pipe that will sit on top of the original pipe and pedestals; these will act as supports for the new pipe.

Powerhouse and Outfall Pipe

The footprint and height of the existing building is large enough to accommodate a new turbine, generator and ancillary equipment. However, the building is in a poor state and will require significant repair and refurbishment, involving a new roof, floor slab and turbine foundations. There is an existing buried tail race pipe that discharges to the river. This will be removed and replaced by two new larger buried pipes, along the same route, and to the same discharge point at the river. A new larger outfall screen will be installed at the end of these pipes. Drawing AH07 shows the outfall detail.

4) Hydrology Information

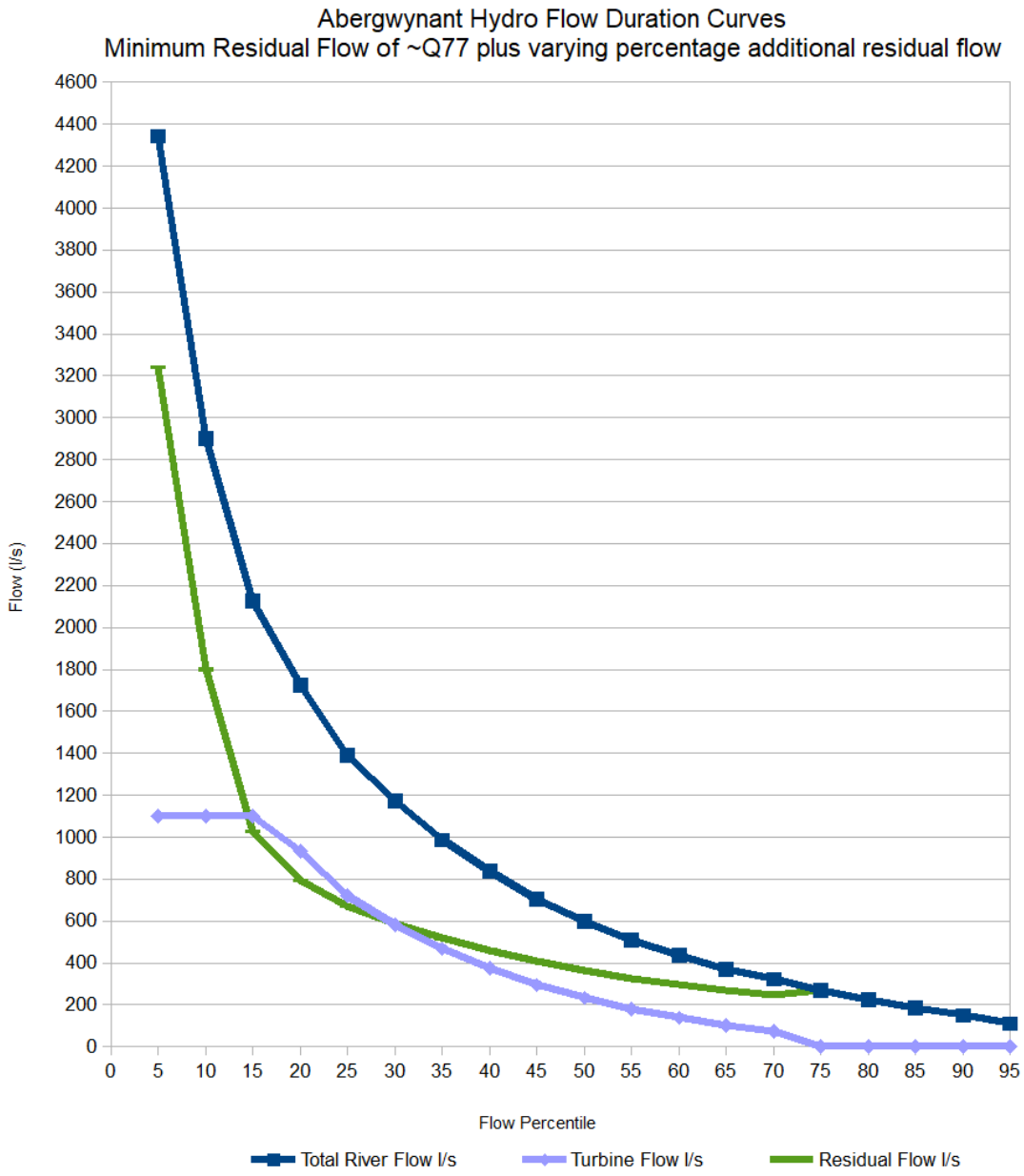
Drawing AH02 shows the catchment area for the existing intake weir. The table below shows the flow duration data for the Natural (Total) river flow, turbine flows, and residual river flows after abstraction.

% time flow exceeded	Total River Flow l/s	Turbine Flow l/s	Residual Flow l/s	Residual Flow As % of Total River Flow
5	4343	1100	3243	75%
10	2901	1100	1801	62%
15	2128	1100	1028	48%
20	1724	931	793	46%
25	1390	721	669	48%
30	1171	584	587	50%
35	986	468	518	53%
40	836	375	461	55%
45	704	295	408	58%
50	600	234	366	61%
55	508	180	327	65%
60	438	139	300	68%
65	369	101	268	73%
70	323	75	247	77%
75	271	0	271	100%
80	225	0	225	100%
85	185	0	185	100%
90	150	0	150	100%
95	111	0	111	100%

River, Turbine and Residual Flow Duration Data for Intake at 267960, 316970

Calculation sheet AHC01 shows that the proposed arrangement of weir notches will provide the required agreed residual flows to protect both bryophytes and fish. To protect the bryophytes, the compensation notch is set up to provide a minimum residual flow of 247 l/s (approximately Q77, rather than the typical Q95)) At lower flows, a smaller percentage abstraction occurs, with a higher abstraction as river flows increase.

The data table above is plotted as flow duration curves on the chart below.



5) Intake Weir Construction, Operation and Maintenance

5.1 Rights of Access

Owen Renewables Cyf own the entirety of the weir structure, on both banks of the river (Land Registry Title Number: CYM854143). There is a lease agreement in place with the owner of the adjacent land to allow access to the weir for repairs, refurbishment and maintenance.

5.2 Sediment Management

As the weir has been in existence for about a century, the weir pool behind the main weir structure is already full of gravel and boulders, and so sediment flows past the weir unhindered. After refurbishment of the weir, sediment transport downstream will continue unhindered, through the fish bypass channel, and over the coanda and main weir crests.

5.3 Maintenance

The intake screens are generally self cleaning, or require brushing on typically weekly intervals. On rare occasions (10 – 20 years) they may need removing for greater cleaning, or replacement. Bypass pipes set into the wing wall can be opened to lower the weir pool level to enable the screens

to be removed in dry conditions on these occasions.

The fish bypass channel may occasionally collect tree branches or boulders. These can be manually removed from the side of the channel, or dislodged to allow them to pass down the channel. On rare occasions a perturbation boulder in the channel may become dislodged. In this case the Q95 and 50% residual notches can be temporarily blocked to allow repair of the channel in dry conditions, (in low flow conditions). In the meantime water will flow over the coanda screens (turbine switched off, so no abstraction) and water can continue downstream.

A sluice gate will be installed between the chamber beneath the coanda screens and the existing chamber, so that the existing chamber and pipeline intake can be isolated from the river.

5.4 Diversion of River Flows During Weir Refurbishment

While the new walls, raised main weir wall, coanda screens, pipeline and associated equipment on the south-west side of the weir are being constructed and installed, the river can continue to pass through the lower breach in the opposite side wing wall, as currently happens. Coffer-dams will be built to isolate the construction areas from higher flows so that this work can be carried out in dry conditions.

To work on the opposite north-east wing wall, breach repair and bypass channel, two openings in the existing chamber side wall, upstream of the weir can temporarily be made, and the river can be diverted into and through this chamber and pass back into the river channel just downstream of the weir, via the new pipe connection. Again, temporary coffer dams can be built to seal off the south-east wing wall. Once the work is complete, the temporary opening into the chamber can be sealed with steel plate and the coffer dam removed.