

THE SYNERGIES OF SMALL HYDRO POWER AND THE WATER FRAMEWORK DIRECTIVE

SEE Young Environmental Engineer of the Year 2009 Award



The Society is pleased to announce that the first winner of this new award is Alexander R. Humphreys for his project called **THE SYNERGIES OF SMALL HYDRO POWER AND THE WATER FRAMEWORK DIRECTIVE**. Alexander Humphreys studied Civil Engineering at Nottingham University and now works for Atkins in Swansea

There is no single solution to the current climate crisis; carbon reduction will be achieved through a combination of economic, social and technical actions. Methods of generating electricity from renewable energy sources will be prominent amongst the technical initiatives employed in the efforts to drive down carbon release. In scenarios where economically viable Large Hydro Power sites are already utilized, Small Hydro Power (SHP) will be a very attractive option.

A major European-wide commitment is the Water Framework Directive. The directive is EC legislation which aims to achieve good ecological and chemical status for rivers and other bodies of water. A key target within its aim is to improve biodiversity within water-based ecosystems.

Alexander Humphreys has been the Project Engineer for a scheme that demonstrates that biodiversity improvements in rivers can be delivered in parallel with innovative SHP facilities, which in turn will contribute to the reduction in the UK's dependency on non-renewable energy sources

OSBASTON WEIR

The earliest record of a weir on the River Monnow at Osbaston in Monmouthshire dates back to the start of the 18th century, when the weir supplied a water wheel at a forge. At the start of the 20th century, the weir provided water to a hydro power facility supplying electricity to Monmouth. The hydro power facility was decommissioned in 1953; no use of the weir has been recorded since that date.

The weir was a total barrier to fish passage for all but the most infrequent high river flows, when it was passable only by stronger migratory salmon and sea trout.

OUTLINE DESIGN

The project consists of a pool-and traverse fish pass channel, and a head race channel supplying water to the generating equipment.



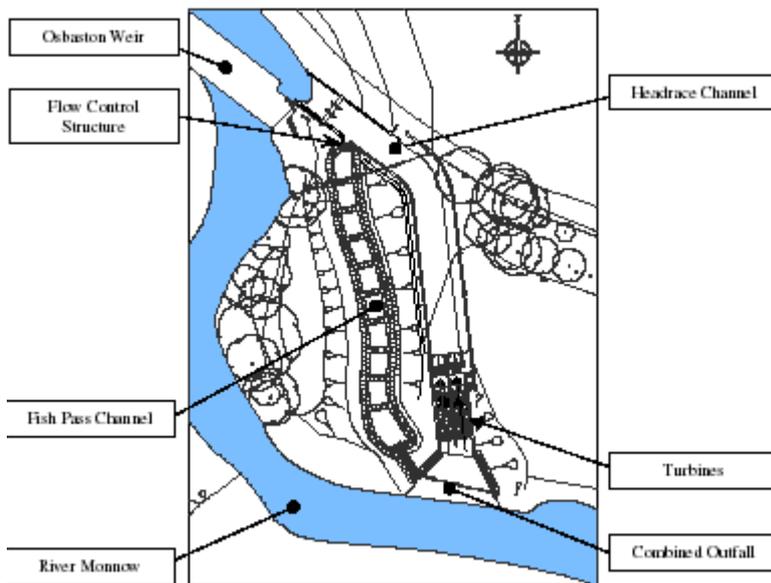


Figure 1 – Site Plan

The fish pass is designed to be suited to a broad range of fish species which includes those indigenous to the Monnow as well as the migratory species.

Electricity is generated by two 3.6m diameter Archimedes-screw turbines, rotating at a speed of 28rpm, producing a maximum power output of 150kW. The estimated annual power output is 670,000kWh, which is equivalent to an annual CO₂ saving of 288 tonnes.

OPERATIONAL AND ENGINEERING DESIGN

Besides being the project engineer, Alexander developed a flow-share relationship with the main river channel with the fish pass taking priority during the fish migration season between October and May.



He also introduced a number of detailed designs including the fish pass channel and the inlet structure, which incorporates a penstock and an advanced electronic fish counter. His design incorporates a series of low-head blockstone weirs (figure 2, below) which divide the 3 metre head drop over the weir into a series of navigable 0.3m increments in water level.

BENEFITS OF THE SCHEME

The Department for Business Enterprise and Regulatory Reform estimates that untapped hydro power from all UK streams and rivers could produce enough electricity to meet 3% of the UK's needs.

However, it has been reported that small hydro power (SHP) installations could become increasingly difficult to promote with the advent of the Water Framework Directive, due to concerns that SHP is potentially damaging to the aquatic environment.

Osbaston Weir demonstrates that environmental enhancements and SHP can be developed in parallel to reduce CO₂ emissions and deliver environmental and social benefits through creating a healthy river environment with a rich biodiversity.

The fish counter has recorded several species of fish using the pass, including salmon which have not been observed in the Monnow upstream of Osbaston Weir in living memory. Not only is this positive in terms of biodiversity, but the establishment of a river as a salmon fishery can also bring major benefits to local communities through a growth in the leisure industry supported by angling. It has been proposed that Osbaston Weir could be used to promote renewable energy and raise awareness of the environment within our river corridors.

With each SHP that is completed, the understanding of the technology and its implementation is improved and refined. For example, monitoring the Archimedes turbines at another small hydro power site indicated that they were not damaging to fish passing through them, leading to the relaxing of the screening conditions on the Abstraction Licence for the Osbaston site.

It is this kind of continual development that improves the economic viability and environmental opportunities of small decentralised generation, promoting industry interest in future investment at other sites.

The Earl of Wessex visited the project on 23rd September 2009

Alexander Humphreys expresses his appreciation to the following for their permission to report this work:

- Peter Gough – Project Manager, Environment Agency Wales
- Ronald Kear – Managing Director, Old Manor Electric Company