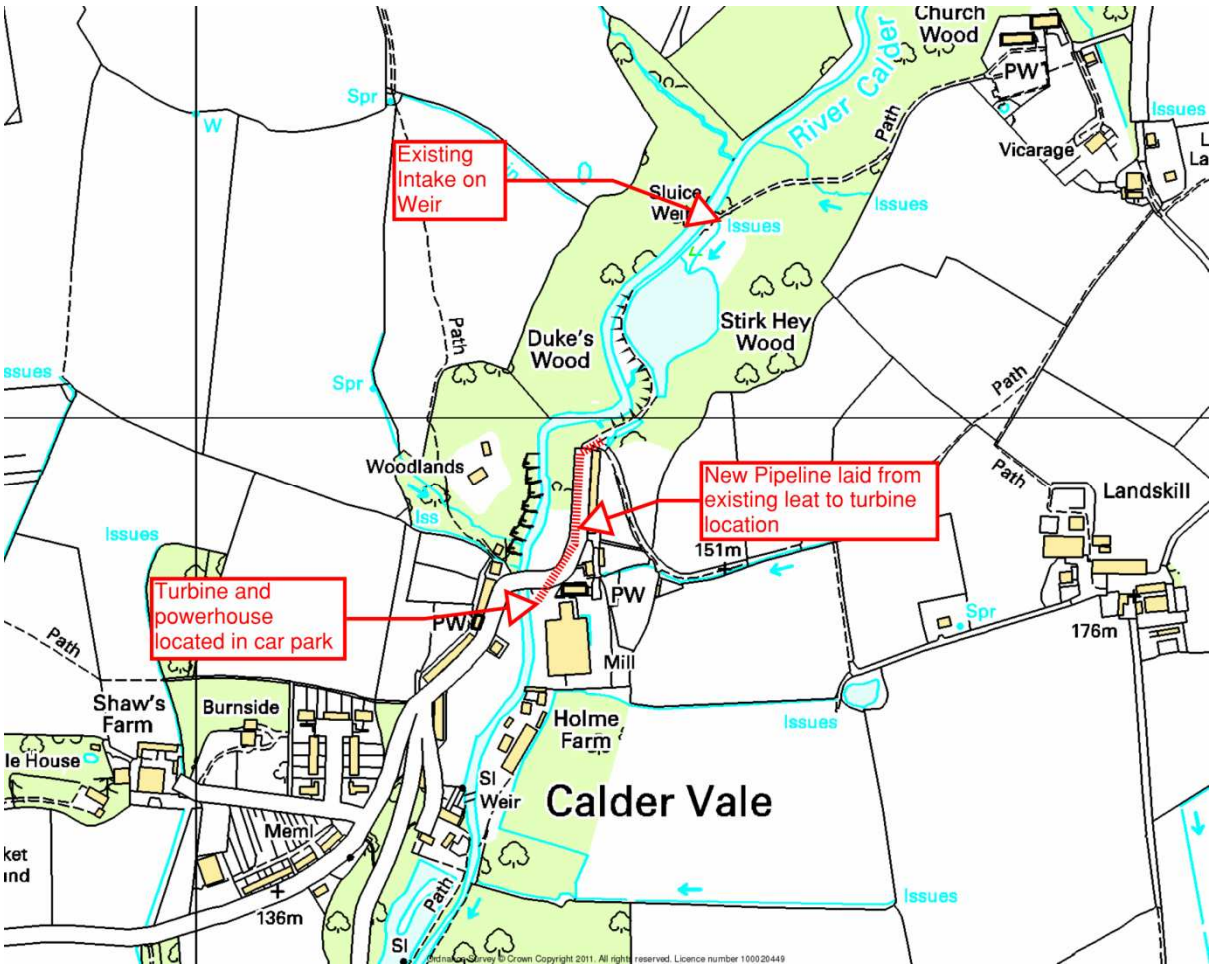
Site 25: Lappet Mill, Calder Vale

Site Assessment

Figure 1 Map showing general layout



Calder Vale Mill or Lappet Mill in Calder Vale is historically a water-powered cotton mill. It was built in 1835. There is a millpond fed from the River Calder using the weir and sluice gate. The headrace is in an open channel for a short distance before being culverted behind Long Row, the old spinner's cottages then emerging to a small basin before feeding into the mill by pipe. Currently, the water from the leat solely provides a supply to the mill's sprinkler system due to inadequate water pressure provided by the mains water supply.

The weir, intake and leat to the mill are all in good condition and the scope to produce energy at this site is good. Unfortunately there is no machinery remaining. The condition of the section of culvert behind Long Row is unknown and the full capacity may not be available due to siltation. Access to lay a new pipe along the same route would be prohibitive. The proposal would therefore be to lay a new pipe down the access road to Long Row and into the mill car park where a new turbine and power house would be constructed. Flow from the turbine would discharge directly back in to the River Calder.

The intake weir would benefit from a more efficient screening system to reduce the maintenance required preventing trash going down the pipe.

Figure 2 The weir and intake sluice

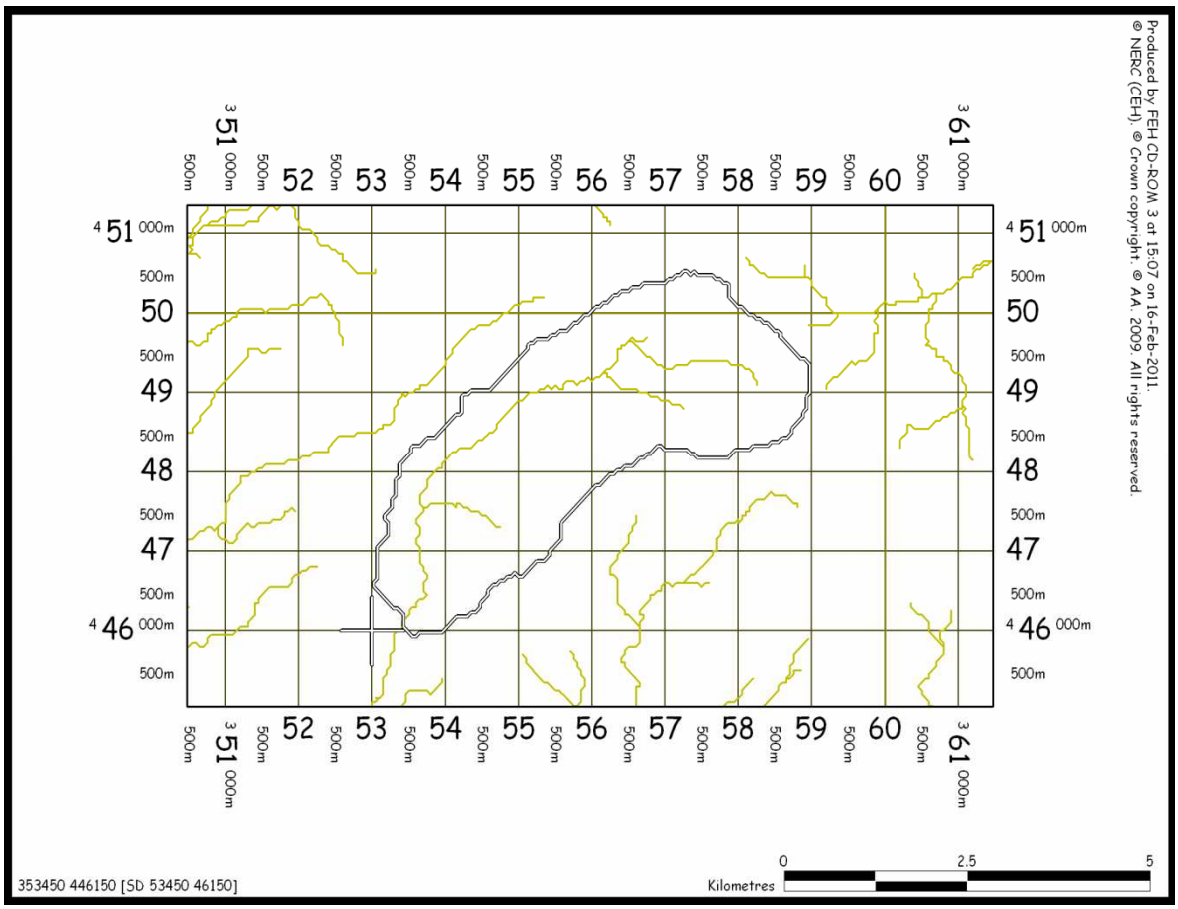
Figure 3 The mill pond

Figure 4 The mill upstream of the culvert

Figure 5 The basin at the culvert outlet

Catchment Analysis

Figure 6 Catchment boundary defined by Flood Estimation Handbook Software



The Flood Estimation Handbook software is used to determine the following catchment descriptors, for the proposed intake location, selected during the site visit.

Intake Grid Reference	353476, 446190
Powerhouse Grid Reference	353318, 445825
Catchment Area	12.67 km^2
Annual Rainfall	1483 mm

The mill currently has abstraction rights to take water from the River Calder. It is not known at this stage what flow is taken

Annual Flow Statistics

Low Flows software is used to produce a Flow Duration Curve (FDC), which demonstrates how the river flow varies throughout the year. It presents the percentage time of the year each flow rate is exceeded. A particular notation is used to refer to FDC flow rates; e.g. 'Q_{95}' refers to the flow rate which is exceeded 95% of the year.

Table 1 Mean flow rate and flow rate at Q_{95}

Period	Mean Flow Rate [m³/s]	Flow Rate at Q_{95} [m³/s]
Annual	0.424	0.0572
January	0.691	0.128
February	0.508	0.0969
March	0.543	0.111
April	0.328	0.074
May	0.229	0.0594
June	0.168	0.0435
July	0.177	0.0416
August	0.271	0.0421
September	0.344	0.051
October	0.477	0.0661
November	0.628	0.103
December	0.729	0.125

Table 2 Annual flow duration data

Exceedance Probability	Flow Rate [m³/s]
5	1.509
10	1.016
20	0.596
30	0.403
40	0.29
50	0.218
60	0.168
70	0.13
80	0.097
90	0.07
95	0.057
99	0.041

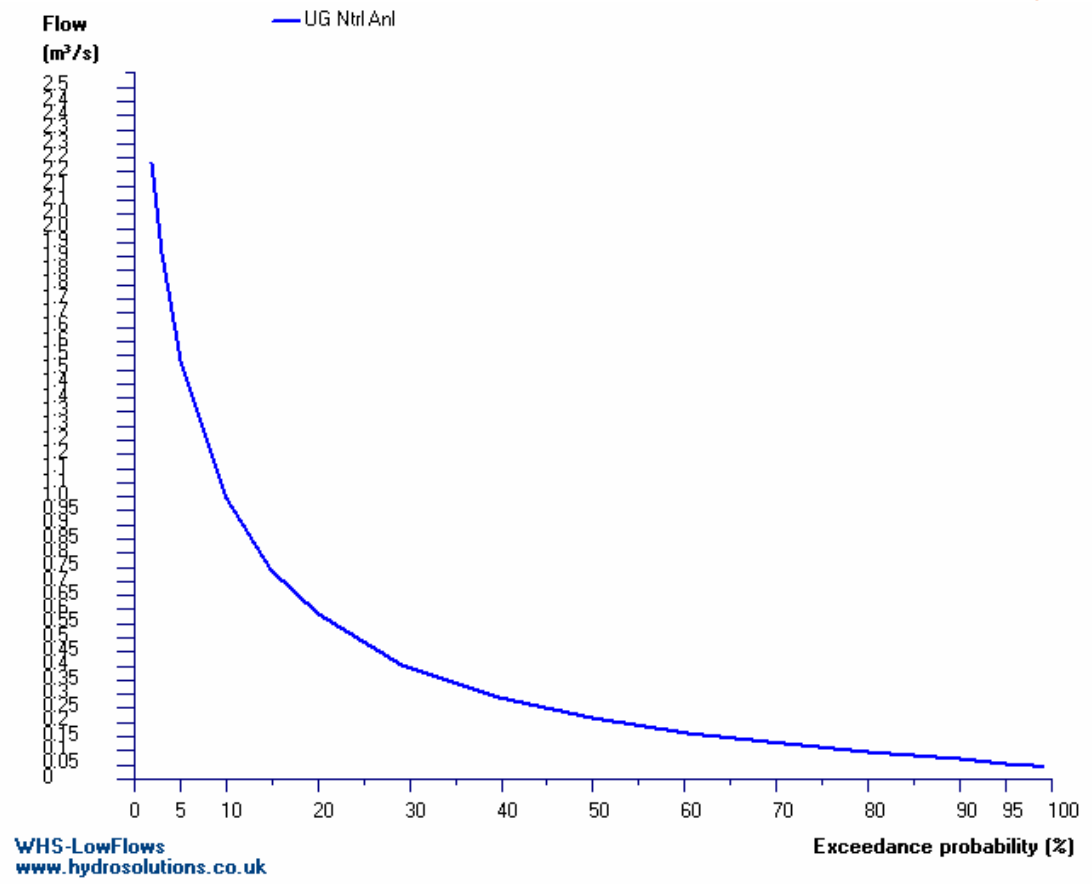


Figure 7 Annual flow duration curve produced using low flows software

Hydropower Analysis

Site: Lappet Mill (Site 25)
Run Date / Time: 17 February 2011 at 15:50

Mean Flow: 0.38 m3/s
Provisional Rated Flow: 0.42 m3/s
Residual Flow: 0.040 m3/s

Rated Flow: 0.38 m3/s
Gross Hydraulic Head: 10.00 m
Nett Hydraulic Head: 9.50 m

Applicable Turbines	Gross Annual Average Output	Nett Annual Average Output	Maximum Power Output	Rated Capacity	Minimum Operational Flow
Propellor	88.7	87.8	31.0	29.7	0.29
Crossflow	113.4	112.3	28.3	26.5	0.097
	MWh	**MWh**	**kW**	**kW**	**m3/s**

Table 3 Hydropower Analysis

Gross Head [m]	10.00 m
Net Head [m]	9.50 m
Design Flow [m³/s]	0.38 m³/s
Rated Capacity [kW]	28.1 kW
Average Annual Energy Output [MWh]	100 MWh
Average annual Carbon Dioxide offset	54.30 tonnes

Impact Assessment

Lappet Mill is within the Forest of Bowland AONB. The site is a conservation area and lies in the character area of Undulating Lowland Farmland with Wooded Brooks. The mill is currently operating and using the water from the River Calder to supply the sprinkler system in the event of fire.

If a scheme were pursued here it would be considered as the refurbishment of an historic scheme, using much of the historic infrastructure. The area of construction is mainly away from any public access and it is not thought the development would have any significant visual impact.

Statutory Requirements

This mill has been listed in the past (Grade III) but is not now listed as that designation no longer exists. However, it is within the Calder Vale conservation area.

It will be necessary to confirm the existing abstraction licence with the Environment Agency and to apply should more water be required. Whilst in-river works will be limited to the turbine tail race, they must be completed between May and September. Planning permission will need to be investigated also for the installation of the turbine, powerhouse and the laying of a pipeline.

An ecologist will advise on the extent of environmental investigation required.

Budget Development Cost

The total budget cost for the whole scheme is **£221,805**. It should be noted that the civil works costs can vary considerably as material costs fluctuate. Likewise, mechanical and electrical (M&E) equipment costs vary in accordance with demand. Professional fees should be considered subject to change, as the scope of licensing and planning requirements are not yet defined. Consequently the budget estimate at this stage should be considered accurate to plus or minus 20%.

Revenue and Simple Payback period

It is most likely that all of the power generated by the hydro electric scheme could be used by the mill and therefore a grid connection will not be required.

Under the current government feed-in tariff regulations, hydropower schemes receive a generation tariff according to their rated capacity. Schemes between 15 kW and 100 MW receive 17.8p/kWh. This generation tariff is received regardless of how the electricity is used. The current base value of electricity per kilowatt hour on top of this has been assumed as 3p/kW.

In conclusion, the total value of the generated electricity would be 20.8 p/kWh, giving an average annual value of approximately **£20,800.** The simple payback, taken as the budget scheme cost divided by the annual value of electricity generated, is **10.5 years**.

Conclusion

This is a relatively straightforward scheme using much of the existing infrastructure, the main cost being the turbine. The power generated could be used to supply the mill only, negating the need for a grid connection. The mill is within the Calder Vale conservation area and Wyre Borough Council will need to be consulted. This scheme is considered to be one of the most attractive in this study due to the short estimated payback time.

Table 4 budget development costs

Budget Scheme Cost Estimate
Lappet Mill, Chipping

ITEM	UNIT	QUANTITY	MIN	MAX
Turbine				
Turbine Quotation	No	1	£90,000.00	£112,500.00
Grid Connection				
Grid Connection	No	1	£0.00	£0.00
Civils				
Weir	m^3	0	£0.00	£0.00
Fish Pass	m^3	0	£0.00	£0.00
Weir Screen Length	m	0	£0.00	£0.00
Fish Pass Length	m	0	£0.00	£0.00
Pipe Installation	m			
Rock	m	0	£0.00	£0.00
Gravels	m	0	£0.00	£0.00
Soft	m	300	£16,500.00	£20,625.00
Pipe Materials	No	1	£0.00	£0.00
Temporary Access	m			
Rock	m	0	£0.00	£0.00
Gravels	m	0	£0.00	£0.00
Soft	m	0	£0.00	£0.00
Temporary Access on Good Ground	m	0	£0.00	£0.00
Powerhouse				
Powerhouse	kW	30	£15,000.00	£18,750.00
Prelims				
Duration	Months	6	£18,000.00	£22,500.00
Sub Total				
Sub Total			£139,500.00	£174,375.00
Professional Fees				
Professional Fees			£20,925.00	£34,875.00
Sub Total				
Sub Total			£160,425.00	£209,250.00
Contingency				
Contingency			£32,085.00	£41,850.00
GRAND TOTAL			£192,510.00	£251,100.00

Further Information

This site report is produced by Inter Hydro Technology on behalf of Forest of Bowland AONB, and funded by a partnership including Lancashire County Council, Lancaster & District Local Strategic Partnership, Pendle Borough Council and Ribble Valley Local Strategic Partnership.

This site report should be read in conjunction with the rest of the Forest of Bowland AONB Hydro Feasibility Study which can be downloaded at

http://www.forestofbowland.com/climatechange#hydro