

## Hydroelectric Power Options

### SUMMARY

- 1.1 At the Corporate Scrutiny and Climate Change Board meeting 19 November 2012 minute item 32/12 Review of Climate Change Strategy noted:

*Resolved to request that reports be brought back to the meeting on 28 January 2013 detailing:*

- options available to the council to utilise hydro power following the installation of the hydro station on the River Derwent*
- long term sustainable transport options.*

This report addresses the options available to the council to utilise hydro power.

- 1.2 This report has been produced to determine at a high level the extent to which further hydro power options are '*available*' to the council. The meaning of '*available*' is taken to mean the reasonable expectation to be '*cost effective, achievable and viable*'.

- 1.3 The desk study finds that:

Option	Extent of Availability/Viability: ( <i>Very Low; Low; Medium; High</i> )
Longbridge Weir Hydro (benchmark for scoring, as this scheme has just been completed)	High
Black Weir, Borrowash	Low (for council scheme) Medium (for Derwent Hydroelectric Power Ltd scheme)
Darley Abbey	Low
Various very small schemes	Very Low

### RECOMMENDATION

- 2.1 To note the study findings regarding the extent to which potential hydroelectric power schemes are available and viable to the council.

### REASONS FOR RECOMMENDATION

- 3.1 To inform members about the potential, and extent of that potential or not, of further hydroelectric power schemes further to the installation at Longbridge Weir near the Council House.

## SUPPORTING INFORMATION

### Methodology

- 4.1 This report is based on a desk study of currently available information.
- 4.2 This report has been produced to determine at a high level the extent to which further hydro power options are '*available*' to the council. The meaning of '*available*' is taken to mean the reasonable expectation to be '*cost effective, achievable and viable*'.
- 4.3 In that sense '*available*' is taken to be comparable to those criteria against which the Longbridge Weir Hydro (LWH) project near the Council House was approved:
- Self funding prudential borrowing – a positive financial Net Present Value (NPV)
- 4.4 To further determine the extent to which further options are available this report tests, qualitatively, for viability against these key issues noted by the British Hydro Association<sup>1</sup> as important in determining whether or not it is worth proceeding to a more detailed feasibility study<sup>2</sup>:
- i. The existence of suitable site
  - ii. Sufficient flow (Q) and useable head (H)
  - iii. The likely acceptability with Environment Agency and other third parties
  - iv. A nearby demand for electricity or reasonable cost grid connection
  - v. Land ownership
  - vi. Initial indication of design power and annual energy output

### Background

- 4.5 At the 18<sup>th</sup> December 2007 meeting of Cabinet the LWH project gained approval for £1.5m of prudential borrowing for delivery of project expected mid 2010.

However, at Cabinet meeting of 15 February 2011, significant and unexpected delays, with associated consequential costs of gaining both Environment Agency Licence and planning approval were noted. Cabinet approved the additional funding to give a revised project cost of £2.119m with project completion expected October 2011.

The introduction of Feed in Tariffs (FITS) ensured that the project was expected at the time of the 15 February meeting to pay for itself over 20 years.

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<sup>1</sup> British Hydro Association (BHA) is the only UK trade association addressing the demands of the hydropower sector. The BHA promotes the hydropower industry in the UK and abroad and aims to increase the awareness of its quality and scope in the wider world.

<sup>2</sup> For succinctness a number of the issues noted by the BHA have been collated under one issue.

- 4.6 During the same broad time period covering the two above Cabinet reports the then Head of Service who sought and gained the above approvals also undertook other studies of potential hydro sites<sup>3</sup>. Whilst the whereabouts or precise nature of these studies are not currently fully known a small body of study findings remain – this evidence has been used to inform this report.

### **Hydro Experience**

- 4.7 The LWH has recently been completed. This completion is broadly coincident with the phased induction of personnel into the refurbished Council House.

The LWH is a significant hydroelectric installation rated at 230kW peak output. Detailed analysis<sup>4</sup> indicates that this is expected to provide a total output of 1,300,000 kWh per annum.

- 4.8 Whilst there are potentially many lessons learned from the experience gained in delivery of the LWH these are not presently known to authors of this report. If further significant investment of prudential borrowing were to be made in another hydro scheme it maybe prudent to undertake a Post Occupancy Evaluation (POE)<sup>5, 6</sup> of LWH. The POE would capture and disseminate any lessons learned and confirm that the NPV remains positive in the light of delays in completion.

### **Options available**

- 4.9 The table in Appendix 2 lists the known potential sites for council hydro electricity schemes. The sites are tested against the BHA criteria and, where known, the economics of the proposed site.
- 4.10 Each site is then summarised in terms of an overall assessment of its Availability/Viability and benchmarked against the Council House Longbridge Weir Scheme thus: Very Low; Low; Medium; High.

### **Conclusions of Desk Study**

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<sup>3</sup> It is likely that majority of these reports were provided by Derwent Hydroelectric Power Limited.

<sup>4</sup> Derwent Hydroelectric Power September 2007

<sup>5</sup> POE – The All Party Parliamentary Group for Excellence in the Built Environment recommends:  
*“Post occupancy evaluation should be mandatory on all public sector projects above a minimum value threshold (e.g. £5m), with a focus on assessing performance against design expectations. This will help determine good and bad design practice and help inform design decisions going forward.”*

And:

*“Poor commissioning often leads to performance issues and one way of improving this is to have a phased handover of the building, using a protocol called Soft Landings.”*

<sup>6</sup>The CH has adopted the principles of Soft Landings.

4.11 The desk study finds that:

Option	Extent of Availability/Viability: ( <i>Very Low; Low; Medium: High</i> )
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#### **Possible ways forward**

- 4.12 The information provided within the report suggests that moving forward with a further scheme funded through the Council is unlikely to be deliverable and affordable. However it would of course be possible to undertake more detailed feasibility work, which may come to a different conclusion.
- 4.13 The emerging Climate Change Strategy suggests that site specific district heating coupled with Combined Heat and Power (CHP) are more likely to provide a sustainable way forward for facilitating low carbon energy sources in the future for the city, rather than just the City Council. A study is in progress which looks at the opportunities for this approach.
- 4.14 It may however be appropriate to commission a piece of more detailed work that sets out for Derby where we should be focussing our limited resources in terms of our energy production and use in the future. For example it may be that if we were to invest in a programme of replacing boilers in the properties that we are expecting to retain in the future, that this may be the most cost effective way to manage our energy usage, rather than focussing on renewables.

### **OTHER OPTIONS CONSIDERED**

5.1 None

**This report has been approved by the following officers:**

<b>Legal officer</b>	N/A
<b>Financial officer</b>	N/A
<b>Human Resources officer</b>	N/A
<b>Service Director(s)</b>	Christine Durrant
<b>Other(s)</b>	N/A

<b>For more information contact:</b>	Paul Pearson 01332 287250 paul.pearson@derby.gov.uk
<b>Background papers:</b>	None
<b>List of appendices:</b>	Appendix 1 – Implications



<b>IMPLICATIONS</b>
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**Financial and Value for Money**

1.1 None

**Legal**

2.1 None

**Personnel**

3.1 None

**Equalities Impact**

4.1 None

**Health and Safety**

5.1 None

**Environmental Sustainability**

6.1 None

**Asset Management**

7.1 None

**Risk Management**

8.1 None

**Corporate objectives and priorities for change**

9.1 None

Option	(i) Suitable site	(ii) Sufficient flow and head	(iii) Acceptability with EA and Third Parties (TP)	(iv) Nearby demand or grid connection	(v) Land ownership	(vi) Indication of power and annual output	Potential economics: Cost, NPV etc	Extent of viability or Availability: Very Low Low Medium High
<b>Longbridge Weir Hydro (LWH) – at or near completion</b>  <u>Shown by way of illustration as benchmark.</u>	<b>Yes.</b>  Adjacent to weir on land owned by council	<b>Yes.</b>  Detailed hydrology analysis confirmed the presence of sufficient flow across the year to satisfy both economics and need to keep a level of over weir-flow at all times.	<b>Yes.</b>  However, it is understood that material issues were encountered in obtaining the EA Abstraction Licence and satisfying other environmental concerns.	<b>Yes.</b>  Council House with straight forward electrical interconnection across council land to both CH and grid	<b>Yes.</b>  Constructed on land owned by council near Council House (CH)	<b>Yes.</b>  On the basis of detailed studies under (ii) and knowledge of size and type of turbine generator possible under (i) it was calculated that:  Peak output = 230kW  Minimum output = 30kW  Annual energy = 1,300,000kWh	<b>Sound business case.</b>  On the basis of:  A. positive responses to (i) to (vi), and B. sound financing cost and modelling illustrating positive Net Present Value and 20 year payback.  <i>(Excluding any potential financial impacts to NPV from delays to completion)</i>	<b>Availability/viability:</b>  <b>High</b>

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<b>Darley Abbey</b>  <b>Black Weir</b> <u>And associated</u> <u>Abstraction Licence</u>		Possibly.	Yes.	Possibly.	Yes.	No.	Yes.	No.	Availability/viability:
	land – see iii) and vi).	There is weir but there is some potential access issues – see v).	Whilst there is a question mark against the precise measure of head and flow our records indicate a Design Flow approx. a third of the LWH.	<u>EA</u> Any application for an Abstraction Licence needs to pass tests for: <ul style="list-style-type: none"> <li>- Justification of Need</li> <li>- Environmental Sustainability</li> <li>- Efficient Use of Water</li> </ul> <u>TP</u> There is a question mark over ownership of a connecting piece of land a joining nearby domestic property	Subject to matching the grid requirements.	Whilst the council own most of the land near the weir a small and critical piece it does not.	The indication is that:  Peak output = 40kW  Annual energy = 320,000kWh	Given the risks: <ul style="list-style-type: none"> <li>- That the land piece is unobtainable or rights of access are not secured for the long-term;</li> <li>- Associated with obtaining an Abstraction Licence</li> </ul> And the potential that the fixed costs associated with addressing these risks diminish the economies of scale.	Low
				renewed. Licences are renewed every 12 years with a presumption of renewal.			generation (for party holding licence).	linked to schemes income.	

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<b>Various very small schemes:</b> <b>Craft Village, Markeaton Park</b> <b>Markeaton Brook</b>	Unknown.	Low	Unknown	Possibly	Unknown	<b>Low</b>  <b>Craft Village:</b>  <b>Peak output</b> <b>= 4.8kW</b> <b>Annual</b> <b>energy =</b> <b>17,500kWh</b>  <b>Brook:</b>  <b>Peak output</b> <b>= 3.5kW</b> <b>Annual</b> <b>energy =</b> <b>15,000kWh</b>	<b>No</b>  <b>Extremely low</b> <b>economies of scale</b> <b>with disproportionate</b> <b>and costly resource to</b> <b>resolve the unknown</b>	<b>Availability/viability:</b>  <b>Very Low</b>
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