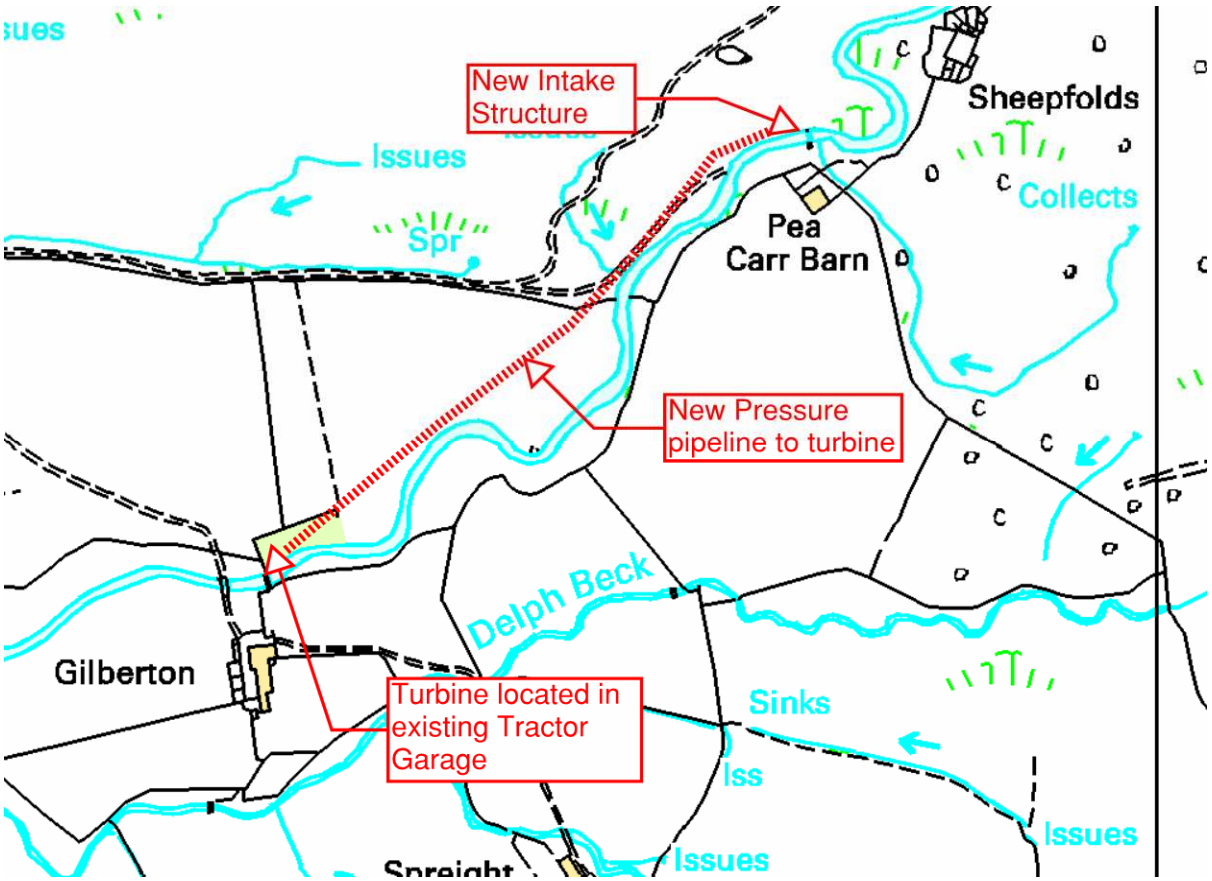
Site 31: Gilberton Farm, Tarnbrook

Site Assessment

Figure 1 Map showing general layout



Gilberton Farm is located between the watercourses Tarnbrook Wyre and Delph Beck. The land is owned by Abbeystead Estates and tenanted. A number of potential ideas were discussed with the tenant farmer during the site visit which included both high and low head schemes.

A high head scheme has been assessed in the first instance, using flows only from Tarnbrook Wyre. The proposal would involve the construction of an impounding weir located at Pea Carr Barn and the laying of a high pressure pipeline to an existing agricultural building, previously used as tractor shed, where a turbine could be housed. Flow from the turbine would then discharge directly back in to the watercourse.

There is an overhead electrical supply to Gilberton Farm, at the end of the network, and this could be utilised to carry power up to 50kW out to the grid. There would also be an option to lay a private electricity cable from the turbine to adjoining farms and possibly the small community of Tarnbrook.

A low head scheme would involve linking a number of the watercourses surrounding the farm by either open channels or pipes and locating a turbine in the garage adjacent to Tarnbrook Wyre adjacent to the Wyre Way footpath. This could be undertaken, though is fairly complex and further analysis would be required to assess the power potential from such a scheme.

Figure 2 Pea Carr Barn and Tarnbrook Wyre

Figure 3 Gilberton Farm

Catchment Analysis

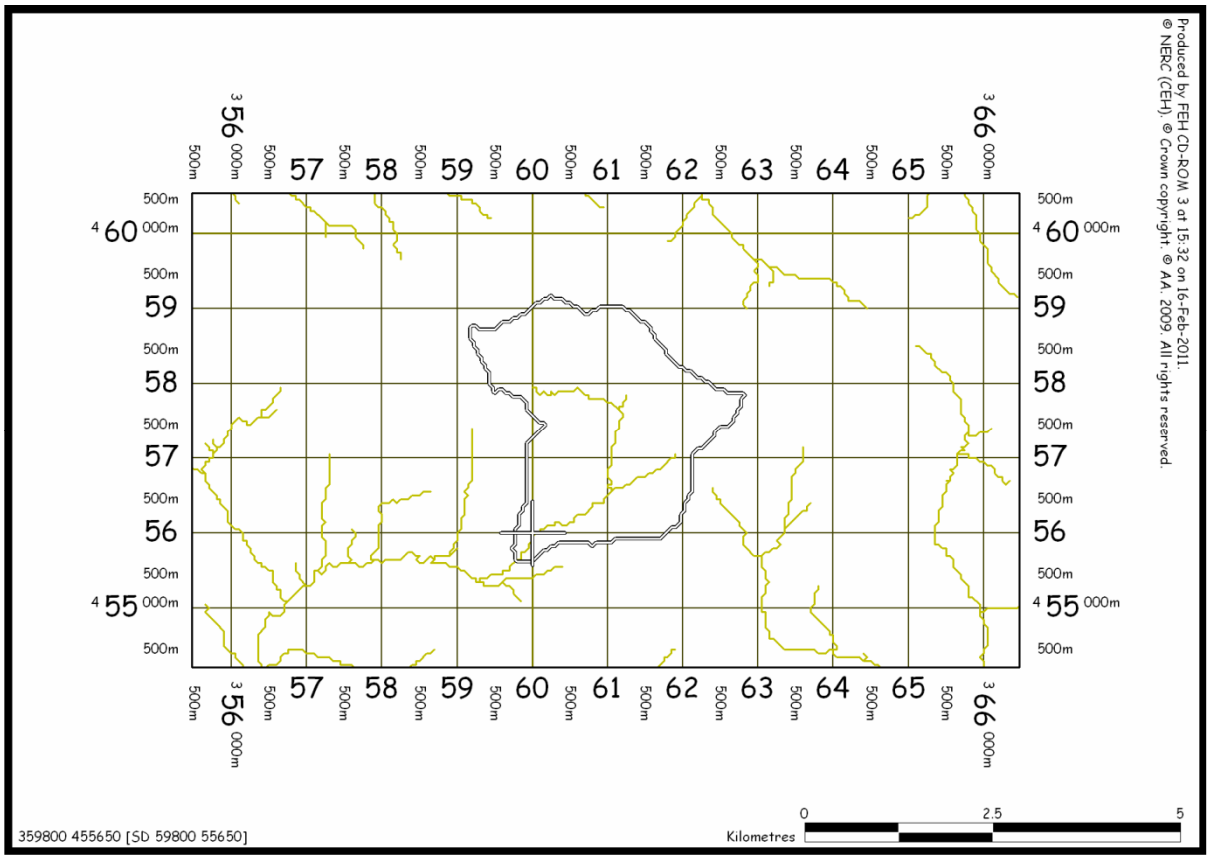


Figure 4 Catchment boundary defined by Flood Estimation Handbook Software

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	359802, 455662
Powerhouse Grid Reference	359534, 455433
Catchment Area	7.47 km^2
Annual Rainfall	1884 mm

There are not understood to be any abstractions at this location.

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 [m^3/s]	Flow Rate at Q_{95} [m^3/s]
Annual	0.366	0.0329
January	0.564	0.0855
February	0.419	0.0606
March	0.478	0.0751
April	0.334	0.0543
May	0.22	0.0328
June	0.162	0.0238
July	0.193	0.0274
August	0.245	0.0236
September	0.318	0.0279
October	0.421	0.0336
November	0.5	0.0649
December	0.537	0.0896

Table 2 Annual flow duration data

Exceedance Probability	Flow Rate [m^3/s]
5	1.353
10	0.9
20	0.511
30	0.337
40	0.237
50	0.174
60	0.13
70	0.097
80	0.067
90	0.043
95	0.033
99	0.023

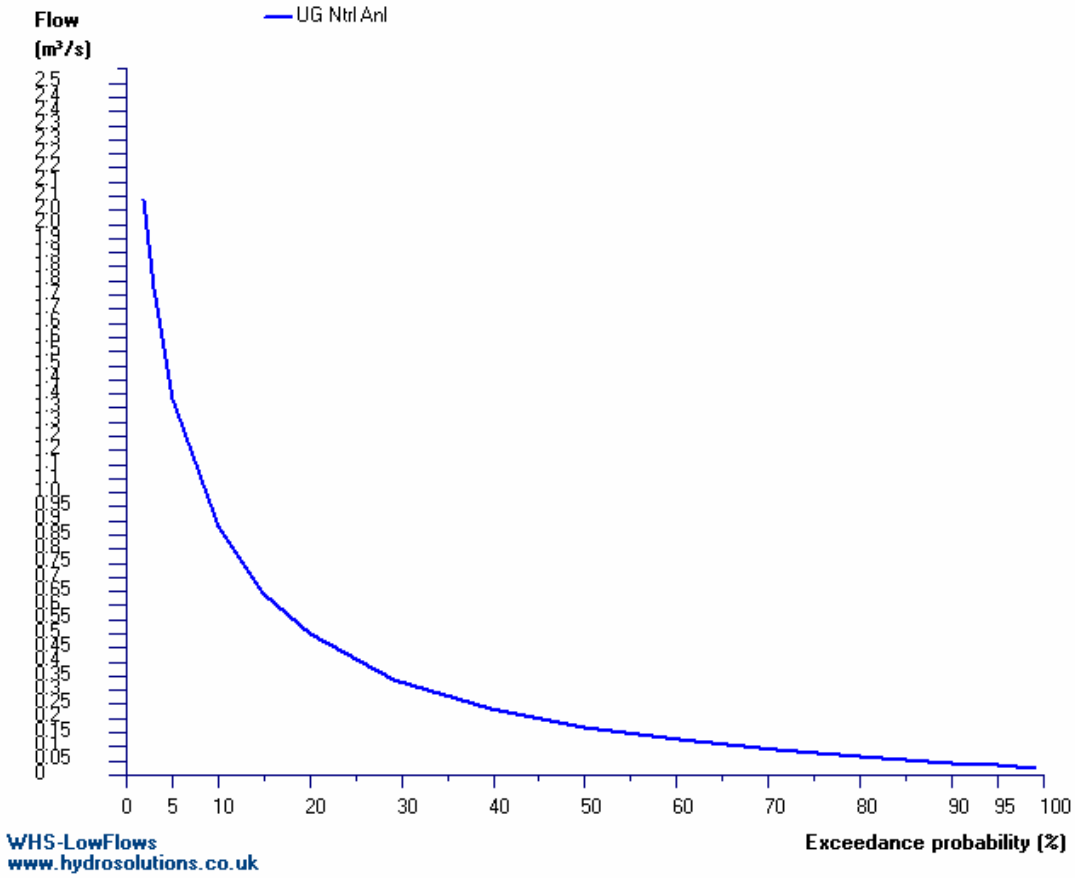


Figure 5 Annual flow duration curve produced using low flows software

Hydropower Analysis

Site: Gilberton (Site 31)
Run Date / Time: 17 February 2011 at 15:56

Mean Flow: 0.33 m3/s
Provisional Rated Flow: 0.36 m3/s
Residual Flow: 0.027 m3/s

Rated Flow: 0.33 m3/s
Gross Hydraulic Head: 15.00 m
Nett Hydraulic Head: 14.25 m

Applicable Turbines	Gross Annual Average Output	Nett Annual Average Output	Maximum Power Output	Rated Capacity	Minimum Operational Flow
Propellor	114.6	113.5	40.7	39.1	0.24
Crossflow	145.4	143.9	37.2	34.9	0.077
	MWh	**MWh**	**kW**	**kW**	**m3/s**

Table 3 Hydropower Analysis

Gross Head [m]	15.00 m
Net Head [m]	14.25 m
Design Flow [m^3/s]	0.33 m^3/s
Rated Capacity [kW]	37.5 kW
Average Annual Energy Output [MWh]	129 MWh
Average annual Carbon Dioxide offset	70.0 tonnes

Impact Assessment

Gilberton Farm is within the Forest of Bowland AONB. The Forest of Bowland Landscape Character Assessment describes the area as being within Undulating Lowland Farmland and Moorland Fringe. The area where the intake structure would be located, as well as approximately 100m of the pipeline, is designated as SSSI.

If a scheme were pursued on Tarnbrook Wyre the turbine would be housed in an existing building. Though part of the scheme's infrastructure would be in a SSSI it is not thought that the development would have any significant environment impact.

Statutory Requirements

In-river works will be required to build the intake weir and the tail race, and the Environment Agency will need to be consulted in order to acquire consent for this, as well as to apply for an abstraction license. Work in the river will only be allowed between May and September. Planning permission is likely to be required to construct the weir and pipeline. An ecologist will advise on the extent of environment assessment required.

Budget Development Cost

The total budget cost for the whole scheme is **£361,250**. 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%.

Table 4 budget development costs

Budget Scheme Cost Estimate
Gilberton Farm, Abbeystead

ITEM	UNIT	QUANTITY	MIN	MAX
Turbine				
Turbine Quotation	No	1	£120,000.00	£150,000.00
Grid Connection				
Grid Connection	No	1	£50,000.00	£0.00
Civils				
Weir	m^3	20	£10,000.00	£12,500.00
Fish Pass	m^3	0	£0.00	£0.00
Weir Screen Length	m	5	£10,000.00	£12,500.00
Fish Pass Length	m	0	£0.00	£0.00
Pipe Installation	m			
Rock	m	350	£38,500.00	£48,125.00
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	£0.00	£0.00
Powerhouse				
Powerhouse	kW	38	£15,000.00	£18,750.00
Prelims				
Duration	Months	4	£12,000.00	£15,000.00
Sub Total				
Sub Total			£255,500.00	£256,875.00
Professional Fees				
Professional Fees			£38,325.00	£51,375.00
Sub Total				
Sub Total			£293,825.00	£308,250.00
Contingency				
Contingency			£58,765.00	£61,650.00
GRAND TOTAL			£352,590.00	£369,900.00

Revenue and Simple Payback period

There is an overhead electrical supply to Gilberton Farm, at the end of the network, and this could be utilised to carry power up to 50kW out to the grid. There would also be an option to lay private electricity cable from the turbine to adjoining farms and possibly the small community of Tarnbrook.

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 **£26,832.** The simple payback, taken as the budget scheme cost divided by the annual value of electricity generated, is **13.5 years**.

Conclusion

A hydro scheme on this site would be a useful green source of power for both Gilberton and adjacent farms and possibly for the small community of Tarnbrook.

The pipeline route may provide a small challenge, but it is anticipated that a significant amount of the construction could be completed by the tenant farmer and possibly by neighbouring farms. This will reduce costs. The payback period may prove to be attractive.

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