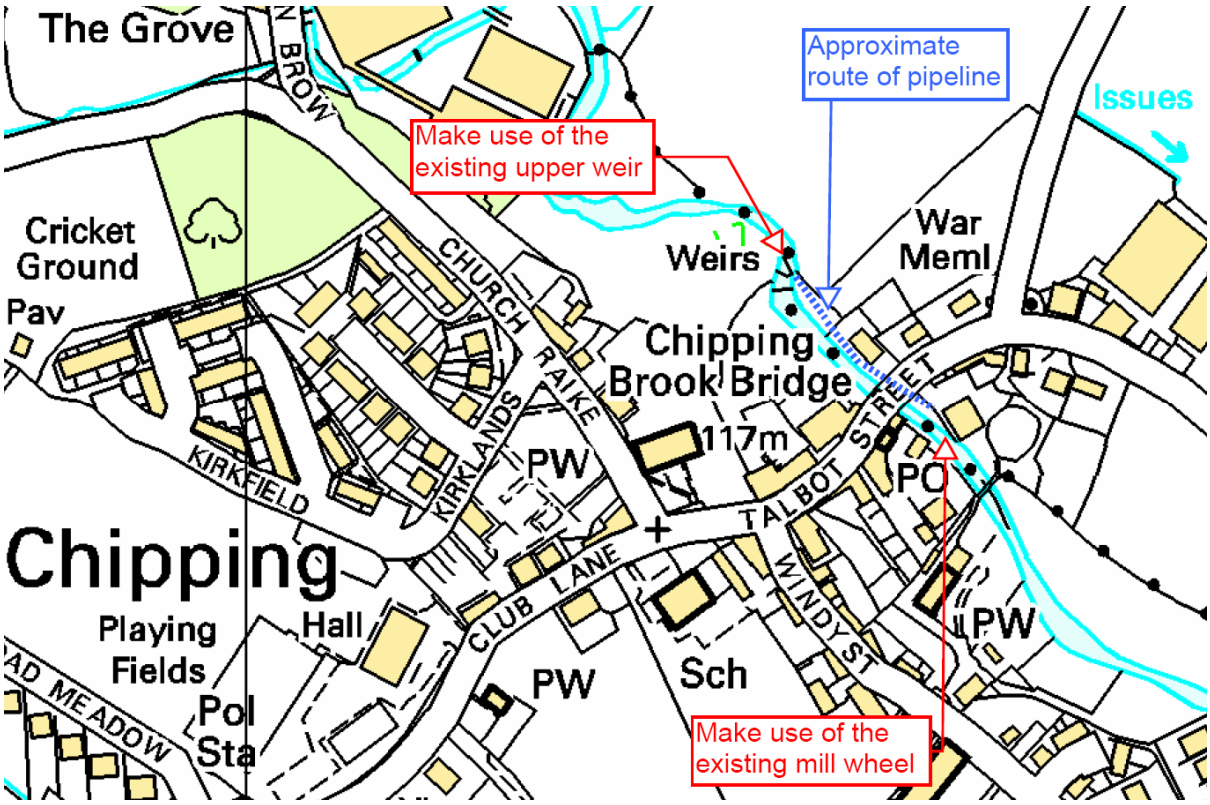
Site 4: Chipping Mill, Chipping

Site Assessment

Figure 1 Map showing general layout



Chipping Mill (historically known as Wharf Mill) is a former corn mill just east of Chipping Church. The mill was in use until the 1960's and is now restored and in use as a private residence. It comprises the two and three-storey sandstone main buildings with an external, breast-shot waterwheel, iron axle, hubs, buckets and rims as well as timber spokes, all in situ and in good working order.

The weir, intake and conduit to the mill are all in good condition and the scope to produce energy at this site is good. The weir would benefit from a new crest and a more efficient screening system, to reduce the maintenance required preventing trash going down the pipe. A generator would also be required for the mill.

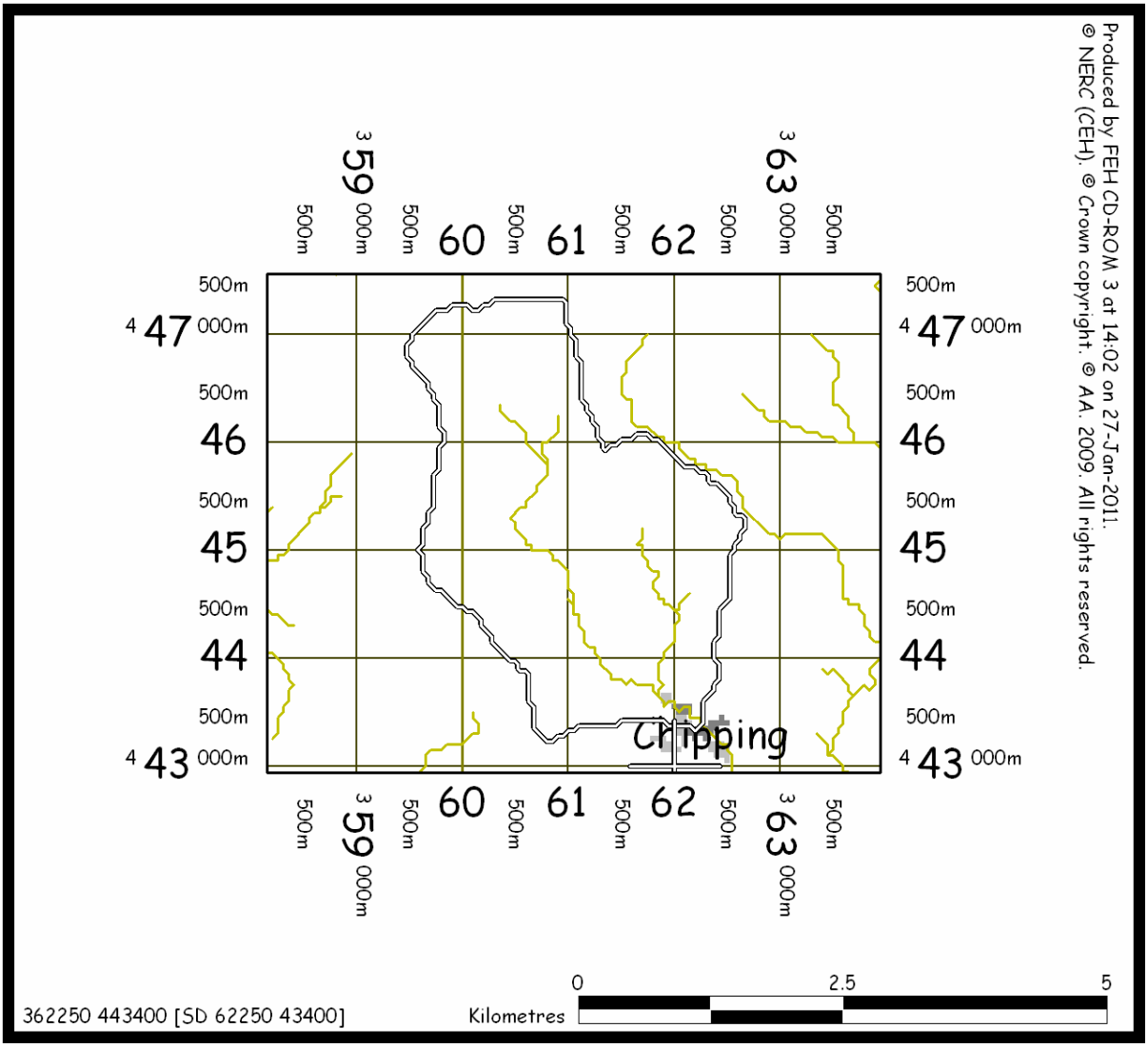
Figure 2 The remaining internal works

Figure 3 The headrace with the top of the mill wheel

Figure 4 The intake with iron grate

Catchment Analysis

Figure 5 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	362270, 443420
Powerhouse Grid Reference	362350, 443330
Catchment Area	8.2 km^2
Annual Rainfall	1597 mm

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	0.289	0.0356
January	0.515	0.0908
February	0.392	0.0758
March	0.385	0.08
April	0.244	0.0553
May	0.152	0.0407
June	0.109	0.0314
July	0.103	0.0286
August	0.152	0.0284
September	0.184	0.0289
October	0.301	0.0415
November	0.424	0.0585
December	0.508	0.077

Table 2 Annual flow duration data

Exceedance Probability	Flow Rate [m³/s]
5	1.027
10	0.69
20	0.415
30	0.279
40	0.196
50	0.144
60	0.108
70	0.081
80	0.059
90	0.043
95	0.036
99	0.028

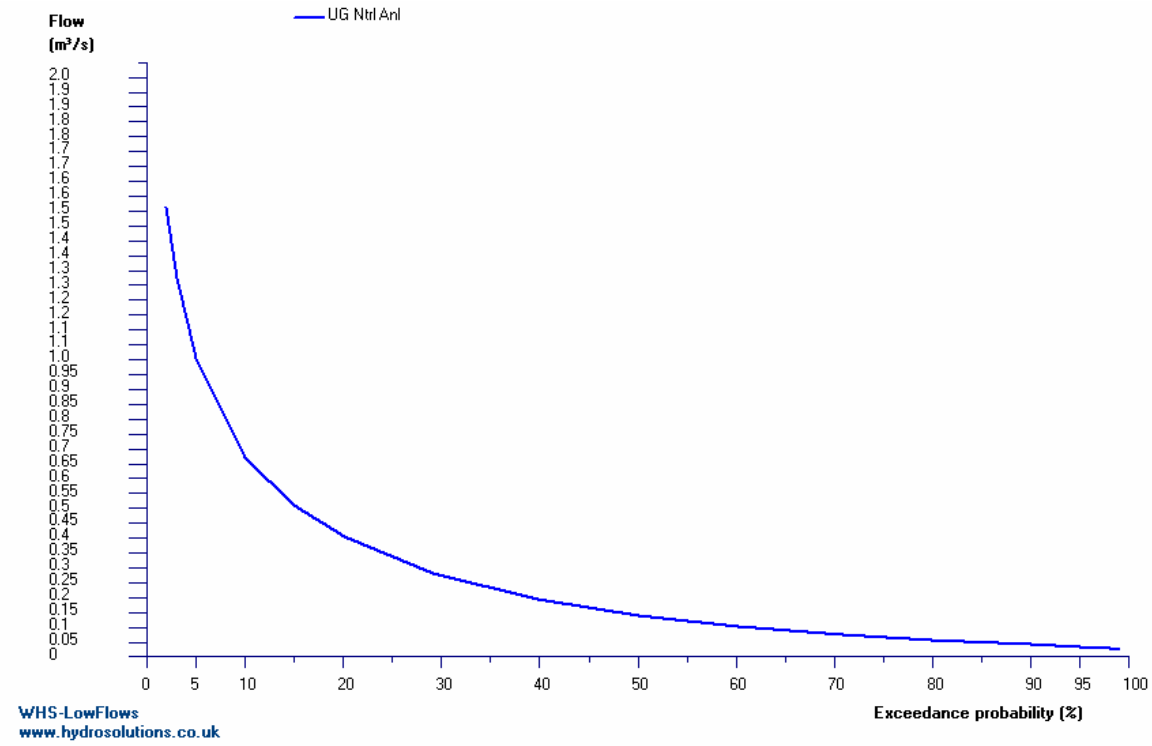


Figure 6 Annual flow duration curve produced using low flows software

Hydropower Analysis

Site: Water Wheel Chipping
Run Date / Time: 27 January 2011 at 14:18

Mean Flow: 0.24 m3/s
Provisional Rated Flow: 0.26 m3/s
Residual Flow: 0.025 m3/s
Rated Flow: 0.23 m3/s
Gross Hydraulic Head: 3.50 m
Nett Hydraulic Head: 3.33 m

Applicable Turbines		Gross Annual Average Output	Nett Annual Average Output	Maximum Power Output	Rated Capacity	Minimum Operational Flow
Propellor	(mgnl)	19.1	19.0	6.7	6.4	0.18
Crossflow		24.5	24.3	6.1	5.7	0.060
		MWh	MWh	kW	kW	m3/s

Table 3 Hydropower Analysis *(marginally applicable turbine indicated by 'mgnl')*

Gross Head [m]	3.5
Net Head [m]	3.33
Design Flow [m^3/s]	0.2 m^3/s
Rated Capacity [kW]	6 kW
Average Annual Energy Output [MWh]	20MWh
Average annual Carbon Dioxide offset	10 tonnes

Impact Assessment

The further restoration of this mill will be of historic benefit to the area. The owners have already done significant work to maintain and restore this existing infrastructure. There is an existing weir and water flows from the weir to the mill building. It is not thought that there will be any significant impact resulting from the commissioning of this scheme.

Chipping is within the Forest of Bowland AONB and is classified under their landscape character assessment as Undulating Lowland Farmland with Parkland. The Waterwheel is just outside the Chipping Conservation area.

Statutory Requirements

It is understood that it will be necessary to apply to the Environment Agency for an abstraction and impoundment licence. Advice should be sought about planning permission for the minor improvements to the weir that may be required.

The building is included on the Lancashire Historic Environments Record and any alterations to the building are likely to require planning permission, and require discussion with the county archaeologist. However, it is not anticipated that the building will require significant alterations.

An ecologist will be able to advise on what degree of environmental assessment is required.

Budget Development Cost

Table 4 Development Budget Cost

Budget Scheme Cost Estimate
Chipping Mill

ITEM	UNIT	QUANTITY	MIN	MAX
Turbine				
Turbine Quotation	No	1	£0.00	£0.00
Grid Connection				
Grid Connection	No	1	£5,000.00	£6,250.00
Civils				
Weir	m^3	4	£2,000.00	£2,500.00
Fish Pass	m^3	0	£0.00	£0.00
Weir Screen Length	m	2	£4,000.00	£5,000.00
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	0	£0.00	£0.00
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		£0.00	£0.00
Powerhouse				
Generator	kW	3	£5,000.00	£6,250.00
Prelims				
Duration	Months	0.5	£1,500.00	£1,875.00
Sub Total				
Sub Total			£17,500.00	£21,875.00
Professional Fees				
Professional Fees			£2,625.00	£4,375.00
Sub Total				
Sub Total			£20,125.00	£26,250.00
Contingency				
Contingency			£4,025.00	£5,250.00
GRAND TOTAL			£24,150.00	£31,500.00

The total budget cost for the whole scheme is £28,000. 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 unlikely that this scheme requires a grid connection, as the energy can be consumed on site. Under the current government feed-in tariff regulations, hydropower schemes receive a generation tariff according to their rated capacity. Schemes less than 15kW receive 19.9p/kWh. This generation tariff is received regardless of how the electricity is used. If this electricity would be used on site, then this would significantly offset import costs. This increases the value of the generated electricity by the import tariff, which is specific to their chosen provider. We have assumed an import value of 5p.

The average annual revenue calculated for this scheme is approximately **£4600**. This works out at a simple pay back time of 6 years. If the mill is unable to use all of the energy produced then this revenue will be reduced, and would be calculated using the Feed in Tariff subsidy minus the annual electricity bill.

Conclusion

There is obvious historical interest and benefit to getting this scheme up and running, and very little work is required. The current owners have refurbished and maintained the system very well. It is recommended that millwright specialists are commissioned to make this scheme generate electricity.

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